Chapter 15

Recreation Resources

15.1 Introduction

This chapter describes recreational resources in the study area; and potential changes that could occur as a result of implementing the alternatives evaluated in this Environmental Impact Statement (EIS). Implementation of the alternatives could affect recreation resources through potential changes in operation of the Central Valley Project (CVP) and State Water Project (SWP) and ecosystem restoration.

15.2 Regulatory Environment and Compliance Requirements

Potential actions that could be implemented under the alternatives evaluated in this EIS could affect recreational resources at reservoirs and lands served by CVP and SWP water supplies. Actions located on public agency lands; or implemented, funded, or approved by Federal and state agencies would need to be compliant with appropriate Federal and state agency policies and regulations, as summarized in Chapter 4, Approach to Environmental Analyses.

15.3 Affected Environment

This section describes recreational resources that could be potentially affected by the implementation of the alternatives considered in this EIS. Changes in recreation opportunities due to changes in CVP and SWP operations may occur in the Trinity River, Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions. Recreational fishing in San Francisco Bay and along the Pacific Coast also may be affected by changes in CVP and SWP operations.

There are extensive recreational opportunities within this study area. However, the recreational opportunities that could be directly or indirectly affected through implementation of the alternatives analyzed in this EIS are related to water-related recreation activities at CVP and SWP reservoirs and in the rivers downstream of those reservoir, fishing opportunities in the Delta and the Pacific Ocean that are affected by the water flows managed by CVP and SWP operations, and bird watching, wildlife viewing, and hunting activities at wildlife refuges that use CVP water supplies. Therefore, the following description of the affected environment is limited to these recreational aspects. The wildlife refuges identified to receive CVP water supplies are shown on Figure 15.1.

15.3.1 Trinity River Region

The Trinity River Region includes the area along the Trinity River from Trinity Lake to the confluence with the Klamath River; and along the lower Klamath River from the confluence with the Trinity River to the Pacific Ocean. Major recreational opportunities occur at Trinity Lake, Lewiston Reservoir, along the Trinity River between Lewiston Reservoir and the confluence with the Klamath River, and along the lower Klamath River.

15.3.1.1 Trinity Lake

Trinity Lake is a CVP facility on the Trinity River that is located approximately 50 miles northwest of Redding, as described in Chapter 5, Surface Water Resources and Water Supplies. Trinity Lake is part of the Whiskeytown-Shasta-Trinity National Recreation Area and part of the Shasta-Trinity National Forest. Recreational facilities and activities at Trinity Lake are administered by the U.S. Forest Service (USFS). When the water storage in the reservoir is at full capacity (water elevation at 2370 feet mean sea level (msl), Trinity Lake has a surface area of 17,222 acres and 147 miles of shoreline (USFS 2014).

Boating, windsurfing, and fishing primarily occur in the northern part of the lake near Trinity Center. Houseboats, motorboats, water skiing primarily occur in the southern part of the lake. There are six public boat ramps on Trinity Lake as summarized in Table 15.1.

Table 15.1 Trinity Lake Boat Ramps

Location	Boat Ramp	Comments	Useable Elevations (feet, msl)
Trinity Lake	Bowerman	–	2,370 to 2,323
Trinity Lake	Clark Spring	–	2,370 to 2,313
Trinity Lake	Fairview	–	2,370 to 2,313
Trinity Lake	Minersville	–	2,305 to 2,170
Trinity Lake	Stuart Fork	–	2,370 to 2,338
Trinity Lake	Trinity Center	–	2,370 to 2,300

Source: USFS 2014

Three major marinas are located at Trinity Lake, as summarized in Table 15.2. The USFS can permit up to 1,000 boat slips at the Trinity Lake marinas (USFS 2014). Many commercial houseboats are available for rent at the marinas. Trinity Lake shoreline includes approximately 32 miles of prime houseboating areas and 18.5 miles of secondary houseboating areas. The USFS issues permits for houseboats and privately-owned recreational occupancy vehicles that use the water overnight. At Trinity Lake, up to 99 permits for privately-owned vessels and 85 permits for commercially-owned vessels may be issued each year.

Table 15.2 Trinity Lake Marinas and Moorage Facilities

Location	Marina and Moorage Facility	Number
Trinity Lake	Cedar Stock Resort & Marina	31 Commercial and 220 Private Slips, including 10 Commercial Houseboats
Trinity Lake	KOA Campground	15 Commercial and 110 Private Slips
Trinity Lake	Pinewood Cove Docks	52 Private Slips
Trinity Lake	Trinity Alps Marina	31 Commercial and 63 Private Slips, including 25 Commercial Houseboats
Trinity Lake	Trinity Center Marina	80 Private Slips

Source: USFS 2014

The Trinity Unit of the Whiskeytown-Shasta-Trinity National Recreation Area includes many campground sites, including campgrounds for group camping opportunities (USFS 2014), as summarized in Table 15.3. There are other campgrounds within the upper elevations of the Trinity Lake watershed that are not directly or indirectly affected by changes in surface water elevations.

Table 15.3 Trinity Lake Major Campgrounds

Location	Campground	Comments	Number of Campsites
Trinity Lake	Alpine View	–	53
Trinity Lake	Bushytail	–	11
Trinity Lake	Captain’s Point	Boat-In Campground	3
Trinity Lake	Clark Springs	–	21
Trinity Lake	Fawn	Group Campground	60
Trinity Lake	Hayward Flat	–	98
Trinity Lake	Jackass Springs	–	10
Trinity Lake	Mariner’s Roost	Boat-In Campground	7
Trinity Lake	Minersville	–	14
Trinity Lake	Ridgeville	Boat-In Campground	10
Trinity Lake	Ridgeville Island	Boat-In Campground	3
Trinity Lake	Stoney Creek	Group Campground	10
Trinity Lake	Stoney Point	–	15
Trinity Lake	Tannery Gulch	–	82

Source: USFS 2014

Trinity Lake recreational areas also include day use areas for picnicking, swimming, and other recreational opportunities, as summarized in Table 15.4. The locations for shoreline day use areas are limited due to the steep and rocky elevations at the shorelines. To develop two swimming beaches at Trinity Lake, the rocky shorelines were covered with sand and/or decomposed granite at a specific elevation. Uses of these locations are less desirable when the water elevations decline.

Table 15.4 Trinity Lake Major Day Use Areas

Location	Day Use Area	Comments	Number
Trinity Lake	Clark Springs Day Use and Beach	Picnic and Swimming	34 picnic sites
Trinity Lake	North Shore Vista	Vistas and Interpretative Site	–
Trinity Lake	Osprey Info Site	Vistas and Interpretative Site	–
Trinity Lake	Stoney Creek	Picnic and Swimming	4 picnic sites
Trinity Lake	Tanbark Picnic	Picnic and Swimming	8 picnic sites
Trinity Lake	Trail of Trees	Interpretative Trail at Tannery Gulch Campground	0.5 miles
Trinity Lake	Trinity Lakeshore Trail	Trail	4 miles
Trinity Lake	Trinity Vista	Vistas and Interpretative Site	–

Source: USFS 2014

Trinity Lake fishing opportunities include Smallmouth Bass, Largemouth Bass, Rainbow Trout, Brown Trout, Chinook Salmon, and Kokanee Salmon (USFS 2014). White Catfish, Brown Bullhead, Green Sunfish, Bluegill, Klamath Smallscale Sucker, and Pacific Lamprey also are present but are not generally considered as part of the recreational fishing opportunities. Wildlife viewing opportunities extend throughout the Trinity Lake area, including viewing of Bald Eagles, Black-tailed Deer, Black Bear, Gray Squirrel, rabbit, turkey, and California Quail.

15.3.1.2 Lewiston Reservoir

Lewiston Reservoir is a CVP facility on the Trinity River that is located immediately downstream of the Trinity Dam, as described in Chapter 5, Surface Water Resources and Water Supplies. Lewiston Reservoir is part of the Whiskeytown-Shasta-Trinity National Recreation Area and part of the Shasta-Trinity National Forest. Recreational facilities and activities are administered by the USFS. When the water storage in the reservoir is at full capacity (water elevation at 1,874 feet msl), the reservoir has a surface area of 759 acres and 15 miles of shoreline (USFS 2014).

The water elevation is generally stable in Lewiston Reservoir because it is used as regulating reservoir for releases to downstream uses. Water is diverted from the lower outlets in Trinity Lake to Lewiston Reservoir to provide cold water to Trinity River and Whiskeytown Lake. Therefore, recreational opportunities in Lewiston Reservoir include boating and fishing; however, there are fewer opportunities for swimming and water skiing. Lewiston Reservoir does not support houseboats. There is one primary boat ramp and two marinas in Lewiston Reservoir, as summarized in Tables 15.5 and 15.6.

Table 15.5 Lewiston Reservoir Boat Ramps

Location	Boat Ramp	Comments	Useable Elevations (feet, msl)
Lewiston Lake	Pine Cove	Open all year	Around 1870

Source: USFS 2014

Table 15.6 Lewiston Lake Marinas and Moorage Facilities

Location	Marina and Moorage Facility	Number
Lewiston Lake	Lakeview Terrace Docks	14 Commercial and 7 Private Slips
Lewiston Lake	Pine Cove Marina	20 Commercial and 34 Private Slips

Source: USFS 2014

The Whiskeytown-Shasta-Trinity National Recreation Area includes campground sites near the Lewiston Reservoir shoreline, including campgrounds for group camping opportunities (USFS 2014), as summarized in Table 15.7. Lewiston Reservoir recreational areas also include day use areas for picnicking, swimming, and other recreational opportunities, as summarized in Table 15.8. Because the water surface elevations are more stable in Lewiston Reservoir than Trinity Lake, the day use areas have more vegetation along the shoreline.

Table 15.7 Lewiston Lake Major Campgrounds

Location	Campground	Comments	Number of Campsites
Lewiston Lake	Ackerman	–	51
Lewiston Lake	Cooper Gulch	–	5
Lewiston Lake	Mary Smith	–	17
Lewiston Lake	Tunnel Rock	–	6

Source: USFS 2014

Table 15.8 Lewiston Major Lake Day Use Areas

Location	Day Use Area	Comments	Number
Lewiston Lake	Baker Gulch Trail	Trail	0,2 miles
Lewiston Lake	Lewiston Vista	Vistas and Interpretative Site	–
Lewiston Lake	North Lakeshore Trail	Trail	2 miles
Lewiston Lake	Pine Cove	Picnic	2 picnic sites
Lewiston Lake	South Lakeshore Trail	Trail	1 mile

Source: USFS 2014

Lewiston Reservoir fishing opportunities include Smallmouth Bass, Rainbow Trout, Brown Trout, Three-spine Stickleback, Golden Shiner, and Kokanee Salmon (USFS 2014). Klamath Smallscale Sucker, and Pacific Lamprey also are present but are not generally considered as part of the recreational fishing opportunities. Wildlife viewing opportunities extend throughout the Lewiston Reservoir area, including viewing of Bald Eagles, Black-tailed Deer, River Otter, ring-tailed cats, raccoon, and California Quail. Waterfowl use Lewiston Reservoir throughout the year with increased populations in the winter.

15.3.1.3 Trinity River from Lewiston Dam to the Klamath River

The Trinity River flows approximately 112 miles from Lewiston Dam to the Klamath River (NCRWQCB et al. 2009) through Trinity, Humboldt, and Del Norte counties.

The first mile of the river below the Lewiston Dam is located within the Whiskeytown-Shasta-Trinity National Recreation Area. Portions of the Trinity River downstream of Lewiston Dam and Junction City to the confluence with North Fork Trinity River are under the jurisdiction of the Department of the Interior, Bureau of Land Management (BLM) (USFWS et al. 1999). Between the confluence with the North Fork Trinity River and the confluence of New River, the area along the Trinity River is located within the USFS Shasta-Trinity National Forest. Between the confluence with the New River and the Hoopa Indian Reservation, most of the area along the Trinity River is located within the USFS Six Rivers National Forest. The remaining portions of the Trinity River to the confluence with the Klamath River are located within the Hoopa Indian Reservation.

On January 19, 1981, the Secretary of the Interior designated the Trinity River starting 100 yards downstream of the Lewiston Dam to the confluence with the Klamath River as part of the National Wild and Scenic Rivers System. The designation also included portions of the South Fork, North Fork, and New River (BLM et al 2012). However, because the flows in the South Fork, North Fork, and New River are not affected by the alternatives considered in this EIS, these rivers are not evaluated in this EIS.

There are approximately 35 developed recreation sites and more than 200 access points along the Trinity River corridor within a half mile of the river, and numerous river access sites between Lewiston Dam and Weitchpec (NCRWQCB et al. 2009; USFWS et al. 1999).

Recreation occurs year-round in the Trinity River area. Water-related activities include boating, kayaking, canoeing, whitewater rafting, inner tubing, fishing, swimming, wading, gold panning, camping, and picnicking (NCRWQCB et al. 2009). Fishing opportunities include steelhead, Rainbow Trout, Brown Trout, and Chinook Salmon.

15.3.1.4 Lower Klamath River from Trinity River Confluence to the Pacific Ocean

The Klamath River continues for 43.5 miles from the Trinity River confluence to the Pacific Ocean (NCRWQCB et al. 2009).

Downstream of the Trinity River, the Klamath River flows through the Hoopa Indian Reservation, Yurok Indian Reservation, and Resighini Indian Reservation as well as lands owned by local agencies and private entities (DOI and DFG 2012). Near the confluence with the Pacific Ocean, the Klamath River flows through the Redwood National Park. These reaches are primarily within Humboldt and Del Norte counties.

The portion of the Klamath River from the confluence with the Trinity River to the Pacific Ocean is part of the Klamath River designated by the Secretary of the Interior to be part of the National Wild and Scenic Rivers System on January 19, 1981. The State of California also designated this reach of Klamath River as wild and scenic under Public Resources Code sections 5093.54 and 5093.545.

Recreation along the Klamath River downstream of the Trinity River is limited (DOI and DFG 2012). Canoeing, kayaking, and whitewater boating occurs along this reach. Whitewater rafting generally requires a minimum flow of 1,800 cfs in this portion of the Klamath River. Four campgrounds, picnic areas, and water access at public lands are located along the Klamath River near the confluence with the Pacific Ocean. Fishing opportunities in the lower Klamath River are primarily related to Chinook Salmon. Del Norte County operates two public boat ramps along the Klamath River. The Redwood National and State Parks operate Lagoon Creek near the confluence of the Klamath River and the Pacific Ocean (RNSP 2013; Del Norte County 2003). There are other trails near the Pacific Ocean, including the California Coastal Trail which is generally located along the northern and eastern banks of the Klamath River at the Pacific Ocean (California Coastal Trail 2014).

15.3.2 Central Valley Region

The Central Valley Region extends from above Shasta Lake to the Tehachapi Mountains, and includes the Sacramento Valley, San Joaquin Valley, Delta, and Suisun Marsh.

15.3.2.1 Sacramento Valley

Recreational opportunities in the Sacramento Valley upstream of the Delta that are influenced by CVP and SWP operations occur at Shasta Lake, Keswick Reservoir, Whiskeytown Lake, Clear Creek, Sacramento River between Keswick Dam and the Delta, Lake Oroville and Thermalito Afterbay, Yuba River from between New Bullards Bar and Feather River, Bear River between Camp Far West Reservoir and Feather River, Feather River between Thermalito Dam and the Sacramento River, Folsom Lake and Lake Natoma, American River between Nimbus Dam and the Sacramento River, and refuges that use CVP water supplies.

15.3.2.1.1 Shasta Lake

Shasta Lake is a CVP facility on the Sacramento River that is located near Redding, as described in Chapter 5, Surface Water Resources and Water Supplies. Shasta Lake is part of the Whiskeytown-Shasta-Trinity National Recreation Area and part of the Shasta-Trinity National Forest. Recreational facilities and activities at Shasta Lake are administered by the USFS. When the water storage in the lake is at full capacity (water elevation at 1067 feet msl), Shasta Lake has a surface area of approximately 30,000 acres and 365 miles of shoreline (Reclamation 2013a; USFS 2014).

Boating, water skiing, other water sports, and fishing occur in many locations in the lake. Many types of boats are used, including fishing boats, deck boats, houseboats, cabin cruisers, pontoon boats, personal watercraft, runabouts, and ski boats (Reclamation 2013a; USFS 2014). There are seven public boat ramps on Shasta Lake, as summarized in Table 15.9.

Table 15.9 Shasta Lake Boat Ramps

Location	Boat Ramp	Comments	Useable Elevations (feet, msl)
Shasta Lake	Antlers	–	1,067 to 992
Shasta Lake	Bailey Cove	–	1,067 to 1,017
Shasta Lake	Centimudi	–	1,067 to 857
Shasta Lake	Hirz Bay	–	1,067 to 972
Shasta Lake	Jones Valley	–	1,067 to 857
Shasta Lake	Packers Bay	–	1,067 to 952
Shasta Lake	Sugar Loaf	–	992 to 907

Source: USFS 2014

A boating safety issue that arises with fluctuations in water level is the associated fluctuation of the pattern of submerged obstacles. When the water level decreases, many rocks, shoals, and islands are much closer to the water surface, and can be easily struck by boats. When the water level rises, debris and obstacles that were previously easily visible may be dangerously out of sight and struck by boats (Reclamation 2013a).

Nine major marinas are located at Shasta Lake, as summarized in Table 15.10. The USFS can permit up to 3,000 boat slips at the Shasta Lake marinas (USFS 2014). Many commercial houseboats are available for rent at the marinas. Shasta Lake shoreline includes approximately 109 miles of prime houseboating areas and 153 miles of secondary houseboating areas. The USFS issues permits for houseboats and privately-owned recreational occupancy vehicles that use the water overnight. At Shasta Lake, up to 613 permits for privately-owned vessels and 450 permits for commercially-owned vessels may be issued each year.

Table 15.10 Shasta Lake Marinas and Moorage Facilities

Location	Marina and Moorage Facility	Number
Shasta Lake	Antlers Resort and Marina	101 Commercial and 200 Private Slips, including 35 Commercial Houseboats
Shasta Lake	Bridge Bay Resort	140 Commercial and 7,773 Private Slips, including 92 Commercial Houseboats
Shasta Lake	Digger Bay Marina	75 Commercial and 145 Private Slips, including 50 Commercial Houseboats
Shasta Lake	Holiday Harbor	95 Commercial and 330 Private Slips, including 70 Commercial Houseboats
Shasta Lake	Jones Valley Marina	90 Commercial and 99 Private Slips, including 64 Commercial Houseboats
Shasta Lake	Packers Bay Marina	51 Commercial Slips, including 26 Commercial Houseboats
Shasta Lake	Shasta Lake RV Resort	22 Private Slips
Shasta Lake	Shasta Marina	54 Commercial and 139 Private Slips, including 24 Commercial Houseboats
Shasta Lake	Silverthorn Resort Marina	59 Commercial and 113 Private Slips, including 35 Commercial Houseboats
Shasta Lake	Sugarloaf Cottages	16 Private Slips
Shasta Lake	Sugarloaf Marina	41 Commercial and 40 Private Slips, including 21 Commercial Houseboats
Shasta Lake	Tsasdi Resort	30 Private Slips

Source: USFS 2014

The Shasta Unit of the Whiskeytown-Shasta-Trinity National Recreation Area includes many campground sites, including campgrounds for group camping opportunities (USFS 2014), as summarized in Table 15.11. There are other campgrounds within the upper elevations of the Shasta Lake watershed that are not directly or indirectly affected by changes in surface water elevations.

Campers are also affected by declining water elevations because this increases the distance from the campsites to the shoreline. Drawdown of the reservoir has an aesthetic effect on users because the land exposed during drawdown is generally composed of bare earth and rock.

Table 15.11 Shasta Lake Major Campgrounds

Location	Campground	Comments	Number of Campsites
Shasta Lake	Antlers	–	59
Shasta Lake	Arbuckle Flat	Boat-In Campground	11
Shasta Lake	Beehive	Shoreline Campground	No specified number
Shasta Lake	Bailey Cove	–	7
Shasta Lake	Dekkas Rock	Group Campground	60
Shasta Lake	Ellery Creek	–	19
Shasta Lake	Gooseneck Cove	Boat-In Campground	8
Shasta Lake	Green’s Creek	Boat-In Campground	9
Shasta Lake	Gregory Creek	Shoreline Campground	18
Shasta Lake	Hirz Bay	Individual and Group Campground	48 Individual Sites and 200 Group Sites
Shasta Lake	Jones Valley (Upper & Lower)	Includes Shoreline Campground at Inlet	21
Shasta Lake	Lakeshore East	–	26
Shasta Lake	Lower Salt Creek	Shoreline Campground	No specified number
Shasta Lake	Mariners Point	Shoreline Campground	No specified number
Shasta Lake	McCloud Bridge	–	14
Shasta Lake	Moore Creek	Individual and Group Campground	12 Individual Sites and 90 Group Sites
Shasta Lake	Nelson Point	Individual and Group Campground	8 Individual Sites and 60 Group Sites
Shasta Lake	Oak Grove	–	45
Shasta Lake	Pine Point	Individual and Group Campground	14 Individual Sites and 100 Group Sites
Shasta Lake	Ski Island	Boat-In Campground	23

Source: USFS 2014

Shasta Lake recreational areas also include day use areas for picnicking, swimming, and other recreational opportunities, as summarized in Table 15.12. The locations for shoreline day use areas are limited due to the steep and rocky elevations at the shorelines. Uses of these locations are less desirable when the water elevations decline.

Table 15.12 Shasta Lake Day Use Areas

Location	Day Use Area	Comments	Number
Shasta Lake	Bailey Cove	Picnic and Trail	9 picnic sites 3.1 miles
Shasta Lake	Clikapudi	Trail	8 miles with 1 mile advanced trail
Shasta Lake	Dekkas Rock	Picnic	5 picnic sites
Shasta Lake	Dry Fork Creek	Trail	4.7 miles
Shasta Lake	Fisherman's Point	Picnic and Trail	7 picnic sites 0.5 miles
Shasta Lake	Hirz Bay	Trail	1.6 miles
Shasta Lake	McCloud Bridge	Picnic	5 picnic sites
Shasta Lake	Packers Bay	Trail	Four Trails: 0.4 to 2.8 miles
Shasta Lake	Potem Falls	Trail	0.3 miles
Shasta Lake	Samwel Cave Nature Trail	Interpretative Trail	1 mile
Shasta Lake	Sugarloaf	Trail	1 mile

Source: USFS 2014

Additional recreational opportunities are provided at the Shasta Dam Visitors Center.

Fishing is also popular at Shasta Lake, performed mostly by boat as opposed to from the shoreline. Anglers can catch warmwater and coldwater fish species year-round due to the summer stratification of the lake into a warm layer above a coldwater pool (Reclamation 2013a). Shasta Lake warm water fishing opportunities include Black Bass, Smallmouth Bass, Largemouth Bass, Spotted Bass, Black Crappie, Channel Catfish, and Bluegill (USFS 2014). There are many bass tournaments at Shasta Lake each summer. The cooler water strata supports fishing for Rainbow Trout and Chinook Salmon.

15.3.2.1.2 Keswick Reservoir

Keswick Reservoir is a CVP afterbay that extends 9 miles along the Sacramento River from Shasta Dam to Keswick Dam, as described in Chapter 5, Surface Water Resources and Water Supplies. Recreational facilities and activities at Keswick Reservoir are administered by BLM, Shasta County, and U.S. Forest Service for the Department of the Interior, Bureau of Reclamation (Reclamation). The maximum water storage elevation at the top of the Keswick Dam spillway is

587 feet msl (Reclamation 2009). The water level fluctuates frequently in Keswick Reservoir, depending on the operations of Shasta Dam.

Water-related activities include boating, fishing, and water sports. The Keswick Boat Launch, operated by BLM, is located on the western shoreline at the south end of the reservoir (BLM 2005).

There are several trails along Keswick Reservoir and areas for off highway vehicles (OHVs) with camping allowed at one of the locations (BLM 2005; BLM 2011). The Sacramento Rail Trail extends from Moccasin Creek below Shasta Dam to Redding along the western shoreline of Keswick Reservoir and the Sacramento River downstream of Keswick Dam. The Fisherman Trail extends along the shoreline from the lower Sacramento Rail Trail to Keswick Dam. The F.B. Trail extends from the Ribbon Bridge downstream of the Keswick Dam to Walker Mine Road along the eastern side of the Keswick Reservoir. There are several other trails at higher elevations above Keswick Reservoir, including the Hornbeck Tail, Upper and Lower Sacramento Ditch Trails, Flanagan Trail, and Chamise Peak Trail.

The Chappie-Shasta OHV Area provides over 200 miles of roads in approximately 52,000 acres (Reclamation 2013a). The area is accessed at two staging areas. The Chappie-Shasta OHV Staging Area and Shasta Campground includes a staging area for day use activities, including picnics, and 22 campsites (BLM 2005). This site is located along the western shoreline of Keswick Reservoir at the trailhead of the Sacramento Rail Trail at Moccasin Creek. The Copley Mountain OHV Staging Area is located along the western shoreline of Keswick Reservoir about midway between Shasta and Keswick dams. This site also provides a staging area for day use activities, including picnics.

Fishing opportunities are primarily for German Brown Trout and Rainbow Trout.

15.3.2.1.3 Whiskeytown Lake

Whiskeytown Lake is a CVP facility on Clear Creek that is located approximately 8 miles west of Redding on the eastern slope of the Coast Range, as described in Chapter 5, Surface Water Resources and Water Supplies. Whiskeytown Lake is part of the Whiskeytown-Shasta-Trinity National Recreation Area. Recreational facilities and activities administered by the National Park Service (NPS). When the water storage in the reservoir is at full capacity (water elevation at 1210 feet msl), Whiskeytown Lake has a surface area of 3,250 acres and 36 miles of shoreline (Reclamation 1997).

Boating, water skiing, sailing, kayaking, and canoeing, swimming, and fishing occur in many locations in the lake. Boat launches are available at Oak Bottom, Brandy Creek, and Whiskey Creek and at marinas at Oak Bottom and Brandy Creek (NPS 2012), as summarized in Table 15.13.

Table 15.13 Whiskeytown Lake Boat Ramps

Location	Boat Ramp	Comments	Useable Elevations (feet, msl)
Whiskeytown Lake	Brandy Creek	–	1210 to 1190
Whiskeytown Lake	Oak Bottom	–	1210 to 1195
Whiskeytown Lake	Oak Bottom Marina	–	1210 to 1198
Whiskeytown Lake	Whiskey Creek	–	1210 to 1195

Sources: NPS 2012; Reclamation 1997

The lake level is relatively stable and do not reduce the ability for boat launching until late summer or early fall.

The Whiskeytown Unit of the Whiskeytown-Shasta-Trinity National Recreation Area includes many campground sites, including campgrounds for group camping opportunities (NPS 2012), as summarized in Table 15.14.

Table 15.14 Whiskeytown Lake Major Campgrounds

Location	Campground	Comments	Number of Campsites
Whiskeytown Lake	Brandy Creek RV	–	37 RV Sites
Whiskeytown Lake	Brandy Creek	Primitive Campground	2 Sites
Whiskeytown Lake	Coggins Park	Primitive Campground	1 Site
Whiskeytown Lake	Crystal Creek	Primitive Campground near Crystal Creek	2 Sites
Whiskeytown Lake	Dry Creek	Group Campground	100 people
Whiskeytown Lake	Horse Camp	Primitive Campground	2 Sites
Whiskeytown Lake	Oak Bottom Tent and Recreation Vehicle (RV)	–	98 Tent Sites and 22 RV Sites
Whiskeytown Lake	Peltier Bridge	Primitive Campground near Clear Creek	9 Sites
Whiskeytown Lake	Sheep Camp	Primitive Campground	4 Sites

Source: NPS 2012

Whiskeytown Lake recreational areas also include day use areas for picnicking, swimming, and other recreational opportunities, as summarized in Table 15.15. Shoreline day use areas are limited at some locations due to the steep and rocky elevations at the shorelines.

Table 15.15 Whiskeytown Lake Day Use Areas

Location	Day Use Area	Comments	Number
Whiskeytown Lake	Boulder Creek Falls	Trail	1 mile with 2.75-mile advanced trail
Whiskeytown Lake	Brandy Creek Beach and Falls	Picnic, Swimming, and Trails	1.6 and 1.5 miles
Whiskeytown Lake	Buck Hollow	Trail	1 mile
Whiskeytown Lake	Camden Water Ditch	Trail	1.1 miles
Whiskeytown Lake	Clear Creek Canal and Vista	Picnic and Trails	2.4 and 4.5 miles
Whiskeytown Lake	Crystal Creek Water Ditch and Falls	Picnic and Trails	0.75 and 0.3 miles
Whiskeytown Lake	Davis Gulch	Trail	3.3 miles
Whiskeytown Lake	East Beach	Swimming	–
Whiskeytown Lake	Guardian Rock	Trail	0.25 miles
Whiskeytown Lake	James K. Carr Trail	Trail	1.7 miles
Whiskeytown Lake	Judge Francis Carr Powerhouse	Picnic	–
Whiskeytown Lake	Kanaka Peak	Trail	3.6 miles
Whiskeytown Lake	Logging Camp	Trail	1 mile
Whiskeytown Lake	Mill Creek	Trail	6.1 miles
Whiskeytown Lake	Mt. Shasta Mine	Trail	3.5 miles
Whiskeytown Lake	Mule Mountain Pass	Trail	4.4 miles
Whiskeytown Lake	Oak Bottom Beach	Picnic and Swimming	–
Whiskeytown Lake	Oak Bottom Ditch	Trail	2.75 miles
Whiskeytown Lake	Papoose Pass	Trail	5.5 miles
Whiskeytown Lake	Peltier	Trail	1.75 miles
Whiskeytown Lake	Rich Gulch	Trail	1.8 miles
Whiskeytown Lake	Salt Creek	Trail	1.8 miles
Whiskeytown Lake	Salt Gulch	Trail	1.6 miles
Whiskeytown Lake	Shasta Divide Nature Trail	Trail	0.4 miles
Whiskeytown Lake	Whiskey Creek	Group Picnic Area and Swimming	–

Source: NPS 2012

Additional recreational opportunities are provided at the Whiskeytown Visitors Center.

Fishing opportunities at Whiskeytown Lake include Brown Trout and Rainbow Trout; Kokanee Salmon; Smallmouth Bass, Largemouth Bass, and Spotted Bass; Bluegill; crappie; and Sacramento Pikeminnow (NPS No Date).

15.3.2.1.4 Clear Creek from Whiskeytown Dam to the Sacramento River

Whiskeytown Lake is operated to release most of the water through the Spring Creek Power Conduit into Keswick Reservoir, as described in Chapter 5, Surface Water Resources and Water Supplies. Flows are also released from Whiskeytown Lake to Clear Creek to be consistent with federal and state requirements. During high flow events, additional flows may be released into Clear Creek.

The initial reaches of Clear Creek downstream of the Whiskeytown Dam are located within the Whiskeytown-Shasta-Trinity National Recreation Area. The remaining portions of Clear Creek flow to the Sacramento River through lands owned by BLM and private owners. All of these reaches are located within Shasta County and the most eastern reaches are within the City of Redding.

BLM has established the Clear Creek Greenway along a large portion of the lower Clear Creek from within the Whiskeytown-Shasta-Trinity National Recreation Area to the Sacramento River (BLM n.d.). The area also includes the Horsetown-Clear Creek Preserve which is a private-public partnership recreation area.

Hiking, picnicking, kayaking, swimming, fishing, and gold panning occur along the lower Clear Creek (SRWP 2010). The Clear Creek Greenway includes ten trails and eight picnic areas (BLM n.d.). Hunting is allowed in the Swasey and Muletown Road areas of the Clear Creek Greenway. Fishing opportunities include steelhead, Chinook Salmon, carp, suckers, Bluegill, bass, and Sacramento Pikeminnow (SRWP 2010).

15.3.2.1.5 Sacramento River from Keswick Dam to the Delta

The Sacramento River from Keswick Dam to the Sacramento-San Joaquin Delta (Delta) is divided into three reaches for discussion in this section: Keswick Reservoir to Red Bluff, Red Bluff to the Feather River, and Feather River confluence to the Delta (near the City of West Sacramento).

Sacramento River from Keswick Dam to Red Bluff

The upper reach of the Sacramento River flows for approximately 60 miles from Keswick Dam to Red Bluff (Reclamation 1997). Water-related recreational activities include boating, picnicking, camping, and wildlife viewing. Boating opportunities include motor-boating, jet-skiing, kayaking, canoeing, and whitewater rafting in some locations (Reclamation 2013a, Reclamation et al. 2002). River flows can increase for short-term periods when water is being released from the CVP facilities and during and following storm events in the upper Sacramento River watershed. Flows in the late fall months may decrease to levels that are not favorable for boating. Water temperatures in this reach are generally cold throughout the year.

Much of the land along the Sacramento River between Balls Ferry and Red Bluff is owned and managed by BLM (Reclamation 2013a). Public access points are provided by the cities of Redding and Anderson and the BLM. Lake Redding Park, Turtle Bay, and the Anderson River Park are some of the prominent access areas. Boat launching can occur at eight public boat ramps and two smaller launch facilities, including at Turtle Bay, Caldwell Park, and South Bonneyview in the City of Redding; Ball Ferry; Battle Creek confluence with the Sacramento River; Bend Bridge; and Red Bluff River Park in the City of Red Bluff.

There are two whitewater river reaches, including between Keswick Dam and the Anderson-Cottonwood Irrigation District Diversion Dam and between Anderson River Park and William B. Ide Adobe State Historic Park.

Camping facilities include public campgrounds along the Sacramento River at Lake Red Bluff Recreation Area (Reclamation 2013a).

There are trails or trail access and picnicking facilities with access to the river in this reach of the Sacramento River (Reclamation 2013a). The trails include the 13-mile Sacramento River Trail between Keswick Dam to Turtle Bay Park in the City of Redding. Many of the picnicking locations are managed by local municipalities, including the cities of Redding, Anderson, and Red Bluff. Coleman National Fish Hatchery, located along Battle Creek near the Sacramento River, provides recreational and educational opportunities.

Fishing opportunities along the upper Sacramento River include Chinook Salmon, steelhead, Rainbow Trout, sunfish, and bass (Reclamation 2013a). Fishing can occur from boats along the Sacramento River and at four public fishing access points, including Turtle Bay East, Kapusta Property, Deschutes Road, Reading Island, Diestlehorst Pasture River Access, Jellys Ferry, and Sacramento River Island.

The Mouth of Cottonwood Creek Wildlife Area is operated by California Department of Fish and Wildlife (DFW). This area provides viewing opportunities for Swainson’s Hawk, Bald Eagle, ringtail cat, River Otter, and other birds and wildlife (Reclamation 2013a). Hunting opportunities on BLM land occur at Inks Creek, Massacre Flat, Perry Rifle, Paynes Creek, Bald Hill and Iron Canyon. Commonly hunted game includes quail, dove, waterfowl, deer, pig, turkey, and bear (Reclamation 2013a).

Sacramento River from Red Bluff to Feather River

The middle reach of the Sacramento River flows approximately 160 miles from Red Bluff to the confluence with the Feather River (Reclamation 1997).

Water-dependent activities along the middle reach include boating, swimming, and fishing (Reclamation 2005a). Water-contact activities are popular in this section of the river due to relatively warm water. Public access points are provided along this reach by California Department of Parks and Recreations (State Parks); and Tehama, Glenn, Colusa, and Sutter counties (Reclamation 2005a; Reclamation 1997). River access in this reach is primarily provided at private fishing access points, marinas, and resorts.

The three major State Parks properties along the middle reach include the Woodson Bridge State Recreation Area, the Bidwell-Sacramento River State Park, and the Colusa-Sacramento River State Recreation area (DFG 2004; Reclamation 2013a). Public access for fishing, hunting, and wildlife viewing also is provided at the DFW Fremont Weir Wildlife Area (DFW 2014a).

Fishing opportunities include Chinook Salmon, steelhead, trout, American Shad, sturgeon, catfish, and Striped Bass (Reclamation 2005a).

Seasonal game includes Ring-necked Pheasants, California Quail, various species of ducks and geese, Mourning Doves, and Mule Deer (Reclamation 2013a).

Sacramento River from Feather River to the Northern Delta Boundary

The lower reach of the Sacramento River flows for approximately 20 river miles between the confluence with Feather River and immediately downstream of the confluence with the American River (USACE 1991). The major portion of this reach of the Sacramento River flows along private property.

Water-related activities in this reach include boating, swimming and beach use, picnicking, biking, sightseeing, and fishing. Public access is provided by Yolo County at Elkhorn Regional Park (Yolo County); Sacramento County and the City of Sacramento at Discovery Park and Miller Park, respectively (Sacramento County 2012; Reclamation 2005a); and by the City of West Sacramento at Broderick Boat Ramp (West Sacramento 2000).

Fishing opportunities in this area include Chinook Salmon, steelhead, American Shad, sturgeon, catfish, and Striped Bass (Reclamation 1997, 2005a).

15.3.2.1.6 Sacramento Valley Wildlife Refuges

Wildlife refuges in the Sacramento Valley that rely upon CVP water supplies include the Sacramento National Wildlife Refuge (NWR) Complex include Sacramento, Delevan, Colusa, and Sutter NWRs and Gray Lodge Wildlife Area, as described in Chapter 5, Surface Water Resources and Water Supplies, and Chapter 10, Terrestrial Biological Resources (Reclamation 2012). Water-related activities include wildlife viewing, hiking along the refuge wetlands, and waterfowl hunting. Shoreline fishing opportunities at Gray Lodge Wildlife Area include bass, sunfish, perch, catfish, and carp (DFW 2014b)

15.3.2.1.7 Feather River Watershed

Antelope Lake, Lake Davis, and Frenchman Lake located in the Upper Feather River; Lake Oroville and Thermalito Forebay and Afterbay; and the lower Feather River are located within areas in the Feather River watershed that could be affected by changes in CVP and/or SWP operations.

Upper Feather River Lakes

The Upper Feather River Lakes, including Antelope Lake, Lake Davis, and Frenchman Lake, are SWP facilities on the upper Feather River upstream of Lake Oroville. These lakes are part of the Plumas National Forest (DWR 2013a).

Recreational facilities and activities at all three lakes are managed by private concessionaires under contract with the Plumas National Forest.

For Antelope Lake, when the water storage in the lake is at full capacity (water elevation at 5,002 feet), the lake has a surface area of 930 acres and 15 miles of shoreline (DWR 2013a; USFS 2011). Water related activities include boating, water skiing, swimming, fishing, camping, and picnicking. There is a boat launching ramp, three fishing access sites, and a picnic area. There are three campgrounds at Antelope Lake, including Boulder Creek, Lone Rock, and Long Point. There are approximately 194 campsites and 4 group campsites at the three campgrounds for use between May through October. Fishing opportunities in Antelope Lake include Rainbow Trout, Brook Trout, crappie, Channel Catfish, and Smallmouth Bass, Largemouth Bass. Hunting opportunities around Antelope Lake include Mule Deer and Black-tailed Deer.

For Lake Davis, when the water storage in the lake is at full capacity (water elevation at 5,785 feet), the lake has a surface area of 4,030 acres and 32 miles of shoreline (DWR 2013a; USFS 2006a). Water related activities include boating, fishing, camping, and picnicking. There are boat launching ramps at Lightning and Honker Cove, car-top boat ramp at Mallard Cove, a fishing access site, and a picnic area. There are three campgrounds at Lake Davis, including Grizzly, Grasshopper, and Lightning Tree. There are approximately 180 campsites at the three campgrounds for use between May through October. Fishing opportunities in Lake Davis include Rainbow Trout, German Brown Trout, Eagle Lake trout, Brown Bullhead, and Largemouth Bass. Hunting opportunities around Lake Davis include Mule Deer and Black-tailed Deer.

For Frenchman Lake, when the water storage in the lake is at full capacity (water elevation at 5,588 feet), the lake has a surface area of 1,580 acres and 21 miles of shoreline (DWR 2013a; USFS 2006b). Water related activities include boating, water skiing, swimming, fishing, camping, picnicking, and ice fishing. There are two boat launching ramps (Frenchman and Lunker Point), six fishing access sites, and a picnic area. There are five campgrounds at Frenchman Lake, including Chilcoot, Cottonwood Springs, Frenchman, Spring Creek, and Big Cove. There are approximately 209 campsites and 2 group campsites at the five campgrounds for use between May through October. Fishing opportunities in Frenchman Lake include Rainbow Trout, Brown Trout, Eagle Lake trout, and Smallmouth Bass. Hunting opportunities around Frenchman Lake include deer and waterfowl.

Lake Oroville and Thermalito Forebay and Afterbay

Lake Oroville and Thermalito Forebay and Afterbay are SWP facilities on the Feather River, as described in Chapter 5, Surface Water Resources and Water Supplies. The upper North Fork arm of Lake Oroville is part of the Lassen National Forest; and the upper Middle Fork and South Fork arms of Lake Oroville are part of Plumas National Forest. The Middle Fork Feather River (from Beckwourth downstream of Lake Davis to Lake Oroville) was designated as part of Public Law 90-542 (Wild and Scenic Rivers Act) to be part of the National Wild and Scenic Rivers System on October 2, 1968. Recreational facilities and activities at the Lake Oroville Complex (including Lake Oroville and Thermalito

Forebay and Afterbay) are managed by State Parks as part of the Lake Oroville State Recreation Area. When the water storage in the lake is at full capacity (water elevation at 900 feet msl), Lake Oroville has a surface area of 15,810 acres and 167 miles of shoreline. Thermalito Forebay has a surface area of 630 acres. Thermalito Afterbay has a surface area of 4,300 acres and 26 miles of shoreline when the water elevation is at 136.5 feet msl (DWR 2007a, 2007c, 2013b).

Water-related activities include boating, whitewater boating, camping, picnicking, and fishing (DWR 2007a). Boating includes kayaking, canoeing, and fishing boats. Whitewater boating occurs on the Big Bend area of the North Fork Feather River when Lake Oroville elevations are sufficiently low to expose several miles of river. This portion of the North Fork Feather River forms the Upper North Fork arm of Lake Oroville. Generally, this area is exposed in the late fall months. Another whitewater area is located in the Bald Rock Canyon on the Middle Fork Feather River. This whitewater area is located upstream of the Middle Fork arm of Lake Oroville.

There are 11 boat ramps on Lake Oroville, as summarized in Table 15.16. Two of the boat ramps are located at marinas (DWR 2007a).

Table 15.16 Lake Oroville, Thermalito Forebay, and Thermalito Afterbay Boat Ramps

Location	Boat Ramp	Comments	Useable Elevations (feet, msl)
Lake Oroville	Bidwell Canyon	Day Use Area Marina with 280 berths and 400 mooring anchors	900 to 700
Lake Oroville	Dark Canyon	Car-Top Launching	900 to 765
Lake Oroville	Enterprise		900 to 835
Lake Oroville	Foreman Creek	Car-Top Launching	900 to approximately 800
Lake Oroville	Lime Saddle	Day Use Area Marina, including houseboat rentals	900 to 702
Lake Oroville	Loafer Creek	Boat-In Campground	900 to 775
Lake Oroville	Monument Hill	Day Use Area	900 to approximately 700
Lake Oroville	Nelson Bar	Car-Top Launching	900 to 825
Lake Oroville	Spillway	Day Use Area	900 to 695
Lake Oroville	Stringtown Creek	Car-Top Launching	900 to 866
Lake Oroville	Vinton Gulch	Car-Top Launching	900 to 825

Location	Boat Ramp	Comments	Useable Elevations (feet, msl)
Thermalito Forebay	North Thermalito Forebay	Day Use Area Also used by California State University, Chico	Water elevation does not vary substantially
Thermalito Forebay	South Thermalito Forebay	Day Use Area	Water elevation does not vary substantially
Thermalito Afterbay	Larkin Road	Car-Top Launching	Water elevation does not vary substantially
Thermalito Afterbay	Oroville Wildlife Area		Water elevation does not vary substantially
Thermalito Afterbay	Thermalito Afterbay Outlet		Water elevation does not vary substantially
Thermalito Afterbay	Wilbur Road		Water elevation does not vary substantially

Sources: DWR 2006, 2007a

There are 16 campgrounds at Oroville Lake and Thermalito complex (DWR 2007a), as summarized in Table 15.17. Campers are affected by declining water elevations because this increases the distance from the campsites to the shoreline, and makes it difficult to access shoreline campgrounds at Bidwell Canyon, Lime Saddle, and Loafer Creek when water elevations are lower than 850 feet msl.

Table 15.17 Lake Oroville, Thermalito Forebay, and Thermalito Afterbay Major Campgrounds

Location	Campground	Comments	Number of Campsites
Lake Oroville	Bidwell Canyon	Campground	75
Lake Oroville	Bloomer Cove	Boat-In Campground	5
Lake Oroville	Bloomer Group	Boat-In Group Campground	75
Lake Oroville	Bloomer Knoll	Boat-In Campground	6
Lake Oroville	Bloomer Point	Boat-In Campground	25
Lake Oroville	Craig Saddle	Boat-In Campground	18
Lake Oroville	Floating Campsites	Boat-In Campground	10 Different Locations with approximately 15 sites per location
Lake Oroville	Foreman Creek	Boat-In Campground	26
Lake Oroville	Goat Ranch	Boat-In Campground	5
Lake Oroville	Lime Saddle	Campground and Group Campground	45

Location	Campground	Comments	Number of Campsites
Lake Oroville	Loafer Creek	Campground and Group Campground Horse Campground	137 6 15
Thermalito Forebay	North Thermalito Forebay “En Route”	Recreational Vehicle Campground	15
Thermalito Afterbay	Oroville Wildlife Area	Primitive Campground	Several

Sources: DWR 2006, 2007a

Lake Oroville recreational areas also include day use areas for picnicking, swimming, and other recreational opportunities, as summarized in Table 15.18. The locations for shoreline day use areas are limited due to the steep and rocky elevations at the shorelines. Uses of these locations are less desirable when the water elevations decline. It is difficult to access shoreline campgrounds at Bidwell Canyon and Loafer Creek when water elevations are lower than 850 feet msl.

Table 15.18 Lake Oroville, Thermalito Forebay, and Thermalito Afterbay Day Use Areas

Location	Day Use Area	Comments	Number
Lake Oroville	Bidwell Canyon With Saddle Dam trailhead	Trail and picnic	4.9 mile trail (hiking and bicycling) 21 picnic sites
Lake Oroville	Chaparral Trail	Interpretative Trail	0.2 miles
Lake Oroville	Dan Beebe Trail With Saddle Dam, Lakeland Boulevard, Oro Dam Boulevard, and visitor center trailheads	Trail	14.3 mile trail (equestrian and hiking)
Lake Oroville	Lake Oroville Visitors Center	Visitors Center and picnic	18 picnic sites
Lake Oroville	Lime Saddle	Picnic	13 picnic sites
Lake Oroville	Loafer Creek	Trail, swimming, and picnic	3.2 mile trail (equestrian and hiking) 1.7 mile trail (hiking and bicycling) 30 picnic sites
Lake Oroville	Model Aircraft Flying Facility	Aircraft staging and picnic	6 picnic sites

Location	Day Use Area	Comments	Number
Lake Oroville	Oroville Dam Overlook and Spillway Day Use Area	Trail, picnic, and shoreline fishing	1 mile along Oroville Dam crest 8 picnic sites
Lake Oroville	Potter's Ravine	Trail	5.5 miles
Lake Oroville	Roy Rogers Trail	Trail	4 miles (equestrian and hiking)
Lake Oroville	Sewim Bo Trail	Trail and picnic	0.5 miles (equestrian and hiking) 1 picnic site
Lake Oroville	Wyk Island Trail	Trail	0.2 miles
Feather River downstream of Oroville Dam	Feather River Fish Hatchery	Hatchery and picnic	1 picnic site
Oroville Dam Crest, Diversion Pool, Thermalito Forebay, and Thermalito Afterbay	Brad Freeman Trail Diversion Pool access road, East Hamilton Road, Powerhouse Road, Toland Road, and Tres Vias Road trailheads	Trail Loop	41 miles
Thermalito Forebay	North Thermalito Forebay	Picnic, swimming, and shoreline fishing	117 picnic sites
Thermalito Forebay	South Thermalito Forebay	Picnic, swimming, and shoreline fishing	10 picnic sites
Thermalito Afterbay	Monument Hill	Picnic, swimming, and shoreline fishing	10 picnic sites
Oroville Wildlife Area	Rabe Road Shooting Range	Range and target shooting and picnic	7 picnic sites
Oroville Wildlife Area	Clay Pit State Vehicular Recreation Area	Off-highway vehicle riding	–
Thermalito Afterbay	Thermalito Afterbay Outlet and Oroville Wildlife Area	Trail, picnic, shoreline fishing, and hunting	Several trails and day use areas

Sources: DWR 2006, 2007a

Fishing is popular at the Lake Oroville complex and is performed by boat and from the shoreline (DWR 2007a). Fishing opportunities in Lake Oroville include Smallmouth Bass, Largemouth Bass, Spotted Bass, red-eye bass, Black Crappie, Bluegill, Green Sunfish, Channel Catfish, and White Catfish, Coho Salmon, Rainbow Trout, and Brown Trout. In Thermalito Forebay, fish species include Brook Trout, Brown Trout, Rainbow Trout, and Chinook Salmon. In Thermalito Afterbay, fishing opportunities include Smallmouth Bass, Largemouth Bass, trout, Channel Catfish, White Catfish, and carp. Downstream in the Feather River, fishing opportunities include steelhead, Chinook Salmon, American Shad, Smallmouth Bass, Largemouth Bass, and White Sturgeon.

Hunting opportunities occur around Thermalito Afterbay and/or Oroville Wildlife Area for turkey (in the spring), dove, quail, waterfowl, pheasant, deer, squirrel, and rabbit.

Feather River from Thermalito Afterbay/Oroville Wildlife Area to Sacramento River

The Feather River flows from the Thermalito Dam to approximately 40 miles downstream to the confluence with the Sacramento River (Reclamation 1997). The Feather River Wildlife Area, managed by DFW, is located along the Feather River near the confluence with the Bear River. The Feather River Wildlife Area includes the Abbott Lake, Star Bend, O'Connor Lakes, Lake of the Woods, and Nelson Slough units; and Bobelaine Audubon Ecological Reserve (DFG 2008a). The southern boundary of the wildlife area is located adjacent to the Sutter Bypass. In Sutter County, water-related recreation opportunities along the Feather River also include public access at Donahue Road Park, Tisdale Boat Ramp, Boyd's Pump boat launch, Feather River parkway, Yuba City Boat Ramp, Riverfront Park in Marysville, and Live Oak Park and Recreation Area (Sutter County 2010). There are several private facilities that offer camping, boating, and river access.

15.3.2.1.8 Yuba River Watershed

Portions of the Yuba River watershed along the North Yuba River between New Bullards Bar Reservoir and Englebright Lake and along the Lower Yuba River between Englebright Lake and the Feather River could be affected by operation of the Lower Yuba River Water Accord (DWR et al. 2007), as described in Chapter 5, Surface Water Resources and Water Supplies. New Bullards Bar Dam and Reservoir are owned and operated by the Yuba County Water Agency to provide flood control, water storage, and hydroelectric generation. The Harry L. Englebright Dam and Reservoir were constructed by the California Debris Commission downstream of New Bullards Bar Reservoir to trap and store sediment from historical hydraulic mining sites in the upper watershed, and provide recreation and hydroelectric generation opportunities (USACE 2013). Following decommissioning of the California Debris Commission in 1986, administration of Englebright Dam and Reservoir (Lake) was assumed by the U.S. Army Corps of Engineers.

Portions of the watershed along the Middle Yuba River between New Bullards Bar Reservoir and Englebright Reservoir are within the Plumas and Tahoe national forests. There are also lands owned and managed by the Bureau of Land Management and U.S. Army Corps of Engineers along this reach of the river.

This reach also includes the confluence with the South Yuba River. Portions of the Lower South Yuba River are designated as a California Wild and Scenic River (USFS et al. No Date). Portions of the South Yuba River State Park located near the confluence along the South Yuba River and Yuba River provide recreational opportunities for swimming, fishing, bird watching, and gold panning (State Parks 2009).

New Bullards Bar Reservoir

The New Bullards Bar Reservoir has a storage capacity of 966,103 acre-feet when the water elevation is at 1,956 feet. When full, the lake has a surface area of 4,790 acres and 71.9 miles of shoreline (YCWA 2012). Recreational facilities and activities are the responsibility of Yuba County Water Agency. Water related activities include boating, fishing, camping from May through September, and picnicking (DWR et al. 2007). There are several campgrounds adjacent to the lake, including Schoolhouse and Dark Day campgrounds along the shoreline and Madrone Cove and Garden Point that are only accessed by boat. Boat access is provided at Emerald Cove Resort and Marina, Cottage Creek, and Dark Day. The Cottage Creek and Dark Day boat ramps are not useable when the lake elevation declines below 1,822 and 1,798 feet, respectively. Fishing opportunities include Rainbow Trout, Brown Trout, Kokanee Salmon, Bluegill, crappie, Bullhead, Smallmouth Bass, and Largemouth Bass.

Englebright Reservoir

The Englebright Reservoir has a storage capacity of approximately 70,000 acre-feet when the water elevation is at 527 feet (USACE 2012, 2013, 2014). When full, the lake has a surface area of 815 acres and 24 miles of shoreline. Recreational facilities and activities are the responsibility of U.S. Army Corps of Engineers. Water related activities include boating, water-skiing, fishing, boat-access camping, and picnicking. There are 96 boat-access only camping sites. There are two boat ramps to provide access to the lower part of the lake. The upper portion of the lake is characterized by narrow canyons and sharp bends which limit boat access. Fishing opportunities include Rainbow Trout, Brown Trout, Kokanee Salmon, sunfish, catfish, Smallmouth Bass, and Largemouth Bass.

Lower Yuba River

Hiking and boating opportunities occur along the 24 miles of the Lower Yuba River between Englebright Reservoir and the Feather River (DWR et al. 2007). Public river access is provided at several locations to support fishing, picnicking, rafting, kayaking, tubing, and swimming. Fishing opportunities include American Shad, Chinook Salmon, steelhead, Smallmouth Bass, and Striped Bass.

15.3.2.1.9 American River Watershed

Folsom Lake and Lake Natoma on the American River and the lower American River are located within areas in the American River watershed that could be affected by changes in CVP and/or SWP operations.

Folsom Lake and Lake Natoma

Folsom Lake is a CVP facility on the American River, as described in Chapter 5, Surface Water Resources and Water Supplies. The El Dorado National Forest is located in the upper American River watershed upstream of Folsom Lake. The State of California designated the North Fork American River from the source to Iowa Hill Bridge upstream of Folsom Lake as wild and scenic. Recreational facilities and activities in the Folsom Lake area are within the Folsom Lake State Recreation Area or the Folsom Powerhouse State Historic Park that are managed by State Parks. Recreational activities upstream of Folsom Lake occur on or adjacent to many lands owned by the Bureau of Land Management, State Parks, and El Dorado County. When the water storage in the lake is at full capacity (466 feet msl), Folsom Lake has a surface area of 11,450 acres and 75 miles of shoreline (State Parks and Reclamation 2003, 2007).

The upper extent of Lake Natoma is located about 1 mile downstream of Folsom Dam. Lake Natoma continues from the Rainbow Bridge to Nimbus Dam, about a 4-mile distance (State Parks and Reclamation 2003, 2007). Recreational facilities and activities at the Lake Natoma area are part of the Folsom Lake State Recreation Area and managed by State Parks. When the water storage in the reservoir is at full capacity (132 feet msl), Lake Natoma has a surface area of 540 acres and 14 miles of shoreline.

Water-related activities at Folsom Lake include boating, jet skiing, water skiing, wind surfing, rafting, sailing, canoeing, kayaking, swimming, and fishing (Reclamation 2005b; State Parks and Recreation 2003, 2007). White water rafting occurs along the South Fork American River upstream of Folsom Lake and at Skunk Hollow and Salmon Falls.

Water-related activities at Lake Natoma generally only includes paddling, rowing, and fishing due to a 5 miles/hour speed limit for motorized watercraft. California State University Sacramento operates an aquatic center at Lake Natoma (Reclamation et al. 2006).

Folsom Lake Marina at Brown’s Ravine is the only marina at Folsom Lake. There are six boat launch facilities at Folsom Lake and three boat launch facilities at Lake Natoma, as summarized in Table 15.19.

Table 15.19 Folsom Lake and Lake Natoma Boat Ramps

Location	Boat Ramp	Comments	Useable Elevations (feet, msl)
Folsom Lake	Beal’s Point	Day Use Area Informal Boat Ramp	465 to 420
Folsom Lake	Brown’s Ravine	Day Use Area Folsom Lake Marina with 685 wet slips and 175 dry storage slips	466 to 395
Folsom Lake	Folsom Point	–	466 to 406

Location	Boat Ramp	Comments	Useable Elevations (feet, msl)
Folsom Lake	Granite Bay	Day Use Area Largest Boat Launch Facility at Folsom Lake	466 to 360
Folsom Lake	Hobie Cove	–	426 to 375
Folsom Lake	Peninsula	Day Use Area	466 to 410
Folsom Lake	Rattlesnake Bar	–	466 to 425
Lake Natoma	Negro Bar	–	121 to 115
Lake Natoma	Nimbus Flat	Main Boat Ramp Informal Boat Ramp	128 to 115 128 to 120
Lake Natoma	Willow Creek	Informal Boat Ramp	125 to 115

Sources: Reclamation et al. 2006; State Parks and Reclamation 2003, 2007

Campgrounds are located at Folsom Lake and Lake Natoma, as summarized in Table 15.20. Campers are also affected by declining water elevations because this increases the distance from the campsites to the shoreline. Drawdown of the reservoir has an aesthetic effect on users because the land exposed during drawdown is generally composed of bare earth and rock.

Table 15.20 Folsom Lake and Lake Natoma Major Campgrounds

Location	Campground	Comments	Number of Campsites
Folsom Lake	Beal's Point	–	49 Camp Sites 20 Recreation Vehicles
Folsom Lake	Peninsula	Campground Boat-In Campground	104 Camp Sites
Lake Natoma	Negro Bar	Group Campground	3 Major Camp Sites

Note: State Parks and Reclamation 2003, 2007; Reclamation et al. 2006

Folsom Lake and Lake Natoma recreational areas also include day use areas for picnicking, swimming, and other recreational opportunities, as summarized in Table 15.21. The locations for shoreline day use areas are limited due to the steep and rocky elevations at the shorelines. Uses of these locations are less desirable when the water elevations decline. The Jedediah Smith Memorial Trail begins at Beal's Point and extends along Lake Natoma to the confluence of the American River and Sacramento River downstream of Nimbus Dam. The Pioneer Express Trail which extends from the Auburn State Recreation Area to Beal's Point is part of the Western States Pioneer Express Trail (a National Recreation Trail).

Table 15.21 Folsom Lake and Lake Natoma Day Use Areas

Location	Day Use Area	Comments	Number
Folsom Lake	Beal's Point	Picnic and Swimming Trailhead for Jedediah Smith Memorial Trail	53 picnic sites in Day Use area 69 at campground
Folsom Lake	Brown's Ravine Trail	Trail (to Old Salmon Falls)	12 miles
Folsom Lake	Darrington Trail	Trail	9 miles
Folsom Lake	Doton's Point ADA Trail	Trail	1 mile
Folsom Lake	Folsom Point	Picnic and water skiing Trail (to Brown's Ravine Trail)	50 picnic sites 4 miles
Folsom Lake	Folsom Powerhouse	Historic Site and Museum Trail	10 picnic sites 1 mile
Folsom Lake	Folsom Reservoir River Access Areas	Whitewater rafting (South Fork)	40 commercial rafting outfitters with 67 permits No permits for private boats
Folsom Lake	Granite Bay	Trail Picnic, Swimming, fishing, equestrian, and hiking	Several trails: 1 to 5 miles 100 picnic sites
Folsom Lake	Los Lagos Trail	Trail	1.5 miles
Folsom Lake	Old Salmon Falls	Swimming, equestrian, and hiking Trailhead for Brown's Ravine and Sweetwater trails	–
Folsom Lake	Peninsula	Trail Picnic	1 mile 6 picnic sites in Day Use area 104 at campground
Folsom Lake	Pioneer Express Trail	Trail	21 miles
Folsom Lake	Rattlesnake Bar	Equestrian	–
Folsom Lake	Skunk Hollow and Salmon Falls	Whitewater rafting (South Fork)	–

Location	Day Use Area	Comments	Number
Folsom Lake	Sweetwater Creek	Trailhead for Sweetwater Trail	–
Folsom Lake	Sweetwater Trail	Trail	2 miles
Lake Natoma	Lake Natoma Trails	Trail	Several trails: 1 to 10 miles
Lake Natoma	Lake Overlook	Trailhead for Lake Natoma Trail	–
Lake Natoma	Negro Bar	Picnic, fishing, and equestrian Trailhead for Lake Natoma Trail	32 picnic sites in Day Use area 17 at campground
Lake Natoma	Nimbus Fish Hatchery	Hatchery	–
Lake Natoma	Nimbus Flat	California State University, Sacramento Aquatic Center Trailhead for Lake Natoma Trail	37 picnic sites
Lake Natoma	Willow Creek	Trailhead for Lake Natoma Trail	4 picnic sites

Sources: Reclamation et al. 2006; State Parks and Reclamation 2003, 2007

Fishing is also popular at Folsom Lake and Lake Natoma from boats and the shoreline. Anglers can catch warmwater and coldwater fish species due to the summer stratification of the lake into a warm layer above a coldwater pool especially in Folsom Lake (State Parks and Reclamation 2007). Warm water fishing opportunities include Smallmouth Bass, Largemouth Bass, Spotted Bass, and black and White Crappie. The cooler water strata support fishing for Rainbow Trout, Brown Trout, and Chinook Salmon.

American River from Nimbus Dam to the Confluence with Sacramento River

The American River flows 14 miles between Nimbus Dam and the confluence with the Sacramento River was designated by the Secretary of the Interior to be part of the National Wild and Scenic Rivers System on January 19, 1981. The State of California also designated the Lower American River as wild and scenic under Public Resources Code sections 5093.54 and 5093.545.

The Jedediah Smith Memorial Trail (also known as the American River Bike Trail) continues along the American River from Beal's Point at Folsom Lake, along Folsom Lake and Lake Natoma, and along the Lower American River through Discovery Park to the confluence with the Sacramento River (Reclamation 2005b).

The American River Parkway is a 26-mile green space designated and managed by Sacramento County Parks and Recreation along the Lower American River from Nimbus Dam to the confluence with the Sacramento River at Discovery Park. This parkway provides extensive recreational opportunities, including boating rafting, kayaking, canoeing, swimming, and fishing (Reclamation 2005b; Sacramento County 2008). Pedestrian access is provided at 87 locations along the parkway. Bicycle access and equestrian access are provided at 65 and 37 locations, respectively. Boat launch ramps are provided at 7 locations and Car-top Boat Launch opportunities are provided at 17 locations. Picnic locations are located at numerous locations along the American River. Fishing opportunities along the Lower American River include Chinook Salmon, steelhead, trout, Striped Bass, American Shad, Largemouth Bass, Bluegill, crappie, sunfish, and catfish (Sacramento County 2008).

Sacramento Municipal Utility District – Rancho Seco Park and Lake

Rancho Seco Park and Lake, operated by Sacramento Municipal Utility District, is used to store CVP water (Reclamation 2005b). The lake has a surface are of 160 acres. Water-related activities include boating, camping, picnicking, bird watching and fishing. Facilities available for these activities are two boat ramps and a fish cleaning facility. Game fish species found at the lake include catfish, Bluegill, crappie, and trout. Birds that use the area include ducks, geese, hawks, Bald Eagles, blue heron, and migratory birds (SMUD 2013).

15.3.2.2 San Joaquin Valley

Recreational opportunities in the San Joaquin Valley upstream of the Delta that are influenced by CVP and SWP operations occur at Millerton Lake, San Joaquin River between Friant Dam and the Delta, New Melones Reservoir, Stanislaus River between Tulloch Dam and San Joaquin River, San Luis Reservoir complex, recreation areas along Delta Mendota Canal and California Aqueduct, and refuges that use CVP water supplies.

15.3.2.2.1 Millerton Lake

Millerton Lake is a CVP facility on the San Joaquin River, as described in Chapter 5, Surface Water Resources and Water Supplies. Millerton Lake is part of the Millerton State Recreation Area. Recreational facilities and activities at Millerton Lake are administered by State Parks. When the water storage in the lake is at full capacity (water elevation at 580.6 feet msl), Millerton Lake has a surface area of approximately 4,900 acres and 44 miles of shoreline (Reclamation and DWR 2011).

Boating, sailing, water skiing, jetskiing, swimming, tournament and recreational fishing, camping, and picnicking (Reclamation and DWR 2011; Reclamation and State Parks 2010). Whitewater rafting opportunities occur upstream of Millerton Lake. There are six public boat ramps on Millerton Lake, as summarized in Table 15.22.

Table 15.22 Millerton Lake Boat Ramps

Location	Boat Ramp	Comments	Useable Elevations (feet, msl)
Millerton Lake	Crow's Nest	On South Shore	580 to 487
Millerton Lake	Grange Cove	On South Shore	Several Boat Ramps: 580 to 500
Millerton Lake	McKenzie Point	On South Shore	580 to 472
Millerton Lake	North Shore	On North Shore	580 to 470
Millerton Lake	South Bay	On South Shore	580 to 500

Sources: Reclamation and DWR 2011; Reclamation and State Parks 2010

The marina at Millerton Lake is located at Winchell Cove on the South Shore (Reclamation and State Parks 2010). The marina includes 500 boat slips. There are also eight boat slips at Crow's Nest.

Campgrounds are located along the Millerton Lake North Shore, as summarized in Table 15.23. Many of these campsites are located along the shoreline. These campsites are affected by declining water elevations because this increases the distance from the campsites to the shoreline.

Table 15.23 Millerton Lake Major Campgrounds

Location	Campground	Comments	Number of Campsites
Millerton Lake	Dumna Strand	–	10
Millerton Lake	Fort Miller	Shoreline Campground	36
Millerton Lake	Group Campsites	Group Campground Amphitheater	Two sites with total of 120 sites
Millerton Lake	Meadows	Campsites Equestrian Campsites	59 4 corrals and campsites
Millerton Lake	Mono	–	16
Millerton Lake	North Fine Gold Campground	Boat-In Campground	15
Millerton Lake	Rocky Point	–	21
Millerton Lake	Temperance Flat Boat	Boat-In Campground	25
Millerton Lake	Valley Oak	–	6

Source: Reclamation and State Parks 2010

Millerton Lake recreational areas also include day use areas for picnicking, swimming, and other recreational opportunities, as summarized in Table 15.24 (Reclamation and State Parks 2010). The locations for shoreline day use areas are less desirable when the water elevations decline.

Table 15.24 Millerton Lake Day Use Areas

Location	Day Use Area	Comments	Number
Millerton Lake	Blue Oak	Picnic and Trail along the South Shore	3 sites 4 miles
Millerton Lake	Buzzard's Roost Trail	Picnic and Trail	2 sites 0.5 miles
Millerton Lake	Crow's Nest	Picnic	13 sites
Millerton Lake	Eagle's Nest	Picnic and Trailhead	2 sites
Millerton Lake	Fort Miller	Trail	0.25 miles
Millerton Lake	Grange Grove	Picnic	74 sites
Millerton Lake	La Playa	Picnic and Swimming	95 sites
Millerton Lake	McKenzie Point	Picnic	–
Millerton Lake	Meadows	Picnic	10 sites
Millerton Lake	Millerton Courthouse	Historic Site and Picnic	3 sites
Millerton Lake	San Joaquin River Trail	Portions along the Millerton Lake shoreline	14 miles
Millerton Lake	South Bay	Picnic	9 sites
Millerton Lake	South Fine Gold	Picnic and Trail	10 sites 11 miles

Sources: Reclamation and State Parks 2010; State Parks 2008

Fishing is also popular at Millerton Lake from boats and shoreline. Fishing opportunities include Striped Bass, Black Bass, Largemouth Bass, Green Sunfish, and American Shad (Reclamation and State Parks 2010).

15.3.2.2.2 San Joaquin River from Friant Dam to the Delta

The San Joaquin River flows 100 miles from Friant Dam to the Delta. Downstream of Friant Dam, the San Joaquin River flows 23 miles through lands within the San Joaquin River Parkway which includes parks, trails, and ecological reserve areas between Friant Dam and State Route 145 managed by the San Joaquin River Parkway and Conservation Trust (Reclamation and DWR 2011).

Water-related recreational activities include boating, canoeing, kayaking, whitewater rafting, camping, picnicking, fishing, and hunting (Reclamation and DWR 2011). Access and facilities for these activities are available at several locations along and adjacent to the San Joaquin River.

Between Friant Dam and the confluence with the Merced River, whitewater rafting occurs between Friant Dam to Skaggs Bridge Park at State Route 145. Public access locations are generally located within the San Joaquin River

Parkway. Seven boat launching locations along the San Joaquin River Parkway that are managed by the San Joaquin River Parkway and Conservation Trust and/or DFW, Fresno County, or private operators. Lost Lake Park, managed by the San Joaquin River Parkway and Conservation Trust and DFW, provides a non-powered car-top boat launch. Sycamore Island Park, managed by San Joaquin River Parkway and Conservation Trust offers a boat ramp for small boats. River access also is available at Skaggs Bridge Park, managed by Fresno County. Picnicking is provided at most of the public access locations and at several other locations within the parkway. Camping is provided at Scout Island and Lost Lake Park managed by Fresno County and the private Fort Washington Beach. Trails include the 5-mile long Lewis S. Eaton Trail.

Downstream of State Route 145, major recreational areas include the 85-acre Mendota Pool in Mendota; Dunkle and Maldonado parks in the City of Firebaugh; and Las Palmas Fishing Access and Laird Park in Stanislaus County. Public access is provided at all of these sites. A boat ramp is located upstream of Mendota Dam.

The majority of these areas permit fishing. Fishing opportunities in the San Joaquin River include sunfish, crappie, Bluegill, Striped Bass, Largemouth Bass, and catfish (Reclamation and DWR 2011).

15.3.2.2.3 San Joaquin Valley Refuges

Wildlife refuges in the San Joaquin Valley that rely upon CVP water supplies include the San Luis NWR (including the San Luis Unit, West Bear Creek Unit, East Bear Creek Unit, Freitas Unit, and Kesterson Unit); Merced NWR; Los Banos Wildlife Area; Volta Wildlife Area; Mendota Wildlife Area; North Grasslands Wildlife Area (including China Island Unit and Salt Slough Unit); and Grasslands Resource Conservation District, as described in Chapter 5, Surface Water Resources and Water Supplies, and Chapter 10, Terrestrial Biological Resources (Reclamation 2012). Water-related activities include wildlife viewing, and hunting. Hunting opportunities include waterfowl, shorebirds, and pheasants (Reclamation and DWR 2011).

Several wildlife areas along the San Joaquin River could be affected by CVP operations of Millerton Lake, including the West Hilmar Wildlife Area downstream of the confluence with the Merced River and the San Joaquin River NWR located between the Tuolumne and Stanislaus rivers (Reclamation and DWR 2011). West Hilmar Wildlife Area includes 340 acres of wildlife area accessible by boat. The San Joaquin River NWR includes over 7,000 acres of riparian woodlands, wetlands, and grasslands for native wildlife with limited access at Pelican Trail.

In the southern San Joaquin Valley, the Kern and Pixley NWRs provide wildlife viewing opportunities.

15.3.2.2.4 Stanislaus River Watershed

New Melones Reservoir and Tulloch Reservoir on the Stanislaus River and the lower Stanislaus River are located within areas in the Stanislaus River watershed that could be affected by changes in CVP operations.

New Melones Reservoir

New Melones Reservoir is a CVP facility on the Stanislaus River, as described in Chapter 5, Surface Water Resources and Water Supplies. Recreation activities and facilities at New Melones Reservoir area are managed by Reclamation. When the water storage in the reservoir is at full capacity, New Melones Reservoir has a surface area of approximately 12,500 acres and 105 miles of shoreline at a surface elevation of 1,088 feet msl (Reclamation 1997, 2010a).

Water-related activities include boating, waterskiing, camping, picnicking, wildlife viewing, spelunking, rock climbing, gold panning, and fishing (Reclamation 2010a). Float planes can land within the North, Middle, and South Bays of the reservoir. A model airplane club operates an airstrip near New Melones Dam. Cave exploration occurs in the Stanislaus River Canyon. Rock climbing occurs on Table Mountain. In years when the reservoir elevation is low, whitewater rafters launch at the Old Camp Nine Bridge.

There are five boat ramps at New Melones Reservoir, as summarized in Table 15.25.

Table 15.25 New Melones Reservoir Boat Ramps

Location	Boat Ramp	Comments	Useable Elevations (feet, msl)
New Melones Reservoir	Angels Creek	–	1,088 to 975
New Melones Reservoir	Glory Hole	Location of New Melones Lake Marina	Several Boat Ramps: 1,088 to 860
New Melones Reservoir	Mark Twain	Unimproved Ramp	1,088 to 760
New Melones Reservoir	Parrotts Ferry	Unimproved Ramp	Several Boat Ramps: 1,088 to 900

Source: Reclamation 2010a

The New Melones Marina is the only location with mooring facilities and houseboat rentals (Reclamation 2010a). Up to 50 private houseboats on mooring balls, 38 private houseboats in slips, and 20 rental houseboats may be maintained on the reservoir.

Campgrounds are located at Glory Hole and Tuttletown, as summarized in Table 15.26 (Reclamation 2010a). Some of the campsites are located along the shoreline. These campsites are affected by declining water elevations because this increases the distance from the campsites to the shoreline.

Table 15.26 New Melones Reservoir Major Campgrounds

Location	Campground	Comments	Number of Campsites
New Melones Reservoir	Glory Hole	Two campgrounds	144
New Melones Reservoir	Tuttletown	Three campgrounds Two Group campgrounds	161 16

Source: Reclamation 2010a

New Melones Reservoir recreational areas also include day use areas for picnicking, swimming, and other recreational opportunities, as summarized in Table 15.27 (Reclamation 2010a). The locations for shoreline day use areas are less desirable when the water elevations decline.

Table 15.27 New Melones Reservoir Day Use Areas

Location	Day Use Area	Comments	Number
New Melones Reservoir	Glory Hole	Picnic and Trails	61 sites Several trails: 0.25 to 2.5 miles
New Melones Reservoir	Mark Twain	Picnic and Norwegian Gulch Trail	0.5 miles
New Melones Reservoir	Natural Bridges	Trail	0.7 miles
New Melones Reservoir	Shoreline	Swimming and Recreational Gold Panning	–
New Melones Reservoir	Table Mountain	Trail	Several trails: 1.5 to 4.0 miles
New Melones Reservoir	New Melones Lake Visitor	Visitor Center	–
New Melones Reservoir	Tuttletown	Picnic and Trail	52 sites Several trails: 0.4 to 1.7 miles

Sources: Reclamation 2010a, 2010b, 2014

Tulloch Reservoir

Tulloch Reservoir is a reservoir owned and operated by the Oakdale and South San Joaquin Irrigation Districts on the Stanislaus River downstream of New Melones Reservoir, as described in Chapter 5, Surface Water Resources and Water Supplies. When the water storage in the reservoir is at full capacity (water elevation at 510 feet msl), the reservoir has a surface area of 1,260 acres and 55 miles of shoreline (CBC 2013; Tri-Dam Project 2002).

Water-related activities include boating, sailing, windsurfing, jet and water skiing, camping, picnicking, and fishing. Most of the shoreline is privately owned with shoreline access and more than 400 private docks for residents (Tri-Dam Project 2012). Public access is provided at a DFW marina and campground with a boat ramp at South Shore.

Stanislaus River from Tulloch Dam to the San Joaquin River

Downstream of Tulloch Dam, the Stanislaus River flows to Goodwin Dam, and then continues approximately 40 miles to the confluence with the San Joaquin River. Water-related activities along the lower portion of the Stanislaus River include whitewater rafting, camping, picnicking, swimming, and fishing. Whitewater rafting begins at Goodwin Dam and continues almost 4 miles to Knights Ferry (Reclamation 1997). Downstream of Knights Ferry, there are seven parks, including Caswell Memorial State Park, a 258-acre park managed by State Parks (Stanislaus County 1987; State Parks 2006a). Fishing opportunities on the lower Stanislaus River include bass, catfish, and crappie.

15.3.2.2.5 San Luis Reservoir State Recreation Area

The San Luis Reservoir complex includes CVP and SWP offstream storage facilities located south of the Delta, as described in Chapter 5, Surface Water Resources and Water Supplies. The San Luis Reservoir complex includes San Luis Reservoir, O'Neill Forebay, and Los Banos Creek Reservoir. The San Luis Reservoir complex is located within the San Luis Reservoir State Recreation Area, and the recreational facilities are operated by State Parks (State Parks 2003). Los Banos Creek Reservoir is a flood detention basin to protect the community of Los Banos and San Luis Canal/California Aqueduct. This reservoir and a similar flood management reservoir that is not within the San Luis Reservoir State Recreation Area (Little Panoche Creek Reservoir) are not affected by CVP and SWP operations. Therefore, Los Banos Creek Reservoir and Little Panoche Creek Reservoir are not considered in detail in this EIS.

When the water storage in the San Luis Reservoir is at full capacity (water elevation at 540 feet msl), the reservoir has a surface area of 12,700 acres and 65 miles of shoreline (Reclamation and State Parks 2013; State Parks 2010).

The O'Neill Forebay is east of the San Luis Reservoir downstream of the San Luis Dam. When the water storage in the forebay is at full capacity (water elevation of 230 feet msl), the reservoir has a surface area of 2,210 acres and 14 miles of shoreline (Reclamation and State Parks 2013; State Parks 2010).

Water-related activities include boating, camping, picnicking, wildlife and scenic viewing, fishing, and hunting occur throughout the San Luis Reservoir State Recreation Area (Reclamation 2005c; State Parks 2010; Reclamation and State Parks 2013). Boat ramps are located at all three reservoirs, as summarized below.

- San Luis Reservoir: Boat ramps at Basalt Area and Dinosaur Point (operational to 340 feet and 360 feet msl, respectively).

- O'Neill Forebay: Boat ramps at Group Campground and Medeiros Campground.
- Los Banos Creek Reservoir: Boat ramp at Los Banos Creek Campground.

Camping occurs at Basalt Area at San Luis Reservoir (79 sites), O'Neill Forebay (50 sites), San Luis Creek Area (53 sites and two group campsites with 90 sites), and Los Banos Creek Area (14 sites) (Reclamation and State Parks 2013). Picnic sites, swimming, and/or trails occur at Basalt Area, Medeiros Area, and Los Banos Creek Area (Reclamation 2005c; State Parks 2010; Reclamation and State Parks 2013).

Fishing opportunities include Striped Bass, American Shad, and catfish (Reclamation and State Parks 2013). Hunting opportunities occur at San Luis Reservoir for waterfowl, deer, and wild pig (Reclamation 2005c; Reclamation and State Parks 2013).

15.3.2.2.6 Delta Mendota Canal

Delta Mendota Canal is a CVP facility, as described in Chapter 5, Surface Water Resources and Water Supplies. The Delta-Mendota Canal includes two fishing sites: one in Stanislaus County and the other in Fresno County (Reclamation 2005c). Fishing opportunities include Striped Bass and catfish (Reclamation 1997).

15.3.2.2.7 California Aqueduct/San Luis Canal

The California Aqueduct is a SWP facility, as described in Chapter 5, Surface Water Resources and Water Supplies. A portion of the canal is also co-located with the CVP San Luis Canal. Fishing is permitted at 12 sites along the California Aqueduct between Bethany Reservoir and Perris Lake in Southern California. Fishing opportunities include Striped Bass, Largemouth Bass, catfish, crappie, Green Sunfish, Bluegill, and starry flounder (Reclamation 1997).

15.3.2.3 Delta

The Delta is located at the terminus of the Sacramento River and the San Joaquin River. Water-related activities in the Delta include boating, sailing, water skiing, canoeing, kayaking, picnicking, fishing, and hunting. Recreational opportunities exist in many areas of the Delta; however, the analysis in this EIS is related to areas that could be affected by changes in CVP and/or SWP water supply operations and restoration in the Yolo Bypass. The following discussion describes recreation throughout the Delta followed by more specific discussions of recreation within the Yolo Bypass and Cache Slough.

15.3.2.3.1 Delta Recreational Opportunities

The primary recreational activities in the Delta are related to boating and fishing (DPC 2012). Public recreation facilities are limited within the Delta. Most recreational opportunities are provided by private enterprises, including marinas, restaurants, hunting venues, and wineries and farm visits. Public access is provided at DFW and U.S. Fish and Wildlife Service (USFWS) sites.

The most recent survey of boating opportunities in the Delta was completed in 2002 by the California Department of Boating and Waterways (DBW 2014; DPC 2012). The survey indicated that of the 95 marinas surveyed, three were publically-owned and 92 were privately-owned (including 87 that were open to the public and five that were for members). The survey indicated that within the Delta there were over 11,600 boat slips, 55 boat launches, 2,182 campsites, and 324 picnic sites.

Public access sites for boating and wildlife and scenic viewing in the Delta include:

- USFWS: Stone Lakes NWR, Antioch Dunes NWR.
- DFW: Calhoun Cut Ecological Reserve, Decker Island Wildlife Area, Lower Sherman Island Wildlife Area, Miner Slough Wildlife Area, Rhode Island Wildlife Area, White Slough Wildlife Area, Woodbridge Ecological Reserve, Fremont Weir Wildlife Area, Sacramento Bypass Wildlife Area, and Yolo Bypass Wildlife Area.
- State Parks: Brannan Island-Franks Tract State Recreation Areas, Delta Meadows State Recreation Area.
- Department of Water Resources: Clifton Court Forebay.
- The Nature Conservancy/DFW: Cosumnes River Preserve.
- Solano Land Trust: Jepson Prairie Preserve.
- East Bay Regional Park District: Big Break Regional Shoreline, Antioch/Oakley Regional Shoreline, Browns Island Regional Preserve, Bay Point Regional Shoreline, Martinez Regional Shoreline, Carquinez Strait Regional Shoreline-Crockett Hills Regional Park, and Contra Costa Canal Trail.
- Municipal Marinas, Boat Launching, and Fishing Access Facilities: City of Antioch Marina and Municipal Boat Ramp; City of Pittsburg Riverview Park; Sacramento County Cliffhouse, Georgiana Slough Fishing Access, Hogback Island Access, and Sherman Island Public Access Facility; City of Sacramento Garcia Bend Park; several public and private marinas in Sacramento County; 12 public and private marinas with over 900 boat slips and boat access within the City of Stockton; San Joaquin County Dos Reis Regional Park, Mossdale Crossing Regional Park, and Westgate Landing Regional Park; and Yolo County Clarksburg River Access.

Several of these sites include launch sites for boats, canoes, and kayaks and numerous trails (DPC 2012; DSC 2011; DFG 2008b, 2008d, 2009; EBRPD 2013a; Antioch 2003; Pittsburg 2001; Sacramento County 2014; Sacramento 2005; Stockton 2007; Yolo County 2009).

One of the larger bodies of water in the Delta is the SWP Clifton Court Forebay. Fishing is the only recreational opportunity that occurs within the Clifton Court Forebay; and the opportunities are limited (DWR 2013c). Public access is restricted near the radial gate along West Canal. However, boat access occurs at a boat dock along West Canal to the east of the radial gate and by a trail from Clifton Court Road.

Fishing opportunities in the Delta generally include Striped Bass, Smallmouth Bass, Largemouth Bass, Spotted Bass, American Shad, Black Crappie, Chinook Salmon, steelhead, catfish, sunfish, Tule Perch, Warmouth, and White Sturgeon (DPC 2006).

Hunting opportunities for waterfowl, shorebirds, doves, and pheasants occur in many areas of the Delta on privately-owned land. Hunting also occurs at several publically-owned sites within the Delta, including:

- USFWS: Stone Lakes NWR.
- DFW: Decker Island Wildlife Area, Lower Sherman Island Wildlife Area, Miner Slough Wildlife Area, Rhode Island Wildlife Area, White Slough Wildlife Area, Yolo Bypass Wildlife Area; and on some lands owned by DWR (including Sherman and Twitchell islands and Clifton Court Forebay).

The Delta Protection Commission identified several physical constraints to Delta recreational opportunities that could be affected by CVP and SWP operations, including changes in water quality and operation of the CVP or SWP water facilities (Delta Cross Channel, South Delta Temporary Barriers, and Montezuma Slough Salinity Gates) (DPC 2012).

15.3.2.3.2 Yolo Bypass and Cache Slough Recreational Opportunities

The primary recreational activities in the Yolo Bypass and Cache Slough areas are related to wildlife viewing and hunting. Many recreational hunting opportunities occur on private lands, including private hunting clubs. Areas within Yolo Bypass and Cache Slough that provide public access for wildlife viewing or hunting within the Yolo Bypass and Cache Slough area, include:

- Fremont Weir Wildlife Area (DFW 2014a).
  - Wildlife viewing and fishing.
  - Hunting for pheasant, waterfowl, Mourning Dove, deer, quail, rabbit, and turkey.
- Sacramento Bypass Wildlife Area (DFW 2014c).
  - Wildlife viewing and fishing, including for White Sturgeon, White Catfish, and Black Crappie in the Tule Canal; and Largemouth Bass, Bluegill, and White Catfish in the borrow pits.
  - Hunting for pheasant and Mourning Dove.
- Yolo Bypass Wildlife Area (DFG 2008c, 2010).
  - Wildlife viewing and hiking.
  - Fishing for sturgeon, Striped Bass, Black Bass, and catfish.

  - Hunting for waterfowl, coots, Moorhens, Snipe, pheasants, and Mourning Doves.
  - Educational and interpretative programs.
- Calhoun Cut Ecological Reserve (DFG 2008d).
  - Waterfowl hunting and fishing from a boat.

There are other publically-owned lands within the Yolo Bypass and Cache Slough that provide habitat or will be restored to provide habitat. However, these lands are generally not available for public access to protect fragile ecosystems.

15.3.2.4 Suisun Marsh

Suisun Marsh is 106,511 acres of wetlands located between the Delta and the San Francisco Bay. Water-related activities at Suisun Marsh include waterfowl hunting, boating, kayaking, hiking, wildlife viewing, fishing, and hunting (Reclamation et al. 2011). Water-related recreation occurs within the two major channels, Montezuma and Suisun sloughs; and several moderately sized channels, Cordelia, Denverton, Nurse, and Hill sloughs.

The DFW manages several areas within the Suisun Marsh for public access, as described in Chapter 10, Terrestrial Biological Resources. These areas include (Reclamation et al. 2011):

- Grizzly Island Wildlife Area
  - Wildlife viewing, hiking, and fishing (February through July, and late September).
  - Hunting (August through mid-September, and October through January).
- Hill Slough Wildlife Area
  - Wildlife viewing and fishing.
- Peytonia Slough Ecological Preserve
  - Kayaking.
  - Wildlife viewing and fishing.
- Belden's Landing Water Access Facility
  - Boat launch ramp and fishing pier.

Suisun City Marina and Solano Yacht Club, Suisun City Boat Launch, and McAvoy Yacht Harbor and Club also provide boat launch ramp facilities (Reclamation et al. 2011). Pier fishing opportunities are provided at Suisun City Boat Launch.

The Solano Land Trust's Rush Ranch also provides opportunities for hiking and picnicking in the wetlands and upland areas near Potrero Hills (Reclamation et al. 2010).

Fishing opportunities within Suisun March include Striped Bass, White Sturgeon, catfish, and carp (Reclamation et al. 2011). Occasionally, Chinook Salmon, steelhead, and Largemouth Bass are caught in Suisun Marsh near Grizzly Island.

Duck hunting generates the most frequent recreational visits in Suisun Marsh (Reclamation et al. 2011). About 37,500 acres of Suisun Marsh are owned and operated by private duck clubs. DFW manages about 15,300 acres of public lands in Grizzly Island Wildlife Area for hunting of waterfowl, Snipe, coots, Moorhens, Mourning Doves, pheasants, rabbits, and Tule Elk.

There are other publically-owned lands within Suisun Marsh that provide habitat or will be restored to provide habitat. However, these lands are generally not available for public access to protect fragile ecosystems.

15.3.3 San Francisco Bay Area Region

The San Francisco Bay Area Region includes portions of Contra Costa, Alameda, Santa Clara, San Benito, and Napa counties that are within the CVP and SWP service areas. This section describes reservoirs in the San Francisco Bay Area Region that could be affected by CVP and SWP operations, including the CVP Contra Loma and San Justo reservoirs; the SWP Bethany Reservoir and Lake Del Valle; the Contra Costa Water District Los Vaqueros Reservoir; and the East Bay Municipal Utility District Upper San Leandro, San Pablo, Briones, and Lafayette reservoirs and Lake Chabot. CVP and SWP are generally not stored in reservoirs within Santa Clara County (SCVWD 2010).

15.3.3.1 Contra Loma Reservoir

The Contra Loma Reservoir is a CVP facility in Contra Costa County that provides offstream storage along the Contra Costa Canal, as described in Chapter 5, Surface Water Resources and Water Supplies. The recreation facilities are managed by East Bay Regional Park District. The 80 acre reservoir is part of 661-acre Contra Loma Regional Park and Antioch Community Park (Reclamation 2014a). Water-related activities include boating, wind surfing, kayaking, picnicking, and fishing. No bodily contact is to occur in Contra Loma Reservoir; therefore, a large swimming pool was constructed for the visitors by the East Bay Regional Park District. There is one boat launch at the reservoir. Contra Loma Reservoir accommodates fishing all year-round. Fishing opportunities include catfish, Black Bass, Striped Bass, Largemouth Bass, Bluegill, crappie, trout, and Redear Sunfish (EBRPD 2013c).

15.3.3.2 San Justo Reservoir

The San Justo Reservoir is a CVP facility in San Benito County that provides offstream storage as part of the San Felipe Division, as described in Chapter 5, Surface Water Resources and Water Supplies. San Justo Reservoir recreation facilities have been closed to the public since 2009 due to an infestation by the zebra mussel. Previously, the recreation facilities were managed by San Benito County Water District (SBCWD 2014).

15.3.3.3 Bethany Reservoir

Bethany Reservoir is a SWP facility located between the California Aqueduct and South Bay Aqueduct in Alameda County, as described in Chapter 5, Surface Water Resources and Water Supplies. The recreation facilities are part of the Bethany Reservoir State Recreation Area and are managed by State Parks. When the water storage in the reservoir is at full capacity (water elevation at 243 feet msl), Bethany Reservoir has 161 acres of surface area and 6 miles of shoreline (DWR 2001). Water-related activities include boating, windsurfing, picnicking, and fishing. There is one boat launch at the reservoir (State Parks 2013a). Fishing opportunities include Striped Bass, Smallmouth Bass, Largemouth Bass, Spotted Bass, White Bass, catfish, crappie, and trout.

15.3.3.4 Lake Del Valle

Lake Del Valle is a SWP facility located along the South Bay Aqueduct in Alameda County, as described in Chapter 5, Surface Water Resources and Water Supplies. The recreation facilities are managed by East Bay Regional Park District as part of the Del Valle Regional Park. When the water storage in the reservoir is at full capacity (water elevation at 703 feet msl), Lake Del Valle has 708 acres of surface area and 16 miles of shoreline (DWR 2001). Water-related activities include boating, windsurfing, camping, swimming, and fishing (DWR 2001). There is a boat launch at the lake (EBRPD 2014). Boating hazards can occur along the variable shoreline when the surface water elevation declines to 678 feet msl. There are seven group campsites for up to 475 and a family campground (DWR 2001; EBRPD 2014). Fishing opportunities include trout, catfish, Largemouth Bass, and Smallmouth Bass, Striped Bass, and Panfish (EBRPD 2014).

15.3.3.5 Los Vaqueros Reservoir

Los Vaqueros Reservoir is a Contra Costa Water District offstream storage facility in Contra Costa County, as described in Chapter 5, Surface Water Resources and Water Supplies. Recreation facilities are managed by Contra Costa Water District. Water-related activities include boating using rented electrical boats, and fishing (CCWD 2014). The Los Vaqueros recreation facilities include a marina, four fishing piers, 55 miles of trails, several individual and group picnic areas, and an interpretative center. Fishing opportunities include Rainbow Trout, Brown Bullhead, White Catfish, Channel Catfish, sunfish, White Crappie, Largemouth Bass, Striped Bass, Chinook Salmon, Kokanee Salmon, Green Sunfish, and Sacramento Perch (EBRPD 2014).

15.3.3.6 San Pablo Reservoir, Lafayette Reservoir, Lake Chabot, and East Bay Municipal Utility District Trails

The East Bay Municipal Utility District reservoirs in Alameda and Contra Costa County are used to store water within and near the East Bay Municipal Utility District service area. Water stored in these reservoirs includes water from local watersheds, the Mokelumne River watershed, and CVP water supplies, as described in Chapter 5, Surface Water Resources and Water Supplies. Recreation is allowed within the waters of San Pablo and Lafayette reservoirs and Lake

Chabot (EBMUD 2011). Recreation is not allowed within the waters of Upper San Leandro and Briones reservoir. East Bay Municipal Utility District maintains trails within the watersheds of the reservoirs.

Recreation facilities at San Pablo Reservoir are managed by East Bay Municipal Utility District. Water-related activities at San Pablo Reservoir include boating, picnicking, and fishing (EBMUD 2014a). There is a boat launch at the reservoir. There are individual sites and nine group picnic areas that can accommodate up to 100 people at each site. Hiking can occur in the San Pablo Reservoir watershed on 8.7 miles of trails which connect to about 13 miles of trails in the Briones Reservoir watershed (EBMUD 2007a). The surface water of the reservoirs can be viewed from many locations along these trails. Fishing opportunities at San Pablo Reservoir include Rainbow Trout, catfish, Black Bass, Bluegill, and crappie (EBMUD 2014a).

Recreation facilities at Lafayette Reservoir are managed by East Bay Municipal Utility District. Water-related activities at Lafayette Reservoir include boating, picnicking, and fishing (EBMUD 2014b). There is a private car-top boat launch at the reservoir. There are 125 picnic sites around the reservoir. Hiking can occur in the Lafayette Reservoir watershed on 7.4 miles of trails. Fishing opportunities at Lafayette Reservoir include Rainbow Trout, catfish, Black Bass, and sunfish.

There are no water-related activities within or adjacent to Upper San Leandro Reservoir. However, East Bay Municipal Utility District maintains over 26 miles of trails within the Upper San Leandro Reservoir watershed. The surface water of the reservoirs can be viewed from many locations along these trails (EBMUD 2007b).

Recreation facilities at Lake Chabot are managed by East Bay Regional Park District as part of the Lake Chabot Regional Park (EBRPD 2011). Water-related activities at Lake Chabot include boating, camping, picnicking, and fishing. There is a boat launch at the reservoir and boat rides are offered on the *Chabot Queen*. Individual campsites and group campsites are located near the southern portion of the park. Picnic sites are located near the Lake Chabot Marina. Hiking can occur along the shoreline on over 9 miles of trails which connect to more than 17 miles of other trails in the watershed (EBRPD 2011, 2013d). Other recreational activities, including equestrian trails and a marksmanship range, are located in the upper Lake Chabot watershed. Fishing opportunities at Lake Chabot include Rainbow Trout, catfish, Black Bass, crappie, Bluegill, and carp.

15.3.4 Central Coast Region

The Central Coast Region includes portions of San Luis Obispo and Santa Barbara counties served by the SWP. The SWP water supplies generally are conveyed to Central Coast municipal, industrial, and agricultural water users in pipelines and closed reservoirs. Water is delivered to southern Santa Barbara County communities through Cachuma Lake. Therefore, in the Central Coast Region, the only recreational opportunities that may be affected by changes in SWP operations would be Cachuma Lake in Santa Barbara County (CCWA 2014).

15.3.4.1 Cachuma Lake

Cachuma Lake is a facility owned and operated by Reclamation in Santa Barbara County, as described in Chapter 5, Surface Water Resources and Water Supplies. Recreation facilities are managed by Santa Barbara County Parks Department. Water-related activities include boating, and fishing within the lake and along the lake shoreline (Reclamation 2010c). Cachuma Lake recreation facilities include a marina with 87 rental boats and a public boat launch, 94 private boat slips, 520 campsites, equestrian campsites, family center, amphitheater, and trails that range from 0.25 to 9 miles in length. Fishing opportunities include trout, catfish, crappie, bass, Redear Perch, and Bluegill.

15.3.5 Southern California Region

The Southern California Region includes portions of Ventura, Los Angeles, Orange, San Diego, Riverside, and San Bernardino counties served by the SWP. The SWP water supplies generally are conveyed to Southern California municipal, industrial, and agricultural water users in canals and pipelines. There are six SWP reservoirs along the main canal, West Branch, and East Branch of the California Aqueduct and many other reservoirs owned and operated by regional and local agencies. The Metropolitan Water District of Southern California's Diamond Valley Lake and Lake Skinner primarily store water from the SWP. Other reservoirs that store SWP water, include United Water Conservation District's Lake Piru; City of Escondido's Dixon Lake; City of San Diego's San Vicente, El Capitan, Lower Otay, Hodges, and Murray reservoirs; Helix Water District's Lake Jennings; and Sweetwater Authority's Sweetwater Reservoir.

This section does not include reservoirs that do not provide recreational opportunities, such as Vail Lake in Riverside County or Olivenhain Reservoir in San Diego County, or reservoirs that do not store SWP water supplies, such as Lake Mathews in Riverside County which is used to store Colorado River water (RCWD 2011; SDCWA 2015; Riverside County 2000).

15.3.5.1 Quail Lake

Quail Lake is a SWP facility in Los Angeles County, as described in Chapter 5, Surface Water Resources and Water Supplies. Recreation facilities are managed by DWR (DWR 2014a). Water-related activities include fishing within the lake and along the shoreline. Fishing opportunities include Channel Catfish, Striped Bass, Blackfish, Tule Perch, Threadfin Shad, and Hitch.

15.3.5.2 Pyramid Lake

Pyramid Lake is a SWP facility located in Los Angeles County and upstream of Castaic Lake on the West Branch of the California Aqueduct, as described in Chapter 5, Surface Water Resources and Water Supplies. Recreation facilities are managed by the U.S. Forest Service (DWR 2000, 2014b). Water-related activities include boating, camping, water skiing, swimming, and fishing. Boat launch facilities are available at Vaqueros Beach and Emigrant Landing. A marina and picnic sites are available at Emigrant Landing. Four picnic and viewing sites are accessible only by boat. Family and group camping are available at two sites.

Fishing opportunities include largemouth, smallmouth, and Striped Bass; catfish, blue gill; crappie; and trout. Reservoir elevations can vary substantially on a daily basis because the lake provides short-term storage for the downstream Castaic Powerplant.

15.3.5.3 Castaic Lake

Castaic Lake is a SWP facility located in Los Angeles County at the terminal end of the West Branch of the California Aqueduct, as described in Chapter 5, Surface Water Resources and Water Supplies. Recreation facilities are managed by the Los Angeles County Department of Parks (DWR 2007b). Water-related activities include boating, water skiing, jet skiing, wakeboarding, camping, picnicking, swimming at the lagoon/afterbay, and fishing. Fishing opportunities include trout, Largemouth Bass, Striped Bass, catfish, and crappie (DWR 2014c).

15.3.5.4 Silverwood Lake

Silverwood Lake is a SWP facility located in San Bernardino County along the East Branch of the California Aqueduct, as described in Chapter 5, Surface Water Resources and Water Supplies. Recreation facilities are managed by State Parks as part of the Silverwood Lake State Recreational Area (State Parks 2006b). Water-related activities include boating, water skiing, camping, picnicking, swimming, and fishing. Facilities available for boating include a boat ramp, marina, and waterskiing area. Camping facilities include 136 family sites, seven walk-in sites, and several group sites for up to 120 people. The park includes two swimming beaches and 13 miles of trails. Fishing opportunities include Largemouth Bass, Striped Bass, Bluegill, crappie, and catfish.

15.3.5.5 Crafton Hills Reservoir

Crafton Hills Reservoir is a SWP facility located in the City of Yucaipa within San Bernardino County, as described in Chapter 5, Surface Water Resources and Water Supplies. Recreation facilities are managed by DWR (DWR 2009). Recreation activities in vicinity of the reservoir are associated with hiking trails in the open space within the Crafton Hills watershed. The surface water of the reservoirs can be viewed from many locations along these trails.

15.3.5.6 Lake Perris

Lake Perris is a SWP facility located in Riverside County at the terminal end of the East Branch of the California Aqueduct, as described in Chapter 5, Surface Water Resources and Water Supplies. Recreation facilities are managed by State Parks as part of the Lake Perris State Recreational Area (State Parks 2013b; DWR 2010). Water-related activities include boating, camping, swimming, picnicking, and fishing. Boating facilities include a marina and three boat launch ramps. Other recreational facilities include two swimming beaches, family campground, seven equestrian camp sites, boat-in picnic sites on Alessandro Island, and the Ya'i Hek'i Regional Indian Museum. Fishing opportunities include Largemouth Bass, catfish, crappie, carp, Bluegill, and Redear Sunfish.

15.3.5.7 Diamond Valley Lake

Diamond Valley Lake is an offstream storage facility located in Riverside County owned and operated by Metropolitan Water District of Southern California, as described in Chapter 5, Surface Water Resources and Water Supplies (MWD 2013). The lake is used to store SWP water. Water-related activities include boating, and fishing. Boating facilities include a marina with boat rentals. Other recreational facilities include a visitor center, Western Science Center, and the Valley-Wide Recreation and Park District Regional Aquatic Center and Community Park. Fishing opportunities include Black Bass, Bluegill, redear sunfish, Rainbow Trout, blue catfish, and Channel Catfish (DVM 2014).

15.3.5.8 Lake Skinner

Lake Skinner is an offstream storage facility located in Riverside County owned and operated by Metropolitan Water District of Southern California, as described in Chapter 5, Surface Water Resources and Water Supplies. Recreation facilities are managed by Riverside County Parks (Riverside County 2014). The lake is used to store SWP water. Water-related activities include boating, camping, and fishing. Other recreational facilities include an amphitheater and Splash Pad. Fishing opportunities include Striped Bass, Largemouth Bass, Bluegill, Rainbow Trout, catfish, and carp.

15.3.5.9 Lake Piru

Lake Piru is located on Piru Creek, a tributary of the Santa Clara River, in Ventura County (UWCD 2014). The lake is owned and operated by United Water Conservation District, as described in Chapter 5, Surface Water Resources and Water Supplies. Lake Piru is located within Los Padres National Forest (PMC 2014). The lake is used to store SWP water.

Recreation facilities are managed by a private concessionaire for the district (UWCD 2014; PMC 2014). Water-related activities include boating, camping, and picnicking. The marina includes a boat launch and private boat slips. There are over 220 campsites, including several group campsites.

15.3.5.10 Dixon Lake

Dixon Lake is located in the hills above the City of Escondido in San Diego County (Escondido 2014a). The lake is owned and operated by the City of Escondido, as described in Chapter 5, Surface Water Resources and Water Supplies. The lake is used to store SWP water.

Recreation facilities are managed by the City of Escondido (Escondido 2014b). Water-related activities include camping, picnicking, and fishing. Boats are allowed on the lake for fishing. There are 45 campsites and 22 picnic sites (Escondido 2014 n.d.; Escondido 2014c). Fishing opportunities include trout, bass, Bluegill, carp, catfish, and crappie.

15.3.5.11 San Vicente, El Capitan, Lower Otay, Hodges, and Murray Reservoirs

San Vicente Reservoir, El Capitan, Lower Otay, Hodges, and Murray reservoirs are located in San Diego County (San Diego 2011). The reservoirs are owned and operated by the City of San Diego, as described in Chapter 5, Surface Water Resources and Water Supplies. The reservoirs are used to store SWP water.

Recreation facilities are managed by the City of San Diego (San Diego 2014a, 2015a, 2015b). Water-related activities at the reservoirs include boating, picnicking, and fishing (San Diego 2014b, 2015a, 2015b). There are 16 picnic sites at Lower Otay Reservoir. Fishing opportunities at Lower Otay Reservoir include Largemouth Bass, Bluegill, black and White Crappie, Channel Catfish, blue catfish, White Catfish, and bullhead. Recreational activities at San Vicente Reservoir are temporarily closed during construction to raise the dam (San Diego 2014c). Fishing opportunities at El Capitan Reservoir include Largemouth Bass, Bluegill, crappie, Channel Catfish, Blue Catfish, Green Sunfish, and carp (San Diego 2014d). Hodges Reservoir provides recreational opportunities including boating, boardsailing, and fishing for bass, catfish, crappie, Bluegill, Bullhead, and carp (San Diego 2015a). Murray Reservoir provides recreational opportunities for boating, floating, swimming, and fishing for Largemouth Bass, Bluegill, Channel Catfish, Black Crappie, and trout (San Diego 2015b).

15.3.5.12 Lake Jennings

Lake Jennings is located in San Diego County (HWD 2014). The lake is owned and operated by Helix Water District, as described in Chapter 5, Surface Water Resources and Water Supplies. The lake is used to store SWP water.

Recreation facilities are managed by Helix Water District (HWD 2014). Water-related activities include boating, camping, picnicking, and fishing. There are 96 campsites. There are a variety of picnic sites at Lake Jennings including: Cloister Cover, Siesta Point, Hermit Cove, and Eagle Point. Bird watchers at Lake Jennings can see Loons, Grebes, Cormorants, Herons, Swans, Geese, Eagles, Hawks, Thrushes, Warblers, and many others. Hikers at Lake Jennings have access to a variety of different trails near the lake including a 5.5 mile loop around the lake. Fishing opportunities include trout, bass, and catfish.

15.3.5.13 Sweetwater Reservoir

Sweetwater Reservoir is located in San Diego County (Sweetwater Authority 2014). The lake is owned and operated by Sweetwater Authority, as described in Chapter 5, Surface Water Resources and Water Supplies. The reservoir is used to store SWP water. Recreation facilities are managed by Sweetwater Authority. Water-related activities include fishing.

15.3.5.14 Lake Arrowhead

Lake Arrowhead is located in San Bernardino County (LACSD 2014). The lake is owned and operated by Arrowhead Lake Association. The Lake Arrowhead Community Services District stores SWP water in the lake, as described in Chapter 5, Surface Water Resources and Water Supplies. Recreation facilities are managed by the Arrowhead Lake Association. Water-related activities include boating, camping, and fishing (Lake Arrowhead 2014).

15.3.6 Recreational Fishing in San Pablo and San Francisco Bays

Recreational fishing for sturgeon, Striped Bass, steelhead, trout, and salmon in San Pablo and San Francisco bays could be affected by changes in populations that may occur due to implementation of the alternatives considered in this EIS. Of these species, the majority of recreational fishing in the San Francisco Bay Estuary is related to Striped Bass and sturgeon fishing, especially in San Pablo and Suisun bays.

Recreational fishing for White Sturgeon is limited to three sturgeons per person each year, with a daily bag limit of one fish/day and a size limitation of 40 to 60 inches (from the nose tip to fork in the tail). In addition, White Sturgeon fishing is not allowed in San Francisco Bay from March 16 through December 31. Green sturgeon fishing is not allowed. Striped bass fishing occurs throughout the year with a daily bag limit two fish/day and a minimum size limitation of 18 inches. Salmon sportfishing also occurs within the San Francisco Bay Estuary during periods specified by the National Marine Fisheries Service (NMFS).

15.3.7 Recreational Salmon Fishing along Northern California Coast

Chinook Salmon, Coho Salmon, and steelhead are generally the primary species for recreational fishing that could be affected by changes in CVP and SWP operations along the Pacific Coast of Northern California from Pigeon Point to southern Oregon (near Elk River). The Pacific Coast salmon fisheries are managed by the Pacific Fishery Management Council (PFMC) in waters between the United States/Canada border to the United States/Mexico border between 3 and 200 nautical miles offshore (PFMC 2014). The State DFW manages the salmon fisheries within 0 to 3 nautical miles offshore with regulations that are generally similar to the PFMC to the salmon fishing requirements. The PFMC analyzes the a fisheries evaluation each year; and defines the periods of time for the fishing season and minimum size fish to be caught for commercial, recreational, and tribal salmon fishing activities, as described in more detail for recreational and commercial salmon fishing in Chapter 19, Socioeconomics.

15.4 Impact Analysis

This section describes the potential mechanisms and analytical methods for change in recreation resources; results of the impact analysis; potential mitigation measures; and cumulative effects.

15.4.1 Potential Mechanisms for Change and Analytical Methods

As described in Chapter 4, Approach to Environmental Analysis, the impact analysis considers changes in recreational resources conditions related to changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison.

As described in Section 15.3, Affected Environment, there are a wide range of recreational opportunities at the reservoirs and along the downstream rivers. This analysis focuses on the potential changes in these recreational opportunities and not specific recreational actions. For example, this analysis focuses on changes in surface water elevations at reservoirs which could affect boating, shoreline camping and picnicking, and use of trails. The changes in reservoir elevations would occur within the historical range of elevation changes; therefore, none of the recreational opportunities would be permanently reduced or expanded. The changes that would occur within the alternatives would change the potential for enjoyable recreational opportunities based upon changes in reservoir surface water elevations and river flows.

Changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison could change recreational opportunities at water bodies affected by CVP and SWP operations.

15.4.1.1 Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Reservoirs that store CVP and SWP water provide a wide diversity of recreational experiences on the water surface, at shoreline campgrounds, and along shoreline trails. By the end of September, the surface water elevations can decline from higher elevations in the spring by up to 100 feet in Shasta Lake and Lake Oroville; and over 50 feet in Trinity and Folsom lakes and New Melones and San Luis reservoirs. As the water elevations declines, boat ramps become unavailable and the water surface recedes along steep slopes from shoreline campgrounds and trails. Changes in CVP and SWP operations under the alternatives could change the surface water elevations, especially in dry and critical dry years as compared to the No Action Alternative and Second Basis of Comparison.

The CalSim II model output includes monthly reservoir elevations for CVP and SWP reservoirs in the Central Valley and Trinity Lake. The end of September reservoir elevations generally indicate low reservoir elevations. To assess changes in recreational resources, changes in reservoir elevations for the end of September were compared between alternatives and the No Action Alternative and Second Basis of Comparison. The reservoir elevations at the end of September were compared to minimum allowable boat ramp elevations as a measure of surface water accessibility.

Reservoirs in the San Francisco Bay Area, Central Coast, and Southern California regions store water from multiple water supplies including CVP and SWP water; however, these reservoirs are not included in the CalSim II model simulation. For the purposes of this EIS analysis, changes in surface water elevations in these reservoirs were assumed to be related to changes in CVP and SWP water deliveries to the areas located to the south of the Delta.

15.4.1.2 Changes in Recreational Resources along Rivers downstream of CVP and SWP Reservoirs

Changes in CVP and SWP operations under the alternatives could change the river flows in Trinity, Sacramento, Feather, American, and Stanislaus rivers in a manner that would affect recreational opportunities including boating and swimming during the spring and summer months, especially in dry and critical dry years.

Results of the CalSim II model were used to assess changes in average monthly flows that could affect recreational opportunities under the alternatives, the No Action Alternative, and the Second Basis of Comparison. This analysis is focused on the Trinity, Sacramento, Feather, American, and Stanislaus rivers. Generally, flow in rivers downstream of San Luis Reservoir and the reservoirs in the San Francisco Bay Area, Central Coast, and Southern California that store CVP and SWP water are based upon minimum instream flow requirements except in high flow events because the reservoirs are operated primarily to provide water into downstream water distribution systems.

15.4.1.3 Changes in Recreational Opportunities at Wildlife Refuges

Changes in CVP and SWP operations under the alternatives would not change water supplies to wildlife refuges that use CVP water for Level 2 water demands, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, these changes are not analyzed in this EIS.

15.4.1.4 Effects Related to Water Transfers

Historically water transfer programs have been developed on an annual basis. The demand for water transfers is dependent upon the availability of water supplies to meet water demands. Water transfer transactions have increased over time as CVP and SWP water supply availability has decreased, especially during drier water years.

Water transfers using CVP and SWP Delta pumping plants and south of Delta canals generally occur when there is unused capacity in these facilities. These conditions generally occur during drier water year types when the flows from upstream reservoirs plus unregulated flows are adequate to meet the Sacramento Valley water demands and the CVP and SWP export allocations. In non-wet years, the CVP and SWP water allocations would be less than full contract amounts; therefore, capacity may be available in the CVP and SWP conveyance facilities to move water from other sources.

Projecting future recreational conditions related to water transfer activities is difficult because specific water transfer actions required to make the water available, convey the water, and/or use the water would change each year due to changing hydrological conditions, CVP and SWP water availability, specific local agency operations, and local cropping patterns. Reclamation recently prepared a long-term regional water transfer environmental document which evaluated potential changes in conditions related to water transfer actions (Reclamation 2014f). Results from this analysis were used to inform the impact assessment of potential effects of water transfers under the alternatives as compared to the No Action Alternative and the Second Basis of Comparison.

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

This EIS includes two bases of comparison, as described in Chapter 3, Description of Alternatives: the No Action Alternative and the Second Basis of Comparison. Both of these bases are evaluated at 2030 conditions. Changes that would occur over the next 15 years without implementation of the alternatives are not analyzed in this EIS. However, the changes to recreational resources that are assumed to occur by 2030 under the No Action Alternative and the Second Basis of Comparison are summarized in this section. Many of the changed conditions would occur in the same manner under both the No Action Alternative and the Second Basis of Comparison.

15.4.2.1 Common Changes in Conditions under the No Action Alternative and Second Basis of Comparison

Conditions in 2030 would be different than existing conditions due to:

- Climate change and sea level rise
- General plan development throughout California, including increased water demands in portions of Sacramento Valley
- Implementation of reasonable and foreseeable water resources management projects to provide water supplies

It is anticipated that climate change would result in more short-duration high-rainfall events and less snowpack in the winter and early spring months. The reservoirs would be full more frequently by the end of April or May by 2030 than in recent historical conditions. However, as the water is released in the spring, there would be less snowpack to refill the reservoirs. This condition would reduce reservoir storage and available water supplies to downstream uses in the summer. The reduced end of September storage also would reduce the ability to release stored water to downstream regional reservoirs. These conditions would occur for all reservoirs in the California foothills and mountains, including non-CVP and SWP reservoirs.

Under the No Action Alternative and the Second Basis of Comparison, land uses in 2030 would occur in accordance with adopted general plans. Development under the general plans would could increase demand for recreational resources.

The No Action Alternative and the Second Basis of Comparison assumes completion of water resources management and environmental restoration projects that would have occurred without implementation of Alternatives 1 through 5, including regional and local recycling projects, surface water and groundwater storage projects, conveyance improvement projects, and desalination projects, as described in Chapter 3, Description of Alternatives. The No Action Alternative and the Second Basis of Comparison also assumes implementation of actions included in the 2008 USFWS Biological Opinion (BO) and 2009 NMFS

BO that would have been implemented without the BOs by 2030, as described in Chapter 3, Description of Alternatives. These projects would include several projects that would affect recreational resources, including restoration of more than 10,000 acres of intertidal and associated subtidal wetlands in Suisun Marsh and Cache Slough; and at least 17,000 to 20,000 acres of seasonal floodplain restoration in Yolo Bypass.

15.4.3 Evaluation of Alternatives

Alternatives 1 through 5 have been compared to the No Action Alternative; and the No Action Alternative and Alternatives 1 through 5 have been compared to the Second Basis of Comparison.

During review of the numerical modeling analyses used in this EIS, an error was determined in the CalSim II model assumptions related to the Stanislaus River operations for the Second Basis of Comparison, Alternative 1, and Alternative 4 model runs. Appendix 5C includes a comparison of the CalSim II model run results presented in this chapter and CalSim II model run results with the error corrected. Appendix 5C also includes a discussion of changes in the comparison of groundwater conditions for the following alternative analyses.

- No Action Alternative compared to the Second Basis of Comparison
- Alternative 1 compared to the No Action Alternative
- Alternative 3 compared to the Second Basis of Comparison
- Alternative 5 compared to the Second Basis of Comparison

15.4.3.1 No Action Alternative

The No Action Alternative is compared to the Second Basis of Comparison.

15.4.3.1.1 Trinity River Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in CVP water supplies and operations under the No Action Alternative as compared to the Second Basis of Comparison would result in similar end of September reservoir elevations (changes within 5 percent) and related recreational resources at Trinity Lake in all water year types, as described in Chapter 5, Surface Water Resources and Water Supplies.

There are several boat ramps at Trinity Lake that provide access at different elevations. Boat ramps at Stuart Fork and Bowerman are not useable when the water elevation is less than 2,323 feet which occurs approximately 80 percent of the time under the No Action Alternative and Second Basis of Comparison. Boat ramps at Clark Springs, Fairview, and Trinity Center are not useable when the water elevation is lower than 2,300 feet which occurs approximately 62 percent of the time under the No Action Alternative and Second Basis of Comparison. The Minersville boat ramp is accessible until the elevation declines below 2,170 feet which occurs approximately 5 percent of the time under the No Action Alternative and Second Basis of Comparison.

Potential Changes in Recreational Resources along Rivers Downstream of the CVP and SWP Reservoirs

The following changes would occur on the Trinity River under the No Action Alternative as compared to the Second Basis of Comparison, as summarized in Chapter 5, Surface Water Resources and Water Supplies.

- Over long-term conditions, 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 in all months.

Flows in Trinity River would be similar during the recreation season (spring and summer months); therefore, recreational opportunities would be similar.

15.4.3.1.2 Central Valley Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in CVP water supplies and operations under the No Action Alternative as compared to the Second Basis of Comparison would result in similar end of September reservoir elevations and related recreational resources at 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, as described in Chapter 5, Surface Water Resources and Water Supplies. Changes in recreational resources at San Luis Reservoir would be reduced in wet year and critical dry years because the end of September surface water elevations would be reduced by 6.2 percent in wet and critical dry years.

There are several boat ramps at each of the reservoirs that provide access at different elevations. At Shasta Lake, boat ramps at Antlers, Hirz Bay, Packers Bay, Sugar Loaf, and Centimundi and Jones Valley are not accessible approximately 55, 35, 20, 10, and 9 percent of the time, respectively, under the No Action Alternative; and approximately 55, 30, 15, 10, and 7 percent of the time, respectively, under the Second Basis of Comparison.

At Lake Oroville, boat ramps at Enterprise, Vinton Gulch, and Nelson Bar; Foreman Creek; Dark Canyon and Loafer Creek; and Bidwell Canyon, Lime Saddle, and Spillway are not accessible approximately 95, 87, 73, and 35 percent of the time, respectively, under the No Action Alternative; and approximately 85, 75, 62, and 25 percent of the time, respectively, under the Second Basis of Comparison.

At Folsom Lake, boat ramps at Rattlesnake Bar, Beal's Point; Peninsula, Brown's Ravine, and Folsom Point; Hobie Cove; and Granite Bay are not accessible approximately 80, 65, 40, 10, and 7 percent of the time, respectively, under the No Action Alternative; and approximately 65, 40, 10, and 7 percent of the time, respectively, under the Second Basis of Comparison.

At New Melones Reservoir, the boat ramp at Angels Creek, Parrott's Ferry, Glory Hole, and Mark Twain are not accessible approximately 65, 25, 18, and 5 percent of the time, respectively, under the No Action Alternative; and approximately 30, 25, 15, 5 percent of the time, respectively, under the Second Basis of Comparison.

At San Luis Reservoir, the boat ramps at Dinosaur Point and Basalt Area are not useable approximately 50 and 10 percent of the time, respectively, under the No Action Alternative; and approximately 20 and 5 percent of the time, respectively, under the Second Basis of Comparison.

At all reservoirs, boating opportunities would be decreased, and shoreline recreational opportunities would be similar or decreased under the No Action Alternative as compared to the Second Basis of Comparison.

Potential Changes in Recreational Resources along Rivers Downstream of the CVP and SWP Reservoirs

The recreational opportunities along the Sacramento, Feather, American, and Stanislaus rivers would be affected by the following changes in river flows, as described in Chapter 5.

- Sacramento River downstream of Keswick Dam
  - 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, 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).
- 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).

- Feather River downstream of the 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).
- 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).
- 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 November through March, May, and June (up to 35.7 percent).

During the spring and summer months, the changes in flow conditions between the No Action Alternative and the Second Basis of Comparison vary on a monthly basis in the Sacramento, Feather, American, and Stanislaus rivers within a water year type. For example, flows in the Sacramento River at Freeport would increase in several months under the No Action Alternative as compared to the Second Basis of Comparison by up to 90 percent, and decrease in several months up to 11 percent. The overall range of flows is within the historical operational range; therefore, recreational opportunities still exist. However, the value of the recreational opportunities would be both improved and reduced depending upon the timing of the changes.

Overall, under the No Action Alternative and the Second Basis of Comparison, recreational opportunities would be 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.

Effects Related to Cross Delta Water Transfers

Potential effects to recreational resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c). Potential effects to recreational resources were identified as changes in reservoir surface water elevations, streams, and the Delta. The analysis indicated that these potential impacts would not be substantial because the conditions with and without the water transfers would be similar.

Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Under the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be less under the No Action Alternative than under the Second Basis of Comparison.

15.4.3.1.3 San Francisco Bay Area, Central Coast, and Southern California Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in recreational resources at reservoirs that store CVP and SWP water supplies are assumed to be related to changes in water deliveries over long-term conditions for this EIS analysis. Monthly deliveries are not necessarily indicative of reservoir storage because all or a portion of the water deliveries could be directly conveyed to water users in any specific month. Therefore, annual deliveries are considered to be relatively proportional to the amount of water that could be stored over all water year types. In the San Francisco Bay Area Region, values for the CVP municipal and industrial water deliveries and the SWP south of the Delta water deliveries (without Article 21 deliveries) were considered; and SWP south of the Delta water deliveries (without Article 21 deliveries) were considered for the Central Coast and Southern California regions. Under the No Action Alternative as compared to the Second Basis of Comparison CVP water deliveries would be reduced by 10 percent and SWP water deliveries would be reduced by 18 percent. Therefore, for this EIS analysis, it is assumed that recreational resources related to surface water elevations in reservoirs that store CVP and SWP water supplies would be reduced by 10 to 18 percent in the

San Francisco Bay Area Region and 18 percent in the Central Coast and Southern California regions.

15.4.3.2 Alternative 1

Alternative 1 is identical to the Second Basis of Comparison. As described in Chapter 4, Approach to Environmental Analysis, Alternative 1 is compared to the No Action Alternative and the Second Basis of Comparison. However, because recreational resource conditions under Alternative 1 are identical to recreational resource conditions under the Second Basis of Comparison; Alternative 1 is only compared to the No Action Alternative.

15.4.3.2.1 Alternative 1 Compared to the No Action Alternative

Trinity River Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in CVP water supplies and operations under Alternative 1 as compared to the No Action Alternative would result in similar end of September reservoir elevations and related recreational resources at Trinity Lake in all water year types, as described in Chapter 5, Surface Water Resources and Water Supplies.

There are several boat ramps at Trinity Lake that provide access at different elevations. Boat ramps at Stuart Fork and Bowerman are not useable when the water elevation is less than 2,323 feet which occurs approximately 80 percent of the time under Alternative 1 and the No Action Alternative. Boat ramps at Clark Springs, Fairview, and Trinity Center are not useable when the water elevation is lower than 2,300 feet which occurs approximately 62 percent of the time under Alternative 1 and the No Action Alternative. The Minersville boat ramp is accessible until the elevation declines below 2,170 feet which occurs approximately 5 percent of the time under Alternative 1 and the No Action Alternative.

The potential for reduced recreational resources at Trinity Lake related to shoreline activities would be less under the No Action Alternative as compared to the Second Basis of Comparison.

Potential Changes in Recreational Resources along Rivers Downstream of the CVP and SWP Reservoirs

The following changes would occur on the Trinity River under Alternative 1 as compared to the No Action Alternative, as summarized in Chapter 5, Surface Water Resources and Water Supplies.

- 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.

Flows in Trinity River would be similar during the recreation season (spring and summer months); therefore, recreational opportunities would be similar.

Central Valley Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in CVP water supplies and operations under Alternative 1 as compared to the No Action Alternative would result in similar end of September reservoir elevations and related recreational resources at 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, as described in Chapter 5, Surface Water Resources and Water Supplies. Changes in recreational resources at San Luis Reservoir would be reduced in wet year and critical dry years because the end of September surface water elevations would be increased by 6.6 percent in wet and critical dry years.

There are several boat ramps at each of the reservoirs that provide access at different elevations. At Shasta Lake, boat ramps at Antlers, Hirz Bay, Packers Bay, Sugar Loaf, and Centimundi and Jones Valley are not accessible approximately 55, 30, 15, 10, and 7 percent of the time, respectively, under Alternative 1; and approximately 55, 35, 20, 10, and 9 percent of the time, respectively, under the No Action Alternative.

At Lake Oroville, boat ramps at Enterprise, Vinton Gulch, and Nelson Bar; Foreman Creek; Dark Canyon and Loafer Creek; and Bidwell Canyon, Lime Saddle, and Spillway are not accessible approximately 85, 75, 62, and 25 percent of the time, respectively, under Alternative 1; and approximately 95, 87, 73, and 35 percent of the time, respectively, under the No Action Alternative.

At Folsom Lake, boat ramps at Rattlesnake Bar, Beal's Point; Peninsula, Brown's Ravine, and Folsom Point; Hobie Cove; and Granite Bay are not accessible approximately 65, 40, 10, and 7 percent of the time, respectively, under Alternative 1; and approximately 80, 65, 40, 10, and 7 percent of the time, respectively, under the No Action Alternative.

At New Melones Reservoir, the boat ramp at Angels Creek, Parrott's Ferry, Glory Hole, and Mark Twain are not accessible approximately 30, 25, 15, 5 percent of the time, respectively, under Alternative 1 as compared to approximately 65, 25, 18, and 5 percent of the time, respectively, under the No Action Alternative.

At San Luis Reservoir, the boat ramps at Dinosaur Point and Basalt Area are not useable approximately 20 and 5 percent of the time, respectively, under Alternative 1; and approximately 50 and 10 percent of the time, respectively, under the No Action Alternative.

At all reservoirs, boating opportunities would be increased, and shoreline recreational opportunities would be similar or increased under Alternative 1 as compared to the No Action Alternative.

Potential Changes in Recreational Resources along Rivers Downstream of the CVP and SWP Reservoirs

The recreational opportunities along the Sacramento, Feather, American, and Stanislaus rivers would be affected by the following changes in river flows, as described in Chapter 5.

- Sacramento River downstream of Keswick Dam
  - 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).
- 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).
- Feather River downstream of the 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).

- 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).
- 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).

During the spring and summer months, the changes in flow conditions between Alternative 1 as compared to the No Action Alternative vary on a monthly basis in the Sacramento, Feather, American, and Stanislaus rivers within a water year type. For example, flows in the Sacramento River at Freeport would increase in several months under Alternative 1 as compared to the No Action Alternative by up to 17 percent, and decrease in several months up to 44 percent. The overall range of flows is within the historical operational range; therefore, recreational opportunities still exist. However, the value of the recreational opportunities would be both improved and reduced depending upon the timing of the changes.

Overall, under Alternative 1 as compared to the No Action Alternative, recreational opportunities would be 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.

Effects Related to Cross Delta Water Transfers

Potential effects to recreational resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 1 and the No Action Alternative, and that impacts on recreational resources would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 1, water could be transferred throughout the year without an annual volumetric limit. Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be increased under Alternative 1 as compared to the No Action Alternative.

San Francisco Bay Area, Central Coast, and Southern California Regions

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in recreational resources at reservoirs that store CVP and SWP water supplies are assumed to be related to changes in water deliveries over long-term conditions for this EIS analysis, as described above under the No Action Alternative as compared to the Second Basis of Comparison. Therefore, under Alternative 1 as compared to the No Action Alternative, recreational resources related to surface water elevations in reservoirs that store CVP and SWP water supplies would be increased by 11 to 21 percent in the San Francisco Bay Area Region and 21 percent in the Central Coast and Southern California regions.

15.4.3.2.2 Alternative 1 Compared to the Second Basis of Comparison

Alternative 1 is identical to the Second Basis of Comparison.

15.4.3.3 Alternative 2

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative; therefore, Alternative 2 is only compared to the Second Basis of Comparison.

15.4.3.3.1 Alternative 2 Compared to the Second Basis of Comparison

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative. Therefore, changes to recreational resources conditions under Alternatives 2 as compared to the Second Basis of Comparison would be the same as the impacts described in Section 15.4.3.1, No Action Alternative.

15.4.3.4 Alternative 3

As described in Chapter 3, Description of Alternatives, CVP and SWP operations under Alternative 3 are similar to the Second Basis of Comparison with modified Old and Middle River flow criteria and New Melones Reservoir operations; and additional predation control actions to reduce the populations of striped bass. As described in Chapter 4, Approach to Environmental Analysis, Alternative 3 is compared to the No Action Alternative and the Second Basis of Comparison.

15.4.3.4.1 Alternative 3 Compared to the No Action Alternative

Trinity River Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in CVP water supplies and operations under Alternative 3 as compared to the No Action Alternative would result in similar end of September reservoir elevations and related recreational resources at Trinity Lake in all water year types, as described in Chapter 5, Surface Water Resources and Water Supplies.

There are several boat ramps at Trinity Lake that provide access at different elevations. Boat ramps at Stuart Fork and Bowerman are not useable when the water elevation is less than 2,323 feet which occurs approximately 80 percent of the time under Alternative 3 and the No Action Alternative. Boat ramps at Clark Springs, Fairview, and Trinity Center are not useable when the water elevation is lower than 2,300 feet which occurs approximately 62 percent of the time under Alternative 3 and the No Action Alternative. The Minersville boat ramp is accessible until the elevation declines below 2,170 feet which occurs approximately 5 percent of the time under Alternative 3 and the No Action Alternative.

Potential Changes in Recreational Resources along Rivers Downstream of the CVP and SWP Reservoirs

The following changes would occur on the Trinity River under Alternative 3 as compared to the No Action Alternative, as summarized in Chapter 5, Surface Water Resources and Water Supplies.

- 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.

Flows in Trinity River would be similar during the recreation season (spring and summer months); therefore, recreational opportunities would be similar.

Central Valley Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in CVP water supplies and operations under Alternative 3 as compared to the No Action Alternative would result in similar end of September reservoir elevations and related recreational resources at Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in below normal, dry, and critical dry years, as described in Chapter 5, Surface Water Resources and Water Supplies. Changes in recreational resources at San Luis Reservoir would be reduced in wet year and critical dry years because the end of September surface water elevations would be increased by 7.9 percent in wet years and 5.7 percent in above normal years.

There are several boat ramps at each of the reservoirs that provide access at different elevations. At Shasta Lake, boat ramps at Antlers, Hirz Bay, Packers Bay, Sugar Loaf, and Centimundi and Jones Valley are not accessible approximately 55, 30, 15, 10, and 7 percent of the time, respectively, under Alternative 3; and approximately 55, 35, 20, 10, and 9 percent of the time, respectively, under the No Action Alternative.

At Lake Oroville, boat ramps at Enterprise, Vinton Gulch, and Nelson Bar; Foreman Creek; Dark Canyon and Loafer Creek; and Bidwell Canyon, Lime Saddle, and Spillway are not accessible approximately 85, 75, 62, and 25 percent of the time, respectively, under Alternative 3; and approximately 95, 87, 73, and 35 percent of the time, respectively, under the No Action Alternative.

At Folsom Lake, boat ramps at Rattlesnake Bar, Beal's Point; Peninsula, Brown's Ravine, and Folsom Point; Hobie Cove; and Granite Bay are not accessible approximately 65, 40, 10, and 7 percent of the time, respectively, under Alternative 3; and approximately 80, 65, 40, 10, and 7 percent of the time, respectively, under the No Action Alternative.

At New Melones Reservoir, the boat ramp at Angels Creek, Parrott's Ferry, Glory Hole, and Mark Twain are not accessible approximately 22, 18, 10, and 5 percent of the time, respectively, under Alternative 3 as compared to approximately 65, 25, 18, and 5 percent of the time, respectively, under the No Action Alternative.

At San Luis Reservoir, the boat ramps at Dinosaur Point and Basalt Area are not useable approximately 28 and 8 percent of the time, respectively, under Alternative 3; and approximately 50 and 10 percent of the time, respectively, under the No Action Alternative.

At Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir, boating opportunities would be increased, and opportunities would be similar at Shasta Lake under Alternative 3 as compared to the No Action Alternative. At Shasta Lake, Lake Oroville, and New Melones Reservoir shoreline recreational opportunities would be increased, and opportunities would be similar at Folsom Lake and San Luis Reservoir under Alternative 3 as compared to the No Action Alternative.

Potential Changes in Recreational Resources along Rivers Downstream of the CVP and SWP Reservoirs

The recreational opportunities along the Sacramento, Feather, American, and Stanislaus rivers would be affected by the following changes in river flows, as described in Chapter 5.

- Sacramento River downstream of Keswick Dam
  - 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).
- Feather River downstream of the 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).
- 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).
- 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).

During the spring and summer months, the changes in flow conditions between Alternative 3 and the No Action Alternative vary on a monthly basis in the Sacramento, Feather, American, and Stanislaus rivers within a water year type. For example, flows in the Sacramento River at Freeport would increase in several months under Alternative 3 as compared to the No Action Alternative by up to 15 percent, and decrease in several months up to 30 percent. The overall range of flows is within the historical operational range; therefore, recreational opportunities still exist. However, the value of the recreational opportunities would be both improved and reduced depending upon the timing of the changes.

Overall, under Alternative 3 as compared to the No Action Alternative, recreational opportunities would be similar or improved on the 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 initially be increased when Alternative 3 is implemented. However, by 2030, Striped Bass fishing opportunities would be reduced under Alternative 3 as compared to the No Action Alternative due to actions to reduce predation.

Recreational opportunities related to sport ocean salmon fishing would be reduced under Alternative 3 as compared to the No Action Alternative.

Effects Related to Cross Delta Water Transfers

Potential effects to recreational resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 3 and the No Action Alternative, and that impacts on recreational resources would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 3, water could be transferred throughout the year without an annual volumetric limit. Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be increased under Alternative 3 as compared to the No Action Alternative.

San Francisco Bay Area, Central Coast, and Southern California Regions

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in recreational resources at reservoirs that store CVP and SWP water supplies are assumed to be related to changes in water deliveries over long-term conditions for this EIS analysis, as described above under the No Action Alternative as compared to the Second Basis of Comparison. Therefore, under Alternative 3 as compared to the No Action Alternative, recreational resources related to surface water elevations in reservoirs that store CVP and SWP water supplies would be increased by 9 to 17 percent in the San Francisco Bay Area Region and 17 percent in the Central Coast and Southern California regions.

15.4.3.4.2 Alternative 3 Compared to the Second Basis of Comparison

Trinity River Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in CVP water supplies and operations under Alternative 3 as compared to the Second Basis of Comparison would result in similar end of September reservoir elevations and related recreational resources at Trinity Lake in all water year types, as described in Chapter 5, Surface Water Resources and Water Supplies.

There are several boat ramps at Trinity Lake that provide access at different elevations. Boat ramps at Stuart Fork and Bowerman are not useable when the water elevation is less than 2,323 feet which occurs approximately 80 percent of the time under Alternative 3 and the Second Basis of Comparison. Boat ramps at Clark Springs, Fairview, and Trinity Center are not useable when the water elevation is lower than 2,300 feet which occurs approximately 62 percent of the time under Alternative 3 and the Second Basis of Comparison. The Minersville boat ramp is accessible until the elevation declines below 2,170 feet which occurs approximately 5 percent of the time under Alternative 3 and the Second Basis of Comparison.

The potential for reduced recreational resources at Trinity Lake related to shoreline activities would be greater in critical dry years and similar in dry years and over the long-term average conditions under the No Action Alternative as compared to the Second Basis of Comparison.

Potential Changes in Recreational Resources along Rivers Downstream of the CVP and SWP Reservoirs

Flows in the Trinity River and recreational opportunities under Alternative 3 would be similar to the Second Basis of Comparison, as summarized in Chapter 5, Surface Water Resources and Water Supplies.

Central Valley Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in CVP water supplies and operations under Alternative 3 as compared to the Second Basis of Comparison would result in similar end of September reservoir elevations and related recreational resources at Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir in all water year types, as described in Chapter 5, Surface Water Resources and Water Supplies.

There are several boat ramps at each of the reservoirs that provide access at different elevations. At Shasta Lake, boat ramps at Antlers, Hirz Bay, Packers Bay, Sugar Loaf, and Centimundi and Jones Valley are not accessible approximately 55, 30, 15, 10, and 7 percent of the time, respectively, under Alternative 3 and the Second Basis of Comparison.

At Lake Oroville, boat ramps at Enterprise, Vinton Gulch, and Nelson Bar; Foreman Creek; Dark Canyon and Loafer Creek; and Bidwell Canyon, Lime Saddle, and Spillway are not accessible approximately 85, 75, 62, and 35 percent of the time, respectively, under Alternative 3 and the Second Basis of Comparison.

At Folsom Lake, boat ramps at Rattlesnake Bar; Beal’s Point; Peninsula, Brown’s Ravine, and Folsom Point; Hobie Cove; and Granite Bay are not accessible approximately 70, 65, 40, 10, and 7 percent of the time, respectively, under Alternative 3 and the Second Basis of Comparison.

At New Melones Reservoir, the boat ramp at Angels Creek, Parrott’s Ferry, Glory Hole, and Mark Twain are not accessible approximately 22, 18, 10, and 8 percent of the time, respectively, under Alternative 3 as compared to approximately 30, 25, 15, and 3 percent of the time, respectively, under the Second Basis of Comparison.

At San Luis Reservoir, the boat ramps at Dinosaur Point and Basalt Area are not useable approximately 28 and 8 percent of the time, respectively, under

Alternative 3; and approximately 20 and 5 percent of the time, respectively, under the Second Basis of Comparison.

Boating opportunities would be increased at New Melones Reservoir, decreased at San Luis Reservoir, and similar at all other reservoirs under Alternative 3 as compared to the Second Basis of Comparison. Shoreline recreational opportunities would be increased at New Melones Reservoir, decreased at Lake Oroville, and similar at all other reservoirs under Alternative 3 as compared to the Second Basis of Comparison.

Potential Changes in Recreational Resources along Rivers Downstream of the CVP and SWP Reservoirs

The recreational opportunities along the Sacramento, Feather, American, and Stanislaus rivers would be affected by the following changes in river flows, as described in Chapter 5.

- Similar or increased flows in the Sacramento River downstream of Keswick Dam and at Freeport.
- Feather River downstream of the 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).
- Similar flows in American River downstream of Nimbus Dam.
- 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, and July 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).

During the spring and summer months, the changes in flow conditions between Alternative 3 and the Second Basis of Comparison vary on a monthly basis in the Sacramento, Feather, American, and Stanislaus rivers within a water year type. For example, flows in the Stanislaus River downstream of Goodwin Dam would increase in several months under Alternative 3 as compared to the Second Basis of Comparison by up to 90 percent, and decrease in several months up to 11 percent. The overall range of flows is within the historical operational range; therefore, recreational opportunities still exist.

Overall, under Alternative 3 as compared to the Second Basis of Comparison, recreational opportunities would be similar or improved on the 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 initially be increased when Alternative 3 is implemented. However, by 2030, Striped Bass fishing opportunities would be reduced under Alternative 3 as compared to the Second Basis of Comparison due to actions to reduce predation.

Recreational opportunities related to sport ocean salmon fishing would be reduced under Alternative 3 as compared to the Second Basis of Comparison.

Effects Related to Cross Delta Water Transfers

Potential effects to recreational resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 3 and the Second Basis of Comparison, and that impacts on recreational resources would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 3 and the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be similar under Alternative 3 and the Second Basis of Comparison.

San Francisco Bay Area, Central Coast, and Southern California Regions

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in recreational resources at reservoirs that store CVP and SWP water supplies are assumed to be related to changes in water deliveries over long-term conditions for this EIS analysis, as described above under the No Action Alternative as compared to the Second Basis of Comparison. Therefore, under Alternative 3 as compared to the Second Basis of Comparison, recreational resources related to surface water elevations in reservoirs that store CVP and SWP water supplies would be similar (changes within 5 percent).

15.4.3.5 Alternative 4

The recreational resources under Alternative 4 would be similar to the conditions under the Second Basis of Comparison with additional predation control actions to reduce the populations of striped bass.

15.4.3.5.1 Alternative 4 Compared to the No Action Alternative

The CVP and SWP operations under Alternative 4 are identical to the CVP and SWP operations under the Second Basis of Comparison and Alternative 1. However, Alternative 4 includes predation controls as compared to the Second Basis. Therefore, reservoir and flow-related changes in recreational resources under Alternative 4 as compared to the No Action Alternative would be the same as the impacts described in Section 15.4.3.2.1, Alternative 1 Compared to the No Action Alternative.

Recreational opportunities related to Striped Bass fishing would initially be increased when Alternative 4 is implemented. However, by 2030, Striped Bass fishing opportunities would be reduced under Alternative 4 as compared to the No Action Alternative due to actions to reduce predation.

Recreational opportunities related to sport ocean salmon fishing would be reduced under Alternative 4 as compared to the No Action Alternative.

15.4.3.5.2 Alternative 4 Compared to the Second Basis of Comparison

The CVP and SWP operations under Alternative 4 are identical to the CVP and SWP operations under the Second Basis of Comparison and Alternative 1. However, Alternative 4 includes predation controls as compared to the Second Basis of Comparison. Therefore, flow-related changes in recreational resources under Alternative 4 are the same as recreational resources under the Second Basis of Comparison.

Recreational opportunities related to Striped Bass fishing would initially be increased when Alternative 4 is implemented. However, by 2030, Striped Bass fishing opportunities would be reduced under Alternative 4 as compared to the Second Basis of Comparison due to actions to reduce predation.

Recreational opportunities related to sport ocean salmon fishing would be reduced under Alternative 4 as compared to the Second Basis of Comparison.

15.4.3.6 Alternative 5

As described in Chapter 3, Description of Alternatives, CVP and SWP operations under Alternative 5 are similar to the No Action Alternative with modified Old and Middle River flow criteria and New Melones Reservoir operations. As described in Chapter 4, Approach to Environmental Analysis, Alternative 5 is compared to the No Action Alternative and the Second Basis of Comparison.

15.4.3.6.1 Alternative 5 Compared to the No Action Alternative

Trinity River Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in CVP water supplies and operations under Alternative 5 as compared to the No Action Alternative would result in similar end of September reservoir elevations and related recreational resources at Trinity Lake in all water year types, as described in Chapter 5, Surface Water Resources and Water Supplies.

There are several boat ramps at Trinity Lake that provide access at different elevations. Boat ramps at Stuart Fork and Bowerman are not useable when the water elevation is less than 2,323 feet which occurs approximately 80 percent of the time under Alternative 5 and the No Action Alternative. Boat ramps at Clark Springs, Fairview, and Trinity Center are not useable when the water elevation is lower than 2,300 feet which occurs approximately 62 percent of the time under Alternative 5 and the No Action Alternative. The Minersville boat ramp is accessible until the elevation declines below 2,170 feet which occurs approximately 8 percent of the time under Alternative 5 and 5 percent of the time under the No Action Alternative.

The potential for reduced recreational resources at Trinity Lake related to shoreline activities would be slightly less in critical dry years and similar over the long-term average conditions and dry years under Alternative 5 as compared to the No Action Alternative.

Potential Changes in Recreational Resources along Rivers Downstream of the CVP and SWP Reservoirs

Flows in the Trinity River and recreational opportunities under Alternative 5 would be similar to the No Action Alternative, as summarized in Chapter 5, Surface Water Resources and Water Supplies.

Central Valley Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in CVP water supplies and operations under Alternative 5 as compared to the No Action Alternative would result in similar end of September reservoir elevations and related recreational resources at Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir in all water year types, as described in Chapter 5, Surface Water Resources and Water Supplies.

There are several boat ramps at each of the reservoirs that provide access at different elevations. At Shasta Lake, boat ramps at Antlers, Hirz Bay, Packers Bay, Sugar Loaf, and Centimundi and Jones Valley are not accessible approximately 55, 35, 20, 10, and 9 percent of the time, respectively, under Alternative 5 and the No Action Alternative.

At Lake Oroville, boat ramps at Enterprise, Vinton Gulch, and Nelson Bar; Foreman Creek; Dark Canyon and Loafer Creek; and Bidwell Canyon, Lime Saddle, and Spillway are not accessible approximately 95, 87, 73, and 35 percent of the time, respectively, under Alternative 5 and the Second Basis of Comparison.

At Folsom Lake, boat ramps at Rattlesnake Bar, Beal's Point; Peninsula, Brown's Ravine, and Folsom Point; Hobie Cove; and Granite Bay are not accessible approximately 80, 65, 40, 10, and 7 percent of the time, respectively, under Alternative 5 and the No Action Alternative.

At New Melones Reservoir, the boat ramp at Angels Creek, Parrott's Ferry, Glory Hole, and Mark Twain are not accessible approximately 35, 30, 22, and 8 percent of the time, respectively, under Alternative 5 as compared to approximately 65, 25, 18, and 5 percent of the time, respectively, under the No Action Alternative.

At San Luis Reservoir, the boat ramps at Dinosaur Point and Basalt Area are not useable approximately 50 and 10 percent of the time, respectively, under Alternative 5 and the No Action Alternative.

Increased shoreline recreational opportunities at New Melones Reservoir in long-term average conditions and dry years, decreased opportunities at New Melones Reservoir in critical dry years, and similar opportunities at all times analyzed at all other reservoirs under Alternative 5 as compared to the No Action Alternative. Increased boating opportunities at New Melones Reservoir and similar opportunities at all other reservoirs under Alternative 5 as compared to the No Action Alternative.

Potential Changes in Recreational Resources along Rivers downstream of the CVP and SWP Reservoirs

The recreational opportunities along the Sacramento, Feather, American, and Stanislaus rivers would be affected by the following changes in river flows, as described in Chapter 5.

- Flows in the Sacramento River downstream of Keswick Dam and near Freeport would be similar.
- Feather River downstream of the 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).
- Flows in the American River downstream of Nimbus Dam 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).

During the spring and summer months, the changes in flow conditions between Alternative 5 and the No Action Alternative vary on a monthly basis in the Sacramento, Feather, American, and Stanislaus rivers within a water year type. For example, flows in the Feather River downstream of Thermalito Complex would increase in several months under Alternative 5 and the No Action Alternative by up to 9 percent, and decrease in several months up to 27 percent. The overall range of flows is within the historical operational range; therefore, recreational opportunities still exist. However, the value of the recreational opportunities would be both improved and reduced depending upon the timing of the changes.

Overall, under Alternative 5 and the No Action Alternative, recreational opportunities would be similar or improved on the Sacramento and American rivers; and both improved and reduced on the Feather and Stanislaus rivers.

Effects Related to Cross Delta Water Transfers

Potential effects to recreational resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 5 and the No Action Alternative, and that impacts on recreational resources would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 5 and the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be similar under Alternative 5 and the No Action Alternative.

San Francisco Bay Area, Central Coast, and Southern California Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in recreational resources at reservoirs that store CVP and SWP water supplies are assumed to be related to changes in water deliveries over long-term conditions for this EIS analysis, as described above under the No Action Alternative as compared to the Second Basis of Comparison. Therefore, under

Alternative 5 as compared to the No Action Alternative, recreational resources would be similar.

15.4.3.6.2 Alternative 5 Compared to the Second Basis of Comparison

Trinity River Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in CVP water supplies and operations under Alternative 5 as compared to the Second Basis of Comparison would result in similar end of September reservoir elevations and related recreational resources at Trinity Lake in all water year types, as described in Chapter 5, Surface Water Resources and Water Supplies.

There are several boat ramps at Trinity Lake that provide access at different elevations. Boat ramps at Stuart Fork and Bowerman are not useable when the water elevation is less than 2,323 feet which occurs approximately 80 percent of the time under Alternative 5 and the Second Basis of Comparison. Boat ramps at Clark Springs, Fairview, and Trinity Center are not useable when the water elevation is lower than 2,300 feet which occurs approximately 62 percent of the time under Alternative 5 and the Second Basis of Comparison. The Minersville boat ramp is accessible until the elevation declines below 2,170 feet which occurs approximately 8 percent of the time under Alternative 5 and 5 percent of the time under the Second Basis of Comparison.

The potential for reduced recreational resources at Trinity Lake related to shoreline activities would be similar under Alternative 5 as compared to the Second Basis of Comparison.

Potential Changes in Recreational Resources along Rivers Downstream of the CVP and SWP Reservoirs

Flows in Trinity River would be similar during the recreation season (spring and summer months); therefore, recreational opportunities would be similar under Alternative 5 as compared to the Second Basis of Comparison.

Central Valley Region

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in CVP water supplies and operations under Alternative 5 as compared to the Second Basis of Comparison would result in similar end of September reservoir elevations and related recreational resources at Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in wet, above normal, and below normal years, as described in Chapter 5, Surface Water Resources and Water Supplies. Changes in recreational resources at San Luis Reservoir would be reduced in dry year and critical dry years because the end of September surface water elevations would be decreased by 6.2 percent in dry years and 8.5 percent in critical dry years.

There are several boat ramps at each of the reservoirs that provide access at different elevations. At Shasta Lake, boat ramps at Antlers, Hirz Bay, Packers Bay, Sugar Loaf, and Centimundi and Jones Valley are not accessible approximately 55, 35, 20, 10, and 9 percent of the time, respectively, under Alternative 5; and approximately 55, 30, 15, 10, and 7 percent of the time, respectively, under the Second Basis of Comparison.

At Lake Oroville, boat ramps at Enterprise, Vinton Gulch, and Nelson Bar; Foreman Creek; Dark Canyon and Loafer Creek; and Bidwell Canyon, Lime Saddle, and Spillway are not accessible approximately 95, 87, 73, and 35 percent of the time, respectively, under Alternative 5; and approximately 85, 75, 62, and 25 percent of the time, respectively, under the Second Basis of Comparison.

At Folsom Lake, boat ramps at Rattlesnake Bar are not accessible 80 percent of the time under Alternative 5, and 70 percent of the time, respectively, under the Second Basis of Comparison. Boat ramps at Beal's Point; Peninsula, Brown's Ravine, and Folsom Point; Hobie Cove; and Granite Bay are not accessible approximately 65, 40, 10, and 7 percent of the time, respectively, under Alternative 5 and the Second Basis of Comparison.

At New Melones Reservoir, the boat ramp at Angels Creek, Parrott's Ferry, Glory Hole, and Mark Twain are not accessible approximately 35, 30, 22, and 8 percent of the time, respectively, under Alternative 5 as compared to approximately 30, 25, 15, and 5 percent of the time, respectively, under the Second Basis of Comparison.

At San Luis Reservoir, the boat ramps at Dinosaur Point and Basalt Area are not useable approximately 50 and 10 percent of the time, respectively, under Alternative 5; and approximately 20 and 5 percent of the time, respectively, under the Second Basis of Comparison.

Decreased shoreline recreational opportunities at Shasta Lake, Lake Oroville, and New Melones Reservoir, and similar opportunities at all other reservoirs under Alternative 5 as compared to the Second Basis of Comparison. Decreased boating opportunities at Lake Oroville, New Melones Reservoir, and San Luis Reservoir and similar opportunities at all other reservoirs under Alternative 5 as compared to the Second Basis of Comparison.

Potential Changes in Recreational Resources along Rivers Downstream of the CVP and SWP Reservoirs

The recreational opportunities along the Sacramento, Feather, American, and Stanislaus rivers would be affected by the following changes in river flows, as described in Chapter 5.

- Sacramento River downstream of Keswick Dam
  - 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 (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).
- Feather River downstream of the 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).
- American River downstream of Nimbus Dam
  - Over long-term conditions, similar flows would occur 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).
- 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).

During the spring and summer months, the changes in flow conditions between Alternative 5 and the Second Basis of Comparison vary on a monthly basis in the Sacramento, Feather, American, and Stanislaus rivers within a water year type. For example, flows in the Sacramento River at Freeport would increase in several months under Alternative 5 as compared to the Second Basis of Comparison by up to 89 percent, and decrease in several months up to 13 percent. The overall range of flows is within the historical operational range; therefore, recreational opportunities still exist. However, the value of the recreational opportunities would be both improved and reduced depending upon the timing of the changes.

Overall, under Alternative 5 as compared to the Second Basis of Comparison, recreational opportunities would be similar or improved on the 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.

Effects Related to Cross Delta Water Transfers

Potential effects to recreational resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 5 and the Second Basis of Comparison, and that impacts on recreational resources would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 5, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Under the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be reduced under Alternative 5 as compared to the Second Basis of Comparison.

San Francisco Bay Area, Central Coast, and Southern California Regions

Potential Changes in Recreational Resources at Reservoirs that Store CVP and SWP Water

Changes in recreational resources at reservoirs that store CVP and SWP water supplies are assumed to be related to changes in water deliveries over long-term conditions for this EIS analysis, as described above under the No Action Alternative as compared to the Second Basis of Comparison. Therefore, under Alternative 5 as compared to the Second Basis of Comparison, recreational resources related to surface water elevations in reservoirs that store CVP and SWP water supplies would be reduced by 10 to 18 percent in the San Francisco Bay Area Region and 18 percent in the Central Coast and Southern California regions.

15.4.3.7 Summary of Impact Assessment

The results of the impact assessment of implementation of Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison are presented in Tables 15.28 and 15.29.

Table 15.28 Comparison of Alternatives 1 through 5 to No Action Alternative

Alternative	Potential Change	Consideration for Mitigation Measures
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 California regions. Recreational opportunities would be similar or improved on Trinity River, Sacramento River downstream of Keswick Dam, and American River downstream of Nimbus Dam. On the Sacramento River near Freeport, Feather River downstream of Thermalito Complex, and the Stanislaus River downstream of Goodwin Dam recreational opportunities would be similar or improved in most spring and summer months; and reduced in July in all years and August in wetter years.	No mitigation measures identified at this time to reduce flow reduction impacts on recreation opportunities.
Alternative 2	No effects on recreational resources.	None needed

Alternative	Potential Change	Consideration for Mitigation Measures
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 opportunities would be similar or improved on Trinity River, Sacramento River downstream of Keswick Dam, and American River downstream of Nimbus Dam. On the Sacramento River near Freeport and Feather River downstream of Thermalito Complex, recreational opportunities would be similar or improved in most spring and summer months; and reduced in August in all years on both rivers and in July on the Feather River in dry years. On the Stanislaus River downstream of Goodwin Dam recreational opportunities would be similar or improved in summer months; and reduced in May and June in all water year types. Recreational opportunities related to Striped Bass fishing and sport ocean salmon fishing would be reduced.	No mitigation measures identified at this time to reduce flow reduction impacts on recreation opportunities. No mitigation measures identified at this time to reduce impacts to reduction in Striped Bass and sport ocean salmon 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 and sport ocean salmon fishing would be reduced.	No mitigation measures identified at this time to reduce flow reduction impacts on recreation opportunities. No mitigation measures identified at this time to reduce impacts to reduction in Striped Bass and sport ocean salmon 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 opportunities would be similar or improved on Trinity River, Sacramento River downstream of Keswick Dam and near Freeport, and American River downstream of Nimbus Dam. On the Feather River downstream of Thermalito Complex, recreational opportunities would be similar or improved in most spring and summer months; and reduced in May in all years. On the Stanislaus River downstream of Goodwin Dam recreational opportunities would be similar or improved in spring months; and reduced in July and August in most water year types.	No mitigation measures identified at this time to reduce flow reduction impacts on recreation opportunities.

Note: Due to the limitations and uncertainty in the CalSim II monthly model and other analytical tools, incremental differences of 5 percent or less between alternatives and the No Action Alternative are considered to be “similar.”

Table 15.29 Comparison of No Action Alternative and Alternatives 1 through 5 to Second Basis of Comparison

Alternative	Potential Change	Consideration for Mitigation Measures
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 opportunities would be similar or improved on Trinity River. On the Sacramento River downstream of Keswick Dam and near Freeport, Feather River downstream of Thermalito Complex, American River downstream of Nimbus Dam, and the Stanislaus River downstream of Goodwin Dam recreational opportunities would be similar or improved in most spring and summer months; and reduced in June in most years, August in some years on the Feather and American rivers, and in May in some years on Sacramento River near Freeport and on the Feather River.	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 and SWP water in the San Francisco Bay Area, Central Coast, and Southern California regions. Recreational opportunities would be similar or improved on Trinity River, Sacramento River downstream of Keswick Dam and near Freeport, and American River downstream of Nimbus Dam. On the Feather River downstream of Thermalito Complex, recreational opportunities would be similar or improved in most spring and summer months; and reduced in August in dry years. On the Stanislaus River downstream of Goodwin Dam recreational opportunities would be similar or improved in summer months; and reduced in May and June in all water year types. Recreational opportunities related to Striped Bass fishing and sport ocean salmon fishing would be reduced.	Not considered for this comparison.
Alternative 4	Reservoir and flow-related recreational opportunities would be similar. Recreational opportunities related to Striped Bass fishing and sport ocean salmon fishing would be reduced.	Not considered for this comparison.

Alternative	Potential Change	Consideration for Mitigation Measures
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 opportunities would be similar or improved on Trinity River. On the Sacramento River downstream of Keswick Dam and near Freeport, Feather River downstream of Thermalito Complex, American River downstream of Nimbus Dam, and the Stanislaus River downstream of Goodwin Dam recreational opportunities would be similar or improved in many spring and summer months. Flows would reduce in May and June in most years on the Sacramento and Feather rivers; in August on the American River; and in June through August on the Stanislaus River.	Not considered for this comparison.

Note: Due to the limitations and uncertainty in the CalSim II monthly model and other analytical tools, incremental differences of 5 percent or less between alternatives and the No Action Alternative are considered to be "similar."

15.4.3.8 Potential Mitigation Measures

Mitigation measures are not included in this EIS to address adverse impacts under the alternatives as compared to the Second Basis of Comparison because this analysis was included in this EIS for information purposes only.

Changes in CVP and SWP operations under Alternatives 1 through 5 as compared to the No Action Alternative would not result in adverse changes in recreational resources at reservoirs. However, implementation of Alternatives 1, 3, 4, and 5 would result in adverse changes in recreational opportunities along rivers downstream of CVP and SWP reservoirs. Implementation of Alternatives 3 and 4 would result in adverse changes in recreational Striped Bass and sport ocean salmon fishing opportunities. Mitigation measures have not been identified at this time.

15.4.3.9 Cumulative Effects Analysis

As described in Chapter 3, the cumulative effects analysis considers projects, programs, and policies that are not speculative; and are based upon known or reasonably foreseeable long-range plans, regulations, operating agreements, or other information that establishes them as reasonably foreseeable.

The cumulative effects analysis for Alternatives 1 through 5 for Recreational Opportunities are summarized in Table 15.30.

Table 15.30 Summary of Cumulative Effects on Recreational Opportunities with Implementation of Alternatives 1 through 5 as Compared to the No Action Alternative

Scenarios	Actions	Cumulative Effects of Actions
Past & Present, and Future Actions Included and in the No Action Alternative and in All Alternatives in Year 2030	Consistent with Affected Environment conditions plus: Actions in the 2008 USFWS BO and 2009 NMFS BO that would have occurred without implementation of the BOs, as described in Section 3.3.1.2 (of Chapter 3, Descriptions of Alternatives), including climate change and sea level rise Actions not included in the 2008 USFWS BO and 2009 NMFS BO that would have occurred without implementation of the BOs, as described in Section 3.3.1.3 (of Chapter 3, Descriptions of Alternatives): - Implementation of Federal and state policies and programs, including Clean Water Act (e.g., Total Maximum Daily Loads); Safe Drinking Water Act; Clean Air Act; and flood management programs - General plans for 2030. - Trinity River Restoration Program. - Central Valley Project Improvement Act programs - Folsom Dam Water Control Manual Update - FERC Relicensing for the Middle Fork of the American River Project - San Joaquin River Restoration Program - Contra Loma Recreation Resource Management Plan - San Luis Reservoir State Recreation Area Resource Management Plan/General Plan	<u>These effects would be the same under all alternatives.</u> Climate change and sea level rise and development under the general plans are anticipated to reduce carryover storage in reservoirs and changes in stream flow patterns in a manner that would change recreational opportunities, and could reduce the opportunities for sport ocean salmon fishing. Other actions, including restoration projects, FERC relicensing projects, and some future projects to improve water quality and/or habitat are anticipated to improve recreational opportunities.
Future Actions Considered as Cumulative Effects Actions in All Alternatives in Year 2030	Actions as described in Section 3.5 (of Chapter 3, Descriptions of Alternatives): - Bay-Delta Water Quality Control Plan Update - FERC Relicensing Projects - Bay Delta Conservation Plan (including the California WaterFix alternative) - Shasta Lake Water Resources, North-of-the-Delta Offstream Storage, Los Vaqueros Reservoir Expansion Phase 2, and Upper San Joaquin River Basin Storage Investigations - El Dorado Water and Power Authority Supplemental Water Rights Project - Semitropic Water Storage District Delta Wetlands - North Bay Aqueduct Alternative Intake - Irrigated Lands Regulatory Program	<u>These effects would be the same under all alternatives.</u> Some of the future reasonably foreseeable actions to improve water quality and FERC Relicensing projects would improve recreational opportunities. Other future reasonably foreseeable actions, such as expanded or new reservoirs would improve recreational opportunities.
No Action Alternative with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO	Implementation of No Action Alternative with future reasonably foreseeable actions would result in changes stream flows would result in changes to related recreational opportunities as compared to historical conditions prior to the BOs.

Scenarios	Actions	Cumulative Effects of Actions
Alternative 1 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant)	Implementation of Alternative 1 with future reasonably foreseeable actions would result in reduced stream flows and related recreational opportunities along 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 in July in all years and August in wetter years compared to the No Action Alternative with the added actions.
Alternative 2 with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO CVP and SWP operational actions No implementation of structural improvements or other actions that require further study to develop a more detailed action description.	Implementation of Alternative 2 with future reasonably foreseeable actions for recreational opportunities would be the same as for the No Action Alternative with the added actions.
Alternative 3 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant) Slight increase in positive Old and Middle River flows in the winter and spring months Increased bag limits for Striped Bass and Pikeminnow Increased sport ocean salmon fishing harvest limitations	Implementation of Alternative 3 with future reasonably foreseeable actions would result in reduced stream flows and related recreational opportunities along the Sacramento River near Freeport, Feather River downstream of Thermalito Complex would be reduced in August in all years on both rivers and in July on the Feather River in dry years. On the Stanislaus River downstream of Goodwin Dam recreational opportunities would be reduced in May and June in all water year types compared to the No Action Alternative with the added actions. Recreational opportunities related to Striped Bass fishing would initially be increased; however by 2030 recreational fishing related to Striped Bass would be reduced. Recreational opportunities related to sport ocean salmon fishing would be reduced.
Alternative 4 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant) Increased bag limits for Striped Bass and Pikeminnow Increased sport ocean salmon fishing harvest limitations	Implementation of Alternative 4 with future reasonably foreseeable actions would result in reduced stream flows and related recreational opportunities along 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 in July in all years and August in wetter years compared to the No Action Alternative with the added actions. Recreational opportunities related to Striped Bass fishing would initially be increased; however by 2030 recreational fishing related to Striped Bass would be reduced. Recreational opportunities related to sport ocean salmon fishing would be reduced.

Scenarios	Actions	Cumulative Effects of Actions
Alternative 5 with Associated Cumulative Effects Actions in Year 20530	Full implementation of the 2008 USFWS BO and 2009 NMFS BO Positive Old and Middle River flows and increased Delta outflow in spring months	Implementation of Alternative 5 with future reasonably foreseeable actions would result in reduced stream flows and related recreational opportunities along the Feather River downstream of Thermalito Complex would be reduced in May in all years compared to the No Action Alternative with the added actions. On the Stanislaus River downstream of Goodwin Dam recreational opportunities would be reduced in July and August in most water year types compared to the No Action Alternative with the added actions.

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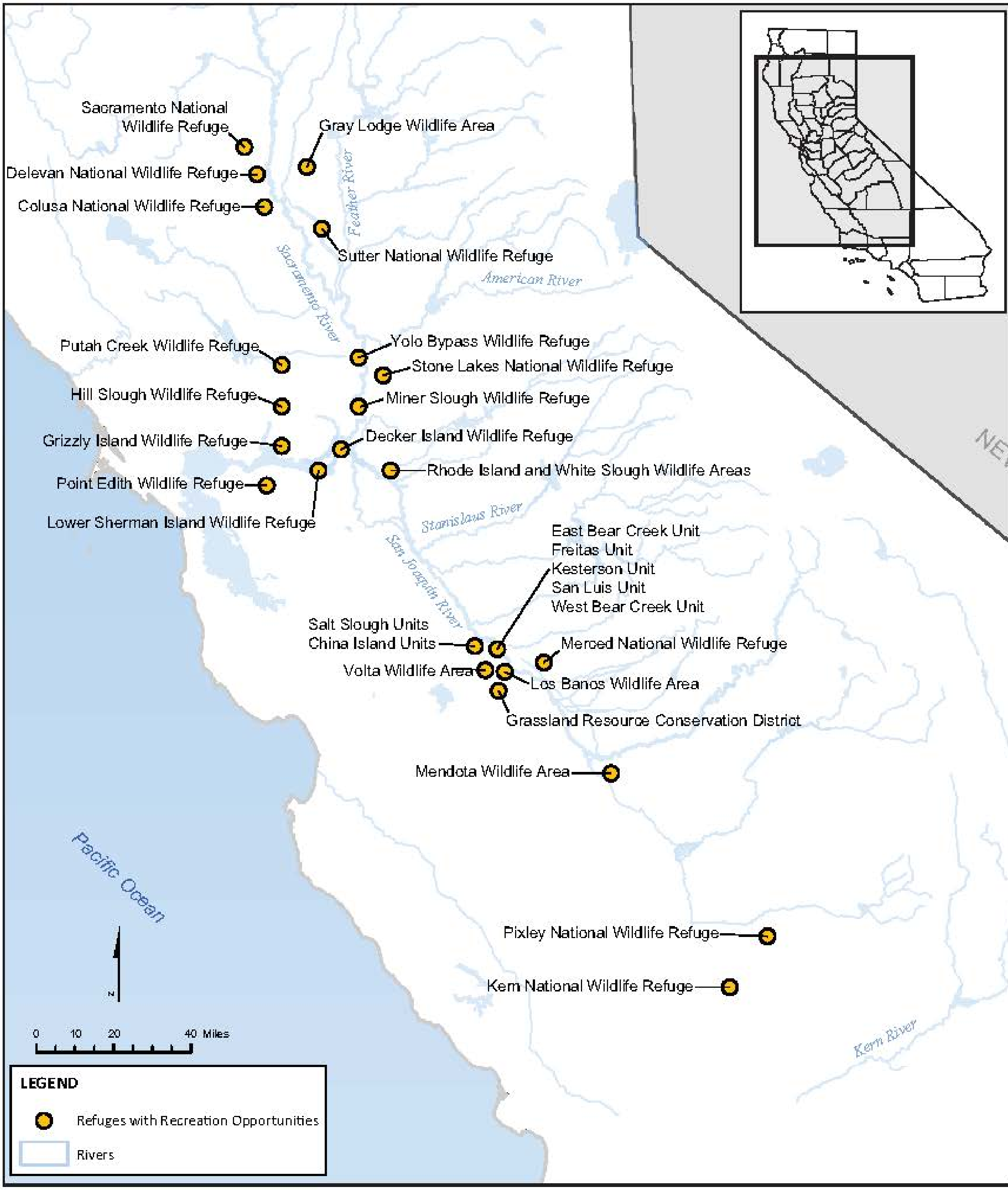

Figure 15.1 Wildlife Refuges Identified to Receive Central Valley Project Water Supplies

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Chapter 16

Air Quality and Greenhouse Gas Emissions

16.1 Introduction

This chapter describes existing and future air quality conditions and the potential for greenhouse gas emissions that could occur as a result of implementing the alternatives that could change the long-term operation of the Central Valley Project (CVP) and State Water Project (SWP) as evaluated in this Environmental Impact Statement (EIS). Implementation of the alternatives could affect CVP and SWP water deliveries which could indirectly affect air quality.

16.2 Terminology

Important air quality and greenhouse gas emission terminology used in this chapter are defined by the U.S. Environmental Protection Agency (USEPA) and the California Air Resources Board (ARB), as summarized below.

- **Attainment Area:** A geographic area considered to have air quality as good as or better than the national and/or state ambient air quality standards. An area may be an attainment area for one pollutant and a non-attainment area for others (USEPA 2006).
- **California Ambient Air Quality Standard (CAAQS):** A legal limit that specifies the maximum level and time of exposure in the outdoor air for a given air pollutant and which is protective of human health and public welfare (California Health and Safety Code section 39606b). CAAQS are recommended by the California Office of Environmental Health Hazard Assessment and adopted into regulation by the ARB. CAAQS are the standards which must be met per the requirements of the California Clean Air Act (ARB 2010).
- **Criteria Pollutant:** An air pollutant for which acceptable levels of exposure can be determined and for which an ambient air quality standard has been set (ARB 2010). The criteria pollutants are ozone (O_3), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter less than 10 microns in aerodynamic diameter (PM_{10}), particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$), and lead (Pb).
- **Greenhouse Gases (GHGs):** Atmospheric gases (such as carbon dioxide (CO_2), methane (CH_4), hydrofluorocarbons (HFC), nitrous oxide (N_2O), O_3, perfluorocarbons (PFC), sulfur hexafluoride (SF_6), and water vapor) that slow the passage of re-radiated heat through the Earth's atmosphere (ARB 2010).

Six of the GHGs are the subject of reductions under the Kyoto Protocol and California Assembly Bill 32 are CO_2, CH_4, N_2O, HFC, PFC, and SF_6.

- **National Ambient Air Quality Standard (NAAQS):** Standards established by USEPA that apply for outdoor air throughout the United States (USEPA 2006).
- **Nonattainment Area:** A geographic area identified by the USEPA and/or ARB as not meeting either NAAQS or CAAQS for a given pollutant (ARB 2010).
- **Precursor:** In photochemistry, a compound antecedent to a pollutant. For example, volatile organic compounds (VOC) and NO_x react in sunlight to form the criteria pollutant ozone. As such, VOCs and NO_x are precursors to O_3 (USEPA 2006).
- **Reactive Organic Gas (ROG):** A photochemically reactive chemical gas composed of non-methane hydrocarbons (HCs) that may contribute to the formation of smog (ARB 2010). ROG may also be referred to as non-methane organic gases, VOCs, or HCs.
- **State Implementation Plan (SIP):** A plan prepared by states and submitted to USEPA describing how each area will attain and maintain NAAQS. SIPs include the technical foundation for understanding the air quality (e.g., emission inventories and air quality monitoring), control measures and strategies, and enforcement mechanisms (ARB 2010).
- **Toxic Air Contaminant (TAC):** An air pollutant, identified in regulation by the ARB, which may cause or contribute to an increase in deaths or in serious illness, or which may pose a present or potential hazard to human health. Health effects of TACs may occur at extremely low levels and it is typically difficult to identify levels of exposure that do not produce adverse health effects (ARB 2010).

In California, local air districts have been established to oversee the attainment of air quality standards within air basins as defined by the State. Local air districts administer air quality laws and regulations within the air basins. The local air districts have permitting authority over all stationary sources of air pollutants within their district boundaries and provide the primary review of environmental documents prepared for projects with air quality issues.

16.3 Regulatory Environment and Compliance Requirements

Potential actions that could be implemented under the alternatives evaluated in this EIS could affect future air quality conditions and the potential for GHG emissions. Implementation of the alternatives could affect CVP and SWP water deliveries which could affect air quality related to agricultural operations and fugitive dust generation. Changes in air quality and GHG emissions are analyzed in this EIS relative to appropriate Federal and state agency policies and regulations, as described in Chapter 4, Approach to Environmental Analyses.

Several of the Federal and state laws and regulations that provide quantitative criteria to determine compliance also are summarized in this subsection of this chapter to provide context for information provided in the remaining sections of this chapter, including:

- Federal Clean Air Act
  - National Ambient Air Quality Standards and Federal Air Quality Designations
  - Federal General Conformity Requirements
- California Clean Air Act
- California Assembly Bill 32, California Global Warming Solutions Act of 2006

16.3.1 Federal Clean Air Act

National air quality policies are regulated through the Federal Clean Air Act (FCAA) of 1970 and its 1977 and 1990 amendments. Basic elements of the FCCA include NAAQS for criteria air pollutants, hazardous air pollutants standards, state attainment plans, motor vehicle emissions standards, stationary source emissions standards and permits, acid rain control measures, stratospheric ozone protection, and enforcement provisions.

16.3.1.1 National Ambient Air Quality Standards and Federal Air Quality Designations

Pursuant to the FCAA, the USEPA established NAAQS for O_3, CO, NO_2, sulfur dioxide (SOx as SO_2), PM_{10}, $PM_{2.5}$, and lead. These pollutants are referred to as criteria pollutants because numerical health-based criteria have been established that define acceptable levels of exposure for each pollutant. The NAAQS and the CAAQS are summarized in Table 16.1 (ARB 2013).

Table 16.1 Federal and State Ambient Air Quality Standards

Pollutant	Averaging Time	National Standards[a] Primary[b, i]	National Standards[a] Secondary[c, i]	California Standards[d]
Ozone	8 Hour 1 Hour	0.075 ppm –	0.075 ppm –	0.07 ppm 0.09 ppm
Carbon monoxide	8 Hour 1 Hour	9 ppm 35 ppm	– –	9.0 ppm 20 ppm
Nitrogen dioxide[j]	Annual Arithmetic Mean 1 Hour	0.053 ppm 100 ppb	0.053 ppm –	0.30 ppm 0.18 ppm
Sulfur dioxide[e]	Annual Arithmetic Mean 24 Hour 3 Hour 1 Hour	0.030 ppm 0.14 ppm – 75 ppb	– – 0.5 ppm –	– 0.04 ppm – 0.25 ppm
PM_{10} [f]	Annual Arithmetic Mean 24 Hour	– 150 $\mu g/m^3$	– 150 $\mu g/m^3$	20 $\mu g/m^3$ 50 $\mu g/m^3$
$PM_{2.5}$[f]	Annual Arithmetic Mean 24 Hour	12 $\mu g/m^3$ 35 $\mu g/m^3$	15 $\mu g/m^3$ 35 $\mu g/m^3$	12 $\mu g/m^3$ –
Sulfates	24 Hour	–	–	25 $\mu g/m^3$
Lead[g, k]	30 Day Average Calendar Quarter Rolling 3-Month Average	– 1.5 $\mu g/m^3$ 0.15 $\mu g/m^3$	– 1.5 $\mu g/m^3$ 0.15 $\mu g/m^3$	1.5 $\mu g/m^3$ – –
Hydrogen sulfide	1 Hour	–	–	0.03 ppm
Vinyl chloride	24 Hour	–	–	0.01 ppm
Visibility-reducing particles	8 Hour	–	–	See Note[h]

Source: ARB 2012, ARB 2013b.

Notes:

a. National standards, other than ozone, particulate matter, and those based on annual averages or annual arithmetic means, are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest eight hour concentration in a year, averaged over three years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$ is equal to or less than one. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard.

b. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

c. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

d. California standards for ozone, carbon monoxide, sulfur dioxide (1-hour and 24-hour), nitrogen dioxide, suspended particulate matter (PM_{10}, $PM_{2.5}$, and visibility reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

e. On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until one year after an area is designated for the 2010 standard, except for areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.

f. On December 14, 2012, the national annual $PM_{2.5}$ primary standard was lowered from 15 μg/m^3 to 12.0 μg/m^3. The existing national 24-hour $PM_{2.5}$ standards (primary and secondary) were retained at 35 μg/m^3, as was the annual secondary standard of 15 μg/m^3. The existing 24-hour PM_{10} standards (primary and secondary) of 150 μg/m^3 also were retained. The form of the annual primary and secondary standards is the annual mean, averaged over 3 years.

g. The national standard for lead was revised on October 15, 2008, to a rolling 3-month average. The 1978 lead standard (1.5 μg/m3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except for areas designated nonattainment for the 1978 standard, where the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

h. In 1989, the ARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are “extinction of 0.23 per kilometer” and “extinction of 0.07 per kilometer” for the statewide and Lake Tahoe Air Basin standards, respectively.

i. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

j. To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 ppb. Note that the national 1-hour standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the national 1-hour standard to the California standards the units can be converted from ppb to ppm. In this case, the national standard of 100 ppb is identical to 0.100 ppm.

k. The ARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

μg/m^3 = micrograms per cubic meter.
ppb = parts per billion (by volume).
ppm = parts per million (by volume).

The USEPA designates areas as attainment, nonattainment, or unclassified for individual criteria pollutants depending on whether the areas achieve (i.e., attain) the applicable NAAQS for each pollutant. For some pollutants, there are numerous classifications of the nonattainment designation, depending on the severity of an area's nonattainment status. Areas that lack monitoring data are designated as unclassified areas, and considered as attainment areas for regulatory purposes.

Under the 1977 FCAA amendments, states (or areas within states) with ambient air quality concentrations that do not meet the NAAQS are required to develop and maintain SIPs. These implementation plans constitute a federally enforceable definition of the state's approach and schedule for the attainment of the NAAQS. If a nonattainment area achieves compliance, the area is classified as an attainment maintenance area for 20 years.

16.3.1.2 Federal General Conformity Requirements

The 1977 FCAA amendments state that the Federal government is prohibited from engaging in, supporting, providing financial assistance for, licensing, permitting, or approving any activity that does not conform to an applicable SIP. In the 1990 FCAA amendments, the USEPA included provisions requiring Federal agencies to ensure that actions undertaken in nonattainment or attainment maintenance areas are consistent with applicable SIPs. The process of determining whether a Federal action is consistent with applicable SIPs is called "conformity" determination. A conformity determination is required only for the project alternative that is ultimately selected and approved. The USEPA general conformity regulation applies only to Federal actions that result in emissions of "nonattainment or maintenance pollutants" or their precursors in federally designated nonattainment or maintenance areas. The emission thresholds that trigger requirements of the general conformity regulation for Federal actions emitting nonattainment or maintenance pollutants, or their precursors, are called *de Minimis* levels, as summarized in Table 16.2.

Table 16.2 General Conformity *de Minimis* Levels

Pollutant	Area Type	Tons/Year
Ozone (VOC or NOx)	Serious nonattainment	50
	Severe nonattainment	25
	Extreme nonattainment	10
	Other areas outside an ozone transport region	100
Ozone (NOx)	Marginal and moderate nonattainment inside an ozone transport region	100
	Maintenance	100
Ozone (VOC)	Marginal and moderate nonattainment inside an ozone transport region	50
	Maintenance within an ozone transport region	50
	Maintenance outside an ozone transport region	100
Carbon monoxide, SO_2 and NO_2	All nonattainment and maintenance	100
PM_{10}	Serious nonattainment	70
	Moderate nonattainment and maintenance	100
$PM_{2.5}$ Direct emissions, SO_2, NOx (unless determined not to be a significant precursor), VOC or ammonia (if determined to be significant precursors)	All nonattainment and maintenance	100
Lead (Pb)	All nonattainment and maintenance	25

Source: USEPA 2015b

16.3.1.3 California Clean Air Act

The California Clean Air Act (CCAA) provides the State with a comprehensive framework for air quality planning regulation. Prior to passage of the CCAA, Federal law contained the only comprehensive planning framework. The CCAA requires attainment of state ambient air quality standards by the earliest practicable date.

The FCAA requires adoption of SIPs for nonattainment areas to describe actions that will be undertaken to achieve the NAAQS. In addition, the CCAA requires local air districts in nonattainment areas to prepare and maintain Air Quality Management Plans (AQMPs) to achieve compliance with CAAQS. These AQMPs also serve as a basis for preparing the SIP for the State of California, which must ultimately be approved by the USEPA and codified in the Code of Federal Register (CFR).

16.4 Affected Environment

This section describes the area of analysis, ambient air quality and conditions, and GHG emissions in the study area.

The air basins and air districts in California, including those in the study area, do not specifically align with the study area regions, as noted below and in the description of each air basin (ARB 2011a; ARB 2011b).

The discussion in this chapter area is organized by the study area regions and air basins. The study area regions include the following air basins and counties.

- Trinity River Region is located within portions of the North Coast Air Basin.
  - The Trinity River Region includes the area in Trinity County along the Trinity River from Trinity Lake to the confluence with the Klamath River; and the area in Humboldt and Del Norte counties along the Klamath River from the confluence with the Trinity River to the Pacific Ocean.
- Central Valley Region is located within portions of the Sacramento Valley, Mountain Counties, San Joaquin Valley, San Francisco Bay Area, Mojave Desert air basins.
  - The Central Valley Region includes all or portions the counties of Shasta, Plumas, Tehama, Glenn, Colusa, Butte, Sutter, Yuba, Nevada, Placer, El Dorado, Sacramento, Yolo, Solano, Napa, San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern that are within the CVP and SWP service areas.
- San Francisco Bay Area Region is located within portions of the San Francisco Bay Area and North Central Coast air basins.
  - The San Francisco Bay Area Region includes portions of Contra Costa, Alameda, Santa Clara, and San Benito counties that are within the CVP and SWP service areas.
- Central Coast Region is located within portions of the South Central Coast Air Basin.
  - The Central Coast Region includes portions of San Luis Obispo and Santa Barbara counties served by the SWP.
- Southern California Region is located within portions of the South Central Coast, South Coast, San Diego, Mojave Desert, and Salton Sea air basins.
  - The Southern California Region includes portions of Ventura, Los Angeles, Orange, San Diego, Riverside, and San Bernardino counties served by the SWP.

16.4.1 Ambient Air Quality

Air quality conditions and potential impacts in the project area are evaluated and discussed qualitatively, rather than quantitatively. The following subsections briefly describe the existing air quality environmental setting by air basin for the project area. The counties within each air basin in the project area are presented in Table 16.3, along with non-attainment designations to characterize existing ambient air quality. Non-attainment designations indicate that concentrations of pollutants measured in ambient air exceed the applicable ambient air quality standards. As shown in Table 16.3, many of the counties included in the project area are designated as nonattainment for the Federal and/or State ozone and particulate matter standards. These air quality issues may be exacerbated under dry conditions because when irrigation water supplies are decreased, there is increased potential for the formation and transport of fugitive dust.

Table 16.3 Pollutants Designated as Nonattainment Pursuant to Federal and State Ambient Air Quality Standards

County	Air Basin	Air District	Federal Nonattainment Designations[a]	State Nonattainment Designations[b]
Trinity River Region				
Trinity	North Coast	North Coast Unified	–	–
Humboldt	North Coast	North Coast Unified	–	–
Del Norte	North Coast	North Coast Unified	–	–
Central Valley Region				
Shasta	Sacramento Valley	Shasta	–	Ozone, PM_{10}
Tehama	Sacramento Valley	Tehama	Ozone (Tuscan Buttes area)	Ozone, PM_{10}
Butte	Sacramento Valley	Butte	Ozone and $PM_{2.5}$ in Chico	Ozone, PM_{10}, $PM_{2.5}$
Glenn	Sacramento Valley	Glenn	–	PM_{10}
Colusa	Sacramento Valley	Colusa	–	PM_{10}
Yuba	Sacramento Valley	Feather River	–	Ozone, PM_{10}
Sutter	Sacramento Valley	Feather River	Ozone	Ozone, PM_{10}
Yolo	Sacramento Valley	Yolo-Solano	Ozone, $PM_{2.5}$	Ozone, PM_{10}
Sacramento	Sacramento Valley	Sacramento Metro	Ozone, $PM_{2.5}$	Ozone, PM_{10}

County	Air Basin	Air District	Federal Nonattainment Designations[a]	State Nonattainment Designations[b]
Plumas	Mountain Counties	Northern Sierra	–	PM_{10} $PM_{2.5}$ (Portola Valley)
Placer	Sacramento Valley, Mountain Counties, Lake Tahoe	Placer	Ozone, $PM_{2.5}$	Ozone, PM_{10}
El Dorado	Sacramento Valley, Mountain Counties, Lake Tahoe	El Dorado	Ozone, $PM_{2.5}$	Ozone, PM_{10}
San Joaquin	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Stanislaus	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Merced	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Fresno	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Madera	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Kings	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Tulare	San Joaquin Valley	San Joaquin Valley	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Kern	San Joaquin Valley, Mojave Desert	San Joaquin Valley, Kern	Ozone, $PM_{2.5}$, PM_{10} (East Kern)	Ozone, PM_{10}, $PM_{2.5}$ (San Joaquin Valley Air Basin)
San Francisco Bay Area Region				
Napa	San Francisco Bay Area	Bay Area	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Solano	Sacramento Valley, San Francisco Bay Area	Yolo-Solano and Bay Area	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Contra Costa	San Francisco Bay Area	Bay Area	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Alameda	San Francisco Bay Area	Bay Area	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Santa Clara	San Francisco Bay Area	Bay Area	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$

County	Air Basin	Air District	Federal Nonattainment Designations[a]	State Nonattainment Designations[b]
San Benito	North Central Coast	Monterey Bay Unified	–	Ozone, PM_{10}
Central Coast Region				
San Luis Obispo	South Central Coast	San Luis Obispo	Ozone (Eastern San Luis Obispo)	Ozone, PM_{10}
Santa Barbara	South Central Coast	Santa Barbara	–	Ozone, PM_{10}
Southern California Region				
Ventura	South Central Coast	Ventura	Ozone	Ozone, PM_{10}
Los Angeles	South Coast, Mojave Desert	South Coast, Antelope Valley	Ozone, $PM_{2.5}$, Lead	Ozone; PM_{10}; $PM_{2.5}$
San Bernardino	South Coast, Mojave Desert	South Coast, Mojave Desert	Ozone, PM_{10}, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
Riverside	South Coast, Mojave Desert, Salton Sea	South Coast, Mojave Desert	Ozone, PM_{10}, $PM_{2.5}$	Ozone; PM_{10}; $PM_{2.5}$
Orange	South Coast	South Coast	Ozone, $PM_{2.5}$	Ozone, PM_{10}, $PM_{2.5}$
San Diego	San Diego County	San Diego	Ozone	Ozone, PM_{10}, $PM_{2.5}$

Sources: USEPA 2014; ARB 2015

Notes:
a. Areas designated as nonattainment by U.S. Environmental Protection Agency related to National Ambient Air Quality Standards as of January 30, 2015.
b. Areas designated as nonattainment by California Air Resources Board related to California Ambient Air Quality Standards as of April 10, 2014. No changes to the state area designations were proposed for 2014.

16.4.1.1 North Coast Air Basin

The North Coast Air Basin includes Humboldt, Del Norte, Trinity, Mendocino, and north Sonoma counties (ARB 2013a). This air basin is located within the Trinity River Region of the study area. The basin is sparsely populated, and stretches along the northern coastline through forested mountains. Prevailing winds blow clean air inland from the Pacific Ocean, and air quality is typically good. Humboldt, Del Norte, and Trinity counties are designated attainment for the federal and state air quality standards (USEPA 2015b, ARB 2014).

16.4.1.2 Sacramento Valley Air Basin

The Sacramento Valley Air Basin encompasses 9 air districts and 11 counties, including: all of Shasta, Tehama, Glenn, Colusa, Butte, Sutter, Yuba, Sacramento, and Yolo counties; the westernmost portion of Placer County; and the northeastern half of Solano County. The air basin is bounded by tall mountains, including the Coast Range to the west, the Cascade Range to the north, and the Sierra Nevada Range to the east. This air basin is located within the northern portion of the Central Valley Region of the study area.

Winters are wet and cool, and summers are hot and dry. When air stagnates, or is trapped by an inversion layer in the valley, ambient pollutant concentrations can reach or exceed threshold levels. On-road vehicles are the largest source of smog-forming pollutants, and particulate matter emissions are primarily from area sources, such as fugitive dust from paved and unpaved roads and vehicle travel (ARB 2013a).

To characterize the existing ambient air quality in the Sacramento Valley Air Basin, data from area monitoring stations were reviewed (ARB 2011d). For the three years from 2007 to 2009, monitoring data indicated the following:

- Concentrations of O_3 and 24-hour $PM_{2.5}$ have exceeded the NAAQS and CAAQS.
- Concentrations of PM_{10} have exceeded the CAAQS but are below the NAAQS.
- Measured concentrations of CO and NO_2 have complied with the NAAQS and CAAQS.
- Monitored SO_2 concentrations are extremely low, and lead concentrations are monitored as part of the air toxics program.

In the time since ARB compiled the 2007 to 2009 air quality monitoring data reported above, Glenn and Colusa counties have been redesignated as attainment for the California ozone standards (ARB 2014). In addition, Sacramento County has been redesignated as attainment for the California $PM_{2.5}$ standards (ARB 2014). No other changes in air quality nonattainment designations have been recorded (USEPA 2014; ARB 2014).

16.4.1.3 Mountain Counties Air Basin

The Mountain Counties Air Basin includes the mountainous areas of the central and northern Sierra Nevada Mountains, from Plumas County south to Mariposa County, including Plumas, Sierra, Nevada, Central Placer, West El Dorado, Amador, Calaveras, Tuolumne, and Mariposa counties (ARB 2013a). This air basin includes portions of the central-eastern Central Valley Region of the study area; as well as areas located to the east of the study area.

Sparsely populated, motor vehicles are the primary source of emissions in the air basin. Air quality issues often result when eastward surface winds transport pollution from more populated air basins to the west and south. Wood smoke from stoves and fireplaces contribute to elevated ambient PM_{10} concentrations during winter. Nevada, Placer, El Dorado, Amador, Calaveras, Tuolumne, and Mariposa counties are designated as nonattainment for the Federal and State ozone standards (ARB 2014). Plumas, Sierra, Nevada, Placer, El Dorado, and Calaveras counties are designated as nonattainment for the State PM_{10} standards (ARB 2014).

16.4.1.4 San Joaquin Valley Air Basin

The San Joaquin Valley Air Basin encompasses eight counties, including: all of San Joaquin, Stanislaus, Madera, Merced, Fresno, Kings, Tulare counties; and western Kern County. It is bounded on the west by the Coast Range, on the east by the Sierra Nevada, and in the south by the Tehachapi Mountains. This air basin is located within the central and southern portions of the Central Valley Region of the study area.

Winters are cool and wet and summers are dry and very hot. The area is heavily agricultural, and hosts other localized industries such as forest products, oil and gas production, and oil refining. On-road vehicles are the largest source of smog-forming pollutants, and PM_{10} emissions are primarily from sources such as agricultural operations and fugitive dust from paved and unpaved roads and vehicle travel (ARB 2013a). Air quality issues may be exacerbated under dry conditions. When water supplies and irrigation levels are decreased in urban, rural, and agricultural areas, there is increased potential for the formation and transport of fugitive dust.

To characterize the existing ambient air quality for the San Joaquin Valley Air Basin, data from area monitoring stations were reviewed (ARB 2011d). For the three years from 2007 to 2009, monitoring data indicated the following:

- Concentrations of O_3 and 24-hour $PM_{2.5}$ have exceeded the NAAQS and CAAQS.
- Concentrations of PM_{10} have exceeded the CAAQS but are below the NAAQS.
- Measured concentrations of CO and NO_2 have complied with the NAAQS and CAAQS.
- Monitored SO_2 concentrations are extremely low, and lead concentrations are monitored as part of the air toxics program.

In the time since ARB compiled the 2007 to 2009 air quality monitoring data reported above, no changes in air quality nonattainment designations have been recorded in the San Joaquin Valley Region counties in this study (USEPA 2015; ARB 2014).

16.4.1.4.1 Dust and Particulate Matter in San Joaquin Valley

The San Joaquin Valley Air Pollution Control District (SJVAPCD) is the local regulatory agency with jurisdiction over air quality issues in the San Joaquin Valley area. In response to the area's historical air quality problems with dust and particulate matter, the SJVAPCD was the first agency in the state to regulate emissions from on-field agricultural operations. In 2004, the agency adopted Rule 4550, the Conservation Management Practices rule, and Rule 3190, the Conservation Management Practices Fee rule. To comply with these rules, farmers with 100 acres or more of contiguous land must prepare and implement biennial Conservation Management Plans to reduce dust and particulate matter emissions from on-farm sources, such as unpaved roads and equipment yards, land preparation, harvest activities, and other farming activities. A handbook titled "Agricultural Air Quality Conservation Management Practices for San Joaquin Valley Farms" was published by the agriculture industry in 2004 to provide guidance to farmers on Conservation Management Practices (SJVAPCD 2004a, 2004b). Examples of Conservation Management Practices include activities that reduce or eliminate the need for soil disturbance, activities that protect soil from wind, dust suppressants, alternatives to burning agricultural wastes, and reduced travel speeds on unpaved roads and equipment yards. Lands not currently under cultivation or used for pasture are exempt from Rule 4550, other than recordkeeping to document the exemption. Fees vary depending on the size of the farm, and include an initial application fee, and a biennial renewal fee.

In addition to requirements for on-field agricultural practices, the SJVAPCD rules and regulations address avoidance of nuisance conditions (Rule 4102), prohibitions on opening burning (Rule 4103), and fugitive-dust control (Regulation VIII). Specifically, the SJVAPCD dust-control rules include Rule 8021 for control of PM_{10} from construction, demolition, excavation, extraction, and other earth moving activities; Rule 8031 for control of PM_{10} from handling and storage of bulk materials; Rule 8051 for control of PM_{10} from disturbed open areas; Rule 8061 for control of PM_{10} from travel on paved and unpaved roads; Rule 8071 for control of PM_{10} from unpaved vehicle and equipment traffic areas; and Rule 8081 for off-field agricultural sources, such as bulk materials handling and transport and travel on unpaved roads. Each of these rules requires fugitive dust control, often through application of water, gravel, or chemical dust stabilizers.

16.4.1.5 San Francisco Bay Area Air Basin

The San Francisco Bay Area Air Basin consists of a single air district and nine counties, including: all of Napa, Marin, San Francisco, Contra Costa, Alameda, San Mateo, and Santa Clara counties; the southern portion of Sonoma County; and the southwestern portion of Solano County (ARB 2013a). The hills of the Coast Range bound the San Francisco and San Pablo bays and the inland valleys of the air basin. This air basin includes the San Francisco Bay Area Region of the study area.

The San Francisco Bay Area Air Basin includes the second largest urban area in California, hosting industry, airports, international ports, freeways, and surface streets. On-road vehicles are the largest source of smog-forming pollutants, and PM_{10} emissions are primarily from area sources, such as fugitive dust from paved and unpaved roads and vehicle travel (ARB 2013a). Air quality in the San Francisco Bay Area is often good as sea breezes blow clean air from the Pacific Ocean into the air basin, but transport of pollutants from the San Francisco Bay

Area can exacerbate air quality problems in the downwind portions of the San Francisco Bay Area Air Basin; as well as in the Sacramento Valley and San Joaquin Valley air basins.

To characterize the existing ambient air quality for the San Francisco Bay Area Air Basin, data from area monitoring stations were reviewed (ARB 2011d). For the three years from 2007 to 2009, monitoring data indicated the following:

- Concentrations of O_3 and 24-hour $PM_{2.5}$ have exceeded the NAAQS and CAAQS.
- Concentrations of PM_{10} exceeded the CAAQS in 2008 but were below the CAAQS in 2007 and 2009. Concentrations of PM_{10} were below the NAAQS.
- Measured concentrations of CO and NO_2 have complied with the NAAQS and CAAQS.
- Monitored SO_2 concentrations are extremely low, and lead concentrations are monitored as part of the air toxics program.

In the time since ARB compiled the 2007 to 2009 air quality monitoring data reported above, no changes in air quality nonattainment designations have been recorded in the San Francisco Bay Region counties in this study (USEPA 2015; ARB 2014).

16.4.1.6 North Central Coast Air Basin

The North Central Coast Air Basin includes Santa Cruz, San Benito and Monterey counties (ARB 2013a). This air basin includes San Benito County which is located within the San Francisco Bay Area Region of the study area.

The North Central Coast Air Basin is in attainment for all NAAQS, and is designated as nonattainment for the State ozone and PM_{10} standards (ARB 2014). Though separated by the Santa Cruz Mountains and Coast Ranges to the north, wind can transport air pollution from the San Francisco Bay Area Air Basin and contribute to elevated ozone concentrations in the area (ARB 2013a).

16.4.1.7 South Central Coast Air Basin

The South Central Coast Air Basin includes San Luis Obispo, Santa Barbara and Ventura counties. It is bordered by the Pacific Ocean on the south and west and lies just north of the highly populated South Coast Air Basin. This air basin includes the Central Coast Region and the northern Southern California Region of the study area.

Sources of pollutants in the air basin include power plants, oil production and refining, vehicle travel, and agricultural operations. San Luis Obispo, Santa Barbara, and Ventura counties are designated as nonattainment for the State ozone and PM_{10} standards. Eastern San Luis Obispo and Ventura counties are designated as nonattainment for the Federal ozone standard (USEPA 2015). Wind patterns link Ventura and Santa Barbara counties, resulting in pollutant transport between the South Central Coast and South Coast air basins. San Luis Obispo County is separated from these counties by mountains, and the air quality in San Luis Obispo County is linked more with conditions in the San Francisco Bay Area Air Basin and San Joaquin Valley Air Basin. Additionally, air emissions from the South Coast Air Basin can be blown offshore, and then carried to the coastal cities of the South Central Coast Air Basin. Under some conditions, the reverse air flow can carry pollutants from the South Central Coast Air Basin to the South Coast Air Basin and contribute to ozone violations there (ARB 2013a).

16.4.1.8 South Coast Air Basin

The South Coast Air Basin is California's largest metropolitan region. The area includes the southern two-thirds of Los Angeles County, all of Orange County, and the western urbanized portions of Riverside and San Bernardino counties. The South Coast Air Basin is bounded by the Pacific Ocean on the west and by mountains on the other three sides. This air basin includes the western-central portion of the Southern California Region of the study area.

The area includes industry, airports, international ports, freeways, and surface streets. On-road vehicles are the largest source of smog-forming pollutants, and PM_{10} emissions are primarily from area sources, such as fugitive dust from paved and unpaved roads and vehicle travel (ARB 2013a). One-third of the state's total criteria pollutant emissions are generated within the basin (ARB 2013a). The pollutant emissions and fugitive dust generated in the South Coast Air Basin affects other air basins. For example, fugitive dust generated in the South Coast Air Basin contributes to poor air quality in the Salton Sea Air Basin and the Coachella Valley portion of Riverside County (USGS 2014).

The persistent high pressure system and frequent low inversion heights caused by the surrounding mountains on three sides of the air basin trap pollutants in the air basin (ARB 2013a). Sunny weather contributes to smog formation. Portions of the South Coast Air Basin are designated as nonattainment for the Federal and State ozone, PM_{10}, and $PM_{2.5}$ standards (ARB 2014; USEPA 2015). Wind often transports air pollutants from the South Coast Air Basin to nearby air basins.

16.4.1.9 Mojave Desert Air Basin

The sparsely populated Mojave Desert Air Basin covers most of California's high desert and is made up of eastern Kern and Riverside counties and northern Los Angeles and San Bernardino counties. The San Gabriel and San Bernardino mountains lie to the south, separating the Mojave Desert Air Basin from the South Coast Air Basin. To the northwest, the Tehachapi Mountains separate the Mojave Desert Air Basin from the San Joaquin Valley Air Basin. This air basin includes the southeastern portion of the Central Valley Region and the northeastern portion of the Southern California Region of the study area.

The primary sources of air pollution in the air basin are military bases, highways, railroads, cement manufacturing, and mineral processing (ARB 2013a). The Mojave Desert Air Basin also is affected by air quality conditions in the San Joaquin Valley and South Coast air basins. Air from the South Coast Air Basin is transported over the San Gabriel Mountains, heavily impacting the areas of the Mojave Desert Air Basin located to the north of the South Coast Air Basin.

The Mojave Desert Air Basin also is located downwind of the San Joaquin Valley Air Basin; and the winds pass through the Tehachapi Mountains carrying air emissions from the San Joaquin Valley Air Basin. Due to the impacts from the South Coast Air Basin, the worst air quality in the Mojave Desert Air Basin is along the southern edge that borders the South Coast Air Basin. This is also where most of the population within the Mojave Desert Air Basin is located (ARB 2013a).

Portions of the Mojave Desert Air Basin are designated as nonattainment for the Federal and State ozone and PM_{10} standards (ARB 2014; USEPA 2015).

16.4.1.10 San Diego Air Basin

The San Diego Air Basin is in the southwest corner of California and comprises all of San Diego County. This air basin includes the southwestern portion of the Southern California Region of the study area.

The population and emissions are concentrated in the western portion of the air basin, which is bordered on the west by the Pacific Ocean. The climate is relatively mild near the ocean, with higher temperatures and seasonal variations further inland (ARB 2013a).

The air basin includes industrial facilities, airports, an international port, freeways, and surface streets. The San Diego Air Basin is designated as nonattainment for the Federal ozone standard and the State ozone, PM_{10}, and $PM_{2.5}$ standards (ARB 2014). Air quality in the San Diego Air Basin is impacted not only by local emission sources, but also from transport of air emissions from the South Coast Air Basin and Mexico.

16.4.1.11 Salton Sea Air Basin

The Salton Sea Air Basin is in the southeast corner of California and includes all of Imperial County and central Riverside County. The air basin is characterized by flat terrain and the Salton Sea surrounded by high mountains to the west, north, and east. The southern portion of the air basin extends towards the Gulf of California. The flat terrain and strong temperature differentials created by intense heating and cooling patterns produce moderate winds and deep thermal circulation systems which disperse local air emissions (DWR 2006). This air basin includes the northeastern portion of the Southern California Region of the study area.

The primary sources of air pollution are from vehicles and equipment exhaust and particulate matter from disturbed soils and wind erosion. The Salton Sea Air Basin is designated as nonattainment for the Federal and State ozone and PM_{10} standards (ARB 2014; USEPA 2015). Portions of the Salton Sea Air Basin located outside of the study area near Calexico also are in nonattainment for $PM_{2.5}$ standards.

16.4.2 Existing Greenhouse Gases and Emissions Sources

This subsection presents an overview of the greenhouse effect and climate change, and potential sources of GHG emissions and information related to climate change and GHG emissions in California. GHG emissions and their climate-related impacts are not limited to specific geographic locations, but occur on global or regional scales. GHG emissions contribute cumulatively to the overall heat-trapping capability of the atmosphere, and the effects of the warming, such as climate change, are manifested in different ways across the planet.

16.4.2.1 Greenhouse Gas Emissions Regulations and Analyses

Global warming is the name given to the increase in the average temperature of the Earth's near-surface air and oceans since the mid-20th century and its projected continuation. Warming of the climate system is now considered to be unequivocal (DWR 2010) with global surface temperature increasing approximately 1.33°F over the last one hundred years. Continued warming is projected to increase global average temperature between 2 and 11 degrees Fahrenheit (°F) over the next one hundred years.

The causes of this warming have been identified as both natural processes and as the result of human actions. The Intergovernmental Panel on Climate Change (IPCC) concludes that variations in natural phenomena such as solar radiation and volcanoes produced most of the warming from pre-industrial times to 1950 and had a small cooling effect afterward. However, after 1950, increasing GHGs concentrations resulting from human activity such as fossil fuel burning and deforestation have been responsible for most of the observed temperature increase. These basic conclusions have been endorsed by more than 45 scientific societies and academies of science, including all of the national academies of science of the major industrialized countries.

Increases in GHG concentrations in the Earth's atmosphere are thought to be the main cause of human-induced climate change. GHGs naturally trap heat by impeding the exit of solar radiation that has hit the Earth and is reflected back into space. Some GHGs occur naturally and are necessary for keeping the Earth's surface inhabitable. However, increases in the concentrations of these gases in the atmosphere during the last hundred years have decreased the amount of solar radiation that is reflected back into space, intensifying the natural greenhouse effect and resulting in the increase of global average temperature (DWR 2010).

The principal GHGs considered in this EIS are CO_2, CH_4, N_2O, SF_6, PFC, and HFC, in accordance with the California Health and Safety Code section 38505(g) (DWR 2010). Each of the principal GHGs has a long atmospheric lifetime (one year to several thousand years). In addition, the potential heat-trapping ability of each of these gases varies significantly from one another, and also vary over time. For example, CH_4 is 25 times as potent as CO_2; while SF_6 is 32,800 times more potent than CO_2 with a 100-year time horizon (IPCC 2007).

The primary man-made processes that release these gases include: burning of fossil fuels for transportation, heating and electricity generation; agricultural practices that release CH_4, such as livestock grazing and crop residue decomposition; and industrial processes that release smaller amounts of high global warming potential gases such as SF_6, PFCs, and HFCs (DWR 2010). Deforestation and land cover conversion have also been identified as contributing to global warming by reducing the Earth's capacity to remove CO_2 from the air and altering the Earth's albedo or surface reflectance, allowing more solar radiation to be absorbed.

16.4.2.2 An Overview of the Greenhouse Effect

The greenhouse effect is a natural phenomenon that is essential to keeping the Earth's surface warm (DWR 2010). Like a greenhouse window, GHGs allow sunlight to enter and then prevent heat from leaving the atmosphere. Solar radiation enters the Earth's atmosphere from space. A portion of this radiation is reflected by particles in the atmosphere back into space, and a portion is absorbed by the Earth's surface and emitted back into space. The portion absorbed by the Earth's surface and emitted back into space is emitted as lower-frequency infrared radiation. This infrared radiation is absorbed by various GHGs present in the atmosphere. While these GHGs are transparent to the incoming solar radiation, they are effective at absorbing infrared radiation emitted by the Earth's surface. Therefore, some of the lower-frequency infrared radiation emitted by the Earth's surface is retained in the atmosphere, creating a warming of the atmosphere.

16.4.2.2.1 Global Climate Trends and Associated Impacts

The rate of increase in global average surface temperature over the last hundred years has not been consistent (DWR 2010). The last three decades have warmed at a much faster rate than the previous seven decades – on average 0.32°F per decade. Eleven of the twelve years from 1995 to 2006, rank among the twelve warmest years in the instrumental record of global average surface temperature since 1850.

Increased global warming has occurred concurrent with many other changes have occurred in other natural systems (DWR 2010). Global sea levels have risen on average 1.8 millimeters per year; precipitation patterns throughout the world have shifted, with some areas becoming wetter and other drier; tropical storm activity in the North Atlantic has increased; peak runoff timing of many glacial and snow fed rivers has shifted earlier; as well as numerous other observed conditions. Though it is difficult to prove a definitive cause and effect relationship between global warming and other observed changes to natural systems, there is high confidence in the scientific community that these changes are a direct result of increased global temperatures.

16.4.2.2.2 Overview of Greenhouse Gas Emission Sources

Naturally occurring GHGs include water vapor, CO_2, methane, and nitrous oxide. Water vapor is introduced to the atmosphere from oceans and the natural biosphere. Water vapor introduced directly to the atmosphere from agricultural or other activities is not long lived, and thus does not contribute substantially to a warming effect (NAS 2005). Carbon and nitrogen contained in CO_2, methane, and nitrous oxide naturally cycle from gaseous forms to organic biomass through processes such as plant and animal respiration and seasonal cycles of plant growth and decay (USEPA 2012). Although naturally occurring, the emissions and sequestration of these gases are also influenced by human activities, and in some cases, are caused by human activities (anthropogenic). In addition to these GHGs, several classes of halogenated substances that contain fluorine, chlorine, or bromine also contribute to the greenhouse effect. However, these compounds are the product of industrial activities for the most part.

Each of the GHGs has a different capacity to trap heat in the atmosphere, with some of these gases being more effective at trapping heat than others. For calculating emissions, ARB (ARB 2007) uses a metric developed by the IPCC to account for these differences and to provide a standard basis for calculations. The metric, called the global warming potential (GWP), is used to compare the future climate impacts of emissions of various long-lived GHGs. The GWP of each GHG is indexed to the heat-trapping capability of CO_2, and allows comparison of the global warming influence of each GHG relative to CO_2. The GWP is used to translate emissions of each GHG to emissions of carbon dioxide equivalents, or CO_2e. In this way, emissions of various GHGs can be summed, and total GHG emissions can be inventoried in common units of metric tons per year of CO_2e. Most international inventories, including the United States inventory, use GWP values from the IPCC Fourth Assessment Report, per international consensus (IPCC 2007; USEPA 2012).

CO_2 is a byproduct of burning fossil fuels and biomass, as well as land-use changes and other industrial processes (USEPA 2012). It is the principal anthropogenic GHG that contributes to the Earth's radiative balance, and it represents the dominant portion of GHG emissions from activities that result from the combustion of fossil fuels (e.g., construction activities, electrical generation, and transportation).

16.4.2.3 California Climate Trends and Greenhouse Gas Emissions

Maximum (daytime) and minimum (nighttime) temperatures are increasing almost everywhere in California but at different rates. The annual minimum temperature averaged over all of California has increased 0.33°F per decade during the period 1920 to 2003, while the average annual maximum temperature has increased 0.1°F per decade (DWR 2010).

With respect to California's water resources, the most significant impacts of global warming have been changes to the water cycle and sea level rise. Over the past century, the precipitation mix between snow and rain has shifted in favor of more rainfall and less snow, and snow pack in the Sierra Nevada is melting earlier in the spring (DWR 2010). The average early spring snowpack in the Sierra Nevada has decreased by about 10 percent during the last century, a loss of 1.5 million acre-feet of snowpack storage. These changes have significant implications for water supply, flooding, aquatic ecosystems, energy generation, and recreation throughout the state.

During the same period, sea levels along California's coast have risen. The Fort Point tide gauge in San Francisco was established in 1854 and is the longest continually monitored gauge in the United States. Sea levels measured at this gauge and two other west coast gauges indicate that the sea levels have risen at an average rate of about 7.9 inches/century (0.08 inch/year) over the past 150 years (BCDC 2011). Continued sea level rise associated with global warming may threaten coastal lands and infrastructure, increase flooding at the mouths of rivers, place additional stress on levees in the Sacramento-San Joaquin Delta, and intensify the difficulty of managing the Sacramento-San Joaquin Delta as the heart of the state's water supply system (DWR 2010).

16.4.2.3.1 Potential Effects of Global Climate Change in California

Warming of the atmosphere has broad implications for the environment. In California, one of the effects of climate change could be increases in temperature that could affect the timing and quantity of precipitation. California receives most of its precipitation in the winter months, and a warming environment would raise the elevation of snow pack and result in reduced spring snowmelt and more winter runoff. These effects on precipitation and water storage in the snow pack could have broad implications on the environment in California.

The following are some of the potential effects of a warming climate in California (California Climate Change Portal 2007):

- Loss of snowpack storage will cause increased winter runoff that generally would not be captured and stored because of the need to reserve flood capacity in reservoirs during the winter.
- Less spring runoff would mean lower early summer storage at major reservoirs, which would result in less hydroelectric power production.
- Higher temperatures and reduced snowmelt would compound the problem of providing suitable cold water habitat for salmonid species. Lower reservoir levels would also contribute to this problem, reducing the flexibility of cold water releases.
- Sea level rise would affect the Delta, worsening existing levee problems, causing more saltwater intrusion, and adversely affecting many coastal marshes and wildlife reserves. Release of water to streams to meet water quality requirements could further reduce storage levels.
- Increased temperatures would increase the agricultural demand for water and increase the level of stress on native vegetation, potentially allowing for an increase in pest and insect epidemics and a higher frequency of large, damaging wildfires.

Future climate scenarios have also been evaluated in the U.S. Global Change Research Program National Climate Assessments. The most recent assessment, *Climate Change Impacts in the United States*, was released in May 2014 (USGCRP 2014). For the Southwest Region of the United States, the report projects that water supply availability would be reduced as compared to recent conditions due to reduced snowpack and declining stream flows. Rising temperatures in the future would increase disruptions to electricity generation which could further reduce water availability. The National Climate Assessment also indicates that mitigation policies and other factors have lowered the United States' nationwide GHG emissions in recent years; however, substantial global emissions reductions are needed to avoid many of the predicted consequences. A considerable amount of planning for resilience and adaptation is underway, but implementation of adaptive measures have been limited in scope.

16.4.2.3.2 Current California Emission Sources

The recent California's GHG emission inventory was released on April 6, 2012, with data updated through October 2011. The GHG emissions in California have been estimated for each year from 2000 to 2009, and are reported for several large sectors of emission sources. The estimates for 2009 are summarized in Table 16.4, reported by sector as millions of tons per year of CO_2 (ARB 2011e).

Table 16.4 California Greenhouse Gas Emissions by Sector in 2009

Sector	Total Emissions (million tons/year of CO_2e)	Percent of Statewide Total Gross Emissions[a]
Agriculture	32.1	7
Commercial and Residential	43	9.4
Electric Power	103.6	22.7
Forestry (excluding CO_2 sinks)	0.2	< 1.0
Industrial	81.4	17.8
Recycling and Waste	7.3	1.6
Transportation	172.9	37.9
High Global Warming Potential substance and ozone-depleting substance use[b]	16.3	3.6
Total	**456.8**	**100**
Forestry Net Emissions	-3.8	–

Source: ARB 2011e.

Notes:

a. Based on the 456.8 million tons/year of CO_2e Total Gross Emissions estimate.

b. High Global Warming Potential substance and ozone-depleting substance use are not attributed to an individual sector.

Total gross statewide GHG emissions in 2009 were estimated to be 456.8 million tons per year of CO_2e. The two largest sectors contributing to emissions in California are transportation and electric power (the latter sector includes both in-state generation and imported electricity). The agricultural sector represents only 7 percent of the total gross statewide emissions.

The agricultural sector includes manure management, enteric fermentation, agricultural residue burning, and soils management. The forestry sector contributes to overall emissions, but is a net sink of emissions.

The California Global Warming Solutions Act of 2006 (California Assembly Bill 32) requires California to reduce statewide emissions to 1990 levels by 2020.

In December 2007, ARB adopted an emission limit for 2020 of 427 million tons per year of CO_2e. Increases in the stateside renewable energy portfolio and reductions in importation of coal-based electrical power will contribute to meeting California's near-term GHG emission reduction goals. The ARB estimates that a reduction of 169 million metric tons net CO_2e emissions below business-as-usual would be required by 2020 to meet the 1990 levels (ARB 2007). This amounts to approximately a 30 percent reduction from projected "business-as-usual" levels in 2020.

16.5 Impact Analysis

This section describes the potential mechanisms and analytical methods for change in air quality and GHG emissions; results of the impact analysis; potential mitigation measures; and cumulative effects.

16.5.1 Potential Mechanisms for Change and Analytical Methods

As described in Chapter 4, Approach to Environmental Analysis, the impact analysis considers changes in air quality and GHG emissions related to changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison.

Changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison could directly or indirectly change air quality and GHG emissions due to use of engines or electricity that operate groundwater wells, changes in cropping patterns, or odor emissions.

16.5.1.1 Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants

Changes in CVP and SWP operations under the alternatives could change the use of individual engines to operate groundwater wells. The CVHM model is used to evaluate changes in groundwater conditions in the Central Valley, as described in Chapter 7, Groundwater Resources and Groundwater Quality. To evaluate the potential for changes in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants, results from the CVHM model that indicate changes in groundwater withdrawals due to changes in CVP and SWP operations. However, it is not known how many of the groundwater pumps use electricity and how many use diesel engines. The diesel engines have the potential to emit criteria air pollutants and precursors, and toxic air contaminants.

Most of the groundwater wells in the Central Valley use electrical pumps. As reported in a recent environmental assessment, approximately 14 to 15 percent of the pumps used diesel fuel in 2003 (Reclamation 2013a). It is assumed for this EIS, that the portion of groundwater pumps that use electricity would remain approximately at 85 percent. Therefore, it is assumed that increases or decreases in groundwater pumping would be indicative of an increase or decrease in the use of diesel engines in the Central Valley as well as in the San Francisco Bay Area, Central Coast, and Southern California regions. Changes in CVP and SWP operations would not result in changes in groundwater pumping in the Trinity River Region; therefore, this analysis does not address Trinity River Region.

16.5.1.2 Changes in Exposure of Sensitive Receptors to Particulate Matter

Changes in CVP and SWP operations under the alternatives could change the potential for dust generation on irrigated lands that would be idled due to reduced CVP and SWP water supplies. However, as described in Chapter 12, Agricultural Resources, irrigated acreage under Alternatives 1 through 5 would be similar to irrigated acreage under both the No Action Alternative and the Second Basis of Comparison. Therefore, there would be no change in potential for dust generation. Therefore, these changes are not analyzed in this EIS.

16.5.1.3 Changes in Exposure of Sensitive Receptors to Odor Emissions from Wetlands

Restoration of seasonal floodplains and tidally-influenced wetlands could result in additional odors at surrounding sensitive receptors near the restoration locations. However, these actions would occur in a similar manner under the No Action Alternative, Alternatives 1 through 5, and Second Basis of Comparison, as described in Chapter 3, Description of Alternatives. Therefore, odor emissions would be the same under all of the alternatives and the Second Basis of Comparison. Therefore, this change is not analyzed in this EIS.

16.5.1.4 Changes in GHG Emissions due to Changes in Energy Generation or Use

Changes in CVP and SWP operations under the alternatives could change CVP and SWP energy generation and use, and the associated GHG emissions. In addition, operational changes could also affect the use of energy by CVP and SWP water users through the implementation of regional and local alternative water supplies, such as recycling or desalination. When CVP and SWP water deliveries decline, CVP and SWP net energy generation changes; and water users are anticipated to increase use of groundwater, recycled water, and/or desalinated water from existing facilities or facilities that are reasonably foreseeable to be constructed by 2030. When CVP and SWP water deliveries increase, CVP and SWP net energy generation would change; and water users are anticipated to reduce use of alternate water supplies either due to economic considerations or to allow the amount of stored water to increase under a conjunctive use pattern. It is not known whether the changes in CVP and SWP net energy generation would be similar to the changes in energy use for alternate regional and local water supplies.

Changes in the timing and magnitude of net CVP and SWP hydropower generation would result in changes in GHG emissions. Increased net CVP and SWP hydropower generation would reduce the need for electricity generated through fossil fuel combustion, and would avoid the GHG emissions that would result from fossil fuel use. In comparison, reduced hydroelectric generation would increase the need for other types of electricity production, including electricity generated from fossil fuels, with the result that GHG emissions would increase.

Potential changes in GHG emissions due to changes in CVP and SWP energy generation or use, and the evaluation of potential for changes in use of energy by CVP and SWP water users to implement alternative water supplies, are analyzed broadly and qualitatively across the overall study area. Some of the changes in energy use and generation will occur across the CVP and SWP system, others may require additional energy resources. Specific locations of the energy sources and users have not been defined.

16.5.1.5 Effects due to Cross Delta Water Transfers

Historically water transfer programs have been developed on an annual basis. The demand for water transfers is dependent upon the availability of water supplies to meet water demands. Water transfer transactions have increased over time as CVP and SWP water supply availability has decreased, especially during drier water years.

Parties seeking water transfers generally acquire water from sellers who have available surface water who can make the water available through releasing previously stored water, pump groundwater instead of using surface water (groundwater substitution); idle crops; or substitute crops that uses less water in order to reduce normal consumptive use of surface water.

Water transfers using CVP and SWP Delta pumping plants and south of Delta canals generally occur when there is unused capacity in these facilities. These conditions generally occur during drier water year types when the flows from upstream reservoirs plus unregulated flows are adequate to meet the Sacramento Valley water demands and the CVP and SWP export allocations. In non-wet years, the CVP and SWP water allocations would be less than full contract amounts; therefore, capacity may be available in the CVP and SWP conveyance facilities to move water from other sources.

Projecting future air quality conditions related to water transfer activities is difficult because specific water transfer actions required to make the water available, convey the water, and/or use the water would change each year due to changing hydrological conditions, CVP and SWP water availability, specific local agency operations, and local cropping patterns. Reclamation recently prepared a long-term regional water transfer environmental document which evaluated potential changes in conditions related to water transfer actions (Reclamation

2014c). Results from this analysis were used to inform the impact assessment of potential effects of water transfers under the alternatives as compared to the No Action Alternative and the Second Basis of Comparison.

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

This EIS includes two bases of comparison, as described in Chapter 3, Description of Alternatives: the No Action Alternative and the Second Basis of Comparison. Both of these bases are evaluated at 2030 conditions. Changes that would occur over the next 15 years without implementation of the alternatives are not analyzed in this EIS. However, the changes to air quality that are assumed to occur by 2030 under the No Action Alternative and the Second Basis of Comparison are summarized in this section. Many of the changed conditions would occur in the same manner under both the No Action Alternative and the Second Basis of Comparison.

16.5.2.1 Common Changes in Conditions under the No Action Alternative and Second Basis of Comparison

Conditions in 2030 would be different than existing conditions due to:

- Climate change and sea level rise
- General plan development throughout California, including increased water demands in portions of Sacramento Valley
- Implementation of reasonable and foreseeable water resources management projects to provide water supplies

It is anticipated that climate change would result in warmer temperatures, more short-duration high-rainfall events, and less snowpack in the winter and early spring months. The reservoirs would be full more frequently by the end of April or May by 2030 than in recent historical conditions. However, as the water is released in the spring, there would be less snowpack to refill the reservoirs. This condition would reduce reservoir storage and available water supplies to downstream uses in the summer. The reduced end of September storage also would reduce the ability to release stored water to downstream regional reservoirs. These conditions would occur for all reservoirs in the California foothills and mountains, including non-CVP and SWP reservoirs.

These changes would result in a decline of the long-term average CVP and SWP water supply deliveries by 2030 as compared to recent historical long-term average deliveries under the No Action Alternative and the Second Basis of Comparison. However, the CVP and SWP water deliveries would be less under the No Action Alternative as compared to the Second Basis of Comparison, as described in Chapter 5, Surface Water Resources and Water Supplies, which could result in more crop idling which could result in increased dust generation.

Under the No Action Alternative and the Second Basis of Comparison, land uses in 2030 would occur in accordance with adopted general plans. Development under the general plans would be required to be implemented in accordance with adopted air quality management plans.

The No Action Alternative and the Second Basis of Comparison assumes completion of water resources management and environmental restoration projects that would have occurred without implementation of Alternatives 1 through 5, including regional and local recycling projects, surface water and groundwater storage projects, conveyance improvement projects, and desalination projects. These projects would increase energy demand and could be associated with increases in indirect greenhouse gas emissions.

By 2030, more efficient energy use, increases in renewable energy production, and energy conservation are also anticipated to reduce future GHG emissions rates.

Under the No Action Alternative and the Second Basis of Comparison, there are several major variables with varying degrees of uncertainty. These variables include future population growth in the air basins, the extent and emissivity of various emissions sources from existing and future activities, and the success of the local jurisdictions and others in implementing effective air emissions control measures. It is assumed that air quality in 2030 will be similar to the conditions described in the Affected Environment even with population growth because the current air quality management plans were developed with consideration of future growth by at least 2030. It is anticipated that the non-attainment areas will reduce the contaminants to a level of attainment in accordance with adopted air quality management plans. In addition, it is assumed that the California Renewables Portfolio Standard (RPS) will be implemented by 2020. The RPS was established in accordance with California Senate Bill 1078 in 2002, Senate Bill 107 in 2006, and Senate Bill 2 in 2011 to require investor-owned utilities, electric service providers, and community-choice aggregators (e.g., local agencies that purchase or generate electricity for their community) to provide at least 33 percent of their total energy procurement from renewable energy sources by 2020.

Increased groundwater use and related groundwater elevation reductions could occur due to reduction in CVP and SWP water supplies. The increased pumping would increase demand for electricity, and could result indirectly in increases in greenhouse gas emissions. As described above, approximately 15 percent of groundwater pumps rely upon diesel fuels. Increased groundwater pumping could result in increased emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants from increased use of diesel engines.

The No Action Alternative and the Second Basis of Comparison would include restoration of more than 10,000 acres of intertidal and associated subtidal wetlands in Suisun Marsh and Cache Slough; and 17,000 to 20,000 acres of seasonal floodplain restoration in Yolo Bypass. Operation of wetlands restoration projects could result in periodic odors due to anaerobic decomposition of organic matter in portions of the wetlands. As a result, odorous compounds, such as ammonia and hydrogen sulfide, are generated and may be released into the environment. Marshes and wetlands can also be a source of odors during some time periods when ponds or shallow water areas undergo algal or vegetative growth. Marshes, wetlands, shallow water areas, or canals may require periodic maintenance to inhibit algal or vegetative growth, and avoid conditions conducive to anaerobic digestion. The occurrence and severity of odor impacts depend on numerous factors, including the nature, frequency, and intensity of the source; wind speed and direction; and the presence of sensitive receptors. Although odors rarely cause any physical harm, they can still be unpleasant to some individuals.

16.5.3 Evaluation of Alternatives

Alternatives 1 through 5 have been compared to the No Action Alternative; and the No Action Alternative and Alternatives 1 through 5 have been compared to the Second Basis of Comparison.

During review of the numerical modeling analyses used in this EIS, an error was determined in the CalSim II model assumptions related to the Stanislaus River operations for the Second Basis of Comparison, Alternative 1, and Alternative 4 model runs. Appendix 5C includes a comparison of the CalSim II model run results presented in this chapter and CalSim II model run results with the error corrected. Appendix 5C also includes a discussion of changes in the comparison of groundwater conditions for the following alternative analyses.

- No Action Alternative compared to the Second Basis of Comparison
- Alternative 1 compared to the No Action Alternative
- Alternative 3 compared to the Second Basis of Comparison
- Alternative 5 compared to the Second Basis of Comparison

16.5.3.1 No Action Alternative

The No Action Alternative is compared to the Second Basis of Comparison.

16.5.3.1.1 Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

As described in Chapter 7, Groundwater Resources and Groundwater Quality, groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would increase by 8 percent under the No Action Alternative as compared to the Second Basis of Comparison. It is not known if the additional groundwater pumping would rely upon electricity or diesel to drive the pump engines. Under the worst case analysis, it is assumed that the increased use of diesel engines would be proportional to the increased use of groundwater. Therefore, under the No Action Alternative, there would be a potential increase in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants as compared to the Second Basis of Comparison.

Effects Related to Cross Delta Water Transfers

Potential effects to air quality could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c). Potential effects to air quality were identified as increased emissions of air pollutants due to the use of diesel engines for groundwater pumps that were used to provide transfer water through groundwater substitution programs. The analysis indicated that the effects could be reduced to avoid substantial impacts through the use of electric engines or reducing the amount of groundwater substitution. Other identified effects were considered to be not substantial or beneficial as related to crop idling to provide transfer water in the seller's service area; and reduction of groundwater pumping that could use diesel engines or dust generation from crop idled lands in the purchaser's service area.

Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Under the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be less under the No Action Alternative than under the Second Basis of Comparison.

16.5.3.1.2 San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies would be decreased by 10 percent and 18 percent, respectively, in the San Francisco Bay Area, Central Coast, and Southern California regions under No Action Alternative as compared to the Second Basis of Comparison. The decrease in surface water supplies could result in additional use of groundwater pumps and emissions of air pollutants and contaminants if the use of diesel engines is also increased.

16.5.3.1.3 Overall Study Area

Changes in GHG Emissions due to Changes in Energy Generation or Use

As described in Chapter 8, Energy, changes in CVP and SWP operations under the No Action Alternative as compared to the Second Basis of Comparison would result in a reduction of CVP and SWP water deliveries to areas located south of the Delta; and therefore, annual energy use for conveyance would decline. CVP annual net generation would be similar; and SWP net energy generation would increase which could result indirectly in less GHG emissions if the hydropower generation replaces fossil fuel generation.

In addition to changes in CVP and SWP energy generation and use and the associated GHG emissions, CVP and SWP operations under the No Action Alternative as compared to the Second Basis of Comparison could potentially increase use of energy by CVP and SWP water users to implement regional and local alternate water supplies, such as increased groundwater pumping and use of recycled water treatment plants and desalination water treatment plants. These facilities would require energy which could result in increased GHG emissions.

16.5.3.2 Alternative 1

Alternative 1 is identical to the Second Basis of Comparison. Alternative 1 is compared to the No Action Alternative and the Second Basis of Comparison. However, because CVP and SWP operations conditions under Alternative 1 are identical to conditions under the Second Basis of Comparison; Alternative 1 is only compared to the No Action Alternative.

16.5.3.2.1 Alternative 1 Compared to the No Action Alternative

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would decrease by 8 percent under Alternative 1 as compared to the No Action Alternative. It is not known if the reduction in groundwater pumping would result in a reduction of the use of electricity or diesel to drive the pump engines. For this analysis, it is assumed that the decreased use of diesel engines would be proportional to the decreased use of groundwater. Therefore, under Alternative 1, there would be a potential decrease in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants as compared to the No Action Alternative.

Effects Related to Cross Delta Water Transfers

Potential effects to air quality could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 1 and the No Action Alternative, and that impacts on air quality would not be substantial due to implementation requirements of the transfer programs.

Under Alternative 1, water could be transferred throughout the year without an annual volumetric limit. Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be increased under Alternative 1 as compared to the No Action Alternative.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies would be increased by 11 percent and 21 percent, respectively, in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 1 as compared to the No Action Alternative. The increase in surface water supplies could result in the reduction in use of groundwater pumps and emissions of air pollutants and contaminants if the use of diesel engines is also decreased.

Overall Study Area

Changes in GHG Emissions due to Changes in Energy Generation or Use

As described in Chapter 8, Energy, changes CVP and SWP operations under Alternative 1 as compared to the No Action Alternative would result in an increase of CVP and SWP water deliveries to areas located south of the Delta; and therefore, annual energy use for conveyance would increase. CVP annual net generation would be similar, and SWP annual net generation would be decrease over the long-term average conditions. This could result in increased GHG emissions if fossil fuel generation replaces hydropower generation.

In addition to changes in CVP and SWP energy generation and use, and the associated GHG emissions, CVP and SWP operations under Alternative 1 as compared to the No Action Alternative could potentially decrease the use of energy by CVP and SWP water users due to less need to implement regional and local alternative water supplies, such as increased groundwater pumping and use of recycled water treatment plants and desalination water treatment plants. As the need for alternative water supplies is decreased, the associated energy demand and indirect GHG emissions would also be decreased under Alternative 1 as compared to the No Action Alternative.

16.5.3.2.2 Alternative 1 Compared to the Second Basis of Comparison

Alternative 1 is identical to the Second Basis of Comparison.

16.5.3.3 Alternative 2

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative, as described in Chapter 3, Description of Alternatives; therefore, Alternative 2 is only compared to the Second Basis of Comparison.

16.5.3.3.1 Alternative 2 Compared to the Second Basis of Comparison

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative. Therefore, changes to air quality and GHG emission conditions under Alternatives 2 as compared to the Second Basis of Comparison would be the same as the impacts described in Section 16.5.3.1, No Action Alternative.

16.5.3.4 Alternative 3

As described in Chapter 3, Description of Alternatives, CVP and SWP operations under Alternative 3 are similar to the Second Basis of Comparison with modified Old and Middle River flow criteria and New Melones Reservoir operations. As described in Chapter 4, Approach to Environmental Analysis, Alternative 3 is compared to the No Action Alternative and the Second Basis of Comparison.

16.5.3.4.1 Alternative 3 Compared to the No Action Alternative

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would decrease by 6 percent under Alternative 3 as compared to the No Action Alternative. It is not known if the reduction in groundwater pumping would result in a reduction of the use of electricity or diesel to drive the pump engines. For this analysis, it is assumed that the decreased use of diesel engines would be proportional to the decreased use of groundwater. Therefore, under Alternative 3, there would be a potential decrease in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants as compared to the No Action Alternative.

Effects Related to Cross Delta Water Transfers

Potential effects to air quality could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 3 and the No Action Alternative, and that impacts on air quality would not be substantial due to implementation requirements of the transfer programs.

Under Alternative 3, water could be transferred throughout the year without an annual volumetric limit. Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be increased under Alternative 3 as compared to the No Action Alternative.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies would be increased by 9 percent and 17 percent, respectively, in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 3 as compared to the No Action Alternative. The increase in surface water supplies could result in the reduction in use of groundwater pumps and emissions of air pollutants and contaminants if the use of diesel engines is also decreased.

Overall Study Area

Changes in GHG Emissions due to Changes in Energy Generation or Use

As described in Chapter 8, Energy, changes in CVP and SWP operations under Alternative 3 as compared to the No Action Alternative would result in an increase of CVP and SWP water deliveries to areas located south of the Delta; and therefore, annual energy use for conveyance would increase. CVP annual net energy generation would be similar; and SWP annual net energy generation would be less which could result in increased GHG emissions if fossil fuel generation replaces hydropower generation.

In addition to changes in CVP and SWP energy generation and use, and the associated GHG emissions, CVP and SWP operations under Alternative 3 as compared to the No Action Alternative could potentially decrease the use of energy by CVP and SWP water users due to less need to implement regional and local alternative water supplies, such as increased groundwater pumping and use of recycled water treatment plants and desalination water treatment plants. As the need for alternative water supplies is decreased, the associated energy demand and GHG emissions would also be decreased under Alternative 3 as compared to the No Action Alternative.

16.5.3.4.2 Alternative 3 Compared to the Second Basis of Comparison

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would be similar (within a 5 percent change) under Alternative 3 as compared to the Second Basis of Comparison. Therefore, the emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants would be similar under Alternative 3 as compared to the Second Basis of Comparison.

Effects Related to Cross Delta Water Transfers

Potential effects to air quality could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 3 and the Second Basis of Comparison, and that impacts on air quality would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 3 and the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be similar under Alternative 3 and the Second Basis of Comparison.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies and emissions from diesel engines used for groundwater pumping would be similar in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 3 as compared to the Second Basis of Comparison.

Overall Study Area

Changes in GHG Emissions due to Changes in Energy Generation or Use

As described in Chapter 8, Energy, changes in CVP and SWP operations under Alternative 3 as compared to the Second Basis of Comparison would result in a decrease of CVP and SWP water deliveries to areas located south of the Delta; and therefore, annual energy use for conveyance would decrease. CVP annual net energy generation would be similar; and SWP annual net energy generation would be greater which could result in decreased GHG emissions if hydropower generation replaces fossil fuel generation.

In addition to changes in CVP and SWP energy generation and use, and the associated GHG emissions, CVP and SWP operations under Alternative 3 as compared to the Second Basis of Comparison could potentially increase the use of energy by CVP and SWP water users to implement regional and local alternative water supplies, such as increased groundwater pumping and use of recycled water treatment plants and desalination water treatment plants. These facilities would require energy which could indirectly result in increased GHG emissions.

16.5.3.5 Alternative 4

The air quality and GHG emissions under Alternative 4 would be identical to the air quality and GHG emissions under the Second Basis of Comparison; therefore, Alternative 4 is only compared to the No Action Alternative.

16.5.3.5.1 Alternative 4 Compared to the No Action Alternative

The CVP and SWP operations under Alternative 4 is identical to the CVP and SWP operations under the Second Basis of Comparison and Alternative 1. Therefore, changes in air quality and GHG emissions under Alternative 4 as compared to the No Action Alternative would be the same as the impacts described in Section 16.5.3.2.1, Alternative 1 Compared to the No Action Alternative.

16.5.3.6 Alternative 5

As described in Chapter 3, Description of Alternatives, CVP and SWP operations under Alternative 5 are similar to the No Action Alternative with modified Old and Middle River flow criteria and New Melones Reservoir operations. As described in Chapter 4, Approach to Environmental Analysis, Alternative 5 is compared to the No Action Alternative and the Second Basis of Comparison.

16.5.3.6.1 Alternative 5 Compared to the No Action Alternative

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would be similar under Alternative 5 as compared to the No Action Alternative. Therefore, the emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants would be similar under Alternative 5 as compared to the No Action Alternative.

Effects Related to Cross Delta Water Transfers

Potential effects to air quality could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 5 and the No Action Alternative, and that impacts on air quality would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 5 and the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be similar under Alternative 5 and the No Action Alternative.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies and emissions from diesel engines used for groundwater pumping would be similar in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 5 as compared to the No Action Alternative.

Overall Study Area

Changes in GHG Emissions due to Changes in Energy Generation or Use

As described in Chapter 8, Energy, changes in CVP and SWP operations under Alternative 5 as compared to the No Action Alternative would result in similar CVP and SWP water deliveries to areas located south of the Delta except in April and May when exports would decline. Overall, annual CVP and SWP net energy generation would be similar under Alternative 5 and the No Action Alternative.

In addition to changes in CVP and SWP energy generation and use, and the associated GHG emissions, CVP and SWP operations under Alternative 5 as compared to the No Action Alternative could potentially increase the use of energy by CVP and SWP water users to implement regional and local alternative water supplies, such as increased groundwater pumping and use of recycled water treatment plants and desalination water treatment plants. These facilities would require energy which could indirectly result in increased GHG emissions.

16.5.3.6.2 Alternative 5 Compared to the Second Basis of Comparison

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would increase by 8 percent under Alternative 5 as compared to the Second Basis of Comparison. It is not known if the additional groundwater pumping would rely upon electricity or diesel to drive the pump engines. Under the worst case analysis, it is assumed that the increased use of diesel engines would be proportional to the increased use of groundwater. Therefore, under Alternative 5, there would be a potential increase in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants as compared to the Second Basis of Comparison.

Effects Related to Cross Delta Water Transfers

Potential effects to air quality could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 5 and the Second Basis of Comparison, and that impacts on air quality would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 5, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Under the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be reduced under Alternative 5 as compared to the Second Basis of Comparison.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies would be decreased by 10 percent and 18 percent, respectively, in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 5 as compared to the Second Basis of Comparison. The decrease in surface water supplies could result in increased use of groundwater pumps and emissions of air pollutants and contaminants if the use of diesel engines is also increased.

Overall Study Area

Changes in GHG Emissions due to Changes in Energy Generation or Use

As described in Chapter 8, Energy, changes in CVP and SWP operations under Alternative 5 as compared to the Second Basis of Comparison would result in a decrease of CVP and SWP water deliveries to areas located south of the Delta; and therefore, annual energy use for conveyance would decrease. CVP annual net generation would be similar; and SWP net energy generation would increase which could result indirectly in less GHG emissions if the hydropower generation replaces fossil fuel generation.

In addition to changes in CVP and SWP energy generation and use, and the associated GHG emissions, CVP and SWP operations under Alternative 5 as compared to the Second Basis of Comparison could potentially increase the use of energy by CVP and SWP water users to implement regional and local alternative water supplies, such as increased groundwater pumping and use of recycled water treatment plants and desalination water treatment plants. These facilities would require energy which could indirectly result in increased GHG emissions.

16.5.3.7 Summary of Environmental Consequences

The results of the environmental consequences of implementation of Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison are presented in Tables 16.5 and 16.6.

Table 16.5 Comparison of Alternatives 1 through 5 to No Action Alternative

Alternative	Potential Change	Consideration for Mitigation Measures
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. Potentially, could indirectly result in an increase of GHG emissions due to a decrease in SWP net energy generation; however, GHG emissions could decrease due to a reduced need for additional energy for alternative water supplies. The overall changes in GHG emissions are not known at this time because the need for energy use by alternative water supplies is not known at this time.	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, 9 to 17 percent in the San Francisco Bay Area Region, and by 17 percent in the Central Coast and Southern California regions. Potentially, could indirectly result in an increase of GHG emissions due to a decrease in SWP net energy generation; however, GHG emissions could decrease due to a reduced need for additional energy for alternative water supplies. The overall changes in GHG emissions are not known at this time because the need for energy use by alternative water supplies is not known at this time.	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	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. Potentially, could indirectly result in an increase of GHG emissions due to the need for additional energy for alternative water supplies. The overall changes in GHG emissions are not known at this time because the need for energy use by alternative water supplies is not known at this time.	None needed

Note: Due to the limitations and uncertainty in the CalSim II monthly model and other analytical tools, incremental differences of 5 percent or less between alternatives and the No Action Alternative are considered to be "similar."

Table 16.6 Comparison of Alternatives 1 through 5 to Second Basis of Comparison

Alternative	Potential Change	Consideration for Mitigation Measures
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. Potentially, could indirectly result in a decrease of GHG emissions due to an increase in SWP net energy generation; however, GHG emissions could increase due to the need for additional energy for alternative water supplies. The overall changes in GHG emissions are not known at this time because the need for energy use by alternative water supplies is not known at this time.	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	Potential Change	Consideration for Mitigation Measures
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. Potentially, could indirectly result in a decrease of GHG emissions due to an increase in SWP net energy generation; however, GHG emissions could increase due to the need for additional energy for alternative water supplies. The overall changes in GHG emissions are not known at this time because the need for energy use by alternative water supplies is not known at this time.	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. Potentially, could indirectly result in a decrease of GHG emissions due to an increase in SWP net energy generation; however, GHG emissions could increase due to the need for additional energy for alternative water supplies. The overall changes in GHG emissions are not known at this time because the need for energy use by alternative water supplies is not known at this time.	Not considered for this comparison.

Note: Due to the limitations and uncertainty in the CalSim II monthly model and other analytical tools, incremental differences of 5 percent or less between alternatives and the No Action Alternative are considered to be "similar."

16.5.3.8 Potential Mitigation Measures

Mitigation measures are presented in this section to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse environmental effects of Alternatives 1 through 5 as compared to the No Action Alternative. Mitigation measures were not included to address adverse impacts under the alternatives as compared to the Second Basis of Comparison because this analysis was included in this EIS for information purposes only.

Changes in CVP and SWP operations under Alternatives 1 through 5 as compared to the No Action Alternative would not result in changes in air quality. Therefore, there would be no adverse impacts to air quality; and no mitigation measures are required.

16.5.3.9 Cumulative Effects Analysis

As described in Chapter 3, the cumulative effects analysis considers projects, programs, and policies that are not speculative; and are based upon known or reasonably foreseeable long-range plans, regulations, operating agreements, or other information that establishes them as reasonably foreseeable.

The cumulative effects analysis considers potential incremental impacts of the alternatives when added to other past and present actions (as described in the Affected Environment section) and reasonably foreseeable future actions (as described in the No Action Alternative section plus cumulative effects) regardless of what agency (federal or non-federal) or person undertakes such actions (40 CFR 1508.7, 1508.25, and 43 CFR 46.115). The quantitative effects of these items are based upon the quantitative comparisons of Alternatives 1 through 5 to the No Action Alternative presented in previous sections of this chapter; and the qualitative cumulative effects of the alternatives are based upon the qualitative comparisons of Alternatives 1 through 5 to the No Action Alternative presented in previous sections of this chapter and the effects of the cumulative actions that are less certain than future actions under the No Action Alternative.

The cumulative effects analysis for Alternatives 1 through 5 for Air Quality issues are summarized in Table 16.7.

Table 16.7 Summary of Cumulative Effects on Air Quality with Implementation of Alternatives 1 through 5 as Compared to the No Action Alternative

Scenarios	Actions	Cumulative Effects of Actions
Past & Present, and Future Actions included in the No Action Alternative and in All Alternatives in Year 2030	Consistent with Affected Environment conditions plus: Actions in the 2008 USFWS BO and 2009 NMFS BO that would have occurred without implementation of the BOs, as described in Section 3.3.1.2 (of Chapter 3, Descriptions of Alternatives), including climate change and sea level rise Actions not included in the 2008 USFWS BO and 2009 NMFS BO that would have occurred without implementation of the BOs, as described in Section 3.3.1.3 (of Chapter 3, Descriptions of Alternatives): • Implementation of Federal and state policies and programs, including Clean Water Act (e.g., Total Maximum Daily Loads); Safe Drinking Water Act; Clean Air Act; and flood management programs • General plans for 2030. • Trinity River Restoration Program. • Central Valley Project Improvement Act programs • Folsom Dam Water Control Manual Update • FERC Relicensing for the Middle Fork of the American River Project • San Joaquin River Restoration Program • Future water supply projects, including water recycling, desalination, groundwater banks and wellfields, and conveyance facilities (projects with completed environmental documents)	These effects would be the same under all alternatives. Climate change and sea level rise, development under the general plans, FERC relicensing projects, and some future projects to improve water quality and/or habitat are anticipated to reduce carryover storage in reservoirs and changes in stream flow patterns in a manner that could reduce hydroelectric generation in the summer and fall months which could result in increased use of fossil fuels and indirectly increase GHG emissions for fossil fuel generation and increased use of diesel engines for additional groundwater use. Reduced CVP and SWP water deliveries south of the Delta would reduce CVP and SWP electricity use for conveyance; and could reduce the need for electricity generation using fossil fuels and indirectly reduce GHG emissions. Future water supply projects are anticipated to both improve water supply reliability due to reduced surface water supplies and to accommodate planned growth in the general plans. It is anticipated that some of these projects could increase energy use, such as implementation of desalination projects. However, other projects, such as water recycling, would not substantially increase energy use because most of the energy use was previously required for wastewater treatment. It is anticipated that energy required for water treatment of alternative water supplies would be similar as treatment for CVP and SWP water supplies. Increased energy use could increase use of electricity generation by fossil fuels; which could increase air quality issues and indirectly increase GHG emissions. Most of these programs were initiated prior to implementation of the 2008 USFWS BO and 2009 NMFS BO which reduced CVP and SWP water supply reliability.

Scenarios	Actions	Cumulative Effects of Actions
Future Actions considered as Cumulative Effects Actions in All Alternatives in Year 2030	Actions as described in Section 3.5 (of Chapter 3, Descriptions of Alternatives): • Bay-Delta Water Quality Control Plan Update • FERC Relicensing Projects • Bay Delta Conservation Plan (including the California WaterFix alternative) • Shasta Lake Water Resources, North-of-the-Delta Offstream Storage, Los Vaqueros Reservoir Expansion Phase 2, and Upper San Joaquin River Basin Storage Investigations • El Dorado Water and Power Authority Supplemental Water Rights Project • Sacramento River Water Reliability Project • Semitropic Water Storage District Delta Wetlands • North Bay Aqueduct Alternative Intake • Irrigated Lands Regulatory Program • San Luis Reservoir Low Point Improvement Project • *Westlands Water District v. United States Settlement* • Future water supply projects, including water recycling, desalination, groundwater banks and wellfields, and conveyance facilities (projects that did not have completed environmental documents during preparation of the EIS)	<u>These effects would be the same under all alternatives.</u> Most of the future reasonably foreseeable actions are anticipated to improve water supplies in California to reduce impacts due to climate change, sea level rise, increased water allocated to improve habitat conditions, and future growth. If CVP and SWP water supply reliability increases, energy use for conveyance of CVP and SWP water supplies also would increase. Some of the future reasonably foreseeable actions are anticipated to potentially reduce CVP and SWP water supply reliability (e.g., Water Quality Control Plan Update and FERC Relicensing Projects). Future water supply projects are anticipated to both improve water supply reliability due to reduced surface water supplies and to accommodate planned growth in the general plans. It is anticipated that some of these projects could increase energy use, such as implementation of desalination projects. However, other projects, such as water recycling, would not substantially increase energy use because most of the energy use was previously required for wastewater treatment. It is anticipated that energy required for water treatment of alternative water supplies would be similar as treatment for CVP and SWP water supplies. Increased use of groundwater pumps would increase energy use.

Scenarios	Actions	Cumulative Effects of Actions
No Action Alternative with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO CVP and SWP	Implementation of No Action Alternative would result in changes stream flows and related changes in hydroelectric generation patterns, and reduced CVP and SWP water supplies as compared to conditions prior to the BOs. If CVP and SWP water supply reliability decreases, energy use for conveyance of CVP and SWP water supplies also would decrease and energy use for alternative water supplies could increase. Increased energy use could increase use of electricity generation by fossil fuels; which could increase air quality issues and indirectly increase GHG emissions.
Alternatives 1 and 4 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant)	Implementation of Alternatives 1 and 4 with reasonably foreseeable actions would result in changes in stream flows and related hydroelectric generation patterns, and increased CVP and SWP water supplies as compared to the No Action Alternative with the added actions. Increased CVP and SWP water supply reliability would increase energy use for conveyance of CVP and SWP water supplies; and it is anticipated that energy use for alternative water supplies would decrease as compared to the No Action Alternative with the added actions. Increased energy use for CVP and SWP conveyance could increase use of electricity generation by fossil fuels; which could increase air quality issues and indirectly increase GHG emissions. However, decreased energy use for alternative water supplies could decrease use of electricity generation by fossil fuels; which could decrease air quality issues and indirectly decrease GHG emissions as compared to for the No Action Alternative with the added actions.
Alternative 2 with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO CVP and SWP operational actions No implementation of structural improvements or other actions that require further study to develop a more detailed action description.	Implementation of Alternative 2 with reasonably foreseeable actions for energy resources would be the same as for the No Action Alternative with the added actions.

Scenarios	Actions	Cumulative Effects of Actions
Alternative 3 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant) Slight increase in positive Old and Middle River flows in the winter and spring months	Implementation of Alternative 3 with reasonably foreseeable actions would result in changes in stream flows and related hydroelectric generation patterns, and increased CVP and SWP water supplies as compared to the No Action Alternative with the added actions. Increased CVP and SWP water supply reliability would increase energy use for conveyance of CVP and SWP water supplies; and it is anticipated that energy use for alternative water supplies would decrease as compared to the No Action Alternative with the added actions. Increased energy use for CVP and SWP conveyance could increase use of electricity generation by fossil fuels; which could increase air quality issues and indirectly increase GHG emissions. However, decreased energy use for alternative water supplies could decrease use of electricity generation by fossil fuels; which could decrease air quality issues and indirectly decrease GHG emissions as compared to for the No Action Alternative with the added actions.
Alternative 5 with Associated Cumulative Effects Actions in Year 20530	Full implementation of the 2008 USFWS BO and 2009 NMFS BO Positive Old and Middle River flows and increased Delta outflow in spring months	Implementation of Alternative 5 with reasonably foreseeable actions would result in similar net CVP and SWP hydroelectric generation, and reduced CVP and SWP water supplies as compared to the No Action Alternative with the added actions. It is anticipated that energy use for alternative water supplies would increase as compared to the No Action Alternative with cumulative effects which could increase air quality issues and indirectly increase GHG emissions as compared to for the No Action Alternative with the added actions.

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Chapter 17

Cultural Resources

17.1 Introduction

Cultural resources are defined as prehistoric and historic archaeological sites, architectural features (e.g., buildings, bridges, flumes, trestles, railroads), and traditional cultural properties. However, the focus of this chapter is more on cultural resources than historic properties.

This chapter describes the known existing cultural resources conditions in the study area and the potential changes that could occur as a result of implementing the alternatives evaluated in this Environmental Impact Statement (EIS). Implementation of the alternatives could affect cultural and historic resources through potential changes in the operation of the Central Valley Project (CVP) and State Water Project (SWP). Changes in CVP and SWP operations could increase the frequency and duration of low-elevation reservoir conditions that would increase the time of exposure of inundated cultural resources within reservoirs that store CVP and SWP water. Changes in CVP and SWP operations also could reduce water supply availability to agricultural lands, and those lands could be subject to land use changes that could increase disturbances of cultural resources if present.

17.2 Regulatory Environment and Compliance Requirements

Potential actions that could be implemented under the alternatives evaluated in this EIS could affect reservoirs, streams, and lands served by CVP and SWP water supplies located on lands with cultural resources. Actions implemented, funded, or approved by Federal and state agencies would need to be compliant with appropriate Federal and state agency policies and regulations, as summarized in Chapter 4, Approach to Environmental Analyses.

17.3 Affected Environment

This section describes the types of cultural resources that could be potentially affected by the implementation of the alternatives considered in this EIS. Changes in areas with cultural resources due to changes in CVP and SWP operations may occur at reservoirs that store CVP and SWP water and on lands that use CVP and SWP water supplies in the Trinity River, Central Valley, San Francisco Bay Area, and Central Coast and Southern California regions.

17.3.1 Prehistoric Context

17.3.1.1 Introduction to the Prehistoric Context

The study area has a long and complex cultural history with distinct regional patterns that extend back more than 11,000 years (Reclamation 1997). The first generally agreed upon evidence for the presence of prehistoric peoples in the study area is represented by the distinctive fluted spear points called Clovis points. These artifacts have been found on the margins of extinct lakes in the San Joaquin Valley. The Clovis points are found on the same surface with the bones of animals that are now extinct, such as mammoths, sloths, and camels. The subsequent period from about 10000 to 8000 BP (before present) was characterized by a small number of sites with stemmed spear points instead of fluted spear points. Approximately 8,000 years ago, many California cultures shifted the main focus of their subsistence strategies from hunting to seed gathering as evidenced by the increase in food-grinding implements found in archaeological sites dating to this period. In the last 3,000 years, the archaeological record becomes more complex as specialized adaptations to locally available resources were developed and populations expanded. Many sites dated to this time period contain mortars and pestles or are associated with bedrock mortars, implying that the occupants exploited acorns intensively. The range of subsistence resources that were used increased, exchange systems expanded, and social stratification and craft specialization occurred as indicated by well-made artifacts such as charm stones and beads, which were often found with burials.

17.3.1.2 Prehistory of the Trinity River Region

The Trinity River Region includes portions of Trinity County including Trinity Lake, Lewiston Reservoir, and Trinity River from Lewiston Reservoir to the Humboldt County boundary (near the eastern boundary of Hoopa Valley Indian Reservation); portions of Humboldt County including the Hoopa Valley Indian Reservation, Trinity River from the Humboldt County border to the Del Norte County border (near the confluence of the Trinity and Klamath rivers); and Del Norte County including the Lower Klamath River from the confluence with the Trinity River to the Pacific Ocean.

The area surrounding the present Trinity Lake and the Trinity River to its confluence with the Klamath River and along the Klamath River to the Pacific Ocean was inhabited by the Wintu, Chimariko, Yurok, and Hupa Indians at the time of Euroamerican contact.

17.3.1.3 Prehistory of the Central Valley Region

The Central Valley Region extends from above Shasta Lake to the Tehachapi Mountains and includes the Sacramento Valley, San Joaquin Valley, and the Delta and Suisun Marsh areas. The Sacramento Valley and San Joaquin Valley are divided into Eastern and Western subregions.

17.3.1.3.1 Prehistory of the Sacramento Valley

The western Sierra Nevada foothills appear to have been first used by Great Basin people around 8000 BP (Reclamation 1997). By approximately 4000 BP, people possibly from the Great Basin were seasonally hunting and gathering in the Sierra Nevada and the Sacramento Valley.

In the northern western portion of Sacramento Valley, between approximately 12,000 and 150 years ago (12000 to 100 BP), the prehistoric societies of northern California underwent a series of slow but significant changes in subsistence and economic orientation, population densities and distribution, and social organization. These changes are thought to reflect migrations of various peoples into the area and displacement of earlier populations (Jensen and Reed 1980; Farber 1985; Reclamation 1997). Early archaeological investigations within Nomlaki and Wintu ethnographic territory, particularly the present Redding area and adjacent tracts of the southern Klamath Mountains, appear to indicate that human occupation of this area began approximately 1050 to 950 BP.

Little is known of human occupation on the floor of the Sacramento Valley prior to 4500 BP (Reclamation 1997). Because of alluvial and colluvial deposition over the past 10,000 years, ancient cultural deposits have been deeply buried in many areas. Initially, humans appeared to adapt to lakes, marshes, and grasslands environments until approximately 8000 to 7000 BP (Placer County 2007). The earliest evidence of widespread villages and permanent occupation of the lower Sacramento Valley, Delta, and Suisun Marsh areas comes from several sites assigned to the Windmiller Pattern (previously, “Early Horizon”), dated circa 4500 to 2500 BP (Ragir 1972; Reclamation 1997; Reclamation et al. 2010).

From circa 2500 to 1500 BP in the Central Valley area, villages were characterized by deep midden deposits, suggesting intensified occupation and a broadened subsistence base (Reclamation 1997, 2005a; Reclamation et al. 2010; Beardsley 1948; Heizer and Fenenga 1939; Moratto 1984).

During the late prehistoric period from 1500 to 100 BP, development may have been initiated due to the southward expansion of Wintuan populations into the Sacramento Valley (Moratto 1984; Reclamation 1997; Reclamation et al. 2010). The period is characterized by intensified hunting, fishing, and gathering subsistence with larger communities, highly developed trade networks, elaborate ceremonial and mortuary practices, and social stratification.

17.3.1.3.2 Prehistory of the San Joaquin Valley

Evidence of prehistoric occupation of the central and southern Sierra Nevada foothills goes back to 9,500 years ago. The vast majority of investigated sites, however, are less than 500 years old, probably representing a relatively recent proliferation of settlements by Yokut Indians (Moratto 1984; Reclamation 1997). The chronological sequence developed in the south-central Sierra Nevada as a result of the Buchanan Reservoir project in present Madera County is still used as a general framework (Reclamation 1997). Similar findings were identified in major settlement sites along the San Joaquin River and in the present New Melones Reservoir area (Reclamation 2010; Reclamation and DWR 2011).

During the early Holocene period (10,000 to 12,000 years ago), peoples probably inhabited or passed through the San Joaquin Valley; however, few indications of this period have been discovered, probably due to burial beneath accumulated river sediment (Reclamation 1997, 2012). Examples of early Holocene cultural remains are known primarily from the Tulare Basin in the southern San Joaquin Valley. Evidence along the southern shoreline of the ancient Tulare Lake indicates that human presence may have occurred from 11000 BP (Reclamation and State Parks 2013).

From approximately 1650 to 950 BP, there is evidence that the people of the eastern San Joaquin Valley may have interacted with people in the Delta area (Reclamation 1997, 2012).

From approximately 450 to 100 BP, the people of the eastern San Joaquin Valley may have interacted with people in the Central Coast and Southern California areas. Material found in Pacheco to Panoche strata indicates a trade relationship with people of the Delta, Central Coast, and Southern California regions (Moratto 1984; Reclamation 1997, 2012).

17.3.1.4 Prehistory of the San Francisco Bay Area Region

The San Francisco Bay Area Region only includes portions of the Bay Area that could be affected through implementation of the alternatives considered in this EIS, which includes Contra Costa, Alameda, Santa Clara, and San Benito counties. The prehistory context is different throughout the San Francisco Bay Area Region. Human occupation in the northern valley regions of present San Benito County occurred as described above for the western San Joaquin Valley (San Benito County 2010).

Human occupation in the coastal regions of present Contra Costa and Alameda counties occurred as described above for the southern portion of the Sacramento Valley (Reclamation 1997; DWR 2008; Zone 7 2006). From 5000 to 2500 BP, dense settlements extended from the coastal marshes to interior grasslands and woodlands (Zone 7 2006). From about 2500 to 950 BP, coastal communities relied upon shellfish, and major shellmounds were created near these communities, including near the present Alameda County shorelines and some interior valleys.

Settlement of the interior valleys of the present Contra Costa, Alameda, and Santa Clara counties occurred during the past 12,000 years. From 6000 to 1700 BP, settlements occurred, as there was less emphasis on nomadic hunting for large animals and increased emphasis on the use of plant materials and hunting, fishing, and shellfish collection (Santa Clara County 2012; CCWD et al. 2009). The communities established economies and traded between the communities.

17.3.1.5 Prehistory of the Central Coast Region

The prehistory of the Central Coast Region for this EIS (present day San Luis Obispo and Santa Barbara counties) is poorly known but may have begun around 11000 BP and probably represents mobile hunter-gatherers (Reclamation 1997; San Luis Obispo County 2010; Santa Barbara 2010). Fishing, intensive shellfish collecting, and hunting began around 9000 BP. Use of milling stones and establishment of communities occurred after about 8500 BP. After about 5000 BP, there was greater reliance on hunting of land and sea mammals, gathering of shellfish, and use of mortars and pestles. Subsequently, larger settlements occurred for ethnographically known peoples, including the Chumash.

17.3.1.6 Prehistory of the Southern California Region

The Southern California Region includes the present Ventura, Los Angeles, Orange, San Diego, Riverside, and San Bernardino counties, which have substantially different prehistory characteristics.

In the coastal areas of the Southern California Region (present Ventura, Los Angeles, Orange, and San Diego counties), early habitation extends over 12,000 years ago (Ventura County 2005; Los Angeles 2005; San Diego County 2011b). Between 12000 and 7500 BP, the inhabitants were hunter-gatherer populations that used land and marine resources. The population along the northern coast of Southern California began expanding between 9000 and 8500 BP. Permanent coastal settlements expanded as plants, shellfish, and marine mammals became a large part of the subsistence (Glassow et al. 2007; Los Angeles 2005). From 5000 to 450 BP, the use of plant materials and exploitation of fish and sea mammals increased sedentism and socioeconomic interaction (Glassow 1999; Los Angeles 2005; San Diego County 2011b).

The interior area within the Southern California Region considered in this EIS includes portions of Riverside and San Bernardino counties that use SWP water supplies, including the Mojave Desert and the Peninsular Ranges.

Clovis (circa 12000 to 10000 BP) is the only cultural complex dating from the Pleistocene that can be consistently identified in the Mojave Desert (Sutton et al. 2007). The Clovis culture characteristics appear to be associated with Paleo-Indian groups as big game hunters. More recently, there have been indications that the people had greater cultural and economic diversity than previously recognized (CDFG 2009). Paleo-Indian groups were likely small, highly mobile populations living in small, temporary camps near permanent water sources (Sutton et al. 2007).

From 10000 and 8000 BP, communities were organized around relatively small social units (Sutton et al. 2007; Riverside County 2000). From 7000 to 4000 BP, hunting continued while foraging subsistence transformed during this period to more collection of plant and animal materials within adjacent ecological zones (CDFG 2009; Riverside County 2000; Sutton et al. 2007). Between 4000 and 1750 BP, permanent seasonally occupied settlements occurred in the lower valley with the use of oak woodlands and mesquite groves (Riverside County 2000; Sutton et al. 2007).

From 1750 to 850 BP, communities increased and trade between communities expanded (CDFG 2009; Gardner 2002, 2006; Riverside County 2000; Sutton et al. 2007; Sutton 1988, 1996; Warren and Crabtree 1986). During this period, the lower Coloradan culture became more prevalent along the shoreline of the Lake Cahuilla area (site of the present Salton Sea and Coachella Valley Water District) (Riverside County 2000). The lower Coloradans relied upon shellfish, fish, aquatic birds, marsh and riparian vegetation, and mammals. The culture may have been influenced by the Anasazi settlements of present Southern Nevada, including cultivation of corns, beans, and squash. The Anasazi people also occupied portions of present San Bernardino County where turquoise was mined. Extensive trading occurred between the people in the inland areas and the people along the coast.

After about 850 BP, populations appeared to decline, and several cultural complexes emerged (Sutton et al. 2007). Late Prehistoric occupation sites were based on hunting and gathering, especially of plant foods and small game (Riverside County 2000). Villages in Antelope Valley began to disappear in the later prehistoric times, probably due to the disappearance of lakes that were the headwaters of the Mojave River or changes in trade route locations (DWR 2009). Lake Cahuilla declined around 450 BP and the large populations dispersed to the Colorado River, western Peninsular Ranges in present western Riverside County, and the Pacific Ocean coast (Riverside County 2000).

17.3.2 Ethnographic Context

17.3.2.1 Introduction to Ethnographic Context

This section provides brief ethnographic sketches for each native cultural group whose traditional territories are within the study area. Each ethnographic sketch presents the territorial limits of each respective cultural group and then focuses mainly on those aspects of culture that are potentially represented in the archaeological record.

The study area encompasses lands occupied by more than 40 distinct Native American cultural groups. Although most California tribes shared similar elements of social organization and material culture, linguistic affiliation and territorial boundaries primarily distinguish them from each other. Before European settlement of California, an estimated 310,000 native Californians spoke dialects of as many as 80 mutually unintelligible languages representing six major North American language stocks (Cook 1978; Moratto 1984; Reclamation 1997; Shipley 1978).

17.3.2.2 Ethnography of the Trinity River Region

The Trinity River Region includes portions of Shasta, Trinity, Siskiyou, Humboldt, and Del Norte counties. This area is bounded by the Sacramento River on the east, the Pacific Ocean on the west, and the middle and upper Klamath Basin on the north. The ethnography of the Yurok, Hupa, Wintu, and Chimariko is described below.

17.3.2.2.1 Yurok

The Yurok inhabited California's northwestern coastline from Little River to Damnation Creek; along the Klamath River from the confluence with the Pacific Ocean up past the Klamath-Trinity confluence to Slate Creek; and approximately 6 miles along the Trinity River upstream of the confluence with the Klamath River (Pilling 1978; USFWS et al. 1999). The Yurok life, communities, society, and ceremonies are deeply connected with the Klamath River (DOI and CDFG 2012). Yurok culture and traditional stories describe that the Klamath River was created to facilitate the interaction with two neighboring people, the Hupa and the Karuk, and with the salmon that lived in the Klamath River. Both the Hupa and Karuk culture and traditional stories also describe this close interaction of the peoples, salmon, and Klamath River.

Yurok are recognized for their highly stylized art forms and their skills in making redwood canoes, weaving fine baskets, hunting, and especially riverine salmon fishing. The ancient traditions are continued through contemporary times (USFWS et al. 1999). The redwood canoes for ocean conditions can be 30 to 40 feet in length, designed to haul large amounts of fish and seal carcasses, and paddled by 5 to 20 paddlers (DOI and CDFG 2012). The canoes are used to gather food and materials, transport people and materials, and for ceremonial aspects of the Yurok culture. The Jump and Deerskin ceremonies are held in late fall to give thanks for abundant food supplies. The Deerskin Ceremony includes a Boat Ceremony in which the participants travel down the Klamath River to thank the river for continuing to flow and provide resources.

17.3.2.2.2 Hupa

The Hupa inhabited the area surrounding the lower reaches of the Trinity River from approximately Salyer to approximately 6 miles upstream from the confluence with the Klamath River (Wallace 1978a; USFWS et al. 1999). Hupa life is defined by extended families affiliated with villages.

The Hupa believe that the Klamath and Trinity rivers were created to provide interaction with other peoples (Yurok and Karuk) and with the salmon (DOI and CDFG 2012). Many of the Hupa ceremonies highlight their relationship with the rivers, including world renewal ceremonies and ceremonies for bountiful harvests. The world renewal ceremonies include the White Deerskin and Jump ceremonies to honor the earth and the creator for providing food and other resources. The ceremonies for bountiful harvest of fish and acorns include the First Salmon ceremony and the Acorn Feast.

17.3.2.2.3 Wintu

When the Europeans and Americans first explored California, most of the western side of the Sacramento Valley north of about Suisun Bay was inhabited by Wintun-speaking people (USFWS et al. 1999). Early in the anthropological study of the region, a linguistic and cultural distinction was recognized between the Wintun-speaking people in the southwestern Central Valley (the Patwin) and the people occupying the northwestern Central Valley and Trinity River Valley (LaPena 1978; USFWS et al. 1999).

17.3.2.2.4 Chimariko

The Chimariko lived in a 20-mile-long reach of the Trinity River from approximately Big Bar to the confluence with the South Fork (Silver 1978a; USFWS et al. 1999). Although the Chimariko language is now extinct, early ethnographers recorded some words, and the language is thought to be of Hokan stock.

17.3.2.3 Ethnography of the Central Valley Region

17.3.2.3.1 Ethnography of the Sacramento Valley

Maidu, Konkow, and Nisenan

Maidu (also known as northeastern Maidu), Konkow (also known as northwestern Maidu), and Nisenan (also known as southern Maidu) inhabited an area of California from Lassen Peak to the Cosumnes River, and from the Sacramento River to Honey Lake (Reclamation 1997; Shipley 1978). Northeastern Maidu territory extended from Lassen Peak on the west to Honey Lake on the east, Sierra Buttes on the south, and Eagle Lake on the north. The Konkow inhabited the region from the Lower Feather River in the north, to the Sutter Buttes in the south, and to the west beyond the Sacramento River. The Nisenan lived in the area east of the Sacramento River and along the Middle Fork Feather River, Bear River, American River, and Cosumnes River from the Sacramento River almost to Lake Tahoe (Riddell 1978; Wilson and Towne 1978; Reclamation 1997, 2005b).

Yana

The Yana of north-central California inhabited an area from Lassen Peak and the southern Cascade foothills on the east, Rock Creek on the south, Pit River on the north, and the eastern bank of the Sacramento River on the west. The western boundary is the most uncertain (J. Johnson 1978a; Reclamation 1997).

Achumawi, Atsugewi, and Shasta

The Achumawi and Atsugewi of northeastern California are two linguistically and culturally distinct but related groups (Reclamation 1997). The Achumawi and Atsugewi languages belong to the Palaihnihan family, or Hokan stock. The territory of the Achumawi extended generally to Mount Lassen, west to Mount Shasta, northeast to Goose Lake, and east to the Warner Range (Kroeber 1925; Olmsted and Stewart 1978; Garth 1978; Reclamation 1997). Overlapping this area to some extent, the Atsugewi territory ranged from Mount Lassen in the southwest, the Pit River in the north, and Horse Lake to the east.

The Shasta peoples were originally thought to be associated with the Achumawi and Atsugewi but then were considered as a separate group (Kroeber 1925; Reclamation 1997; Shipley 1978). The Shasta peoples inhabited the area from southern Oregon at the Rogue River, south to the present Cecilville, and the area between the Marble and Salmon mountains to Mount Shasta in the west and the

Cascade Range in the east. In California, the core areas of settlement were in Shasta Valley, Scotts Valley, and along the Klamath River from about Scotts River to the town of Hornbrook (Silver 1978b).

Plains Miwok

The Plains Miwok established villages along river courses in the foothills located east of Sacramento and the Delta (Reclamation 2005b).

Nomlaki

Two major divisions existed among the Nomlaki: the River and Hill Nomlaki (Goldschmidt 1978; DuBois 1935; Reclamation 1997). The River Nomlaki occupied the Sacramento River Valley in present eastern Tehama County. The Hill Nomlaki occupied the eastern side of the Coast Ranges in present Tehama and Glenn counties. The Nomlaki and Wintu conducted trading between the peoples (Goldschmidt 1978; DuBois 1935; Reclamation 1997).

Patwin

The Patwin lived along the western side of the Sacramento Valley from the present Princeton to Benicia, including Suisun Marsh (Kroeber 1925; Reclamation 1997; Reclamation et al. 2010). Within this large area, the Patwin have traditionally been divided into River, Hill, and Southern Patwin groups. Settlements generally were located on high ground along the Sacramento River or tributary streams, or in the eastern Coast Range valleys. The ethnographically recorded villages of Aguasto and Suisun were located near San Pablo and Suisun bays (P. Johnson 1978b; Reclamation 1997; Reclamation et al. 2010).

17.3.2.3.2 Ethnography of the San Joaquin Valley

Eastern Miwok

The Miwok cultures in present California include the Coast Miwok, Lake Miwok, and Eastern Miwok divisions. The Eastern Miwok included five separate groups (Bay, Plains, Northern Sierra, Central Sierra, and Southern Sierra) that inhabited the area from present Walnut Creek in Contra Costa County and the Delta, along the lower Mokelumne and Cosumnes rivers and along the Sacramento River from present Rio Vista to Freeport, the foothill and mountain areas of the upper Mokelumne River and Calaveras River watersheds, the upper Stanislaus River and Tuolumne River watersheds, and the upper Merced River and Chowchilla River watersheds, respectively (Levy 1978a; Reclamation 1997; Shipley 1978). No one Miwok tribal organization encompassed all the peoples speaking Miwokan languages, nor was there a single tribal organization that encompassed an entire division.

Yokuts

Yokuts are a large and diverse number of people in the San Joaquin Valley and Sierra Nevada foothills of central California, including the Southern San Joaquin Valley Yokuts, Northern San Joaquin Valley Yokuts, and Foothill Yokuts (Reclamation 1997; Reclamation et al. 2011a; SJRRP 2011). The three subdivisions of the Yokuts languages belong to the Yokutsan family, or Penutian stock (Shipley 1978).

The Southern Valley Yokuts inhabited the southern San Joaquin Valley from present Fresno to the Tehachapi Mountains (Wallace 1978b). The Northern Valley Yokuts inhabited the northern San Joaquin Valley from Bear Creek to the San Joaquin River near present Mendota, western San Joaquin Valley near present San Luis Reservoir, and eastern present Contra Costa and Alameda counties (ECCCHCPA et al. 2006; Wallace 1978c; Reclamation and State Parks 2012; Reclamation and DWR 2011). The Foothill Yokuts inhabited the western slopes of the Sierra Nevada foothills from the Fresno River to the Kern River (Spier 1978b; Reclamation and State Parks 2013). Yokuts were mobile hunters and gatherers with semipermanent villages and seasonal travel corridors to food sources.

The Yokuts probably traded with the Costanoan people from the coastal areas based upon the abalone and other mussel shells found in settlement sites (Reclamation and State Parks 2012).

Dumna and Kechayi

The Dumna and Kechayi lived along the San Joaquin River in the Sierra Nevada foothills near the present Millerton Lake (Reclamation and State Parks 2013).

17.3.2.4 Ethnography of the San Francisco Bay Area Region

Native inhabitants of the San Francisco Bay Area Region include the Miwok, Cholvon Northern Valley Yokuts, and the Costanoan Indians (Reclamation 1997; CCWD et al. 2009; ECCCHCPA et al. 2006; EBMUD 2009; Reclamation 2005b; Santa Clara County 2012; San Benito County 2013).

17.3.2.4.1 Miwok

In the San Francisco Bay Area Region, the Coast Miwok people lived along lower San Joaquin River and San Pablo Bay and in the interior of the present Contra Costa and Alameda counties (Reclamation 1997; ECCCHCPA et al. 2006; Kelly 1978). The Bay Miwok villages were located in the San Ramon Valley with other settlements on the western slopes of the Diablo Range. The Volvons, speakers of the Bay Miwok language, settled along Marsh Creek and Kellogg Creek on the northern side of the Diablo Range and near the present Los Vaqueros Reservoir (CCWD et al. 2009). The Miwok people may have held lands at the peak of Mount Diablo.

17.3.2.4.2 Costanoan

The Costanoans (also known as Ohlone) are a linguistically defined group with several autonomous tribelets that speak related languages (Levy 1978b; Reclamation 1997; EBMUD 2009; Zone 7 2006; Santa Clara County 2012). The Costanoans inhabited coastal shorelines along San Francisco, San Pablo, and Suisun Bay and along the Pacific Ocean Coast from the Golden Gate to Monterey Bay and interior valleys that extended approximately 60 miles inland, including areas within Santa Clara and San Benito counties (Reclamation 1997; ECCCHCPA et al. 2006; San Benito County 2010).

17.3.2.5 Ethnography of the Central Coast Region

The Central Coast Region considered in this EIS includes the coastal areas of present San Luis Obispo and Ventura counties. This area was home to the Salinan, Chumash, and Tataviam people.

The Salinan territory extends from about the present location of Soledad (Monterey County) to San Luis Obispo (Hester 1978). The Chumash are considered to have been one of the most elaborate cultures in California. The Chumash culture is characterized by large villages with social ranking, intensive trade, craft specialization, and well-developed art styles (Grant 1978b; Greenwood 1978; Kroeber 1925; Moratto 1984; Reclamation 1997; San Luis Obispo County 2010; Santa Barbara 2010; Santa Barbara County 2010). The Chumash inhabited the central coastal area of California from approximately present San Luis Obispo to Malibu Canyon and inland to western San Joaquin Valley.

17.3.2.6 Ethnography of the Southern California Region

The coastal portion of the Southern California Region considered in this EIS includes the present Ventura, Los Angeles, Orange, and San Diego counties. The interior portion of the Southern California Region includes the present western and central Riverside County and western San Bernardino County.

17.3.2.6.1 Prehistory of Southern California Region, Coastal Portion

The Chumash and Tataviam people lived in the present Ventura County and northern Los Angeles County areas. The ethnography of the Chumash people is similar to that described above for the Central Coast Region. The Tataviam people lived inland of the Chumash and Gabrielino on the upper reaches of the Santa Clara River drainage east of Piru Creek and extending over the Sawmill Mountains to the edge of the southwestern Antelope Valley (King and Blackburn 1978).

The Gabrielino and Juaneño people lived in the present Los Angeles and Orange counties areas. The Gabrielino (also known as Gabrielino Tongva or Gabrieleño) occupied the Southern California coast in the vicinity around Mission San Gabrielal areas. The Juaneño occupied the area around the mission (Bean and Smith 1978; Los Angeles 2005; Riverside County 2000). These people traded with other people in Southern California.

The Luiseño and Tipai-Ipai people lived in the present Orange and San Diego counties areas. The Luiseño occupied most of the San Luis Rey and Santa Margarita River drainages near San Luis Rey Mission (Bean and Shipek 1978). The Luiseño shared many cultural traits with the Gabrielino and Chumas people. The Tipai-Ipai (also known as Kumeyaay) occupied extreme Southern California and Northern Baja California in autonomous, seminomadic bands of patrilineal clans (Luomala 1978; San Diego County 2011b; CDFG 2009). The Ipai occupied the areas north of the San Diego River, and the Tipai occupied the area south of the San Diego River (San Diego County 2011b).

17.3.2.6.2 Prehistory of Southern California Region, Interior Portion

The Cahuilla, Serrano, Tubatalabal, Kawaiisu, and Quechan people lived in present Riverside, eastern Los Angeles, southeastern Kern, and western San Bernardino counties. The Tubatalabal also lived in the southeastern San Joaquin Valley in present southeastern Kern County.

Cahuilla

The Cahuilla lived inland within present Riverside County. Villages were located in canyons or on alluvial fans close to food and water sources. The Cahuilla interacted frequently with other people in Southern California (Bean 1978; Riverside County 2000).

Serrano

The Serrano lived in the San Bernardino Mountains within present northeastern Los Angeles County and southwestern San Bernardino County and in the northwestern valleys and mountains of Riverside County. Villages were located close to food and water sources along perennial streams and lakes. The Serrano interacted frequently with other people in Southern California (Riverside County 2000; DWR 2009).

Kawaiisu

The Kawaiisu occupied a mountainous area between the Mojave Desert and the southern San Joaquin Valley, mostly in Kern County, and the Tehachapi Valley (Zigmond 1986; California State Parks 2014). The Kawaiisu lived in permanent winter villages and traveled during the warmer months into the Mojave Desert and Antelope Valley. They traded and interacted with neighboring groups, including the Chumash, Yokuts, and Tubatalabal people.

Quechan

The Quechan were Yuman people that occupied areas along the Colorado River and adjacent valleys, including present Coachella and Imperial valleys (Riverside County 2000). The Quechan had a strong tribal identity and traveled extensively for trade.

17.3.3 Historical Context

The historical context presented in this section is focused on historical activities and resources that affected and/or were affected by implementation of water resource actions of CVP and SWP water users. Changes in CVP and SWP operations under implementation of alternatives considered in this EIS could not only affect CVP and SWP facilities. These changes also could affect regional and local water supplies, reservoirs, and associated land uses of those that use CVP and SWP water.

17.3.3.1 Introduction to Historical Context

Initial contact with Europeans and Americans occurred with Spanish missionaries and soldiers, who entered California from the south in 1769, eventually founding 21 missions along the California coast (Reclamation 1997). This period is characterized by the establishment of missions and military presidios, the development of large tracts of land owned by the missions, and subjugation of the local Indian population for labor. This way of life began to change in 1822 when Mexico became independent of Spain. The mission lands were divided by government grants into large ranchos often consisting of tens of thousands of acres. The owners of these large *estancias* built homes, often of adobe, and maintained large herds of cattle and horses.

During the Spanish and Mexican periods, explorers entered the region. Fort Ross on the Sonoma coast was established by the Russians from 1812 until 1841 to support hunting, fishing, and whaling businesses (Reclamation 1997). American explorer Jedediah Smith and Peter Skene Odgen, Chief Trader for the Hudson Bay Company, with other members of the Hudson Bay Company also came to California during this period.

In 1848, the Treaty of Guadalupe Hidalgo transferred the lands of California from the Mexican Republic to the United States and initiated what is called the American Period in California history (Reclamation 1997). During that same year, gold was discovered in the foothills of the Sierra Nevada, and thousands of hopeful miners as well as storekeepers, settlers, and farmers entered the region. Mining in the Trinity River Region was expanded for both gold and copper mines (Placer County 2007).

To support this growth, extensive transportation systems were created to support wagon routes, steamboats on the major rivers, and numerous railroads (Reclamation 1997). Many of the supply centers and shipment points along these transportation corridors developed into cities, towns, and settlements. Logging and ranching also expanded to meet the needs of the new settlers. American ranchers found Central California ideally suited for grazing large herds of stock. During the latter part of the 19th century, American ranchers amassed large tracts of former rancho land, and several great cattle empires were formed. As settlements grew, farming increased. A primary constraint to expansion of crop diversity and areas under cultivation was the lack of water. Irrigation was virtually unknown in California until the 1880s, when large-scale irrigation systems were developed to improve agriculture yields. With the development of irrigation and improved transportation, new crops were added to the grains obtained from dry farming, including vegetables, fruits, and nuts.

Irrigation capabilities further expanded in the 1950s and 1960s with the implementation of multiple water projects. The availability of water also expanded the agricultural and urban water supplies in the Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions.

17.3.3.2 History of the Trinity River Region

Explorers from the Philippines and Europe may have visited and interacted with the Yurok people as early as the late 1700s. Peter Skene Odgen and Jedediah Smith initially visited the Lower and Middle Klamath River reaches in the 1820s. In 1828, Jedediah Smith and his party of explorers were the first white men known to have visited the Trinity River watershed (USFWS et al. 1999).

Although the area was first used extensively by trappers, gold was discovered on the Trinity River in 1848, and by the late 1840s, gold mining was a major activity along the Trinity River (Hoover et al. 1990; Del Norte County 2003; USFWS et al. 1999). Weaverville was the center of gold mining activity after 1849 with numerous mining camps and settlements along the Trinity River. Mining continued along the Trinity River through the early and mid-1900s with large-scale dragline and bucket dredging operations beginning in 1939. Logging has occurred since the 1880s and continues in the Trinity River Region. These activities resulted in significant changes to rivers and may have caused the destruction of many prehistoric or historic archaeological sites (Hoover et al. 1990).

Increased activities within the Trinity River Region led to conflicts between the new residents and the Yurok and Hupa people. On November 16, 1855, the Klamath Indian Reservation was established by Executive Order for lands from the mouth of the Klamath River to a location upstream of Tectah Creek that extended 1 mile wide on either side of the river for the approximately 20-mile reach (DOI and CDFG 2012). The Hoopa Valley Reservation was established in 1864 and expanded in 1891 to include lands from the mouth of the Klamath River to the Hoopa Valley that extended 1 mile wide on either side of the river including portions of the Klamath Indian Reservation. In 1988, the Hoopa-Yurok Settlement Act (Public Law 100-580) partitioned portions of the previously established reservations into the Yurok Indian Reservation and Hoopa Valley Reservation and established the Resighini Rancheria.

17.3.3.3 History of the Central Valley Region

17.3.3.3.1 History of the Sacramento Valley

Europeans, Americans, and Canadians may have initially entered the Sacramento Valley in the late 1700s and early 1800s as part of missionary or military expeditions (Reclamation 1997, 2005a; Reclamation et al. 2006; Placer County 2007). By 1776, Jose Canizares explored areas located south of the present Sacramento community, and in 1813, there was a major battle between the Spanish and the Miwok people near the confluence of the Cosumnes River along the Sacramento River. Fur trappers moved through this area from the 1820s to 1840s.

The first settlements in this area occurred in the 1830s and 1840s on Mexican Land Grants. The New Helvetica Land Grant, which included more than 40,000 acres in the Sacramento Valley, was awarded to John Sutter in 1841 (DSC 2011).

Following the discovery of gold on the New Helvetica Land Grant in 1848 near present-day Coloma, numerous mining-related settlements were established in areas with the Nisenan, Maidu, Konkow, and Atsugewi people in the eastern portion of the Sacramento Valley and in areas with the Nomlaki and Wintu people in the western Sacramento Valley. Many of the Native Americans died after exposure to diseases from the new settlers, including malaria. Numerous other Native American died during battles against the new settlers.

Mining activities in the northern Sacramento Valley foothills and mountains near present Redding primarily were related to gold and copper (Reclamation 2013a). Mining activities in the central Sierra Nevada foothills primarily were related to gold. In 1848, mining started along the Trinity River and upper Sacramento River tributaries, primarily for copper and gold (Reclamation 2013a; Reclamation et al. 2006). Smelters, mills, and communities grew rapidly near the mining areas, including the town of Keswick, and communities were established within and adjacent to the present day Folsom Lake. The development of hydraulic mining in 1851 required establishment of substantial water diversions, flumes, and ditches to convey the water and displacement of vast amounts of sediment into the streams and along the banks of the waterways.

Logging also was a dominant industry in the western Sacramento Valley since the 1850s (Reclamation 1997, 2013a). The logging industry grew as the railroads were extended. Establishment of logging in the Sierra Nevada foothills and mountains also led to development of water infrastructure to move and/or mill the logs. One of the first water system infrastructures developed for these purposes was the original Folsom Dam constructed in 1893 (Reclamation et al. 2006).

Agricultural activities were successful throughout the Sacramento Valley to serve the mining communities (Reclamation 1997). The completion of the first transcontinental railroad in 1869 increased the number of settlers and allowed transport of crops from the Sacramento Valley to Nevada, Utah, and subsequently to other areas of the nation (Reclamation 2005b). The expanded agricultural markets expanded due to the establishment and development of commercial crops, accessibility to markets, and new farming techniques and irrigation.

Construction of hydroelectric power and water storage facilities in the Sacramento Valley foothills started in the early 1900s to provide hydropower and water supplies to local and regional users, as well as export to other portions of the state using CVP, SWP, City and County of San Francisco, and East Bay Municipal Utility District facilities.

17.3.3.3.2 History of the San Joaquin Valley

The San Joaquin Valley area was not widely settled by Europeans or Mexicans when California lands were under Spanish rule (1769 to 1821) or Mexican rule (1821 to 1848). Numerous expeditions travelled through the San Joaquin Valley during this period but did not establish major settlements (Reclamation 2010). During the Spanish rule, several settlements occurred along Fresno Slough (Reclamation and State Parks 2012; Reclamation and DWR 2011). There were several settlements along the San Joaquin River and along the western boundary of the San Joaquin Valley during Mexican rule when ranches were established in the Coast Range foothills, including in Pacheco Pass and along Los Banos Creek.

In the latter half of the 19th century, agricultural settlements and mining camps were established in the San Joaquin Valley along the railroad corridors

(Reclamation 1997; Reclamation and DWR 2011). The town of Rootville, subsequently renamed Millerton in honor of Major Miller, was established near the present Millerton Lake with a military post, Camp Barbour (later named Fort Miller) to maintain order in the mining camps.

Initially, agricultural activities were related to ranching and dry farming. Livestock ranching expanded in the late 1860s (Reclamation et al. 2011b). With the increased availability of electric pumps, groundwater and surface water irrigation was used throughout the valley. Many irrigation districts were formed after the passage of the Wright Act in 1877 that provided methods to finance major irrigation projects. One of the first irrigation systems constructed in the eastern San Joaquin Valley was the "Main Canal" as part of the Miller and Lux's San Joaquin and Kings River Canal and Irrigation Company (Reclamation and State Parks 2013).

Historic resources are related to the settlement of the valley and include homesteads, transportation infrastructure (such as ship landings, ferry ports, and bridges), food processing and other industrial facilities, residential properties, commercial establishments, mining features (in the eastern portion), and government facilities (Reclamation 1997, 2010; Reclamation and DWR 2011).

17.3.3.3.3 History of the Delta and Suisun Marsh

Communities were not established in the Delta and Suisun Marsh areas until the mid-1800s. There were numerous Spanish expeditions under Spanish rule. In the 1830s and 1840s, Mexico established land grants, including Rancho Suisun located west of present City of Fairfield (Reclamation et al. 2010).

Following the discovery of gold in the Sacramento Valley, settlements occurred in the Delta to provide support services and agricultural products for those traveling to the gold fields and the Sacramento and San Francisco areas. Passage of the Swamp and Overflow Act in 1850 led to the transfer of lands from the U.S. Government in the Delta to the State of California, which subsequently sold the land to individuals. The new settlers in the Delta constructed levees to protect the lands from periodic flooding and drained other lands to reduce the potential for mosquito-borne diseases. By the 1920s, numerous communities were established around food processing and packing houses that supported a wide range of crops such as asparagus, barley, celery, corn, winter grain, sugar beets, onions, and alfalfa for local dairy farms were introduced to the area (DSC 2011; Reclamation et al. 2010). By the 1950s, major food packers and processors moved from the Delta, and many communities became smaller. Recreational opportunities were established in the 1850s with duck hunting opportunities in the Suisun Marsh area.

17.3.3.4 History of the San Francisco Bay Area Region

In 1579, Sir Francis Drake and other Spanish explorers led expeditions into the San Francisco Bay Area. However, in general, the Spanish did not settle Northern California until the 1700s when other Europeans established trading settlements for fur, mining, and other products. Initially, the Spanish confined their settlement to the coastline to establish military bases, or presidios (Hoover et al. 1990). Father Junipero Serra and other Franciscans worked with the Spanish explorers to establish missions along the Alta California coastal areas between present Sonoma County (San Francisco Solano established in 1823) to present Ventura County (San Buenaventura established in 1782), including three missions in areas that use CVP and SWP water (Mission San Jose established in 1797, Mission Santa Clara established in 1777, and Mission San Juan Bautista established in 1797).

San Jose was one the first towns established in Alta California as Pueblo de San José de Guadalupe (Santa Clara County 2012). The Spanish government awarded land grants in the San Francisco Bay Area Region (DWR 2008; EBMUD 2009; Hoover et al. 1990; Reclamation 2005b; San Benito County 2010; Zone 7 2006). In 1821, Mexico won independence from Spain, began to establish more secular communities around the missions, and divided many of the ranchos into smaller pueblos (Santa Clara County 2012). These actions supported growth in the present California coastal areas.

Following California statehood in 1849, ranching and farming communities were established in the interior valleys of the San Francisco Bay Area Region (Santa Clara County 2012; CCWD et al. 2009; ECCCHCPA et al. 2006). Starting in the late 1800s, expansion of the railroads in the area and use of improved irrigation systems led to the expansion of agriculture throughout the area. In mid-1900s, industrial expansion occurred in Contra Costa, Alameda, and Santa Clara counties.

17.3.3.5 History of the Central Coast Region

In 1542, Portuguese explorer Juan Rodríguez Cabrillo entered Santa Barbara Harbor (Puerto de Santa Bárbara). In 1587, Pedro de Unamuno brought his ship into Morro Bay, explored inland to the present site of the City of San Luis Obispo, and claimed the area for Spain. In 1595, Sebastián Rodríguez Cermeño entered San Luis Obispo Bay (Hoover et al. 1990). The explorations laid the foundation for the founding of five missions in the Central Coast Region considered in this EIS. Ranchos were granted throughout the region in the 1830s and 1840s.

Following the California statehood, ranching and farming continued to be the main economic activity of the Central Coast Region to the present.

17.3.3.6 History of the Southern California Region

In 1540, Hernando de Alarcón explored the inland areas of the Southern California Region with an expedition that had explored the Colorado River. In 1542, Cabrillo apparently became the first European to sight the coast of Southern California, including the Los Angeles area and Santa Catalina Island, although he did not make landfall (Hoover et al. 1990).

In 1769, Gaspar de Portolá explored a trail by land from present San Diego through present San Diego, Orange, and Los Angeles counties (Hoover et al. 1990). He camped near the Los Angeles River and the Indian Village of Yang-Na (within the present City of Los Angeles). In 1772, Pedro Fages made an inland journey from present San Diego through western Riverside County to San Luis Obispo (Hoover et al. 1990; Riverside County 2000). In 1776, friar Francisco Garcés explored from present San Gabriel Valley to the Antelope Valley. More than 20 missions were established along the Southern California coastline (Los Angeles 2005). Pueblos were established near the missions, including the Pueblo of Los Angeles in 1781.

The first known discovery of gold in California was made between 1775 and 1780 in the Potholes district of southeastern California in present Imperial County (Clark 1970). Other placer deposits were found in 1828 at San Ysidro in present San Diego County, and in 1835 and 1842 at San Francisquito Canyon and Placerita Canyon, respectively, in present Los Angeles County (Clark 1970; Vredenburgh 1991). Some of the mines continued to produce gold through the early 1990s.

Following the end of Spanish Rule, the Mexican Government deeded the extensive land holdings to ranchos to develop ranches and orchards (Riverside County 2000). Oranges and lemons became major agricultural crops between the 1850s and 1880s, and railroads were built to transport the products.

Water supply systems were constructed to provide water to missions and pueblo villages. One of the first systems was the Zanja Madre that was constructed in 1781 to convey water to the pueblo in the present City of Los Angeles (Los Angeles 2005; DWR 2009). The system was expanded in the 1850s and 1860s to convey water to vineyards and fruit orchards. During the late 1800s and early 1900s, numerous dams and conveyance facilities were constructed in the area to support the communities and agriculture.

17.3.4 Known Cultural Resources

The following subsections describe known cultural resources in the counties within the study area as determined through review of reports prepared for other projects in the study area. No physical or record surveys were conducted for this EIS because no site-specific construction actions were considered in this EIS. The EIS evaluates alternatives to continue the coordinated long-term operation of the CVP and SWP. The resources described in this subsection indicate the types of resources that occur in areas served by CVP and SWP water and adjacent areas. Therefore, some of the known resources presented in this chapter are located in portions of the counties that are not within the CVP and SWP water service areas.

17.3.4.1 Known Cultural Resources of the Trinity River Region

Within Trinity County, a cultural resources records search of the Trinity River Region was conducted for the Trinity River Mainstem Fishery Restoration EIS/Environmental Impact Report (EIR) (USFWS et al. 1999). The area covered included 660 feet on either side of the Trinity River from Trinity Lake to the eastern boundary of Hoopa Valley Indian Reservation and the inundation areas of the Trinity Lake and Lewiston Reservoir. More than 150 recorded cultural resources were identified along the mainstem of Trinity River within Trinity County, including 20 types of prehistoric and historic sites. Among these were Native American villages, camps, and lithic scatters; historic Indian sites; mines; ditches; cabins; structures; a school; USFWS stations and campgrounds; cemeteries; a rock wall; trails; a wagon road; and a bridge. Fifty-one sites are inundated within Trinity Lake and Lewiston Reservoir. Few of these sites have been evaluated for eligibility to be included in the National Register of Historic Places (NRHP). With respect to more recent historic sites in Trinity County, none of the sites listed in the NRHP, California State Historical Landmarks, California Register of Historical Resources (CRHR), and/or Points of Interest is located within or along banks of the Trinity River (CSPOHP 2014a).

Within Humboldt County, numerous culturally sensitive areas are located along the Lower Klamath and Lower Trinity rivers. The culturally sensitive areas include the areas along the riverbanks associated with religious and/or resource-producing important sites, in addition to specific known cultural resources. Many cultural resource locations are in the Hoopa Valley Indian Reservation and Yurok Reservation, including villages, cemeteries, ceremonial and gathering areas, and along ridgeline corridors that were used for traveling between villages (Humboldt County 2012). With respect to more recent historic sites in Humboldt County, none of the sites listed in the NRHP, California State Historical Landmarks, CRHR, and/or Points of Interest is located within or along banks of the Trinity or Klamath rivers (CSPOHP 2014b).

Within Del Norte County, numerous culturally sensitive areas are located along the Lower Klamath River, including areas within the Yurok Reservation and the Resighini Rancheria along the southern shoreline of the mouth of the Klamath River at the Pacific Ocean (Del Norte County 2003). The mouth of the Klamath River is of great spiritual significance for the Yurok people (Yurok Tribe 2005). The Yurok Tribe has suggested that the entire Klamath River, including the Lower Klamath River, be designated as a Cultural Riverscape and be submitted for consideration as a NRHP (Yurok Tribe 2005). With respect to more recent historic sites in Del Norte County, none of the sites listed in the NRHP, California State Historical Landmarks, CRHR, and/or Points of Interest is located within or along banks of the Klamath River (CSPOHP 2014c).

17.3.4.2 Previously Recorded Cultural Resources in the Central Valley Region

The Central Valley Region is rich in both historic- and prehistoric-period resources (Reclamation 1997), including large, deep midden sites (which generally contains waste materials that indicate human inhabitation) that provide information on prehistoric culture extending over thousands of years.

As described above, implementation of the alternatives considered in this EIS could affect cultural resources at CVP and SWP reservoir facilities and in areas that use CVP and SWP water that could experience land uses because of changes in CVP and SWP water supply availability.

17.3.4.2.1 Cultural Resources at CVP and SWP Reservoir Facilities in the Sacramento Valley

Previous cultural resource studies were conducted at and/or near Shasta Lake, Lake Oroville, and Folsom Lake.

The studies near Shasta Lake surveyed approximately 8 percent of the study area and identified 261 cultural resources, including 190 prehistoric properties, 45 historic resources, and 26 properties with prehistoric and historic resources (Reclamation 2013a). The prehistoric sites include habitation sites, artifact and lithic scatters, caves used as shelter, and cemeteries. The historic sites included bridges, railways, a dam, buildings, ranches, orchards, mines, towns, and cemeteries. Several prehistoric and historic cemeteries located within the inundation area were moved prior to completion of the Shasta Lake complex. The Dog Creek Bridge is the only resource in this area that is listed on the NRHP. The Shasta and Keswick dams were determined to be NRHP-eligible.

The studies near Lake Oroville identified 261 cultural resources areas, including 234 prehistoric properties, 462 historic resources, and 91 properties with prehistoric and historic resources (DWR 2004, 2007). Within the Lake Oroville inundation area, 93 prehistoric properties and 19 historic sites were identified prior to the completion of the reservoir. The prehistoric sites include habitation sites, milling sites, quarries, artifact and lithic scatters, caves used as shelter, rock art, fishing and hunting grounds, battle sites, trails, and cemeteries. The historic sites included bridges, railways, a dam, buildings, ranches, orchards, mines, towns, and cemeteries.

Oroville Dam and peripheral dams, Thermalito Diversion Dam, Thermalito Forebay and Afterbay, Fish Barrier Dam, Hyatt Pumping-Generating Plant and Intake Structure, Thermalito Power Plant and Power Canal, Lake Oroville Visitor Center and Visitor Viewing Platform, and Feather River Fish Hatchery were determined to be NRHP-eligible.

The studies near Folsom Lake identified 185 prehistoric properties and 59 historic sites (Reclamation 2005b; Reclamation et al. 2006). The prehistoric sites include habitation sites, middens, groundstones, and artifact and lithic scatters. The historic sites included buildings, mining areas, and refuse dumps. Folsom Dam was determined to be NRHP-eligible.

17.3.4.2.2 Cultural Resources at CVP and SWP Reservoir and Pumping Plant Facilities in the San Joaquin Valley

Previous cultural resource studies were conducted at and/or near New Melones Reservoir, San Luis Reservoir, and Millerton Lake and San Joaquin River downstream of Friant Dam.

The studies near New Melones Reservoir surveyed approximately 78 percent of the study area and identified 725 cultural resources within the New Melones Reservoir area or within 0.25 mile of this area (Reclamation 2010). The prehistoric sites include habitation sites, artifact and lithic scatters, mortars, caves, rock art, and cemeteries. The historic sites included bridges, buildings, ranches, orchards, towns, water and power systems, transportation infrastructure, and cemeteries. Many of the sites are located within the inundation area. However, substantial surveys were conducted prior to construction of New Melones Reservoir in the 1980s.

The studies near San Luis Reservoir identified 51 prehistoric and historic cultural resources (Reclamation and State Parks 2012). The prehistoric sites include habitation sites and artifact and lithic scatters. The historic sites included bridges, water infrastructure, buildings, ranches, orchards, towns, and cemeteries. One of the major historic sites in this area is the remnant locations of Rancho San Luis Gonzaga. Many portions of the ranch are located within the inundation area. However, many of the structures were moved to a site near Pacheco Pass. The remaining portions of the ranch were deeded to the State of California in 1992 to become part of the Pacheco State Park. Rancho San Luis Gonzaga, a historic stock ranch landscape, has been designated by the state to be a Historic District/Cultural Landscape that is potentially NRHP-eligible and CRHR-eligible.

Recent studies along the San Joaquin River identified 19 prehistoric sites within the seasonal inundation area of Millerton Lake (Reclamation and DWR 2011; Reclamation and State Parks 2013). Additional sites are located within the area of the lake that is constantly inundated. Some of the known sites include the remains of Kuyu Illik; the Dumna "head" village; the Kechaye/"Dumna" village of Sanwo Kianu; remains of Fort Miller, Millerton, and Collins Sulphur Springs; and prehistoric sites with housepits, mortars, grinding sticks, and rock alignments (Reclamation and State Parks 2013).

Along the San Joaquin River downstream of Friant Dam (which forms Millerton Lake) to the confluence of the Merced River, 84 prehistoric sites, 18 historic sites, and 7 sites with both prehistoric and historic resources were identified as part of the San Joaquin River Restoration Program. The prehistoric sites include habitation sites, artifact and lithic scatters, and bedrock milling features. The historic sites included bridges, buildings, ranches, orchards, towns, water and power systems, and transportation infrastructure.

The Friant Dam, Friant-Kern Canal, associated features (berms, siphons, control structures, inlets, outlets, and check structures), approximately 40 bridges that cross the canal, and Little Dry Creek Wasteway Facility are considered historic resources (Reclamation and State Parks 2013; Reclamation et al. 2011b). The Friant Dam and Friant-Kern Canal was determined to be NRHP-eligible.

17.3.4.2.3 Cultural Resources in the areas that use CVP and SWP Water Supplies in the Central Valley

Numerous cultural and historical resources are in the Central Valley, as summarized in Table 17.1. Most of the cultural resources are located within areas that would not be affected by land use changes that could result from changes in CVP and SWP water supplies. The resources listed in Table 17.1 also include the sites described above near CVP and SWP facilities.

Table 17.1 Previously Recorded Cultural and Historical Resources of the Central Valley Region

County	Historic Site Types	Prehistoric Site Types
Butte	26 NRHP properties, 8 California Historical Landmarks, and 21 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014e).	1,198 Known Prehistoric Site Types (Reclamation 1997).
Colusa	7 NRHP properties, 3 California Historical Landmarks, and 3 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014g).	115 Known Prehistoric Site Types (Reclamation 1997).
El Dorado	18 NRHP properties, 30 California Historical Landmarks, 8 California Points of Historical Interest; numerous historic sites, such as mining features, building foundations, trash scatters, and bridges, were inundated by Folsom Lake (Reclamation 1997; CSPOHP 2014h).	595 Known Prehistoric Site Types (Reclamation 1997).
Fresno	38 NRHP properties, 8 California Historic Landmarks, and 13 of which are California Points of Historical Interest (Reclamation 1997; CSPOHP 2014i).	2,603 Known Prehistoric Site Types (Reclamation 1997).
Glenn	2 NRHP properties, 2 California Historical Landmarks, and 17 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014j).	373 Known Prehistoric Site Types (Reclamation 1997).
Kern	20 NRHP properties, 47 California Historic Landmarks, and 11 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014k).	3,850 Known Prehistoric and Historic Site Types (Reclamation 1997).
Kings	4 NRHP properties, 3 California Historic Landmarks; the San Luis Canal, the only CVP facility in Kings County, has no historic or architectural resources in its vicinity (Reclamation 1997; CSPOHP 2014l).	56 Known Prehistoric Site Types (Reclamation 1997).
Madera	2 NRHP property, 1 California Historic Landmarks, and 9 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014n).	2,043 Known Prehistoric Site Types (Reclamation 1997).
Merced	14 NRHP properties, 5 California Historic Landmarks, 1 CRHR properties, and 8 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014p).	316 Known Prehistoric Site Types (Reclamation 1997).

County	Historic Site Types	Prehistoric Site Types
Napa	76 NRHP properties, 17 California Historical Landmarks, and 13 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014q).	700 Known Prehistoric Site Types (Reclamation 1997).
Placer	18 NRHP properties, 20 California Historical Landmarks, 21 California Points of Historical Interest; numerous historic sites, such as mining features, building foundations, trash scatters, and bridges, were inundated by Folsom Lake, which is a CVP facility (Reclamation 1997; CSPOHP 2014s).	627 Known Prehistoric Site Types (Reclamation 1997).
Plumas	6 NRHP properties, 13 California Historical Landmarks, and 5 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014t).	1,639 prehistoric sites in Plumas County (Plumas County 2012).
Sacramento	90 NRHP properties, 56 California Historical Landmarks, 4 CRHR properties, 20 California Points of Historical Interest; numerous historic sites, such as mining features, building foundations, trash scatters, and bridges, were inundated by Folsom Lake; the Folsom Mining District surrounds Lake Natoma (Reclamation 1997; CSPOHP 2014u). There are over 40 historic sites along the Sacramento River between Sutter County boundary and Freeport (Reclamation 2005b); including Natomas Main Drainage Canal, Town of Freeport, Sacramento Weir, Yolo Bypass, homes and farms, and a church. There are 14 historic sites along the American River between Folsom Dam and the confluence with the Sacramento River (Reclamation 2005b).	407 Known Prehistoric Site Types (Reclamation 1997). There are 24 prehistoric sites along the Sacramento River between Sutter County boundary and Freeport (Reclamation 2005b). There are 22 prehistoric sites along the American River between Folsom Dam and the confluence with the Sacramento River (Reclamation 2005b).
San Joaquin	31 NRHP properties, 25 California Historic Landmarks, 3 CRHR properties, and 7 are California Points of Historical Interest (Reclamation 1997; CSPOHP 2014v).	189 Known Prehistoric Site Types (Reclamation 1997).

County	Historic Site Types	Prehistoric Site Types
Shasta	26 NRHP properties, 19 California Historical Landmarks, 1 CRHR properties, 15 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014w). The Anderson-Cottonwood Irrigation District Diversion Dam has been determined to be eligible for NRHP listing (Reclamation 2013a).	1,419 Known Prehistoric Site Types. Many of these sites occur along the Sacramento River near Redding and between Battle Creek and Table Mountain (Reclamation 2013a).
Solano	23 NRHP properties, 14 California Historical Landmarks, and 9 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014x).	300 Known Prehistoric Site Types (Reclamation 1997).
Stanislaus	21 NRHP properties, 5 California Historic Landmarks, and 7 are California Points of Historical Interest; the former right-of-way for the Patterson and Western Railroad, which was constructed in 1916, bisects the Delta-Mendota Canal (Reclamation 1997; CSPOHP 2014y).	280 Known Prehistoric Site Types (Reclamation 1997).
Sutter	7 NRHP properties, 2 California Historical Landmarks, and 22 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014z).	62 Known Prehistoric Site Types (Reclamation 1997).
Tehama	10 NRHP properties, 3 California Historical Landmarks, and 1 California Point of Historical Interest (Reclamation 1997; CSPOHP 2014aa).	1,415 Known Prehistoric Site Types (Reclamation 1997).
Tulare	34 NRHP properties, 8 California Historic Landmarks, and no California Points of Historical Interest (Reclamation 1997; CSPOHP 2014ab).	1,857 Known Prehistoric Site Types (Reclamation 1997).
Yolo	21 NRHP properties, 2 California Historical Landmarks, 1 CRHR properties, and 8 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014ad).	175 Known Prehistoric Site Types (Reclamation 1997). Includes possible fishing stations along Putah and Cache Creeks, the Sacramento, and ephemeral tributaries to these watercourses.
Yuba	10 NRHP properties, 6 California Historical Landmarks, and 14 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014ae).	1,112 Known Prehistoric Site Types (Reclamation 1997).

17.3.4.3 Previously Recorded Cultural Resources in the San Francisco Bay Area Region

The San Francisco Bay Area Region includes Alameda, Contra Costa, Santa Clara, and San Benito counties. Much of this region is highly urbanized and that development has affected archaeological resources. Numerous cultural and historical resources are in the San Francisco Bay Area Region, as summarized in Table 17.2. Most of the cultural resources are located within areas that would not be affected by land use changes that could result from changes in CVP and SWP water supplies.

Table 17.2 Previously Recorded Cultural Resources of the San Francisco Bay Area Region

County	Historic Site Types	Prehistoric Site Types
Alameda	141 NRHP properties, 34 California Historical Landmarks, 2 CRHR properties, and 4 California Points of Historical Interest (CSPOHP 2014af).	No comprehensive inventory of prehistoric sites in Alameda County (Zone 7 2006).
Contra Costa	40 NRHP properties, 13 California Historical Landmarks, 1 CRHR property, and 12 California Points of Historical Interest (CSPOHP 2014ag).	No comprehensive inventory of prehistoric sites in Contra Costa County (Contra Costa County 2005). Up to 41 sites were identified in the Kellogg Creek Historic District near Los Vaqueros Reservoir (CCWD et al. 2009).
San Benito	12 NRHP properties, 5 California Historic Landmarks, and 2 California Points of Historical Interest (Reclamation 1997; CSPOHP 2014ah).	180 Known Prehistoric Site Types (Reclamation 1997).
Santa Clara	101 NRHP properties, 41 California Historical Landmarks, and 58 California Points of Historical Interest (CSPOHP 2014ai; Santa Clara County 1994).	Between 1912 and 1960, 43 sites were recorded in the Santa Clara Valley portion of Santa Clara County (Santa Clara 2012).

17.3.4.4 Previously Recorded Cultural Resources in the Central Coast and Southern California Regions

The Central Coast Region includes San Luis Obispo and Santa Barbara counties. Within the Central Coast Region, the SWP provides water supplies to portions of San Luis Obispo and Santa Barbara counties. Within the Southern California Region, the SWP provides water supplies to portions of Ventura, Los Angeles, Orange, Riverside, San Bernardino, and San Diego counties. Numerous cultural and historical resources are in the Central Coast and Southern California regions, as summarized in Table 17.3. Most of the cultural resources are located within areas that would not be affected by land use changes that could result from changes in SWP water supplies.

Table 17.3 Previously Recorded Cultural and Historical Resources of the Central Coast and Southern California Regions

County	Historic Site Types	Prehistoric Site Types
San Luis Obispo	34 NRHP properties, 2 California Historical Landmarks, and 4 California Points of Historical Interest (CSPOHP 2014ao).	The San Luis Obispo County General Plan discusses several hundred prehistoric resources throughout San Luis Obispo County related to the Chumash people (San Luis Obispo County 2010).
Santa Barbara	43 NRHP properties, 16 California Historical Landmarks, and 7 California Points of Historical Interest (CSPOHP 2014ap).	The 2010 Santa Barbara Conservation Element of the Comprehensive Plan noted prehistoric resources throughout Santa Barbara County related to the Chumash people (Santa Barbara County 2010).
Los Angeles	431 NRHP properties, 90 California Historical Landmarks, 6 CRHR property, and 65 California Points of Historical Interest (CSPOHP 2014aj).	Over 4,196 prehistoric sites in Los Angeles County (SCAG 2011).
Orange	108 NRHP properties, 24 California Historical Landmarks, and 20 California Points of Historical Interest (CSPOHP 2014ak).	Over 1,710 prehistoric sites in Orange County (SCAG 2011; Orange County 2005).
Riverside	52 NRHP properties, 23 California Historical Landmarks, and 72 California Points of Historical Interest (CSPOHP 2014al).	Over 19,858 prehistoric sites in Orange County (SCAG 2011). Some of the Cahuilla, Serrano, and Luiseño communities were inundated within Lake Perris (Reclamation and DWR 2003).
San Bernardino	56 NRHP properties, 39 California Historical Landmarks, 2 CRHR property, and 119 California Points of Historical Interest (CSPOHP 2014am).	Over 29,480 prehistoric sites in San Bernardino County, including the Calico “Early Man” Site (SCAG 2011).
San Diego	130 NRHP properties, 63 California Historical Landmarks, 3 CRHR property, and 16 California Points of Historical Interest (CSPOHP 2014an).	The San Diego County General Plan discussed that there are many prehistoric sites within San Diego County; however, the number and locations are not identified to protect the resources (San Diego County 2011a).

County	Historic Site Types	Prehistoric Site Types
Ventura	34 NRHP properties, 11 California Historical Landmarks, and 4 California Points of Historical Interest (CSPOHP 2014aq).	Over 1,806 prehistoric sites in San Bernardino County (SCAG 2011).

17.4 Impact Analysis

This section describes the potential mechanisms for change in cultural resources and analytical methods, results of the impact analysis, potential mitigation measures, and potential cumulative effects.

17.4.1 Potential Mechanisms for Change and Analytical Tools

As described in Chapter 4, Approach to Environmental Analysis, the environmental consequences assessment considers changes in cultural resources conditions related to changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison that could result in land disturbance or increased exposure of cultural resources sites.

17.4.1.1 Changes in the Potential for Land Disturbance

Under Alternatives 1 through 5, No Action Alternative, and Second Basis of Comparison, CVP and SWP water supplies would continue to be provided within the currently designated service areas. Implementation of the alternatives does not include expansion of designated service areas or increased water contract amounts. Land use in 2030 would be consistent with existing general plan projections under all alternatives and the Second Basis of Comparison. The CVP and SWP water contract amounts would be the same under all alternatives and the Second Basis of Comparison. The alternatives would not result in expansion of municipal or agricultural lands, or associated disturbances of cultural resources because of expansion of development or cultivated lands in addition to the conditions projected under existing general plans. Therefore, changes in CVP and SWP water supply availability that would result in changes in land use and associated potential for disturbance of cultural resources are not analyzed in this EIS.

17.4.1.2 Changes in Potential Exposure of Cultural Resources at Reservoirs that Store CVP and SWP Water

Changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison could result in increased periods of time when low water elevations occur in reservoirs that store CVP and SWP water, including the CVP and SWP reservoirs. The lowest reservoir elevations generally occur in September in dry and critical dry years, as described in Chapter 5, Surface Water Resources and Water Supplies. The minimum and maximum elevations of the reservoir surface water under Alternatives 1 through 5, No Action Alternative, and Second Basis of Comparison would be the same as under current conditions.

17.4.1.3 Effects Related to Cross Delta Water Transfers

Water transfer programs have been used to provide water to existing agricultural and municipal service areas when other water supplies are not available. It is anticipated that water transfers under all alternatives and the Second Basis of Comparison would continue in this manner to provide water supplies to land uses projected under existing general plans which would not result in expansion of municipal or agricultural lands, or associated disturbances of cultural resources because of expansion of development or cultivated lands in addition to conditions projected under existing general plans. Therefore, effects related to cross Delta water transfers and associated potential for disturbance of cultural resources are not analyzed in this EIS.

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

The impact analysis in this EIS is based upon the comparison of the alternatives to the No Action Alternative and the Second Basis of Comparison in the Year 2030. Many of the changed conditions would occur in the same manner under both the No Action Alternative and the Second Basis of Comparison (e.g., climate change, sea level rise, general plan development, and implementation of reasonable and foreseeable projects). Because of these changes, especially climate change and sea level rise, it is anticipated that reservoir elevations at the end of September would be lower, flows patterns in the rivers downstream of the reservoirs would be different than under recent condition, and CVP and SWP water deliveries would be less than under recent condition, as described in Chapter 5, Surface Water Resources and Water Supplies. In all regions, the minimum reservoir elevations under the No Action Alternative and Second Basis of Comparison would be similar to minimum elevations during recent conditions.

17.4.3 Evaluation of Alternatives

As described in Chapter 4, Approach to Environmental Analysis, Alternatives 1 through 5 have been compared to the No Action Alternative, and the No Action Alternative and Alternatives 1 through 5 have been compared to the Second Basis of Comparison.

During review of the numerical modeling analyses used in this EIS, an error was determined in the CalSim II model assumptions related to the Stanislaus River operations for the Second Basis of Comparison, Alternative 1, and Alternative 4 model runs. Appendix 5C includes a comparison of the CalSim II model run results presented in this chapter and CalSim II model run results with the error corrected. Appendix 5C also includes a discussion of changes in the comparison of the following alternatives analyses.

- No Action Alternative compared to the Second Basis of Comparison
- Alternative 1 compared to the No Action Alternative

- Alternative 3 compared to the Second Basis of Comparison
- Alternative 5 compared to the Second Basis of Comparison

17.4.3.1 No Action Alternative

As described in Chapter 4, Approach to Environmental Analysis, the No Action Alternative is compared to the Second Basis of Comparison.

17.4.3.1.1 Potential Exposure of Cultural Resources at Reservoirs that Store CVP and SWP Water

As described above, the minimum reservoir elevations in all regions under the No Action Alternative and the Second Basis of Comparison would be within historic ranges and would not expose lands that are not currently exposed. Therefore, conditions of cultural resources would be similar under the No Action Alternative and Second Basis of Comparison.

17.4.3.2 Alternative 1

Alternative 1 is identical to the Second Basis of Comparison. Alternative 1 is compared to the No Action Alternative and the Second Basis of Comparison. However, because cultural resource conditions under Alternative 1 are identical to cultural resource conditions under the Second Basis of Comparison, Alternative 1 is only compared to the No Action Alternative.

17.4.3.2.1 Alternative 1 Compared to the No Action Alternative

Potential Exposure of Cultural Resources at Reservoirs that Store CVP and SWP Water

As described above, the minimum reservoir elevations in all regions under Alternative 1 as compared to the No Action Alternative would be within historic ranges and would not expose lands that are not currently exposed. Therefore, conditions of cultural resources would be similar under Alternative 1 and the No Action Alternative.

17.4.3.2.2 Alternative 1 Compared to the Second Basis of Comparison

Alternative 1 is identical to the Second Basis of Comparison.

17.4.3.3 Alternative 2

The cultural resources conditions under Alternative 2 would be identical to the conditions under the No Action Alternative; therefore, Alternative 2 is only compared to the Second Basis of Comparison.

17.4.3.3.1 Alternative 2 Compared to the Second Basis of Comparison

Changes to cultural resources conditions under Alternatives 2 as compared to the Second Basis of Comparison would be the same as the impacts described in Section 17.4.3.1, No Action Alternative.

17.4.3.4 Alternative 3

CVP and SWP operations under Alternative 3 are similar to the Second Basis of Comparison with modified Old and Middle River flow criteria and New Melones Reservoir operations.

17.4.3.4.1 Alternative 3 Compared to the No Action Alternative

Potential Exposure of Cultural Resources at Reservoirs that Store CVP and SWP Water

As described above, the minimum reservoir elevations in all regions under Alternative 3 as compared to the No Action Alternative would be within historic ranges and would not expose lands that are not currently exposed. Therefore, conditions of cultural resources would be similar under Alternative 3 as compared to the No Action Alternative.

17.4.3.4.2 Alternative 3 Compared to the Second Basis of Comparison

Potential Exposure of Cultural Resources at Reservoirs that Store CVP and SWP Water

As described above, the minimum reservoir elevations in all regions under Alternative 3 as compared to the Second Basis of Comparison would be within historic ranges and would not expose lands that are not currently exposed. Therefore, conditions of cultural resources would be similar under Alternative 3 and Second Basis of Comparison.

17.4.3.5 Alternative 4

The cultural resources conditions under Alternative 4 would be identical to the conditions under the Second Basis of Comparison. Therefore, Alternative 4 is only compared to the No Action Alternative.

17.4.3.5.1 Alternative 4 Compared to the No Action Alternative

Changes in cultural resources conditions under Alternative 4 as compared to the No Action Alternative would be the same as the impacts described in Section 17.4.3.2.1, Alternative 1 Compared to the No Action Alternative.

17.4.3.6 Alternative 5

The CVP and SWP operations under Alternative 5 are similar to the No Action Alternative with modified Old and Middle River flow criteria and New Melones Reservoir operations.

17.4.3.6.1 Alternative 5 Compared to the No Action Alternative

Potential Exposure of Cultural Resources at Reservoirs that Store CVP and SWP Water

As described above, the minimum reservoir elevations in all regions under Alternative 5 as compared to the No Action Alternative would be within historic ranges and would not expose lands that are not currently exposed. Therefore, conditions of cultural resources would be similar under Alternative 5 as compared to the No Action Alternative.

17.4.3.6.2 Alternative 5 Compared to the Second Basis of Comparison

Potential Exposure of Cultural Resources at Reservoirs that Store CVP and SWP Water

As described above, the minimum reservoir elevations in all regions under Alternative 5 as compared to the Second Basis of Comparison would be within historic ranges and would not expose lands that are not currently exposed. Therefore, conditions of cultural resources would be similar under Alternative 5 and Second Basis of Comparison.

17.4.3.7 Summary of Impact Analysis

The results of the impact analysis of implementation of Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison are presented in Tables 17.4 and 17.5.

Table 17.4 Comparison of Alternatives 1 through 5 to No Action Alternative

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 1	No effects to cultural resources	None needed
Alternative 2	No effects to cultural resources	None needed
Alternative 3	No effects to cultural resources	None needed
Alternative 4	No effects to cultural resources	None needed
Alternative 5	No effects to cultural resources	None needed

Table 17.5 Comparison of No Action Alternative and Alternatives 1 through 5 to Second Basis of Comparison

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 1	No effects to cultural resources	None needed
Alternative 2	No effects to cultural resources	None needed
Alternative 3	No effects to cultural resources	None needed
Alternative 4	No effects to cultural resources	None needed
Alternative 5	No effects to cultural resources	None needed

17.4.3.8 Potential Mitigation Measures

Mitigation measures are presented in this section to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse environmental effects of Alternatives 1 through 5, as compared to the No Action Alternative. Mitigation measures were not included to address adverse impacts under the alternatives as compared to the Second Basis of Comparison because this analysis was included in this EIS for information purposes only.

Implementation of Alternatives 1 through 5 as compared to the No Action Alternative would not result in increased potential exposure or disturbance of cultural resources. Therefore, there would be no adverse impacts to cultural resources because of implementation of the alternatives; and no mitigation measures are needed.

17.4.3.9 Cumulative Effects Analysis

As described in Chapter 3, the cumulative effects analysis considers projects, programs, and policies that are not speculative and are based upon known or reasonably foreseeable long-range plans, regulations, operating agreements, or other information that establishes them as reasonably foreseeable.

The cumulative effects analysis for Alternatives 1 through 5 for Cultural Resources are summarized in Table 17.6.

Table 17.6 Summary of Cumulative Effects on Cultural Resources with Implementation of Alternatives 1 through 5 as Compared to the No Action Alternative

Scenarios	Actions	Cumulative Effects of Actions
Past & Present, and Future Actions Included in All Alternatives in Year 2030	Consistent with Affected Environment conditions plus: Actions in the 2008 USFWS BO and 2009 NMFS BO that would have occurred without implementation of the BOs, as described in Section 3.3.1.2 (of Chapter 3, Descriptions of Alternatives), including climate change and sea level rise Actions not included in the 2008 USFWS BO and 2009 NMFS BO that would have occurred without implementation of the BOs, as described in Section 3.3.1.3 (of Chapter 3, Descriptions of Alternatives): - Implementation of Federal and state policies and programs, including Clean Water Act (e.g., Total Maximum Daily Loads); Safe Drinking Water Act; Clean Air Act; and flood management programs - General plans for 2030. - Trinity River Restoration Program. - Central Valley Project Improvement Act programs - Iron Mountain Mine Superfund Site	<u>These effects would be the same under all alternatives.</u> Community development would occur in accordance with general plan projections for 2030. Development within the Delta would be subject to the requirements of the Delta Protection Commission and Delta Stewardship Council. Future development projects are anticipated to potentially effect cultural resources. However, development of these future programs would include preparation of environmental documentation that would identify methods to minimize adverse impacts to cultural resources. Restoration plans for the ongoing programs would be completed. Development along river corridors in the Central Valley. Future restoration projects are anticipated to potentially affect cultural resources. However, development of these future programs would include preparation of environmental documentation that would identify methods to

Scenarios	Actions	Cumulative Effects of Actions
	- Nimbus Fish Hatchery Fish Passage Project - Folsom Dam Water Control Manual Update - FERC Relicensing for the Middle Fork of the American River Project - Lower Mokelumne River Spawning Habitat Improvement Project - Dutch Slough Tidal Marsh Restoration - Suisun Marsh Habitat Management, Preservation, and Restoration Plan Implementation - Tidal Wetland Restoration: Yolo Ranch, Northern Liberty Island Fish Restoration Project, Prospect Island Restoration Project, and Calhoun Cut/Lindsey Slough Tidal Habitat Restoration Project - San Joaquin River Restoration Program - Future water supply projects, including water recycling, desalination, groundwater banks and wellfields, and conveyance facilities (projects with completed environmental documents)	minimize adverse impacts to cultural resources. Climate change and sea level rise, development under the general plans, FERC relicensing projects, and some future projects to improve water quality and/or habitat are anticipated to reduce availability of CVP and SWP water supplies as compared to past conditions. Future water supply projects are anticipated to both increase water supply reliability due to reduced surface water supplies and to accommodate planned growth in the general plans. Most of these programs were initiated prior to implementation of the 2008 USFWS BO and 2009 NMFS BO which reduced CVP and SWP water supply reliability. Future water supply projects are anticipated to potentially effect cultural resources. However, development of these future programs would include preparation of environmental documentation that would identify methods to minimize adverse impacts to cultural resources.
Future Actions considered as Cumulative Effects Actions in All Alternatives in Year 2030	Actions as described in Section 3.5 (of Chapter 3, Descriptions of Alternatives): - Bay-Delta Water Quality Control Plan Update - FERC Relicensing Projects - Bay Delta Conservation Plan (including the California WaterFix alternative) - Shasta Lake Water Resources, North-of-the-Delta Offstream Storage, Los Vaqueros Reservoir Expansion Phase 2, and Upper San Joaquin River Basin Storage Investigations	<u>These effects would be the same under all alternatives.</u> Most of the future reasonably foreseeable actions are anticipated to reduce water supply impacts due to climate change, sea level rise, increased water allocated to improve habitat conditions, and future growth. Some of the reasonably foreseeable actions related to improved water quality and habitat conditions (e.g., Water Quality Control Plan Update and FERC Relicensing Projects), could in further

Scenarios	Actions	Cumulative Effects of Actions
	- El Dorado Water and Power Authority Supplemental Water Rights Project - Sacramento River Water Reliability Project - Semitropic Water Storage District Delta Wetlands - North Bay Aqueduct Alternative Intake - San Luis Reservoir Low Point Improvement Project - Future water supply projects, including water recycling, desalination, groundwater banks and wellfields, and conveyance facilities (projects that did not have completed environmental documents during preparation of the EIS)	reductions in CVP and SWP water deliveries. Future development of the cumulative projects are anticipated to potentially affect cultural resources. However, development of these future programs would include preparation of environmental documentation that would identify methods to minimize adverse impacts to cultural resources.
No Action Alternative with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO	Community development and restoration projects for the ongoing programs would be completed. Climate change and sea level rise, FERC relicensing projects, and some future projects to improve water quality and/or habitat are anticipated to reduce availability of CVP and SWP water supplies as compared to past conditions. Future water supply projects are anticipated to both increase water supply reliability due to reduced surface water supplies and to accommodate planned growth in the general plans. Future development projects are anticipated to potentially affect cultural resources. However, development of these future programs would include preparation of environmental documentation that would identify methods to minimize adverse impacts to cultural resources.

Scenarios	Actions	Cumulative Effects of Actions
Alternative 1 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant)	Implementation of Alternative 1 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with the added actions.
Alternative 2 with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO CVP and SWP operational actions No implementation of structural improvements or other actions that require further study to develop a more detailed action description.	Implementation of Alternative 2 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with the added actions.
Alternative 3 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant) Slight increase in positive Old and Middle River flows in the winter and spring months	Implementation of Alternative 3 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with the added actions.
Alternative 4 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant)	Implementation of Alternative 4 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with the added actions.
Alternative 5 with Associated Cumulative Effects Actions in Year 20530	Full implementation of the 2008 USFWS BO and 2009 NMFS BO Positive Old and Middle River flows and increased Delta outflow in spring months	Implementation of Alternative 5 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with the added actions.

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Chapter 18

Public Health

18.1 Introduction

This chapter describes public health hazards in the study area related to changes in the environment that could occur as a result of implementing the alternatives evaluated in this Environmental Impact Statement (EIS). Implementation of the alternatives considered in this EIS could affect public health through changes in available water supplies from the Central Valley Project (CVP) and State Water Project (SWP); changes in irrigated crop acreage related to potential changes in operation of the CVP and SWP; changes in wetlands acreage related to potential changes in ecosystem restoration; and changes in water quality related to potential changes in operation of the CVP and SWP.

Changes in available water supplies, agricultural resources, wetlands, and water quality are described in more detail in Chapter 5, Surface Water Resources and Water Supplies; Chapter 12, Agricultural Resources; and Chapter 6, Water Quality, respectively.

18.2 Regulatory Environment and Compliance Requirements

Potential actions that could be implemented under the alternatives evaluated in this EIS could affect public health throughout the study area. Some of the actions considered in the alternatives evaluated in this EIS could include facilities located on public agency lands; or actions implemented, funded, or approved by Federal and state agencies. These actions would need to be compliant with appropriate Federal and state agency policies and regulations, as summarized in Chapter 4, Approach to Environmental Analyses.

18.3 Affected Environment

This section describes the following public health factors that could be potentially affected by the implementation of the alternatives considered in this EIS.

- Changes in available water supplies.
- Increases in the potential for mosquito-borne diseases due to an increase in wetlands.
- Changes in the potential for Valley Fever from disturbed soils when irrigation water supplies change.
- Changes in the potential for bioaccumulation of mercury in fish and shellfish.

Changes in the potential of direct or indirect exposure to high water quality concentrations of various constituents also may occur due to implementation of the alternatives. These direct changes to water quality and the related changes to drinking water safety and consumption of fish or shellfish exposed to high concentrations of constituents of concern are described in Chapter 6, Water Quality.

Public health effects that could occur due to construction activities are not discussed in this chapter, including increased exposure to naturally occurring asbestos, methane production from disturbance of peat soils, disturbance of oil and gas production fields, use and transport of hazardous wastes, and changes in wastewater or stormwater discharges. Although several of the alternatives include assumptions of constructed facilities, those actions will require subsequent planning and environmental documentation prior to implementation. The subsequent environmental documentation and related permits will evaluate public health effects associated with construction and implementation of those facilities.

18.3.1 Public Health Issues Related to Available Water Supplies

Water supply availability can affect public health in several ways. Potential direct effects to public health are related to reduction of municipal water supplies. Potential indirect effects to public health are related to reduction of industrial and irrigation water supplies which could affect the ability to earn an income to fund food, shelter, and other critical factors necessary for public health. Effects related to loss of jobs.

Availability of water supplies substantially decreased for CVP and SWP water users during recent droughts in 1976-1977, 1987-1992, and 2012-2014. In addition, as described in Chapter 5, Surface Water Resources and Water Supplies, the frequency of substantially reduced water supplies provided by the CVP and SWP have increased since the 1976-1977 drought due to changes in regulations and increased water demands by users with higher priorities for water use.

During the 2014 drought, CVP and SWP water supply allocations have been reduced substantially to protect future water supplies and the ability to meet existing regulations, as described in Chapter 5, Surface Water Resources and Water Supplies. The allocations were modified throughout the 2013-2014 winter with the allocations that are the most stringent in the history of the CVP and/or SWP operations, as summarized below (Reclamation 2014a, 2014b; DWR 2013, 2014).

- CVP North of Delta Water Users.
  - Sacramento River Settlement Contractors – allocated 40 percent of total contracted water supply.
  - Sacramento Valley Refuges that use CVP water supplies – allocated 40 percent of total contracted water supply.

- Agricultural Water Service Contractors – allocated 0 percent of total contracted water supply.
- Municipal and Industrial Water Service Contractors – allocated 50 percent of historic water use.

- CVP In-Delta Water Service Contractor: Contra Costa Water District – allocated 50 percent of historic water use.
- CVP South of Delta Water Users.
  - San Joaquin River Exchange and Settlement Contractors – allocated 65 percent of total contracted water supply.
  - San Joaquin Valley Refuges that use CVP water supplies – allocated 65 percent of total contracted water supply.
  - Agricultural Water Service Contractors – allocated 0 percent of total contracted water supply.
  - Municipal and Industrial Water Service Contractors – allocated 50 percent of historic water use.
- CVP Friant Division Contractors – allocated 0 percent of total contracted water supply.
- CVP Eastside Water Service Contractors: Water supplies delivered from New Melones Reservoir – allocated 55 percent of total contracted water supply.
- SWP Water Service Contractors – 5 percent of total contracted water supply.

Another potential indirect effect to public health is related to reduction of stored water in the CVP and SWP reservoirs which could affect the ability to provide enough water for firefighting,

18.3.1.1 Public Health and Safety Related to Available Municipal and Industrial Water Supplies

The Department of the Interior, Bureau of Reclamation (Reclamation) current *Draft Municipal and Industrial Shortage Policy* (Reclamation 2005) describes that the CVP water service contractors should develop public health and safety volumes based California's public health and safety criteria or criteria developed in coordination with Reclamation. Currently, California does not have a uniform set of public health and safety criteria for municipal and industrial water supplies. At this time, most of the urban communities have not adopted specific public health and safety criteria. However, in some of the recently completed Urban Water Management Plans, criteria have been identified to protect public health and safety that range from 25 to 50 percent of the total water demand, as described in Chapter 5, Surface Water Resources and Water Supplies (CCWD 2011; City of Folsom 2011; Metropolitan 2010). The Urban Water Management Plans indicate that during the critical periods with reductions in water supplies, municipal and industrial water uses will be focused on inside water uses with little or no outside irrigation water.

At this time, no specific volumes have been identified for public health and safety quantities for the CVP and/or SWP water users. During the 2014 drought, the Department of Water Resources (DWR) and Reclamation identified 1,500 cubic feet per second as a minimum amount of CVP and SWP Delta exports for public health and safety uses for municipal and industrial water supplies. This amount is also defined by the limitations of the CVP and SWP conveyance facilities, as described in Chapter 5, Surface Water Resources and Water Supplies.

As described above, in 2014, CVP and SWP water supply allocations are at historically low values. However, it is difficult to identify local public health and safety issues, non-agricultural related industrial job losses, and economic losses associated with reductions in CVP and/or SWP water supplies. The potential economic losses, socioeconomic effects, and environmental justice effects are described in Chapter 19, Socioeconomics, and Chapter 21, Environmental Justice.

18.3.1.2 Public Health and Safety Related to Available Agricultural Water Supplies

Agricultural water suppliers have developed responses to the reductions in agricultural water supplies from the CVP and SWP, as described in Chapter 12, Agricultural Resources. Historically, the number of employment opportunities that rely directly or indirectly on the availability of CVP and/or SWP water supplies for irrigation have declined in the areas where the water supplies have declined, communities within the Central Valley Region and Southern California Region, as described in Chapter 19, Socioeconomics.

18.3.1.3 Public Health and Safety Related to Water Supply Availability for Wildland Firefighting

Complex terrain, Mediterranean climate, productive natural plant communities, and ample natural and aboriginal ignition sources has caused California to be a complex wildfire-prone and fire-adapted landscape. While natural wildfires support ecosystem health and are critical to maintaining the structure and function of ecosystems, wildfires pose a significant threat to life, public health, infrastructure, properties, and natural resources.

In accordance with Public Resources Code sections 4201 to 4204 and Government Code sections 51175 to 51189, the California Department of Forestry and Fire Prevention (CAL FIRE) has mapped areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. The zones are referred to as Fire Hazard Severity Zones and represent the risks associated with wildland fires. Under CAL FIRE regulations, areas within very high fire-hazard risk zones must comply with specific building and vegetation requirements intended to reduce property damage and loss of life within these areas.

According to CAL FIRE, there is an increasing trend of acres burned statewide, with particular increase in conifer vegetation types (CAL FIRE FRAP 2010). Statewide, there are 21.3 million acres of land designated as high priority landscape. The high priority landscape areas include locations with high value water supplies and high threats of fire and large communities which should be protected to prevent wildfire threats to maintain ecosystem health, water supplies, and large communities. These areas include the upper Trinity River watershed in the Trinity River Region; the upper Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and Millerton Lake watersheds in the Central Valley Region; and communities in throughout the Southern California Region. Areas designated as high priority landscape occur within 46 of 58 counties. Many rural counties have significant numbers of communities and acreage in medium priority landscape, including 508 communities with some high priority landscape areas.

CAL FIRE manages the State Responsibility Areas, and local fire districts manage Local Responsibility Areas. First responders are typically the local fire districts. The U.S. Forest Service provides wildland fire protection both independently and cooperatively with the California Department of Forestry and Fire Protection. In addition, the U.S. Department of the Interior National Park Service and Bureau of Land Management provide resource management and fire protection on portions of Federal lands.

Firefighting actions frequently involve use of water from reservoirs located close to wildland fires in the Trinity River, Central Valley, Central Coast, and Southern California regions, including reservoirs owned by Reclamation and DWR.

18.3.2 Public Health Issues Related to Mosquito-Borne Diseases

There are more than 50 species of mosquitos in California, including members of the four major genera: 24 species of *Aedes*, 5 species of *Anopheles*, 11 species of *Culex*, and 4 species of *Culiseta* (CDPH et al. 2012). Not all of these species are known to transmit mosquito-borne viruses, as described below. There are approximately 15 mosquito-borne viruses that occur in California; however, the most significant viruses that cause human disease are St. Louis encephalitis virus (SLEV), western equine encephalomyelitis (WEEV), and West Nile virus (WNV) (CDPH et al. 2014). No cases of SLEV or WEEV have been reported in humans over the past few years in California. Malaria also is a mosquito-borne disease that is caused by a parasite instead of a virus.

The *Culex tarsalis* has been identified as part of transmission of SLEV, WEEV, and WNV, especially in rural areas. The *Culex pipiens* and *Culex quinquefasciatus* have been identified as part of the transmission of WNV and SLEV. The *Culex stigmatosoma* has been identified as part of the transmission of WNV and SLEV, especially among birds. The *Aedes melanimon, Aedes vexans*, and *Culex erythrothorax* have been identified as species involved in transmitting the virus between birds and mammals or between mammals.

Mosquitoes, especially *Culex tarsalis*¸ live in every area of California, and can be a threat to the health of humans and domestic animals throughout the state. The mosquito life cycle requires water for the egg, larva, and pupa stages. Some of the species are more associated with irrigated agriculture, and others are more associated with urban communities (CDPH et al. 2014). Most of the diseases are not treatable and vaccines are not available for humans. Methods to prevent mosquitoes from becoming adults and methods to prevent mosquitos from biting humans are the only available and practical methods to protect public health.

California Health and Safety Code (Sections 2001 – 4(d); 2002; and 2060(b)) describes that landowners are legally responsible to eliminate public nuisances from their properties, including mosquito breeding habitat (CDPH 2008; CDPH et al. 2012). Federal, state, and local agencies supplement the preventive activities of individual landowners toward protecting humans and domestic animals from mosquito-borne diseases. The California Department of Public Health (CDPH) monitors mosquito populations throughout the state. In 1915, the state legislature enacted the Mosquito Abatement Act to allow local mosquito abatement special districts. The local mosquito and vector control districts monitor mosquito populations and take actions such as eliminating breeding sites, using biological control (predators such as mosquitofish), and using chemical control, to reduce mosquito population size (CDPH 2013a).

18.3.2.1 St. Louis Encephalitis Virus

The SLEV is a mosquito-borne virus that circulates among birds and is transmitted to humans via mosquito bites CALSURV 2013a; CDPH 2007). Human infection with SLE can cause mild to severe fever and headaches due to inflammation of the brain. In severe cases, the illness can cause disorientation and comas and possibly cause death. Elderly can become more severely ill than young children with SLEV as compared to WEEV.

Since the SLEV was first recognized in 1933 in St. Louis, Missouri, outbreaks have been reported throughout the United States, Canada, and northern Mexico, generally between August and October (CALSURV 2013a). In 1984 and 1989, 29 human cases were reported in the San Joaquin Valley of the Central Valley Region. During the same time periods, 26 human cases were reported in the Los Angeles area of the Southern California Region. The last human case reported in California occurred in 1997 in Los Angeles County.

18.3.2.2 Western Equine Encephalitis

The WEEV is another mosquito-borne virus that circulates among birds and is transmitted to horses and humans by mosquitoes (CDPH 2007). Symptoms are similar to SLEV. Infants and small children are most severely afflicted with WEEV as compared to SLEV. There is a vaccine for horses, but not for humans. Historically, substantial number of horses died due to this disease as well as humans. Recently, there has not been a recorded case of WEEV in humans in California (CDPH et al. 2014).

18.3.2.3 West Nile Virus

West Nile virus (WNV) can cause mild to severe illness in human, other mammals, and birds.

The virus circulates among birds and is transmitted to humans primarily by *Culex* mosquitoes (CDPH et al. 2014). The WNV was first detected in North America in New York in 1999, and has subsequently spread to 48 states, Canada, and Mexico.

The WNV first appeared in humans in California in 2002 with the identification of one human case (CALSURV 2013b). In 2003, three human cases and one equine case were reported with numerous verified findings of WNV activity among dead birds and mosquitoes. In 2004, the WNV was reported in 58 counties, with 779 human cases, including 29 WNV-associated deaths (CALSURV 2013b). From 2003 through 2013, there were 4,004 reported human cases of WNV with 145 deaths; 16,299 reported bird deaths; and 1,202 reported cases involving horses (CDPH 2014a). In 2007, 2008, and between 2010 and 2013, the majority of reported human cases occurred in the six counties in Southern California Region, with most of the cases reported in Los Angeles County. Between 2007 and 2013, numerous human cases were reported in Butte, Sutter, Sacramento, Stanislaus, Fresno, Tulare, and Kern counties in the Central Valley Region. During this same period, no human cases were reported in the Trinity River Region; Lassen, Plumas, and Nevada counties in the Central Valley Region; San Benito County in the San Francisco Bay Area Region; and San Luis Obispo County in the Central Coast Region.

In humans, WNV may not result in any symptoms or only mild viral symptoms, including mild fever, headache, body aches, skin rash, and swollen lymph glands. Symptoms in less than 1 percent of people that are infected can include headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, and paralysis that are associated with meningitis or encephalitis.

18.3.2.4 Malaria

Malaria also is a mosquito-borne disease caused by a parasite that destroys the red blood cells of its host. People with malaria often experience fever, chills, and flu-like illness which can lead to death (CDPH et al. 2012). Malaria is no longer endemic in California, as well as the rest of the United States, due to intense mosquito control efforts and anti-malarial drugs. However, the disease is diagnosed every year, especially in people who have traveled outside the United States. In 2012, 92 human cases were reported in California (CDPH 2013). Of the 92 cases, 90 patients had traveled to countries characterized as endemic with malaria during the previous three years. The *Anopheles* mosquitoes can transmit the parasite to humans and are prevalent in California (CDPH et al. 2012).

18.3.3 Public Health Issues Related to Valley Fever

Valley fever is an illness that is caused by inhaling the spores of a fungus *Coccidioides immitis* (CDPH 2013c). This fungus lives in the top layers of some soils within 2 to 12 inches from the ground surface. When the soil is disturbed by digging, vehicles, cultivation, or wind, the fungal spores can be inhaled by persons within the area. Irrigated soils are less likely to contain the fungus than dry, previously undisturbed soils.

In most cases, symptoms in humans include mild cough and flu-like symptoms (CDPH 2013c). However, in about 40 percent of the reported cases, the illness can last for more than a month, make the person susceptible to pneumonia, and include cough, fever, chest pain, headache, muscle ache, rash, joint pain, and/or fatigue. In about 5 percent of the reported cases, the disease becomes "disseminated Valley Fever" and can cause meningitis and/or affect bones, joints, skin, or other organs. There are no vaccines to prevent Valley Fever.

The *Coccidioides immitis* is endemic in many areas of the southwestern United States, Mexico, Central America, and South America. In California, the fungus is found in many areas of the San Joaquin Valley and Southern California (CDPH 2011, 2014b). In California between 2001 and 2012, there were over 35,000 reported cases of Valley Fever. The number of incidences increased from 1,483 cases in 2001 to 4,094 cases in 2012. The highest number of cases reported during this period occurred in Kings, Kern, Fresno, Tulare, and Madera counties in the San Joaquin Valley within the Central Valley Region; San Luis Obispo County in the Central Coast Region; and Los Angeles County in the Southern California Region.

In general, the people who have the highest risk of exposure to the fungus include construction workers, archeologists, geologists, wildland fighters, military personnel, mining or gas/oil extraction workers, and agricultural workers in non-irrigated areas (CDPH 2013c). Other employees also may be at risk. For example, members of the cast and crew of a television film became ill with Valley Fever after working on an outdoor set in Ventura County (CDCP 2014).

In 2011, Fresno, Kern, Kings, San Joaquin, San Luis Obispo, and Tulare counties conducted an analysis of information related to Valley Fever incidences (Fresno County et al. 2011). The observations included:

- More incidences were reported in the western parts of Kern, Kings, Fresno, and San Joaquin counties than in other portions of the counties.
- More incidences were reported in northern San Luis Obispo County and southern Tulare County than other portions of the counties.
- In recent years, there was increased reporting of Valley Fever in the prison populations in Fresno and Kings counties. In Kern County, 8 percent of the reported cases between 2005 and 2008 were prison inmates. In Fresno County, incidences at Pleasant Valley State Prison were 43 percent of the total cases in the county between 2004 and 2010. In Kings County, incidences at state prisons were 58 percent of the total cases in the county between 2007 and 2010.

In 2012, the San Joaquin Valley Air Pollution Control District (SJVAPCD) evaluated causes for Valley Fever and options to reduce social and economic effects of Valley Fever in the San Joaquin Valley (SJVAPCD 2012). The analysis described that Valley Fever appears to be related to a fungus that forms in subsoil strata that are dry through a portion of the year. The analysis referred to other studies that correlated weather patterns with outbreaks of Valley Fever during dry periods following periods of heavy rainfall. The study also indicated that airborne *Coccidioides* spores do not generally come from irrigated agriculture. It appears that it is more likely that the spores are from non-irrigated lands, including undisturbed natural lands, undeveloped land, and grazing areas. The study indicated that additional monitoring or reduction of particulate matter of

10 microns, or PM_{10}, did not appear to be useful in reduction of the potential for Valley Fever. The study recommended additional funding to develop a vaccine for Valley Fever.

18.3.4 Public Health Issues Related to High Concentrations of Mercury in Fish and Shellfish

As described in Chapter 6, Water Quality, high concentrations of certain substances accumulate in fish and shellfish based upon the water quality. The California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA) evaluates concentrations of potentially toxic substances in edible tissues of fish and shellfish harvested in water bodies in California (OEHHA 2014a). Based upon the evaluation, general and specific safe eating guidelines are developed for the fish and shellfish, as summarized in Table 18.1. For the water bodies in the study area, the primary constituents that have triggered the development of safe eating guidelines are mercury, dieldrin, and/or polychlorinated biphenyl (PCB). Other constituents are present, including selenium; however, the concentrations do not exceed thresholds that would trigger safe eating guidelines. The OEHHA develops two separate guidelines: (1) Guidelines for Children from 1 to 17 years and Women from 18 to 45 years; and (2) Guidelines for Women over 45 years old and Men over 17 years old. The guidelines recommend the number of servings per week by fish or shellfish harvested from specific waters. A “serving size” is defined as “about the size and thickness of your hand” (OEHHA 2014a).

Table 18.1 Summary of Safe Eating Guidelines for Fish and Shellfish from Water Bodies in the Study Area Based on Mercury and PCB (servings per week)

Region	Water Body	Fish and Shellfish[a]	Guidelines for Children and Women up to 45 Years Old[b]	Guidelines for Men and Women over 45 Years Old[b]
Trinity River	Trinity Lake	Rainbow Trout, Brown Trout, White Catfish	2	5
		Largemouth Bass, Smallmouth Bass	Do not eat	1
	Lewiston Lake	Trout	5	7
Central Valley	Sacramento River and Northern Delta	American Shad, Chinook Salmon, Rainbow Trout, Steelhead Trout	2 to 3	7
		Clams	7	7
		Bluegill, other sunfish, carp or goldfish, catfish, crappie, Crayfish, Hardhead, Hitch, sucker	1	3

Region	Water Body	Fish and Shellfisha	Guidelines for Children and Women up to 45 Years Oldb	Guidelines for Men and Women over 45 Years Oldb
Central Valley (continued)		Bass, Pikeminnow, White Sturgeon	Do not eat	1
		Striped Bass	Do not eat	2
	Lake Oroville	Bluegill and Green Sunfish	2	5
		Carp, Coho salmon	1	2
		Largemouth Bass, Smallmouth Bass, Redeye, or Spotted Bass; Channel Catfish; White Catfish	Do not eat	1
	Lower Feather River	American Shad, Chinook Salmon, Steelhead Trout	2 to 3	7
		Carp, sucker	1	2
		Redear, other sunfish	1	3
		Black Bass, catfish, Pikeminnow, Striped Bass, White Sturgeon	Do not eat	1
	Englebright Lake	Rainbow Trout	2	7
		Bluegill, other sunfish	1	2
		Largemouth Bass, Smallmouth Bass, Spotted Bass	Do not eat	1
	Rollins Reservoir	Catfish	1	2
	Camp Far West Reservoir	Bluegill, other sunfish	1	3
		Largemouth Bass, Smallmouth Bass, Spotted Bass, catfish	Do not eat	1
	Folsom Lake	Bluegill, Green Sunfish, or other sunfish; Rout: 16 inches or less	2	5

Region	Water Body	Fish and Shellfisha	Guidelines for Children and Women up to 45 Years Oldb	Guidelines for Men and Women over 45 Years Oldb
Central Valley (continued)		Catfish; Chinook Salmon; Largemouth Bass, Smallmouth Bass, Spotted Bass, trout: over 16 inches	Do not eat	1
	Lake Natoma	Bluegill, Green Sunfish, or other sunfish; trout: 16 inches or less	2	5
		Chinook Salmon; Largemouth Bass, Smallmouth Bass, Spotted Bass, trout: over 16 inches	Do not eat	1
		Catfish	Do not eat	Do not eat
	Lower American River	American Shad, Chinook Salmon, steelhead trout	2 to 3	7
		Redear or other sunfish, sucker, white catfish	1	2
		Striped Bass	Do not eat	2
		Bass, Pikeminnow	Do not eat	1
	Lower Mokelumne River	American Shad, Chinook Salmon, steelhead trout	2 to 3	7
		Clams	7	7
		Bluegill or other sunfish, Crayfish, catfish	1	2
		Striped Bass	Do not eat	2
		Bass, Pikeminnow, White Sturgeon	Do not eat	1
	San Joaquin River (Friant Dam to Port of Stockton)	Chinook Salmon, steelhead trout	2	7
		Bluegill or other sunfish	2	5
		American Shad	3	7
		Carp, catfish, sucker	1	2

Region	Water Body	Fish and Shellfisha	Guidelines for Children and Women up to 45 Years Oldb	Guidelines for Men and Women over 45 Years Oldb
Central Valley (continued)		Striped Bass	Do not eat	2
		Bass, white sturgeon	Do not eat	1
	Central and South Delta	American Shad, Chinook Salmon, Bluegill or other sunfish, steelhead trout	2	7
		Catfish, Crayfish	2	5
		Clams	7	7
		Bass, carp, crappie, sucker	1	2
		Striped Bass	Do not eat	2
		White Sturgeon	Do not eat	1
San Francisco Bay Area	San Francisco Bay	Chinook Salmon	2	7
		Brown Rockfish, Red Rock Crab	2	5
		Jacksmelt	2	2
		California Halibut	1	2
		White Croaker	1	1
		Sharks, Striped Bass, White Sturgeon	Do not eat	1
		Surfperches	Do not eat	Do not eat
	San Pablo Reservoir	Crappie	2	5
		Trout	5	5
		Largemouth Bass, Smallmouth Bass, Spotted Bass	Do not eat	1
		Carp, catfish	Do not eat	Do not eat
	Lafayette Reservoir	Crappie	4	7
		Bass	1	2
		Carp or Goldfish	Do not eat	1

Region	Water Body	Fish and Shellfisha	Guidelines for Children and Women up to 45 Years Oldb	Guidelines for Men and Women over 45 Years Oldb
San Francisco Bay Area (continued)	Lake Chabot	Redear or other sunfish	2	4
		Channel Catfish	1	1
		Bass	Do not eat	1
		Carp	Do not eat	Do not eat
Southern California Region	Pyramid Lake	Rainbow Trout	7	7
		Channel Catfish	1	2
		Largemouth Bass, Smallmouth Bass	Do not eat	1
		Bullhead	Do not eat	Do not eat
	Silverwood Lake	Rainbow Trout	7	7
		Tule Perch	1	1
		Largemouth Bass, Bluegill, Channel Catfish	Do not eat	1
		Striped Bass, Blackfish, Tui Chub	Do not eat	Do not eat
Statewide	All Lakes and Reservoirs without Site-Specific Advice	Rainbow trout	2	6
		Bullhead, catfish, Bluegill or other sunfish, Brown Trout: 16 inches or less	1	2
		Bass, carp, Brown Trout: over 16 inches	Do not eat	1
	All Rivers, Estuaries, and Coastal Waters without Site-Specific Advice	American Shad, Chinook Salmon, steelhead trout	2 to 3	7

Region	Water Body	Fish and Shellfisha	Guidelines for Children and Women up to 45 Years Oldb	Guidelines for Men and Women over 45 Years Oldb
Statewide (continued)		Striped Bass	Do not eat	2
		White Sturgeon	Do not eat	1

Sources: OEHHA 2014b, 2014c, 2014d, 2014e, 2014f, 2014g, 2014h, 2014i, 2014j, 2014k, 2014l, 2014m, 2014n, 2014o, 2014p, 2014q, 2014r, 2014s, 2014t, 2014u, 2014v, 2014w

Notes:
a. All fish and shellfish names are as appears in the OEHHA guidelines.
b. The OEHHA guidelines refer to the total number of servings of fish per week for one water body, not just the total for a specific species. For example, OEHHA guidelines for Men eating fish from Trinity Lake would include no more than 5 servings of Rainbow Trout, Brown Trout, or White Catfish; OR 1 serving of Largemouth Bass or Smallmouth Bass.

Resident Delta fish accumulate mercury primarily through dietary exposure; larger, piscivorous (fish-eating) fish show the greatest levels of tissue mercury. In contrast to anadromous fish (migratory species), the resident fish experience constant exposure to local mercury sources. Resident species include larger fish with human health exposure (such as Largemouth Bass) and smaller, forage fish (such as Inland Silversides). Fish tissues are the ultimate route of exposure to mercury for humans who consume locally caught fish.

Historically, substantial levels of mercury contamination have occurred in fish throughout the Delta. Mercury concentrations in tissue of the larger piscivorous fish are lower in for fish in the central Delta as compared to fish from the Mokelumne, Cosumnes, Sacramento, and San Joaquin rivers (CVRWQCB 2010a, 2010b). Larger, piscivorous resident fish, in general, provide a good record of fish tissue mercury as a baseline condition for the Delta. Largemouth Bass were chosen because they are popular sport fish, top predators, live for several years, and tend to stay in the same area (exhibit high site fidelity). Consequently, they are excellent indicators of long-term average mercury exposure, risk, and spatial pattern for ecological and human health. Mercury in sport fish from the Delta region was reported for Largemouth Bass as a median tissue mercury concentration of 0.53 mg mercury per kilogram (Hg/kg) wet weight (Davis et al. 2003). Current fish tissue concentrations thus exceed both adopted regulatory standards and guidance from the U.S. Environmental Protection Agency (USEPA). In the 2010 Delta TMDL for methylmercury, the Central Valley Regional Water Quality Control Board (Central Valley RWQCB) established a fish tissue threshold (fillet concentrations, wet weight mercury) of 0.24 mg Hg/kg wet weight in trophic level 4 fish (adult, top predatory sport fish, such as Largemouth Bass) (Central Valley Water Board 2010a). These values are slightly lower than USEPA's national recommended water quality criterion for fish tissue of 0.3 mg Hg/kg wet weight for protection of human health and wildlife (USEPA

2001). Therefore, the Delta average for Largemouth Bass fillet concentrations in the study by Davis et al. exceeds both recommended safe consumption guidelines.

18.4 Impact Analysis

This section describes the potential mechanisms for change in conditions and analytical methods; results of impact analyses; potential mitigation measures; and cumulative effects.

18.4.1 Potential Mechanisms for Change and Analytical Methods

As described in Chapter 4, Approach to Environmental Analysis, the impact analysis considers changes in public health factors related to changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison.

Changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison could change public health factors affected by CVP and SWP operations.

18.4.1.1 Changes in Public Health Factors Related to Available CVP and SWP Agricultural Water Supplies

Changes in water supply availability to agricultural water users could result in reductions of irrigated acreage and related jobs. The availability of jobs can affect public health, as described in Section 18.3.2, Public Health Issues Related to Available Water Supplies. As described in Chapter 12, Agricultural Resources, agricultural acreage would be similar under Alternatives 1 through 5, No Action Alternative, and Second Basis of Comparison. Therefore, the change in public health conditions would be the same under all of the alternatives and the Second Basis of Comparison; and is not analyzed in this EIS.

18.4.1.2 Changes in Public Health Factors Related to Available Municipal Water Supplies

As described in Section 18.3.2, Public Health Issues Related to Available Water Supplies, water supply availability can affect public health related to direct use within the household and indirect effects related to adequate water supplies for industrial and commercial water users that provide employment. As described in Chapter 5, Surface Water Resources and Water Supplies, and Chapter 18, Socioeconomics, t municipal and industrial water users would rely upon alternate water supplies to meet water demands in 2030. Therefore, public health conditions related to availability of municipal and industrial water supplies would be the same under all of the alternatives and the Second Basis of Comparison; and is not analyzed in this EIS.

18.4.1.3 Changes in Public Health Factors Related to Wildland Firefighting and CVP and SWP Reservoir Storage

Stored water in water supply reservoirs is used for wildland firefighting in the California foothills and mountains, including water stored in CVP and SWP reservoirs. During drier periods, reduced storage levels could affect the availability of water for wildlife firefighting, as indicated in changes in CVP and SWP reservoir at the end of September in critical dry water years, as described in Chapter 5, Surface Water Resources and Water Supplies.

Reservoirs that store water in the San Francisco Bay Area, Central Coast, and Southern California regions are managed to store water supplies as part of short-term conveyance management or storage for regional and local water supplies using water from numerous sources and water for wildland firefighting is not known; and therefore, are not analyzed in this EIS.

18.4.1.4 Changes in Public Health Factors Related to Wetlands Restoration and Mosquito-Borne Diseases

Wetlands provide habitat for mosquito breeding, especially in tidally-influenced wetlands with slow moving water and floodplains after the majority of the water recedes. Management practices (e.g., designing wetlands to provide flushing flows, use of biological controls) can reduce the nuisance and public health aspects of mosquito populations. The extent of seasonal floodplains and tidally-influenced wetlands in Yolo Bypass, Cache Slough, and Suisun Marsh areas would increase in a similar manner under all of the alternatives and the Second Basis of Comparison, as described in Chapter 3, Description of Alternatives. Therefore, the potential for changes in public health conditions related to mosquito populations would be the same under all of the alternatives and the Second Basis of Comparison; and is not analyzed in this EIS.

18.4.1.5 Changes in Public Health Factors Related to Potential Valley Fever

As described above, recent studies have indicated that valley fever exposure appears to be related to cultivated lands, including lands that are idled due to agricultural practices or reduced water supply availability. Changes in CVP and SWP operations under the alternatives and the Second Basis of Comparison would not affect the extent of non-irrigated lands. Therefore, the potential for changes in public health conditions related to Valley Fever would be the same under all of the alternatives and the Second Basis of Comparison; and is not analyzed in this EIS.

18.4.1.6 Changes in Public Health Factors Related to Mercury in Fish used for Human Consumption

As described above, fish used for human consumption in the Delta have mercury levels that exceed OEHHA guidelines. Changes in CVP and SWP operations under the alternatives and the Second Basis of Comparison would change the accumulated mercury concentrations in fish in the Delta. As described in Chapter 6, Surface Water Quality, the bioavailability and toxicity of mercury is enhanced through the natural, bacterial conversion of mercury to methylmercury in marshlands or wetlands. These stagnant locations with reduced oxygen concentrations promote chemical reduction processes that make methylation possible. The methylmercury model is based upon the Total Maximum Daily Load translation equation for mercury developed by the Central Valley Regional

Water Quality Control Board. The model estimates fish tissue concentrations from waterborne concentrations of mercury in the Delta and evaluates the potential to cause exceedances of water quality or tissue benchmarks. The tissue concentrations associated with the Alternatives 1 through 5 were compared to the No Action Alternative and the Second Basis of Comparison.

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

This EIS includes two bases of comparison, as described in Chapter 3, Description of Alternatives: the No Action Alternative and the Second Basis of Comparison. Both of these bases are evaluated at 2030 conditions. Changes that would occur over the next 15 years without implementation of the alternatives are not analyzed in this EIS. However, the changes to public health that are assumed to occur by 2030 under the No Action Alternative and the Second Basis of Comparison are summarized in this section. Many of the changed conditions would occur in the same manner under both the No Action Alternative and the Second Basis of Comparison.

18.4.2.1 Common Changes in Conditions under the No Action Alternative and Second Basis of Comparison

Conditions in 2030 would be different than existing conditions due to:

- Climate change and sea level rise
- General plan development throughout California, including increased water demands in portions of Sacramento Valley
- Implementation of reasonable and foreseeable water resources management projects to provide water supplies

It is anticipated that climate change would result in more short-duration high-rainfall events and less snowpack in the winter and early spring months. The reservoirs would be full more frequently by the end of April or May by 2030 than in recent historical conditions. However, as the water is released in the spring, there would be less snowpack to refill the reservoirs. This condition would reduce reservoir storage and available water supplies to downstream uses in the summer. The reduced end of September storage also would reduce the ability to release stored water to downstream regional reservoirs. These conditions would occur for all reservoirs in the California foothills and mountains, including non-CVP and SWP reservoirs.

These changes would result in a decline of the long-term average CVP and SWP water supply deliveries by 2030 as compared to recent historical long-term average deliveries under the No Action Alternative and the Second Basis of Comparison. However, the CVP and SWP water deliveries would be less under the No Action Alternative as compared to the Second Basis of Comparison, as described in Chapter 5, Surface Water Resources and Water Supplies. Due to climate change and related lower snowfall, end of September low reservoir storage would be lower in critical dry years by 2030 as compared to recent historical conditions in Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir. Therefore, the potential for reduced reservoir water supplies for wildland firefighting would be greater under the No Action Alternative and Second Basis of Comparison as compared to recent historical conditions.

Under the No Action Alternative and the Second Basis of Comparison, land uses in 2030 would occur in accordance with adopted general plans.

The No Action Alternative and the Second Basis of Comparison assumes completion of water resources management and environmental restoration projects that would have occurred without implementation of Alternatives 1 through 5, including regional and local recycling projects, surface water and groundwater storage projects, conveyance improvement projects, and desalination projects, as described in Chapter 3, Description of Alternatives. The No Action Alternative and the Second Basis of Comparison also assumes implementation of actions included in the 2008 U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BO) and 2009 National Marine Fisheries Service (NMFS) BO that would have been implemented without the BOs by 2030, as described in Chapter 3, Description of Alternatives.

Under the No Action Alternative and Second Basis of Comparison, it is anticipated that mercury concentrations in fish tissue within the Delta will be either similar or greater than recent historical conditions. Phase 1 of the Delta Mercury Program mandated by the Central Valley RWQCB is currently being completed to protect people eating one meal per week of larger fish from the Delta, including Largemouth Bass. Phase 1 is focused on studies and pilot projects to develop and evaluate management practices to control methylmercury from mercury sources in the Delta and Yolo Bypass; and to reduce total mercury loading to the San Francisco Bay. Following completion of Phase 1 in 2019, Phase 2 will be implemented through 2030. Phase 2 will focus on methylmercury control programs and reduction programs for total inorganic mercury. Due to the extent of these studies, it is not anticipated that changes in methylmercury or total mercury concentrations in fish tissue will be reduced by 2030. Future mercury reduction and control programs will reduce mercury sources and related fish tissue concentrations; however, that will occur after 2030.

18.4.3 Evaluation of Alternatives

As described in Chapter 4, Approach to Environmental Analysis, Alternatives 1 through 5 have been compared to the No Action Alternative; and the No Action Alternative and Alternatives 1 through 5 have been compared to the Second Basis of Comparison.

During review of the numerical modeling analyses used in this EIS, an error was determined in the CalSim II model assumptions related to the Stanislaus River operations for the Second Basis of Comparison, Alternative 1, and Alternative 4 model runs. Appendix 5C includes a comparison of the CalSim II model run results presented in this chapter and CalSim II model run results with the error corrected. Appendix 5C also includes a discussion of changes in the comparison of groundwater conditions for the following alternative analyses.

- No Action Alternative compared to the Second Basis of Comparison
- Alternative 1 compared to the No Action Alternative
- Alternative 3 compared to the Second Basis of Comparison
- Alternative 5 compared to the Second Basis of Comparison

18.4.3.1 No Action Alternative

The No Action Alternative is compared to the Second Basis of Comparison.

18.4.3.1.1 Trinity River Region

Changes in Public Health Factors Related to Wildland Firefighting and CVP and SWP Reservoir Storage

Changes in CVP water supplies and operations under the No Action Alternative as compared to the Second Basis of Comparison would result in similar end of September reservoir elevations in critical dry years (changes within 5 percent) at Trinity Lake, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, the potential for water availability for wildland firefighting would be similar under the No Action Alternative as compared to the Second Basis of Comparison.

18.4.3.1.2 Central Valley Region

Changes in Public Health Factors Related to Wildland Firefighting and CVP and SWP Reservoir Storage

Changes in CVP water supplies and operations under the No Action Alternative as compared to the Second Basis of Comparison would result in similar end of September reservoir elevations in critical dry years (changes within 5 percent) at Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, the potential for water availability for wildland firefighting would be similar under the No Action Alternative as compared to the Second Basis of Comparison.

End of September surface water elevations at San Luis Reservoir in critical dry years would be 6 percent lower under the No Action Alternative as compared to the Second Basis of Comparison. Therefore, the potential for water availability for wildland firefighting would be reduced at San Luis Reservoir under the No Action Alternative as compared to the Second Basis of Comparison.

Changes in Public Health Factors Related to Mercury in Fish used for Human Consumption

Mercury concentrations in Largemouth Bass would be similar (within 5 percent change) in most locations in the Delta, except for Rock Slough, San Joaquin River near Antioch, and Montezuma Slough in Suisun Marsh. In these areas, the mercury concentrations would increase by 7 percent over long-term conditions under the No Action Alternative as compared to the Second Basis of Comparison.

Under dry and critical dry years, mercury concentrations would increase by 7 to 8 percent at Rock Slough, intakes of the Banks and Jones pumping plants, and Victoria Canal. All values exceed the threshold of 0.24 mg/kg ww for mercury.

18.4.3.2 Alternative 1

Alternative 1 is identical to the Second Basis of Comparison. Alternative 1 is compared to the No Action Alternative and the Second Basis of Comparison. However, because CVP and SWP operations under Alternative 1 are identical to conditions under the Second Basis of Comparison; Alternative 1 is only compared to the No Action Alternative.

18.4.3.2.1 Alternative 1 Compared to the No Action Alternative

Trinity River Region

Changes in Public Health Factors Related to Wildland Firefighting and CVP and SWP Reservoir Storage

Changes in CVP water supplies and operations under Alternative 1 as compared to the No Action Alternative would result in similar end of September reservoir elevations in critical dry years at Trinity Lake, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, the potential for water availability for wildland firefighting would be similar under Alternative 1 as compared to the No Action Alternative.

Central Valley Region

Changes in Public Health Factors Related to Wildland Firefighting and CVP and SWP Reservoir Storage

Changes in CVP water supplies and operations under Alternative 1 as compared to the No Action Alternative would result in similar end of September reservoir elevations in critical dry years at Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, the potential for water availability for wildland firefighting would be similar under Alternative 1 as compared to the No Action Alternative.

End of September surface water elevations at San Luis Reservoir in critical dry years would be 7 percent higher under Alternative 1 as compared to the No Action Alternative. Therefore, the potential for water availability for wildland firefighting would be increased at San Luis Reservoir under Alternative 1 as compared to the No Action Alternative.

Changes in Public Health Factors Related to Mercury in Fish used for Human Consumption

Mercury concentrations in Largemouth Bass would be similar in most locations in the Delta, except for Rock Slough, San Joaquin River near Antioch, and Montezuma Slough in Suisun Marsh. In these areas, the mercury concentrations would decrease by 6 percent over the long-term conditions under Alternative 1 as compared to the No Action Alternative. Under dry and critical dry years, mercury concentrations would decrease by 6 to 8 percent at Rock Slough, intakes of the

Banks and Jones pumping plants, and Victoria Canal. All values exceed the threshold of 0.24 mg/kg ww for mercury.

18.4.3.2.2 Alternative 1 Compared to the Second Basis of Comparison

Alternative 1 is identical to the Second Basis of Comparison.

18.4.3.3 Alternative 2

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative; therefore, Alternative 2 is only compared to the Second Basis of Comparison.

18.4.3.3.1 Alternative 2 Compared to the Second Basis of Comparison

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative. Therefore, changes to public health conditions under Alternatives 2 as compared to the Second Basis of Comparison would be the same as the impacts described in Section 18.4.3.1, No Action Alternative.

18.4.3.4 Alternative 3

As described in Chapter 3, Description of Alternatives, CVP and SWP operations under Alternative 3 are similar to the Second Basis of Comparison with modified Old and Middle River flow criteria and New Melones Reservoir operations. As described in Chapter 4, Approach to Environmental Analysis, Alternative 3 is compared to the No Action Alternative and the Second Basis of Comparison.

18.4.3.4.1 Alternative 3 Compared to the No Action Alternative

Trinity River Region

Changes in Public Health Factors Related to Wildland Firefighting and CVP and SWP Reservoir Storage

Changes in CVP water supplies and operations under Alternative 3 as compared to the No Action Alternative would result in similar end of September reservoir elevations in critical dry years at Trinity Lake, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, the potential for water availability for wildland firefighting would be similar under Alternative 3 as compared to the No Action Alternative.

Central Valley Region

Changes in Public Health Factors Related to Wildland Firefighting and CVP and SWP Reservoir Storage

Changes in CVP water supplies and operations under Alternative 3 as compared to the No Action Alternative would result in similar end of September reservoir elevations in critical dry years at Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, the potential for water availability for wildland firefighting would be similar under Alternative 3 as compared to the No Action Alternative.

Changes in Public Health Factors Related to Mercury in Fish used for Human Consumption

Mercury concentrations in Largemouth Bass would be similar (within 5 percent change) in most locations in the Delta, except for San Joaquin River near Antioch and Montezuma Slough in Suisun Marsh. In these areas, the mercury concentrations would decrease by 6 percent over the long-term conditions under Alternative 3 as compared to the No Action Alternative. Mercury concentrations under the dry and critical dry years would be similar throughout the Delta. All values exceed the threshold of 0.24 mg/kg ww for mercury.

18.4.3.4.2 Alternative 3 Compared to the Second Basis of Comparison

Trinity River Region

Changes in Public Health Factors Related to Wildland Firefighting and CVP and SWP Reservoir Storage

Changes in CVP water supplies and operations under Alternative 3 as compared to the Second Basis of Comparison would result in similar end of September reservoir elevations in critical dry years at Trinity Lake, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, the potential for water availability for wildland firefighting would be similar under Alternative 3 as compared to the Second Basis of Comparison.

Central Valley Region

Changes in Public Health Factors Related to Wildland Firefighting and CVP and SWP Reservoir Storage

Changes in CVP water supplies and operations under Alternative 3 as compared to the Second Basis of Comparison would result in similar end of September reservoir elevations in critical dry years at Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, the potential for water availability for wildland firefighting would be similar under Alternative 3 as compared to the Second Basis of Comparison.

Changes in Public Health Factors Related to Mercury in Fish used for Human Consumption

Mercury concentrations in Largemouth Bass would be similar throughout the Delta under Alternative 3 as compared to the Second Basis of Comparison, as summarized in Chapter 6, Surface Water Quality. All values exceed the threshold of 0.24 mg/kg ww for mercury.

18.4.3.5 Alternative 4

The public health conditions under Alternative 4 would be identical to the conditions under the Second Basis of Comparison; therefore, Alternative 4 is only compared to the No Action Alternative.

18.4.3.5.1 Alternative 4 Compared to the No Action Alternative

The CVP and SWP operations under Alternative 4 are identical to the CVP and SWP operations under the Second Basis of Comparison and Alternative 1. Therefore, changes in public health conditions under Alternative 4 as compared to the No Action Alternative would be the same as the impacts described in Section 12.4.4.2.1, Alternative 1 Compared to the No Action Alternative.

18.4.3.6 Alternative 5

As described in Chapter 3, Description of Alternatives, CVP and SWP operations under Alternative 5 are similar to the No Action Alternative with modified Old and Middle River flow criteria and New Melones Reservoir operations. As described in Chapter 4, Approach to Environmental Analysis, Alternative 5 is compared to the No Action Alternative and the Second Basis of Comparison.

18.4.3.6.1 Alternative 5 Compared to the No Action Alternative

Trinity River Region

Changes in Public Health Factors Related to Wildland Firefighting and CVP and SWP Reservoir Storage

Changes in CVP water supplies and operations under Alternative 5 as compared to the No Action Alternative would result in similar end of September reservoir elevations in critical dry years at Trinity Lake, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, the potential for water availability for wildland firefighting would be similar under Alternative 5 as compared to the No Action Alternative.

Central Valley Region

Changes in Public Health Factors Related to Wildland Firefighting and CVP and SWP Reservoir Storage

Changes in CVP water supplies and operations under Alternative 5 as compared to the No Action Alternative would result in similar end of September reservoir elevations in critical dry years at Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, the potential for water availability for wildland firefighting would be similar under Alternative 5 as compared to the No Action Alternative.

Changes in Public Health Factors Related to Mercury in Fish used for Human Consumption

Mercury concentrations in Largemouth Bass would be similar throughout the Delta under Alternative 5 as compared to the No Action Alternative, as summarized in Chapter 6, Surface Water Quality. All values exceed the threshold of 0.24 mg/kg ww for mercury.

18.4.3.6.2 Alternative 5 Compared to the Second Basis of Comparison

Trinity River Region

Changes in Public Health Factors Related to Wildland Firefighting and CVP and SWP Reservoir Storage

Changes in CVP water supplies and operations under Alternative 5 as compared to the Second Basis of Comparison would result in similar end of September reservoir elevations in critical dry years at Trinity Lake, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, the potential for water availability for wildland firefighting would be similar under Alternative 5 as compared to the Second Basis of Comparison.

Central Valley Region

Changes in Public Health Factors Related to Wildland Firefighting and CVP and SWP Reservoir Storage

Changes in CVP water supplies and operations under Alternative 5 as compared to the Second Basis of Comparison would result in similar end of September reservoir elevations in critical dry years at Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, the potential for water availability for wildland firefighting would be similar under Alternative 5 as compared to the Second Basis of Comparison.

End of September surface water elevations at San Luis Reservoir in critical dry years would be 9 percent lower under Alternative 5 as compared to the Second Basis of Comparison. Therefore, the potential for water availability for wildland firefighting would be reduced at San Luis Reservoir under Alternative 5 as compared to the Second Basis of Comparison.

Changes in Public Health Factors Related to Mercury in Fish used for Human Consumption

Mercury concentrations in Largemouth Bass would be similar in most locations in the Delta, except for Rock Slough, San Joaquin River near Antioch, and Montezuma Slough in Suisun Marsh. In these areas, the mercury concentrations would increase by 7 to 8 percent over long-term conditions under Alternative 5 as compared to the Second Basis of Comparison. During dry and critical dry years, mercury concentrations also would increase by 7 percent at intakes to Banks Pumping Plant and Jones Pumping Plant; and 13 percent at Rock Slough. All values exceed the threshold of 0.24 mg/kg ww for mercury.

18.4.3.7 Summary of Environmental Consequences

The results of the environmental consequences of implementation of Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison are presented in Tables 18.2 and 18.3, respectively.

Table 18.2 Comparison of Alternatives 1 through 5 to No Action Alternative

Alternative	Potential Change	Consideration for Mitigation Measures
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

Note: Due to the limitations and uncertainty in the CalSim II monthly model and other analytical tools, incremental differences of 5 percent or less between alternatives and the Second Basis of Comparison are considered to be “similar.”

Table 18.3 Comparison of No Action Alternative and Alternatives 1 through 5 to Second Basis of Comparison

Alternative	Potential Change	Consideration for Mitigation Measures
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.

Note: Due to the limitations and uncertainty in the CalSim II monthly model and other analytical tools, incremental differences of 5 percent or less between alternatives and the Second Basis of Comparison are considered to be “similar.”

18.4.3.8 Potential Mitigation Measures

Mitigation measures are presented in this section to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse environmental effects of Alternatives 1 through 5 as compared to the No Action Alternative. Mitigation measures were not included to address adverse impacts under the alternatives as compared to the Second Basis of Comparison because this analysis was included in this EIS for information purposes only.

Changes in CVP and SWP operations under Alternatives 1 through 5 as compared to the No Action Alternative would not result in changes in public health factors. Therefore, there would be no adverse impacts to public health factors; and no mitigation measures are required.

18.4.3.9 Cumulative Effects Analysis

As described in Chapter 3, the cumulative effects analysis considers projects, programs, and policies that are not speculative; and are based upon known or reasonably foreseeable long-range plans, regulations, operating agreements, or other information that establishes them as reasonably foreseeable.

The cumulative effects analyses for Alternatives 1 through 5 for Public Health are summarized in Table 18.4.

Table 18.4 Summary of Cumulative Effects on Public Health with Implementation of Alternatives 1 through 5 as Compared to the No Action Alternative

Scenarios	Actions	Cumulative Effects of Actions
Past & Present, and Future Actions included in the No Action Alternative in All Alternatives in Year 2030	Consistent with Affected Environment conditions plus: Actions in the 2008 USFWS BO and 2009 NMFS BO that would have occurred without implementation of the BOs, as described in Section 3.3.1.2 (of Chapter 3, Descriptions of Alternatives), including climate change and sea level rise Actions not included in the 2008 USFWS BO and 2009 NMFS BO that would have occurred without implementation of the BOs, as described in Section 3.3.1.3 (of Chapter 3, Descriptions of Alternatives): - Implementation of Federal and state policies and programs, including Clean Water Act (e.g., Total Maximum Daily Loads); Safe Drinking Water Act; Clean Air Act; and flood management programs - General plans for 2030. - Trinity River Restoration Program. - Central Valley Project Improvement Act programs	These effects would be the same under all alternatives. Climate change and sea level rise, development under the general plans, FERC relicensing projects, and some future projects to improve water quality and/or habitat are anticipated to reduce end of September storage in CVP and SWP reservoirs. Mercury concentrations in fish tissue within the Delta will be either similar or greater than recent historical conditions because Phases 1 and 2 of the Delta Mercury Program would be completed by 2030, as mandated by the Central Valley RWQCB, including methylmercury control programs and reduction programs for total inorganic mercury. Due to the extent of these programs, it is anticipated that the programs would be initiated; however, future reductions in mercury sources and related reductions of mercury and

Scenarios	Actions	Cumulative Effects of Actions
	- Folsom Dam Water Control Manual Update - FERC Relicensing for the Middle Fork of the American River Project - Lower Mokelumne River Spawning Habitat Improvement Project - Dutch Slough Tidal Marsh Restoration - Suisun Marsh Habitat Management, Preservation, and Restoration Plan Implementation - Tidal Wetland Restoration: Yolo Ranch, Northern Liberty Island Fish Restoration Project, Prospect Island Restoration Project, and Calhoun Cut/Lindsey Slough Tidal Habitat Restoration Project - San Joaquin River Restoration Program - Future water supply projects, including water recycling, desalination, groundwater banks and wellfields, and conveyance facilities (projects with completed environmental documents)	methylmercury concentrations in fish tissue would actually occur after 2030.
Future Actions considered as Cumulative Effects Actions in All Alternatives in Year 2030	Actions as described in Section 3.5 (of Chapter 3, Descriptions of Alternatives): - Bay-Delta Water Quality Control Plan Update - FERC Relicensing Projects - Bay Delta Conservation Plan (including the California WaterFix alternative) - Shasta Lake Water Resources, North-of-the-Delta Offstream Storage, Los Vaqueros Reservoir Expansion Phase 2, and Upper San Joaquin River Basin Storage Investigations - El Dorado Water and Power Authority Supplemental Water Rights Project - Sacramento River Water Reliability Project - Semitropic Water Storage District Delta Wetlands	These effects would be the same under all alternatives. Reasonably foreseeable storage projects would increase reservoir storage at Shasta Lake and Los Vaqueros Reservoir, and provide new reservoir storage at North-of-the-Delta Offstream Storage, Upper San Joaquin River Basin Storage, and Delta Wetlands.

Scenarios	Actions	Cumulative Effects of Actions
	- North Bay Aqueduct Alternative Intake - San Luis Reservoir Low Point Improvement Project - Future water supply projects, including water recycling, desalination, groundwater banks and wellfields, and conveyance facilities (projects that did not have completed environmental documents during preparation of the EIS)	
No Action Alternative with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO	Climate change and sea level rise, FERC relicensing projects, and some future projects to improve water quality and/or habitat are anticipated to reduce end of September CVP and SWP reservoir storage as compared to past conditions. Mercury and methylmercury concentrations in fish tissue would be similar or greater than past conditions.
Alternative 1 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant)	Implementation of Alternative 1 with future reasonably foreseeable actions would result in similar changes as under the No Action Alternative with the added actions.
Alternative 2 with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO CVP and SWP operational actions No implementation of structural improvements or other actions that require further study to develop a more detailed action description.	Implementation of Alternative 2 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with the added actions.
Alternative 3 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant) Slight increase in positive Old and Middle River flows in the winter and spring months	Implementation of Alternative 3 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with the added actions.

Scenarios	Actions	Cumulative Effects of Actions
Alternative 4 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant)	Implementation of Alternative 4 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with the added actions.
Alternative 5 with Associated Cumulative Effects Actions in Year 20530	Full implementation of the 2008 USFWS BO and 2009 NMFS BO Positive Old and Middle River flows and increased Delta outflow in spring months	Implementation of Alternative 5 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with the added actions.

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Chapter 19

Socioeconomics

19.1 Introduction

This Chapter describes socioeconomic conditions in the Study Area; and potential changes that could occur as a result of implementing the alternatives evaluated in this Environmental Impact Statement (EIS). Implementation of the alternatives could affect socioeconomic conditions through potential changes in operation of the Central Valley Project (CVP) and State Water Project (SWP) that would change CVP and SWP water supply availability to agricultural water users and municipal and industrial (M&I) water users. Changes in CVP and SWP operations also would result in changes to recreational resources at reservoirs that store CVP and SWP water.

Changes in agricultural production, including costs to provide Alternative water supplies when CVP and SWP water supplies are not available, are presented in Chapter 12, Agricultural Resources. Changes in reservoir recreational opportunities that would occur due to reduction in reservoir storage elevations are presented in Chapter 15, Recreational Resources. The results of these analyses are summarized in Section 19.4, Environmental Consequences, of this Chapter and considered in the determination of regional socioeconomics effects.

19.2 Regulatory Environment and Compliance Requirements

Potential actions that could be implemented under the alternatives evaluated in this EIS could affect socioeconomic conditions in portions of the Study Area affected by or served by CVP and SWP water supplies. Actions located on public agency lands; or implemented, funded, or approved by Federal and state agencies would need to be compliant with appropriate Federal and state agency policies and regulations, as summarized in Chapter 4, Approach to Environmental Analyses.

19.3 Affected Environment

This section describes socioeconomic conditions that could be potentially affected by implementation of the alternatives considered in this EIS. The socioeconomic conditions described in this Chapter are related to population, employment, income, and taxes.

Housing information is not described in this Chapter because implementation of the No Action Alternative, Second Basis of Comparison, and Alternatives 1 through 5 would not result in changes to land use that would displace or relocate housing stocks. Land use would be the same under the No Action Alternative, Second Basis of Comparison, and Alternatives 1 through 5, as described in Chapter 13, Land Use. The only changes in land use between recent historical conditions and conditions in 2030 for the No Action Alternative, Second Basis of Comparison, and Alternatives 1 through 5 would occur due to ecosystem restoration on agricultural lands, open space, and public lands that do not support housing units.

19.3.1 Characterization of Socioeconomic Conditions

Characterization of the socioeconomic conditions within the Study Area is based upon publically available data sources. The data sources used include the U.S. Census Bureau, U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics, California Department of Finance, California Employment Development Department, and California Board of Equalization. The data were summarized and used to compare historical and current trends in the socioeconomic conditions in the Study Area.

Population and income data used to characterize the socioeconomic conditions are reported from 2000 to 2012 by the California Department of Finance.

The employment data presented in this Chapter are reported from 2001 to 2008 and from 2008 to 2012 (the latest values from consistent data sources). The first period from 2001 to 2008 represents a period of time prior to implementation of the 2008 U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BO) and the 2009 National Marine Fisheries Service (NMFS) BO. The second period from 2008 to 2012 represents a period of time following implementation of the 2008 USFWS BO and 2009 NMFS BO.

There are two estimates of employment that are typically used to describe employment. The civilian labor force employment data compiled by the Bureau of Labor Statistics reflect the employment status of individuals that are covered by unemployment insurance by “place of residence,” and includes the self-employed, employees on unpaid leave of absence, unpaid family workers, and household workers. These data do not include sole proprietors, some self-employed, and some farm workers and domestic workers. Employment by industry data compiled by the Bureau of Economic Analysis, including farm employment, reflect jobs by “place of work” and include sole proprietors and active partners, self-employed, farm workers, and domestic workers. Individuals with more than one job are counted only once in civilian labor force data and counted in each job in the employment by industry data. Therefore, the employment by industry data are greater than the civilian labor force data.

19.3.2 Trinity River Region

The Trinity River Region includes the area in Trinity County along the Trinity River from Trinity Lake to the confluence with the Klamath River; and in Humboldt and Del Norte counties along the lower Klamath River from the confluence with the Trinity River to the Pacific Ocean. Tribal lands along the Trinity or lower Klamath River within the Trinity River Region include the

Hoopa Valley Indian Reservation, Yurok Indian Reservation, and Resighini Rancheria.

Trinity County includes extensive trails, lakes, and the Trinity River Scenic Byway, providing several venues for outdoor enthusiasts and travelers. The recreation and tourism industries are major contributors to the local economy of Trinity County (EDD 2013).

Humboldt County is the largest and most populous of the north coast counties. Its 2012 population of 134,728 ranked 35th among the 58 counties in California (EDD 2014a). Humboldt County encompasses 2.3 million acres, 80 percent of which is forestlands, protected redwoods and recreation areas (Humboldt County 2014). Humboldt County is the leading timber producing county in the state (CDFA 2014). As described in Chapter 13, Land Use, the portion of Humboldt County in the Trinity River Region evaluated in this EIS is located along the Trinity and Klamath rivers. This portion of the county includes the communities of Willow Creek and Orleans within Humboldt County; Hoopa in the Hoopa Valley Indian Reservation; and the communities of Weitchpec, Cappell, Pecwan, and Johnson’s in the Yurok Tribe Indian Reservation (Humboldt County 2012).

Del Norte County is the northernmost county in California. The county includes Redwood National Park and other state parks making tourism a natural industry in the county (EDD 2014b). As described in Chapter 13, Land Use, the portion of Del Norte County in the Trinity River Region evaluated in this EIS is located along the lower Klamath River. Most of this area is located within the Yurok Indian Reservation, and includes the communities of Requa and Klamath (Del Norte County 2003).

19.3.2.1 Population

Population in the Trinity River Region, by county and for the region as a whole, is presented in Table 19.1. The population of Trinity River Region has increased, although at a small average annual growth rate for the period shown.

Table 19.1 Population Characteristics in Trinity River Region

Area	Population 2000	Population 2012	Average Annual Growth Rate (percent) 2000-2012
Trinity County	13,022	13,471	0.3
Humboldt County	126,518	134,728	0.5
Del Norte County	27,507	28,527	0.3
Total Trinity River Region	167,047	176,726	0.5
STATE OF CALIFORNIA	**33,873,086**	**37,427,946**	**0.9**

Sources: DOF 2013a, 2013b, 2014

Tribal enrollment for the Hoopa Valley Tribe, Yurok Tribe, Karuk Tribe, and Resighini Rancheria as reported by the Bureau of Indian Affairs is presented in Table 19.2. These values do not necessarily include all members that live within the area, and should be considered as representative of trends. Values were only available for the years of 2001, 2003, 2005, and 2013.

Table 19.2 Tribal Enrollment in Trinity River Region

Tribe	2001	2003	2005	2013
Hoopa Valley Tribe	1,893	1,893	1,893	1,719[a]
Yurok Tribe	4,466	4,466	4,912	Not available
Karuk Tribe	3,165	3,165	3,427	Not available
Resighini Rancheria	90	175	111	Not available
TOTAL	**9,614**	**9,699**	**10,343**	**–**

Sources: BIA 2003, 2006, 2008, 2014

Note:
a. Value is reported as population, not enrollment, for Hoopa Valley Tribe in 2013.

19.3.2.2 Employment

Civilian labor force characteristics for the Trinity River Region are presented in Table 19.3. The civilian labor force (composed of employment and unemployment) in the Trinity River Region increased between 2001 and 2008 and between 2008 and 2012 (BLS 2014).

Table 19.3 Civilian Labor Force and Unemployment Rates in Trinity River Region

Area	Civilian Labor Force (subject to unemployment insurance)			Unemployment Rate (percent)		
	2001	2008	2012	2001	2008	2012
Trinity County	5,394	4,855	5,019	9.3	12.7	15.8
Humboldt County	60,443	60,039	60,144	6.0	7.2	10.5
Del Norte County	10,221	11,376	11,381	8.0	8.8	13.4
Total Trinity River Region	76,058	76,270	76,544	6.5	7.8	11.2
STATE OF CALIFORNIA	**17,152,106**	**18,392,000**	**18,494,881**	**5.4**	**7.2**	**10.5**

Source: BLS 2014

Available labor force and unemployment rates for members of the tribes in the Trinity River Region are presented in Table 19.4. These individuals may or may not be included in the values presented in Table 19.3 because different sources are used for each table.

Table 19.4 Available Labor Force and Unemployment Rates Related to the Tribes in Trinity River Region

Area	Civilian Labor Force				Unemployment Rate (percent)			
	2001	2003	2005	2013	2001	2003	2005	2013
Hoopa Valley Tribe	1,043	1,043	1,043	NA	40	40	40	42
Yurok Tribe	2,151	2,151	1,096	NA	74	74	74	38
Karuk Tribe	3,307	3,307	915	NA	14	14	63	29
Resighini Rancheria	37	44	45	NA	57	59	60	NA

Sources: BIA 2003, 2006, 2008, 2014

Note:
NA = Not Available

Total employment and the farm employment in 2001, 2008 and 2012 in the Trinity River Region counties are presented in Table 19.5. The Trinity River Region farm employment represents less than 1 percent of farm employment in the state and the lowest amount of farm employment in counties within the Study Area, as indicated in Figure 19.1.

Table 19.5 Employment in Trinity River Region

Area	Total Employment			Farm Employment[a]		
	2001	2008	2012	2001	2008	2012
Trinity County	4,878	4,930	4,788	155	161	165
Humboldt County	68,596	71,552	68,861	1,662	1,383	1,227
Del Norte County	10,266	11,531	10,720	384	309	231
Total Trinity River Region	83,740	88,013	84,369	2,201	1,853	1,623
STATE OF CALIFORNIA	**19,411,367**	**20,820,306**	**20,653,860**	**479,283**	**438,013**	**443,764**

Source: BEA 2014a.

Note:
a. Farm employment includes employment numbers in forestry, fishing, and related activities.

19.3.2.3 Income

Per capita personal income for the Trinity River Region counties for 2000, 2008, and 2012 is presented in Table 19.6. Humboldt County had the highest per capita income, and Del Norte County had the lowest.

Table 19.6 Per Capita Personal Income in Trinity River Region

Area	Per Capita Personal Income			Average Annual Growth Rate (percent)	
	2000	2008	2012	2000-2008	2008-2012
Trinity County	$20,489	$28,861	$34,027	4.4	4.2
Humboldt County	$23,980	$32,859	$35,681	4.0	2.1
Del Norte County	$18,563	$26,420	$30,016	4.5	3.2
Total Trinity River Region	$22,818	$31,497	$34,647	4.1	2.4
STATE OF CALIFORNIA	**$33,404**	**$44,003**	**$43,647**	**3.5**	**1.4**

Source: BEA 2014e

19.3.2.4 Local Government Finances

The sales tax rates, as of April 1, 2014, were 7.5 percent in all three counties in the Trinity River Region (BOE 2014). Total annual taxable sales within the Trinity River Region in 2000, 2008, and 2012 are presented in Table 19.7. The region's total taxable sales represents less than one tenth of one percent of total annual state taxable sales.

Table 19.7 Total Taxable Sales in Trinity River Region

Area	Total Taxable Sales (millions)			Average Annual Growth Rate (percent)	
	2000	2008	2012	2000-2008	2008-2012
Trinity County	$61	$74	$87	2.6	3.9
Humboldt County	$1,293	$1,693	$1,768	3.4	1.1
Del Norte County	$176	$232	$226	3.5	-0.6
Total Trinity River Region	$1,530	$1,999	$2,081	3.4	1.0
STATE OF CALIFORNIA	**$441,854**	**$531,654**	**$407,714**	**2.3**	**-6.4**

Sources: BOE 2000, 2008, 2012

Total property tax charges (secured and unsecured) within the Trinity River Region in Fiscal Year 2011-2012 were $160.2 million (California State Controller 2012). The Humboldt County share of the total property tax revenues was the largest at $126 million. The Del Norte and Trinity counties contributions to the total were $19 million and $13 million, respectively.

19.3.3 Central Valley Region

The Central Valley Region extends from above Shasta Lake to the Tehachapi Mountains, and includes the Sacramento Valley, San Joaquin Valley, and Delta and Suisun Marsh subregions.

19.3.3.1 Sacramento Valley

The Sacramento Valley includes the counties of Shasta, Plumas, Tehama, Glenn, Colusa, Butte, Sutter, Yuba, Nevada, Placer, and El Dorado counties. Sacramento, Yolo, and Solano counties also are located within the Sacramento Valley; however, these counties are discussed below as part of the Delta and Suisun Marsh subsection. Other counties in Sacramento Valley are not anticipated to be affected by changes in CVP and SWP operations, and are not discussed here, including: Alpine, Sierra, Lassen, and Amador counties.

The Sacramento Valley includes major agricultural counties, including Glenn, Colusa, Sutter and Placer counties, as described in Chapter 12, Agricultural Resources. The region also includes some of the leading major timber producing counties of the state. Shasta County is the second and Plumas County is the fifth among the leading timber producing counties in the state.

19.3.3.1.1 Population

Population characteristics in the Sacramento Valley portion of the Central Valley Region are presented in Table 19.8. Among the counties evaluated in the Sacramento Valley portion of the Central Valley Region, Placer County had the highest average annual population growth rate between 2000 and 2012; and Plumas County was the only county with a reduction in population.

Table 19.8 Population Characteristics in Central Valley Region – Sacramento Valley

Area	Population		Average Annual Growth Rate (percent)
	2000	2012	2000-2012
Shasta County	163,256	177,516	0.8
Plumas County	20,824	19,901	-0.4
Tehama County	56,039	62,985	1.1
Glenn County	26,453	28,105	0.6
Colusa County	18,804	21,552	1.2
Butte County	203,171	220,465	0.7
Yuba County	60,219	72,642	1.6
Nevada County	92,033	97,366	0.5
Sutter County	78,930	94,620	1.7
Placer County	248,399	351,463	3.2
El Dorado County	156,299	180,483	1.3
Sacramento Valley Subtotal	1,124,427	1,333,615	1.4
Total Central Valley Region	6,214,316	7,408,750	1.5
STATE OF CALIFORNIA	**33,873,086**	**37,668,804**	**0.9**

Sources: DOF 2013a, 2013b, 2014

19.3.3.1.2 Employment

Civilian labor force characteristics for the counties in the Sacramento Valley portion of the Central Valley Region are presented in Table 19.9. The civilian labor force increased between 2001 and 2012. The data for 2008 represents the employment situation immediately following the recent economic recession that started in 2007. The average unemployment rate in the civilian labor force increased from 2001 to 2012. The average unemployment rate in the Sacramento Valley portion of the Central Valley Region between 2001 and 2012 has been higher than the state unemployment rate; and lower than for the counties in the Central Valley Region.

Table 19.9 Civilian Labor Force and Unemployment Rates in Central Valley Region – Sacramento Valley

Area	Civilian Labor Force (subject to unemployment insurance)			Unemployment Rate (percent)		
	2001	2008	2012	2001	2008	2012
Shasta County	77,647	82,675	81,245	6.3	10.0	13.4
Plumas County	9,958	9,824	9,478	7.6	10.5	14.7
Tehama County	24,574	25,185	25,251	6.5	9.2	13.9
Glenn County	11,239	12,196	12,841	8.8	10.4	14.7
Colusa County	9,130	10,505	11,860	12.8	13.7	20.0
Butte County	95,216	102,952	102,063	6.6	8.4	12.2
Yuba County	24,862	27,729	27,772	8.5	11.8	16.9
Nevada County	46,947	50,428	50,742	4.4	6.5	9.4
Sutter County	38,457	41,100	42,810	9.7	12.3	17.6
Placer County	139,106	177,243	178,818	4.0	6.4	9.4
El Dorado County	84,064	90,732	90,525	4.3	6.9	10.4
Sacramento Valley Subtotal	561,200	630,569	633,405	5.8	8.3	12.0
Total Central Valley Region	3,519,870	3,885,435	3,990,083	6.8	8.7	12.6
STATE OF CALIFORNIA	**17,152,106**	**18,392,000**	**18,494,881**	**4.9**	**7.2**	**10.5**

Source: BLS 2014

Total employment and farm employment in 2001, 2008, and 2012 in the Sacramento Valley portion of the Central Valley Region are presented in Table 19.10. The contribution of farm employment to the total employment in the Sacramento Valley portion of the Central Valley Region declined between 2001 and 2008 and increased slightly by 2012.

Table 19.10 Employment in Central Valley Region – Sacramento Valley

Area	Total Employment			Farm Employment		
	2001	2008	2012	2001	2008	2012
Shasta County	85,937	91,883	86,696	1,821	1,781	1,751
Plumas County	10,813	10,524	9,493	288	140	138
Tehama County	23,760	24,284	22,669	2,716	2,332	3,042
Glenn County	11,526	11,987	11,856	2,873	1,927	2,049
Colusa County	9,770	10,863	11,266	2,943	1,954	1,831
Butte County	99,757	105,703	101,805	5,293	4,618	4,527
Yuba County	26,162	26,473	26,861	2,494	1,722	1,623
Nevada County	51,323	57,968	55,898	1,161	1,153	1,089
Sutter County	39,489	43,764	43,329	5,454	4,165	4,427
Placer County	158,070	192,171	188,729	2,064	1,925	1,844
El Dorado County	78,052	95,608	90,435	1,937	1,849	1,737
Sacramento Valley Subtotal	594,659	671,228	649,037	29,044	23,566	24,058
Total Central Valley Region	3,616,241	3,997,557	3,923,230	256,672	226,321	230,832
STATE OF CALIFORNIA	**19,411,367**	**20,820,306**	**20,653,860**	**479,283**	**438,013**	**443,764**

Source: BEA 2014a

Note:
Farm employment includes employment numbers in forestry, fishing, and related activities.

The annual farm employment for the Sacramento Valley portion of the Central Valley Region declined in 2004 and remained relatively stable through 2012, as shown in Figure 19.2. The overall trend in farm employment is influenced by the farm employment trends in Butte, Sutter, Tehama, Colusa, and Glenn counties, as shown in Figure 19.3. The decrease in farm employment is related to the reduction in cultivated acreage during this period, as described in Chapter 12, Agricultural Resources.

The farm employment numbers presented in Table 19.10 include only workers directly involved in farming, forestry, and fishing activities. However, farming is one of the most important basic industries in the Central Valley Region; and supports many other businesses including farm inputs (e.g., fertilizer, seed, machinery, and fuel) and processing of food and fiber grown on farms. As a result, employment both directly on farm and indirectly dependent on farming is higher than the values displayed in Table 19.10.

19.3.3.1.3 Income

The average per capita personal incomes for the counties in the Sacramento Valley portion of the Central Valley Region are presented in Table 19.11. Per capita personal incomes increased by an average annual rate of between 3 and 6 percent from 2000 to 2008. Following the economic downturn that started in 2007, the average annual growth in per capita personal income slowed between 2008 and 2012, except in Tehama County.

Table 19.11 Per Capita Personal Income in Central Valley Region – Sacramento Valley

Area	Per Capita Personal Income			Average Annual Growth Rate (percent)	
	2000	2008	2012	2000-2008	2008-2012
Shasta County	$25,385	$34,995	$37,593	4.1	1.8
Plumas County	$26,415	$38,401	$43,085	4.8	2.9
Tehama County	$19,461	$25,805	$30,094	3.6	3.9
Glenn County	$20,210	$32,054	$38,568	5.9	4.7
Colusa County	$24,656	$39,568	$45,800	6.1	3.7
Butte County	$23,143	$32,379	$35,696	4.3	2.5
Yuba County	$19,537	$27,655	$32,835	4.4	4.4
Nevada County	$32,253	$44,960	$47,924	4.2	1.6
Sutter County	$25,581	$33,117	$36,243	3.3	2.3
Placer County	$38,034	$49,436	$52,544	3.3	1.5
El Dorado County	$37,397	$50,052	$54,533	3.7	2.2
Average in Sacramento Valley Counties	$29,317	$40,177	$43,873	4.0	2.2
Central Valley Region	$28,163	$37,207	$40,619	3.5	2.2
STATE OF CALIFORNIA	**$33,404**	**$44,003**	**$46,477**	**3.5**	**1.4**

Source: BEA 2014e

19.3.3.1.4 Local Government Finances

As of April 1, 2014, the county sales tax rates in the counties within the Sacramento Valley portion of the Central Valley Region was 7.5 percent for all counties except Nevada County (BOE 2014). The Nevada County sales tax rate was 7.625 percent. These rates include the state, county, local and district taxes.

The total annual taxable sales in the Sacramento Valley portion of the Central Valley Region in 2000, 2008, and 2012 are presented in Table 19.12. The total taxable sales represent about 3 percent of total annual state taxable sales. The lower rates of growth for the period 2008 to 2012 may be attributable to the effects of the recession that started in 2007 and a decline in employment, as discussed above.

Table 19.12 Total Taxable Sales in Central Valley Region – Sacramento Valley

Area	Total Taxable Sales (millions)			Average Annual Growth Rate	
	2000	2008	2012	2000-2008	2008-2012
Shasta County	$2,055	$2,641	$2,642	3.2	0.0
Plumas County	$187	$222	$197	2.1	-2.9
Tehama County	$470	$684	$748	4.8	2.3
Glenn County	$231	$318	$327	4.1	0.7
Colusa County	$223	$329	$337	5.0	0.6
Butte County	$2,039	$2,678	$2,714	3.5	0.3
Yuba County	$392	$515	$486	3.5	-1.4
Nevada County	$997	$1,187	$1,105	2.2	-1.8
Sutter County	$1,021	$1,287	$1,367	2.9	1.5
Placer County	$4,742	$6,635	$7,066	4.3	1.6
El Dorado County	$1,324	$1,788	$1,740	3.8	-0.7
Sacramento Valley Subtotal	$13,680	$18,283	$18,729	3.7	0.6
Central Valley Region	$83,363	$109,401	$114,959	3.5	1.2
STATE OF CALIFORNIA	**$441,854**	**$531,654**	**$407,714**	**2.3**	**-6.4**

Sources: BOE 2000, 2008, 2012

Combined (secured and unsecured) property tax revenues in each of the counties in the Sacramento Valley portion of the Central Valley Region for Fiscal Year 2011-2012 are presented in Table 19.13. Total property tax revenues from these counties accounted for about 3 percent of the total state property tax revenues.

Table 19.13 Property Tax Revenues, Fiscal Year 2011-2012, in Central Valley Region – Sacramento Valley

Area	Property Tax Revenues (millions)
Shasta County	$168
Plumas County	$41
Tehama County	$48
Glenn County	$30
Colusa County	$36
Butte County	$203
Yuba County	$62
Nevada County	$183
Sutter County	$103
Placer County	$692
El Dorado County	$300
Sacramento Valley Subtotal	$1,866
Central Valley Region	$9,874
STATE OF CALIFORNIA	**$55,459**

Source: California State Controller 2012

19.3.3.2 San Joaquin Valley

The San Joaquin Valley includes the counties of Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern counties. San Joaquin County also is located within the San Joaquin Valley; however, this county is discussed below as part of the Delta and Suisun Marsh subsection. Other counties in the San Joaquin Valley are not anticipated to be affected by changes in CVP and SWP operations, and are not discussed here, including: Calaveras, Mariposa, and Tuolumne counties.

The San Joaquin Valley includes the major agricultural counties, of Fresno, Kern, Kings and Tulare, as described in Chapter 12, Agricultural Resources.

19.3.3.2.1 Population

Population characteristics in the San Joaquin Valley portion of the Central Valley Region are presented in Table 19.14. Among the counties in the San Joaquin Valley portion of the Central Valley Region, Kern County had the highest average annual population growth rate between 2000 and 2012; and Stanislaus and Kings counties had the lowest growth rate.

Table 19.14 Population Characteristics in Central Valley – San Joaquin Valley

Area	Population		Average Annual Growth Rate (percent)
	2000	2012	2000-2012
Stanislaus County	446,997	519,339	1.3
Madera County	123,109	152,325	1.8
Merced County	210,554	260,029	1.8
Fresno County	799,407	943,493	1.4
Tulare County	368,021	451,540	1.7
Kings County	129,461	151,774	1.3
Kern County	661,653	849,977	2.1
San Joaquin Valley Subtotal	2,739,202	3,328,477	1.6
Total Central Valley Region	6,062,064	7,238,742	1.5
STATE OF CALIFORNIA	**33,873,086**	**37,668,804**	**0.9**

Sources: DOF 2013a, 2013b, 2014

19.3.3.2.2 Employment

Civilian labor force characteristics for the counties in the San Joaquin Valley portion of the Central Valley Region are presented in Table 19.15. The civilian labor force increased between 2001 and 2012. The data for 2008 represents the employment situation immediately following the recession that started in 2007. The average unemployment rate in the civilian labor force increased from 2001 to 2012. The average unemployment rates for the San Joaquin Valley portion of the Central Valley Region between 2001 and 2012 have been higher than for the entire Central Valley Region and the state.

Table 19.15 Civilian Labor Force and Unemployment Rates in Central Valley Region – San Joaquin Valley

Area	Civilian Labor Force (subject to unemployment insurance)			Unemployment Rate (percent)		
	2001	2008	2012	2001	2008	2012
Stanislaus County	214,292	231,965	239,461	8.3	11.0	15.2
Madera County	53,956	65,100	68,167	9.6	9.4	13.6
Merced County	91,825	102,251	111,322	10.1	12.5	17.0
Fresno County	389,805	430,163	442,453	10.7	10.5	15.2
Tulare County	175,357	199,124	207,634	11.4	10.8	15.8
Kings County	50,233	58,801	60,886	10.7	10.5	15.3
Kern County	297,982	359,573	396,657	8.6	9.8	13.3
San Joaquin Valley Subtotal	1,273,450	1,446,977	1,526,580	9.8	10.5	14.9
Total Central Valley Region	3,448,061	3,807,278	3,911,569	6.8	8.7	12.6
STATE OF CALIFORNIA	**17,152,106**	**18,392,000**	**18,494,881**	**4.9**	**7.2**	**10.5**

Source: BLS 2014

Total employment and farm employment in 2001, 2008 and 2012 in the San Joaquin Valley portion of the Central Valley Region are presented in Table 19.16. The contribution of farm employment to the total employment declined between 2001 and 2008, and then increased slightly in 2012, except in Tulare County. In Tulare County, farm employment increased between 2001 and 2008 and decreased between 2008 and 2012.

Table 19.16 Employment in Central Valley Region – San Joaquin Valley

Area	Total Employment			Farm Employment		
	2001	2008	2012	2001	2008	2012
Stanislaus County	208,016	221,632	214,446	18,708	16,000	15,784
Madera County	50,975	59,354	59,027	6,296	4,750	5,186
Merced County	82,803	92,891	93,766	14,147	12,029	8,075
Fresno County	401,025	446,939	437,934	56,655	50,798	51,277
Tulare County	168,523	191,195	186,875	42,851	38,080	36,369
Kings County	48,960	57,513	55,008	4,705	4,061	6,620
Kern County	311,946	369,152	386,642	46,307	47,661	52,583
San Joaquin Valley Subtotal	1,272,248	1,438,676	1,433,698	189,669	173,379	175,894
Total Central Valley Region	3,616,241	3,997,557	3,923,230	256,672	226,321	230,832
STATE OF CALIFORNIA	**19,411,367**	**20,820,306**	**20,653,860**	**479,283**	**438,013**	**443,764**

Source: BEA 2014a

Note:
Farm employment includes employment numbers in forestry, fishing, and related activities.

Annual farm employment for the San Joaquin Valley portion of the Central Valley Region declined in 2004 and continued to fluctuate through 2012, as shown in Figure 19.2. Farm employment in the San Joaquin Valley portion of the Central Valley Region represents a major portion of the overall farm employment in the Central Valley.

Within the counties in the San Joaquin Valley portion of the Central Valley Region, farm employment declined between 2003 and 2006 and remained about the same between 2007 and 2012. The overall trend in farm employment is influenced by the farm employment trends in Fresno, Kern, and Tulare counties, as shown in Figure 19.4. The decrease in farm employment is related to the reduction in cultivated acreage during this period, as described in Chapter 12, Agricultural Resources.

The farm employment numbers presented in Table 19.16 include only workers directly involved in farming, forestry, and fishing activities. However, farming is one of the most important basic industries in the Central Valley; and supports many other businesses including farm inputs (e.g., fertilizer, seed, machinery, and fuel) and processing of food and fiber grown on farms. As a result, employment both directly on farm and indirectly dependent on farming is higher than the values displayed in Table 19.16.

Total farm-dependent employment is not reported in the U.S. Bureau of Economic Analysis or the U.S. Bureau of Labor Statistics; however, the employment values can be estimated by studies of local economies. A study of the local economy in four counties of the San Joaquin Valley found that, for every on-farm job, about two and one-half additional jobs are supported because of inputs purchased for farming operations (NEA 1997). This estimate includes the associated effects of workers on those farms and businesses spending their incomes on other purchases; however, the estimated values do not include employment in the processing sector. Another study indicated that the employment multiplier of the agricultural production and processing industry is 1.92, or that for every 100 agricultural production and processing jobs in the San Joaquin Valley, 92 other jobs were created in the San Joaquin Valley (UCAIC 2009).

San Joaquin Valley employment also includes employment associated with adult prison facilities. The San Joaquin Valley portion of the Central Valley Region includes eight (or about 24 percent) of the 33 adult prison facilities operated by the California Department of Corrections and Rehabilitation. These prisons are home to about a quarter of the total prison population in the state and employ about a quarter of the total prison staff in the state. Employment for these prisons is summarized in Table 19.17.

Table 19.17 California State Prisons in Central Valley Region - San Joaquin Valley

Prison Facility	Location	Staff
Central California Women's Facility	Chowchilla, Madera County	1,064
Valley State Prison	Chowchilla, Madera County	1,021
Pleasant Valley State Prison	Coalinga, Fresno County	1,357
Avenal State Prison	Avenal, Kings County	1,475
California State Prison	Corcoran, Kings County	2,003
Wasco State Prison	Wasco, Kern County	1,523
North Kern State Prison	Delano, Kern County	1,393
Kern Valley State Prison	Delano, Kern County	1,545

Sources: CDCR 2014a, 2014b, 2014c, 2014d, 2014e, 2014f, 2014g, 2014h

Federal prisons are located at Atwater in Merced County, Mendota in Fresno County, and Taft in Kern County within the San Joaquin Valley portion of the Central Valley Region (BOP 2014).

19.3.3.2.3 Income

The average per capita personal income in the San Joaquin Valley portion of the Central Valley Region was lower than that for the entire Central Valley Region, as presented in Table 19.18. The average per capita personal income in the San Joaquin Valley portion of the Central Valley Region was a little more than two-thirds of the average per capita personal income in the Central Valley Region and the state. With the exception of Stanislaus County, most counties in the San Joaquin Valley portion of the Central Valley Region had higher annual average growth in per capita personal income between 2000 and 2008 than the entire Central Valley Region and the state.

Table 19.18 Per Capita Personal Income in Central Valley Region – San Joaquin Valley

Area	Per Capita Personal Income			Average Annual Growth Rate (percent)	
	2000	2008	2012	2000-2008	2008-2012
Stanislaus County	$24,284	$31,093	$34,138	3.1	2.4
Madera County	$18,983	$26,693	$31,169	4.4	4.0
Merced County	$19,976	$26,963	$30,630	3.8	3.2
Fresno County	$23,001	$30,977	$34,074	3.8	2.4
Tulare County	$20,070	$28,035	$31,307	4.3	2.8
Kings County	$16,912	$26,339	$31,835	5.7	4.9
Kern County	$21,507	$29,527	$34,453	4.0	3.9
Average in San Joaquin Valley Counties	$21,755	$29,505	$33,303	3.9	3.1
Central Valley Region	$28,183	$37,198	$40,601	3.5	2.2
STATE OF CALIFORNIA	**$33,404**	**$44,003**	**$46,477**	**3.5**	**1.4**

Source: BEA 2014e

19.3.3.2.4 Local Government Finances

As of April 1, 2014, the county sales tax rates in the counties within the San Joaquin Valley portion of the Central Valley ranged from 7.5 percent in Merced, Kern, and Kings counties to 8.225 percent in Fresno County (BOE 2014).

The total annual taxable sales for the counties in the San Joaquin Valley portion of the Central Valley Region in 2000, 2008, and 2012 are presented in Table 19.19. The contribution of the area to California total annual taxable sales increased between 2000 and 2012. The lower rates of growth for the period 2008 to 2012 may be attributable to the effects of the recession that started in 2007 and a decline in employment, as discussed above.

Table 19.19 Total Taxable Sales in Central Valley Region – San Joaquin Valley

Area	Total Taxable Sales (millions)			Average Annual Growth Rate (percent)	
	2000	2008	2012	2000-2008	2008-2012
Stanislaus County	$5,195	$6,729	$7,178	3.3	1.6
Madera County	$881	$1,327	$1,356	5.2	0.5
Merced County	$1,740	$2,388	$2,512	4.0	1.3
Fresno County	$8,472	$11,729	$12,021	4.2	0.6
Tulare County	$3,222	$4,755	$5,499	5.0	3.7
Kings County	$888	$1,389	$1,386	5.8	-0.1
Kern County	$6,938	$12,086	$14,666	7.2	5.0
Total San Joaquin Valley	$27,337	$40,403	$44,619	5.0	2.5
Central Valley Region	$81,975	$107,699	$113,368	3.5	1.3
STATE OF CALIFORNIA	**$441,854**	**$531,654**	**$407,714**	**2.3**	**-6.4**

Sources: BOE 2000, 2008, 2012

The combined (secured and unsecured) property tax revenues in each of the counties in the San Joaquin Valley portion of the Central Valley Region for Fiscal Year 2011-2012 are presented in Table 19.20. Total property tax revenues from these counties accounted for about 6 percent of the total state property tax revenues.

Table 19.20 Property Tax Revenues, Fiscal Year 2011-2012, in Central Valley Region – San Joaquin Valley

Area	Property Tax Revenues (millions)
Stanislaus County	$426
Madera County	$128
Merced County	$197
Fresno County	$755
Tulare County	$327
Kings County	$104
Kern County	$1,102
San Joaquin Valley Subtotal	$3,039
Central Valley Region	$9,874
STATE OF CALIFORNIA	**$55,459**

Source: California State Controller 2012

19.3.3.3 Delta and Suisun Marsh

The Delta and Suisun Marsh portion of the Central Valley Region includes Sacramento, Yolo, Solano, San Joaquin, and Contra Costa counties. These counties include some of the leading agricultural areas in the state. In addition to agriculture, this area includes important transportation infrastructures including inland shipping ports (Port of West Sacramento and Port of Stockton); major employment centers (cities of Sacramento, West Sacramento, Fairfield, Stockton, and Concord); and water-based recreation activities (e.g., boating, fishing, and water skiing).

19.3.3.3.1 Population

Population characteristics in the counties of the Delta and Suisun Marsh portion of the Central Valley Region are presented in Table 19.21. San Joaquin County had the highest average annual population growth rate between 2000 and 2012, and Solano County had the lowest growth rate.

Table 19.21 Population Characteristics in Central Valley Region – Delta and Suisun Marsh

Area	Population		Average Annual Growth Rate (percent)
	2000	2012	2000-2012
Sacramento County	1,223,499	1,433,525	1.3
Yolo County	168,660	204,349	1.6
Solano County	394,930	415,787	0.4
San Joaquin County	563,598	692,997	1.7
Contra Costa County	948,816	1,066,602	1.0
Delta and Suisun Marsh Subtotal	3,299,503	3,813,260	1.2
Total Central Valley Region	6,062,064	7,238,742	1.5
STATE OF CALIFORNIA	**33,873,086**	**37,668,804**	**0.9**

Sources: DOF 2013a, 2013b, 2014

19.3.3.3.2 Employment

Civilian labor force characteristics for the Sacramento, Yolo, Solano, San Joaquin, and Contra Costa counties are presented in Table 19.22. The civilian labor force in these counties increased between 2001 and 2012. The data for 2008 represents the employment situation immediately following the recession in 2007.

Table 19.22 Civilian Labor Force and Unemployment Rates in Central Valley Region – Delta and Suisun Marsh

Area	Civilian Labor Force (subject to unemployment insurance)			Unemployment Rate (percent)		
	2001	2008	2012	2001	2008	2012
Sacramento County	624,693	680,373	680,349	4.5	7.2	10.6
Yolo County	88,331	98,438	98,475	5.1	7.4	11.5
Solano County	197,178	211,369	217,024	4.6	6.8	10.1
San Joaquin County	266,288	293,190	298,468	7.5	10.4	15.2
Contra Costa County	508,730	524,519	535,782	4.1	6.2	9.0
Delta and Suisun Marsh Subtotal	1,685,220	1,807,889	1,830,098	4.9	7.4	10.8
Total Central Valley Region	3,448,061	3,807,278	3,911,569	6.8	8.7	12.6
STATE OF CALIFORNIA	**17,152,106**	**18,392,000**	**18,494,881**	**4.9**	**7.2**	**10.5**

Source: BLS 2014

Total employment and farm employment in 2001, 2008, and 2012 in the Sacramento, Yolo, Solano, San Joaquin, and Contra Costa counties are presented in Table 19.23. The contribution of farm employment to the total employment declined slightly between 2001 and 2008, and then increased slightly between 2008 and 2012.

Table 19.23 Employment in Central Valley Region – Delta and Suisun Marsh

Area	Total Employment			Farm Employment		
	2001	2008	2012	2001	2008	2012
Sacramento County	739,256	806,976	784,386	5,176	4,019	3,924
Yolo County	110,902	122,054	117,609	5,244	5,364	5,745
Solano County	162,874	174,565	169,096	3,321	2,144	2,116
San Joaquin County	260,809	286,171	277,260	21,088	16,939	17,496
Contra Costa County	475,493	497,887	492,144	3,130	910	1,599
Delta and Suisun Marsh Subtotal	1,749,334	1,887,653	1,840,495	37,959	29,376	30,880
Total Central Valley Region	3,616,241	3,997,557	3,923,230	256,672	226,321	230,832
STATE OF CALIFORNIA	**19,411,367**	**20,820,306**	**20,653,860**	**479,283**	**438,013**	**443,764**

Source: BEA 2014a

Note:
Farm employment includes employment numbers in forestry, fishing, and related activities.

Annual farm employment for the Sacramento, Yolo, Solano, San Joaquin, and Contra Costa counties declined in 2004, slightly increased in 2006, and continued to fluctuate through 2012, as shown in Figure 19.5. Within these counties, farm employment started to decline in 2004 and began to increase slightly in 2006, as shown in Figure 19.5. The overall trend in farm employment in the Delta and Suisun Marsh portion of the Central Valley Region is influenced by the farm employment trends in San Joaquin County. The decrease in farm employment is related to the reduction in cultivated acreage during this period, as described in Chapter 12, Agricultural Resources.

The farm employment numbers presented in Table 19.23 include only workers directly involved in farming, forestry, and fishing activities. However, farming is one of the most important basic industries in many counties in the Central Valley Region; and supports many other businesses including farm inputs (e.g., fertilizer, seed, machinery, and fuel) and processing of food and fiber grown on farms. As a result, employment both directly on farm and indirectly dependent on farming is higher than the values displayed in Table 19.23.

19.3.3.3.3 Income

The average per capita personal income in the Sacramento, Yolo, Solano, San Joaquin, and Contra Costa counties was about 15 percent higher than the average per capita personal income in the entire Central Valley Region, as presented in Table 19.24. San Joaquin and Contra Costa counties experienced the lowest average annual growth rates in per capita personal income between 2000 and 2008. Between 2008 and 2012, Yolo County was the only county with a slightly higher average annual growth rate as compared to the entire Central Valley Region.

Table 19.24 Per Capita Personal Income in Central Valley Region – Delta and Suisun Marsh

Area	Per Capita Personal Income			Average Annual Growth Rate (percent)	
	2000	2008	2012	2000-2008	2008-2012
Sacramento County	$29,406	$38,782	$41,837	3.5	1.9
Yolo County	$27,093	$37,488	$41,811	4.1	2.8
Solano County	$28,373	$39,178	$42,354	4.1	2.0
San Joaquin County	$25,147	$31,250	$33,024	2.8	1.4
Contra Costa County	$45,576	$58,547	$61,638	3.2	1.3
Average in Delta and Suisun Marsh Counties	$33,079	$42,861	$45,829	3.3	1.7
Central Valley Region	$28,183	$37,198	$40,601	3.5	2.2
STATE OF CALIFORNIA	**$33,404**	**$44,003**	**$46,477**	**3.5**	**1.4**

Source: BEA 2014e

19.3.3.3.4 Local Government Finances

As of April 1, 2014, the county sales tax rates in the Sacramento, Yolo, Solano, San Joaquin, and Contra Costa counties ranged between 7.5 percent in Yolo to 8 percent in San Joaquin (BOE 2014).

Total annual taxable sales for Sacramento, Yolo, Solano, San Joaquin, and Contra Costa counties in 2000, 2008, and 2012 are presented in Table 19.25. Between 2000 and 2008 Yolo, Solano, and San Joaquin counties experienced average annual growth in total taxable sales that were higher than the entire Central Valley Region and the state. Between 2008 and 2012, Sacramento County experienced negative average annual growth in total taxable sales.

Table 19.25 Total Taxable Sales in Central Valley Region – Delta and Suisun Marsh

Area	Total Taxable Sales (millions)			Average Annual Growth Rate (percent)	
	2000	2008	2012	2000-2008	2008-2012
Sacramento County	$16,594	$19,332	$19,090	1.9	-0.3
Yolo County	$2,416	$3,347	$3,475	4.2	0.9
Solano County	$4,424	$6,033	$6,038	4.0	0.0
San Joaquin County	$6,582	$8,696	$9,011	3.5	0.9
Contra Costa County	$12,331	$13,308	$13,997	1.0	1.3
Delta and Suisun Marsh Counties	$42,347	$50,715	$51,611	2.3	0.4
Central Valley Region	$81,975	$107,699	$113,368	3.5	1.3
STATE OF CALIFORNIA	**$441,854**	**$531,654**	**$407,714**	**2.3**	**-6.4**

Sources: BOE 2000, 2008, 2012

The combined (secured and unsecured) property tax revenues in Sacramento, Yolo, Solano, San Joaquin, and Contra Costa counties for Fiscal Year 2011-2012 are presented in Table 19.26. Total property tax revenues from these counties accounted for about 9 percent of the total state property tax revenues.

Table 19.26 Property Tax Revenues, Fiscal Year 2011-2012, in Central Valley Region – Delta and Suisun Marsh

Area	Property Tax Revenues (millions)
Sacramento County	$1,539
Yolo County	$270
Solano County	$497
San Joaquin County	$684
Contra Costa County	$1,979
Delta and Suisun Marsh Counties	$4,969
Central Valley Region	$9,874
STATE OF CALIFORNIA	**$55,459**

Source: California State Controller 2012

19.3.4 San Francisco Bay Area Region

The San Francisco Bay Area Region includes portions of Napa, Alameda, Santa Clara, and San Benito counties that are within the CVP and SWP service areas. Contra Costa County also is part of the San Francisco Bay Area Region. However, for this chapter, Contra Costa County is discussed under Section 19.3.4.3, Delta and Suisun Marsh.

19.3.4.1 Population

Population characteristics in the San Francisco Bay Area Region are presented in Table 19.27. The population of the San Francisco Bay Area Region grew slightly less than a quarter million, or at an average annual growth rate of less than one half of one percent between 2000 and 2012.

Table 19.27 Population Characteristics in San Francisco Bay Area Region

	Population		Average Annual Growth Rate (percent)
Area	2000	2012	2000-2012
Alameda County	1,443,939	1,530,176	0.5
Santa Clara County	1,682,585	1,813,696	0.6
San Benito County	53,234	56,137	0.4
Napa County	124,279	137,731	0.9
Total San Francisco Bay Area Region	3,304,037	3,537,740	0.6
STATE OF CALIFORNIA	**33,873,086**	**37,668,804**	**0.9**

Sources: DOF 2013a, 2013b, 2014

19.3.4.2 Employment

Civilian labor force characteristics for the counties in the San Francisco Bay Area Region are presented in Table 19.28. The civilian labor force in the counties within the San Francisco Bay Area Region declined between 2001 and 2008, and then increased between 2008 and 2012. The data for 2008 represents the employment situation immediately following the onset of the recession in 2007.

Table 19.28 Civilian Labor Force and Unemployment Rates in San Francisco Bay Area Region

Area	Civilian Labor Force (subject to unemployment insurance)			Unemployment Rate (percent)		
	2001	2008	2012	2001	2008	2012
Alameda County	778,472	757,566	775,855	4.8	6.2	9.0
Santa Clara County	939,501	870,251	910,983	5.1	6.0	8.4
San Benito County	27,461	24,870	26,611	6.3	9.6	13.9
Napa County	70,447	75,670	77,843	3.6	5.1	7.8
Total San Francisco Bay Area Region	1,815,881	1,728,357	1,791,292	4.9	6.1	8.7
STATE OF CALIFORNIA	**17,152,106**	**18,392,000**	**18,494,881**	**4.9**	**7.2**	**10.5**

Source: BLS 2014

Total employment and farm employment in 2001, 2008 and 2012 in the San Francisco Bay Area Region are presented in Table 19.29. The contribution of farm employment to total employment in the San Francisco Bay Area Region declined slightly between 2001 and 2008, and remained relatively stable between 2008 and 2012.

Table 19.29 Employment in San Francisco Bay Area Region

Area	Total Employment			Farm Employment		
	2001	2008	2012	2001	2008	2012
Alameda County	886,316	906,403	894,625	1,704	1,475	1,291
Santa Clara County	1,226,987	1,176,129	1,187,799	5,969	4,436	2,643
San Benito County	21,722	21,827	21,116	1,969	1,244	1,073
Napa County	84,369	91,837	93,050	4,835	5,730	3,148
Total San Francisco Bay Area Region	2,219,394	2,196,196	2,196,590	14,477	12,885	8,155
STATE OF CALIFORNIA	**19,411,367**	**20,820,306**	**20,653,860**	**479,283**	**438,013**	**443,764**

Source: BEA 2014a

Note:
Farm employment includes employment numbers in forestry, fishing, and related activities.

As shown in Table 19.29, overall farm employment has declined by 45 percent between 2001 and 2012, as presented in Figure 19.1. The decrease in farm employment is related to the reduction in cultivated acreage during this period, as described in Chapter 12, Agricultural Resources.

19.3.4.3 Income

The average per capita personal incomes for the counties in the San Francisco Bay Area Region are presented in Table 19.30. Among the four counties in this region, San Benito County had the lowest per capita personal income. Santa Clara County had the lowest average annual per capita growth rate between 2000 and 2008. All counties experienced smaller average annual per capita growth rates between 2008 and 2012 compared to the 2000 to 2008 period.

Table 19.30 Per Capita Personal Income in San Francisco Bay Area Region

Area	Per Capita Personal Income			Average Annual Growth Rate (percent)	
	2000	2008	2012	2000-2008	2008-2012
Alameda County	$39,613	$50,302	$54,683	3.0	2.1
Santa Clara County	$55,588	$59,927	$66,535	0.9	2.6
San Benito County	$29,608	$36,100	$38,030	2.5	1.3
Napa County	$38,854	$51,712	$54,807	3.6	1.5
Total San Francisco Bay Area Region	$47,546	$55,050	$60,493	1.8	2.4
STATE OF CALIFORNIA	**$33,404**	**$44,003**	**$46,477**	**3.5**	**1.4**

Source: BEA 2014e

19.3.4.4 Local Government Finances

As of April 1, 2014, the county sales tax rates in the San Francisco Bay Area region ranged between 7.5 percent in San Benito and 9.0 percent in Alameda (BOE 2014).

Total annual taxable sales for the counties in the San Francisco Bay Area Region in 2000, 2008, and 2012 are presented in Table 19.31. Between 2000 and 2008 all counties in the region, except Santa Clara County, experienced small increases in average annual growth in total taxable sales. All counties experienced increasing growth rates between 2008 and 2012. Santa Clara County had the highest annual average growth rate in total taxable sales among all the counties in the region during this period.

Table 19.31 Total Taxable Sales in San Francisco Bay Area Region

Area	Total Taxable Sales (Millions)			Average Annual Growth Rate (percent)	
	2000	2008	2012	2000-2008	2008-2012
Alameda County	$23,764	$23,863	$25,182	0.1	1.4
Santa Clara County	$37,304	$32,274	$36,220	-1.8	2.9
San Benito County	$476	$505	$530	0.7	1.2
Napa County	$1,908	$2,549	$2,719	3.7	1.6
Total San Francisco Bay Area Region	$63,451	$59,191	$64,651	-0.9	2.2
STATE OF CALIFORNIA	**$441,854**	**$531,654**	**$407,714**	**2.3**	**-6.4**

Sources: BOE 2000, 2008, 2012

The combined (secured and unsecured) property tax revenues in each of the counties in the San Francisco Bay Area Region for Fiscal Year 2011-2012 are presented in Table 19.32. Total property tax revenues in the four counties accounted for about 13 percent of the total state property tax revenues.

Table 19.32 Property Tax Revenues, Fiscal Year 2011-2012, in San Francisco Bay Area Region

Area	Property Tax Revenues (millions)
Alameda County	$2,830
Santa Clara County	$3,973
San Benito County	$68
Napa County	$327
Total San Francisco Bay Area Region	$7,198
STATE OF CALIFORNIA	**$55,459**

Source: California State Controller 2014

19.3.5 Central Coast Region

The Central Coast Region includes portions of San Luis Obispo and Santa Barbara counties served by the SWP. San Luis Obispo and Santa Barbara counties are among the top 15 counties in total agricultural production in the state.

19.3.5.1 Population

Population characteristics in the Central Coast Region are presented in Table 19.33. The population of the Central Coast Region grew by an average annual growth rate of about one half of one percent between 2000 and 2012.

Table 19.33 Population Characteristics in Central Coast Region

Area	Population		Average Annual Growth Rate (percent)
	2000	2012	2000-2012
San Luis Obispo County	246,681	271,502	0.8
Santa Barbara County	399,347	426,351	0.5
Total Central Coast Region	646,028	697,853	0.6
STATE OF CALIFORNIA	**33,873,086**	**37,668,804**	**0.9**

Sources: DOF 2013a, 2013b, 2014

19.3.5.2 Employment

Civilian labor force characteristics for the counties in the Central Coast Region are presented in Table 19.34. The civilian labor force in the Central Coast Region increased between 2000 and 2012.

Table 19.34 Civilian Labor Force and Unemployment Rates in Central Coast Region

Area	Civilian Labor Force (subject to unemployment insurance)			Unemployment Rate (percent)		
	2001	2008	2012	2001	2008	2012
San Luis Obispo County	126,176	136,615	138,650	4.0	5.7	9.3
Santa Barbara County	203,039	218,429	225,635	4.4	5.4	8.8
Total Central Coast Region	329,215	355,044	364,285	4.3	5.6	5.9
STATE OF CALIFORNIA	**17,152,106**	**18,392,000**	**18,494,881**	**4.9**	**7.2**	**10.5**

Source: BLS 2014

Total employment and farm employment in 2001, 2008, and 2012 in the Central Coast Region are presented in Table 19.35. Farm employment accounted for less than ten percent of total employment during this period.

Table 19.35 Employment in Central Coast Region

Area	Total Employment			Farm Employment		
	2001	2008	2012	2001	2008	2012
San Luis Obispo County	140,320	155,093	156,757	7,775	6,866	7,374
Santa Barbara County	243,955	260,056	257,841	15,228	16,483	18,075
Total Central Coast Region	384,275	415,149	414,598	23,003	23,349	25,449
STATE OF CALIFORNIA	**19,411,367**	**20,820,306**	**20,653,860**	**479,283**	**438,013**	**443,764**

Source: BEA 2014a
Note: Farm employment includes employment numbers in forestry, fishing, and related activities.

The farm employment numbers presented in Table 19.35 include only workers directly involved in farming, forestry, and fishing activities. However, farming is one of the most important basic industries in many counties in the Central Coast Region; and supports many other businesses including farm inputs (e.g., fertilizer, seed, machinery, and fuel) and processing of food and fiber grown on farms. As a result, employment both directly on farm and indirectly dependent on farming is higher than the values displayed in Table 19.35.

19.3.5.3 Income

Per capita personal incomes for the counties in the Central Coast Region are lower than those for the state. Both San Luis Obispo and Santa Barbara had average annual per capita personal income growth rates between 2000 and 2008 that were among the highest in the state. Per capita personal income for each of the two counties in the Central Coast Region in 2000, 2008 and 2012 are presented in Table 19.36.

Table 19.36 Per Capita Personal Income in Central Coast Region

Area	Per Capita Personal Income			Average Annual Growth Rate (percent)	
	2000	2008	2012	2000-2008	2008-2012
San Luis Obispo County	$28,671	$40,204	$43,698	4.3	2.1
Santa Barbara County	$33,317	$45,997	$47,862	4.1	1.0
Central Coast Region	$31,540	$43,735	$46,241	4.2	1.4
STATE OF CALIFORNIA	**$33,404**	**$44,003**	**$46,477**	**3.5**	**1.4**

Source: BEA 2014e

19.3.5.4 Local Government Finances

As of April 1, 2014, the county sales tax rates in the San Luis Obispo and Santa Barbara counties were 7.5 percent and 8.0 percent, respectively (BOE 2014).

Total annual taxable sales for San Luis Obispo and Santa Barbara counties in the Central Coast Region in 2000, 2008, and 2012 are presented in Table 19.37. The Central Coast Region's average annual growth in total taxable sales were higher than for the state.

Table 19.37 Total Taxable Sales in Central Coast Region

Area	Total Taxable Sales (Millions)			Average Annual Growth Rate (percent)	
	2000	2008	2012	2000-2008	2008-2012
San Luis Obispo County	$2,925	$3,974	$5,026	3.9	6.0
Santa Barbara County	$4,823	$5,884	$6,051	2.5	0.7
Central Coast Region	$7,748	$9,858	$11,077	3.1	3.0
STATE OF CALIFORNIA	**$441,854**	**$531,654**	**$407,714**	**2.3**	**-6.4**

Sources: BOE 2000, 2008, 2012

The combined (secured and unsecured) property tax revenues in the Central Coast Region for Fiscal Year 2011-2012 are presented in Table 19.38. Total property tax revenues in the two counties accounted for about 2 percent of the total state property tax revenues.

Table 19.38 Property Tax Revenues, Fiscal Year 2011-2012, in Central Coast Region

Area	Property Tax Revenues (millions)
San Luis Obispo County	$443
Santa Barbara County	$695
Central Coast Region	$1,138
STATE OF CALIFORNIA	**$55,459**

Source: California State Controller 2014

19.3.6 Southern California Region

The Southern California Region includes portions of Ventura, Los Angeles, Orange, San Diego, Riverside, and San Bernardino counties served by the SWP.

19.3.6.1 Population

Population characteristics in Southern California Region are presented in Table 19.39. Among the counties in the Southern California Region, Riverside County had the highest average annual population growth rate, and Los Angeles County had the lowest average annual population growth rate between 2000 and 2012.

Table 19.39 Population Characteristics in Southern California Region

Area	Population		Average Annual Growth Rate (percent)
	2000	2012	2000-2012
Ventura County	753,197	829,065	0.8
Los Angeles County	9,519,330	9,889,520	0.3
Orange County	2,846,289	3,057,879	0.6
San Diego County	2,813,833	3,128,734	0.9
Riverside County	1,545,387	2,234,193	3.1
San Bernardino County	1,710,139	2,059,699	1.6
Total Southern California Region	19,188,175	21,199,090	0.8
STATE OF CALIFORNIA	**33,873,086**	**37,668,804**	**0.9**

Sources: DOF 2013a, 2013b, 2014

19.3.6.2 Employment

Civilian labor force characteristics for the counties in the Southern California Region are presented in Table 19.40. The civilian labor force in the Southern California Region increased between 2001 and 2012. The average unemployment rates for the Southern California Region have been lower than for the state.

Table 19.40 Civilian Labor Force and Unemployment Rates in Southern California Region

Area	Civilian Labor Force (subject to unemployment insurance)			Unemployment Rate (percent)		
	2001	2008	2012	2001	2008	2012
Ventura County	399,325	429,444	440,649	4.8	6.3	9.0
Los Angeles County	4,752,839	4,934,756	4,879,674	5.7	7.5	10.9
Orange County	1,513,234	1,618,079	1,618,677	4.0	5.3	7.6
San Diego County	1,409,726	1,548,233	1,599,133	4.2	6.0	8.9
Riverside County	711,134	912,717	944,458	5.5	8.5	12.2
San Bernardino County	763,221	863,293	860,895	5.1	8.0	12.0
Total Southern California Region	9,549,479	10,306,522	10,343,486	5.1	7.0	10.2
STATE OF CALIFORNIA	**17,152,106**	**18,392,000**	**18,494,881**	**4.9**	**7.2**	**10.5**

Source: BLS 2014

Total employment and farm employment in 2001, 2008, and 2012 in the Southern California Region are presented in Table 19.41. Farm employment accounted for less than one percent of total employment.

Table 19.41 Employment in Southern California Region

Area	Total Employment			Farm Employment[1]		
	2001	2008	2012	2001	2008	2012
Ventura County	399,928	436,031	431,196	21,329	23,430	24,826
Los Angeles County	5,440,785	5,695,501	5,669,105	11,082	8,709	7,589
Orange County	1,845,392	1,999,036	1,963,080	7,888	4,713	3,183
San Diego County	1,723,801	1,901,598	1,887,077	17,871	15,718	14,778
Riverside County	677,214	866,247	864,308	20,892	15,669	15,024
San Bernardino County	730,150	881,700	864,432	6,050	3,931	3,688
Total Southern California Region	10,817,270	11,780,113	11,679,198	85,112	72,170	69,088
STATE OF CALIFORNIA	**19,411,367**	**20,820,306**	**20,653,860**	**479,283**	**438,013**	**443,764**

Source: BEA 2014a

Note:

Farm employment includes employment numbers in forestry, fishing, and related activities.

19.3.6.3 Income

Among the six counties in this region, San Bernardino County had the lowest per capita personal income in 2000 and 2008, as presented in Table 19.42. In 2012, Riverside County had the lowest per capita personal income.

Table 19.42 Per Capita Personal Income in Southern California Region

Area	Per Capita Personal Income			Average Annual Growth Rate (percent)	
	2000	2008	2012	2000-2008	2008-2012
Ventura County	$34,296	$46,634	$48,837	3.9	1.2
Los Angeles County	$29,878	$42,881	$44,474	4.6	0.9
Orange County	$38,357	$49,436	$52,342	3.2	1.4
San Diego County	$33,779	$47,197	$49,719	4.3	1.3
Riverside County	$24,528	$30,842	$31,742	2.9	0.7
San Bernardino County	$22,624	$30,220	$32,072	3.7	1.5
Total Southern California Region	$30,801	$41,078	$44,004	3.7	1.7
STATE OF CALIFORNIA	**$33,404**	**$44,003**	**$46,477**	**3.5**	**1.4**

Source: BEA 2014e

19.3.6.4 Local Government Finances

As of April 1, 2014, the county sales tax rates in the Southern California Region ranged from 7.5 percent in Ventura County to 9.0 percent in Los Angeles County (BOE 2014).

Total annual taxable sales for the counties in the Southern California Region in 2000, 2008, and 2012 are presented in Table 19.43. The counties in this region have had higher average annual growth rates in total taxable retail sales compared to the state. Between 2000 and 2008, Riverside and San Bernardino led the region with higher average annual growth rates. However, between 2008 and 2012, the two counties experienced declining growth rates.

Table 19.43 Total Taxable Sales in Southern California Region

Area	Total Taxable Sales (millions)			Average Annual Growth Rate (percent)	
	2000	2008	2012	2000-2008	2008-2012
Ventura County	$9,096	$11,322	$11,958	2.8	1.4
Los Angeles County	$106,674	$131,882	$135,296	2.7	0.6
Orange County	$44,462	$53,607	$55,231	2.4	0.7
San Diego County	$36,245	$45,329	$47,947	2.8	1.4
Riverside County	$16,979	$26,004	$28,096	5.5	2.0
San Bernardino County	$18,885	$27,778	$29,532	4.9	1.5
Total Southern California Region	$232,342	$295,921	$308,059	3.1	1.0
STATE OF CALIFORNIA	**$441,854**	**$531,654**	**$407,714**	**2.3**	**-6.4**

Sources: BOE 2000, 2008, 2012

The combined (secured and unsecured) property tax revenues in the Southern California Region for Fiscal Year 2011-2012 are presented in Table 19.44. Total property tax revenues accounted for about 55 percent of the total state property tax revenues.

Table 19.44 Property Tax Revenues, Fiscal Year 2011-2012, in Southern California Region

Area	Property Tax Revenues (millions)
Ventura County	$1,230
Los Angeles County	$14,191
Orange County	$5,046
San Diego County	$4,646
Riverside County	$2,812
San Bernardino County	$2,132
Southern California Region	$30,057
STATE OF CALIFORNIA	**$55,459**

Source: California State Controller 2012

19.3.7 Ocean Salmon Fishery

The ocean salmon fishery along the southern Oregon and northern California coast are affected by the population of salmon that rely upon the northern California rivers, including the Sacramento and San Joaquin rivers. Changes in CVP and SWP water operations would affect the flow patterns and water quality of the Sacramento and San Joaquin rivers; and the survivability of the salmon that use those rivers for habitat, as described in Chapter 9, Fish and Aquatic Resources. This section discusses the economic contributions of the Pacific Coast salmon fishery.

Management of the California ocean salmon fishery is a combined effort of the California Department of Fish and Wildlife (CDFW) and the Pacific Fishery Management Council (PFMC), a regional council of the National Oceanic and Atmospheric Administration. The California Department of Fish and Wildlife manages salmon harvest from the shoreline to three nautical miles off the California coast. From three nautical miles to two hundred nautical miles offshore is managed by the PFMC. The PFMC is responsible for developing the Pacific Coast Salmon Fishery Management Plan (FMP) that guides management of the ocean commercial and recreational fishery in California, Oregon, and Washington (PFMC 2014a). The annual ocean salmon fishery regulations promote the maximum amount of harvest while ensuring that suitable population levels are maintained (NOAA 2014).

19.3.7.1 Commercial Ocean Fisheries for Salmon along the Southern Oregon and Northern California Coasts

The commercial ocean salmon fishery plays a large role in the overall California commercial ocean industry, as shown in Table 19.45. The total harvest value for Chinook salmon ranked fourth among all commercially harvested ocean species in 2012. The harvest value rank of Chinook salmon in California between 2001 and 2012 as compared to the other commercially harvested ocean species are presented in Table 19.46.

Table 19.45 Top Ten Species by Total Value for Commercially Harvested Ocean Species in California in 2012

Rank	Species	Total Value
1	Dungeness Crab	$85,643,530
2	California Market Squid	$63,883,456
3	California Spiny Lobster	$13,706,721
4	**Chinook Salmon**	**$12,841,853**
5	Sablefish	$8,987,599
6	Pacific Oyster	$8,736,923
7	Sea Urchins	$8,320,111
8	Spot Shrimp	$4,462,204
9	Pacific Sardine	$4,248,504
10	Kumamoto Oyster	$3,170,760

Sources: NMFS 2014a, 2014b, 2014c, 2014d, 2014e, 2014f, 2014g, 2014h, 2014i, 2014j

Table 19.46 Chinook Salmon Total Harvest Value Ranking as compared to Other Commercially Harvested Ocean Species in California

Year	Total Value of Chinook Salmon Landings	Rank
2001	$4,760,786	7
2002	$7,610,882	4
2003	$12,153,111	3
2004	$17,770,036	3
2005	$12,804,188	3
2006	$5,260,526	4
2007	$7,835,240	4
2008	Season Closed	
2009	Season Closed	
2010	$1,214,959	19
2011	$5,096,433	7
2012	$12,841,853	4

Source: NMFS 2014k

Annual revenues from commercial ocean salmon fishery in California have fluctuated with changes in salmon prices and total landings. The dollar per dressed pound for Chinook salmon paid to the commercial operator can change within a season, across seasons, and at different ports, as presented in Table 19.47. Prices for Chinook salmon have increased over the past years; however, the costs for fuel, labor, and equipment maintenance also have increased.

Table 19.47 Average Annual Commercial Chinook Salmon Prices

Year	Average Annual California Price (dollar per dressed pound)	Average Annual Oregon Price (dollar per dressed pound)
2001	$1.98	$1.61
2002	$1.55	$1.54
2003	$1.91	$1.97
2004	$2.87	$3.45
2005	$2.97	$3.17
2006	$5.13	$5.48
2007	$5.18	$5.66
2008	Season Closed	$7.31
2009	Season Closed	Season Closed
2010	$5.46	$5.49
2011	$5.17	$5.96
2012	$5.34	$5.75

Source: PFMC 2014b (Tables D-4, D-5)

The total value of landings for the commercial ocean fishery in southern Oregon and California are presented in Table 19.48.

Table 19.48 Value of Landings for Salmon for the Commercial Ocean Salmon Fishery

Year	Total Value, California	Total Value, Oregon
2001	$4,773	$4,721
2002	$7,776	$5,391
2003	$12,181	$7,222
2004	$17,895	$9,919
2005	$12,913	$8,503
2006	$5,350	$2,701
2007	$7,902	$2,822
2008	Season Closed	$51,118
2009	Season Closed	$51,118
2010	$1,246	$2,791
2011	$5,133	$2,401
2012	$13,521	$4,271

Sources: PFMC 2014b (Tables D-4, D-5); PacFIN 2014

The economic contribution of the California commercial ocean salmon fishery extends beyond the revenues received by fishermen. Supporting industries include fish processors, boat manufacturers, repair and maintenance. The economic contribution of the commercial ocean salmon fishery can be estimated through the use of Input-Output models. Economic contributions are estimated by PFMC using an Input-Output model, the Fishery Economic Assessment Model (FEAM), as summarized in Table 19.49 for the commercial ocean salmon fishery by management area.

Table 19.49 Estimated Total Economic Impact for the Commercial Fishery by PFMC

Year	Economic Values by Management Areas ($1,000)					
	KMZ – Oregon	KMZ – California	Fort Bragg	San Francisco	Monterey	Total
2001	$635	$328	$1,033	$10,857	$2,297	$15,150
2002	$806	$797	$3,730	$15,516	$4,179	$25,028
2003	$699	$259	$15,160	$15,795	$2,491	$34,404
2004	$1,502	$2,373	$7,434	$23,356	$5,257	$39,922
2005	$1,259	$582	$5,420	$13,496	$7,083	$27,840
2006	$378	$0	$2,471	$6,389	$985	$10,223
2007	$780	$1,156	$3,407	$8,131	$1,658	$15,132
2008	$72	$0	$0	$0	$0	$72
2009	$42	$0	$0	$0	$0	$42
2010	$367	$35	$1,780	$140	$161	$2,483
2011	$504	$505	$4,952	$2,225	$979	$9,165
2012	$698	$725	$4,706	$10,653	$5,759	$22,541
2013	$1,252	$2,146	$12,909	$19,181	$4,010	$39,498

Source: PFMC 2014b (Tables IV-16, IV-17)

Notes:

All values estimated using the Fishery Economic Assessment Model, and presented as 2013 dollars.

Southern Oregon values include data for Brookings, Oregon which may include values from landings outside of the KMZ.

a. KMZ –Oregon represents the area from Humbug Mountain to the Oregon-California Border, and includes landings at the Brookings port and season length and quota values for the entire area including Chetco River Ocean Terminal Area between Twin Rocks and the Oregon-California border.

b. KMZ –California represents the area from Oregon-California Border to Humboldt South Jetty, and includes landings at the Crescent City and Eureka ports.

Fisherman and industries that rely on the commercial ocean salmon fishery have access to financial assistance from the federal government in years of low revenue or closure. The fishery can be declared a failure by the Department of Commerce after requests are sent by state or local officials and certain criteria have been met. After a fishery failure is declared, disaster relief can be provided in the form of monetary compensation, community grants, low-interest loans, habitat restoration, or fishery capacity reduction. Disaster relief related to the California commercial ocean salmon fishery has occurred six times between 1994 and 2009, as summarized in Table 19.50 (CRS 2013). Direct payments may involve a minimum amount to any permit holder and additional amounts based upon past landing values (Hackett and Hansen 2008). Disaster relief funds distribution is conducted by the PFMC and the California Salmon Council.

Table 19.50 Disaster Relief Monies and Programs for the Commercial Ocean Salmon Fishery in California

Year	Programs	Dollar Value
1994	Fishery capacity reduction, habitat restoration jobs, and data collection jobs	$12 Million
1995	Similar programs as in 1994	$13 Million
1998	Fishery capacity reduction	$3.5 Million
2007	Direct payments to fisherman and businesses dependent on the Klamath River salmon	$60.4 Million
2008	Direct payments to fisherman and businesses dependent on the Sacramento River salmon	$170 Million
2009-2010	Continuation of 2008 programs	Remainder of the 2008 $170 Million

Source: CRS 2013

19.3.7.2 Ocean Sport Fisheries for Salmon along the Southern Oregon and Northern California Coasts

The PFMC and CDFW also manages the ocean sport fishery. The economic contribution of the ocean sport salmon fishery can be estimated through the use of Input-Output models. Economic contributions are estimated by PFMC using an Input-Output model, the Fishery Economic Assessment Model (FEAM), as summarized in Table 19.51.

Table 19.51 Estimated Total Economic Impact for the Recreational Fishery by PFMC

Year	Economic Values by Management Areas ($1,000)					
	KMZ – Oregon	KMZ-California	Fort Bragg	San Francisco	Monterey	Total
2001	$1,052	$1,136	$2,101	$7,683	$3,079	$15,051
2002	$775	$1,026	$2,221	$9,646	$4,752	$18,420
2003	$608	$743	$1,677	$6,990	$2,288	$12,306
2004	$751	$1,229	$2,175	$11,310	$4,439	$19,904
2005	$501	$794	$1,759	$8,554	$3,234	$14,842
2006	$426	$743	$1,450	$5,812	$1,947	$10,378
2007	$437	$977	$1,170	$4,119	$1,427	$8,130
2008	$189	$0	$26	$0	$0	$215
2009	$241	$276	$0	$0	$0	$517
2010	$229	$201	$421	$1,712	$1,140	$3,703
2011	$241	$744	$972	$3,367	$1,778	$7,102
2012	$732	$1,614	$970	$6,069	$2,947	$12,332

Source: PFMC 2014b (Tables IV-16, IV-17)

Notes:
All values estimated using the Fishery Economic Assessment Model, and presented as 2013 dollars.
Southern Oregon values include data for Brookings, Oregon which may include values from landings outside of the KMZ.

a. KMZ –Oregon represents the area from Humbug Mountain to the Oregon-California Border, and includes landings at the Brookings port and season length and quota values for the entire area including Chetco River Ocean Terminal Area between Twin Rocks and the Oregon-California border.
b. KMZ –California represents the area from Oregon-California Border to Humboldt South Jetty, and includes landings at the Crescent City and Eureka ports.

19.3.8 Ocean Salmon Fisheries for the Yurok and Hoopa Valley Tribes

The salmon populations are extremely important to the Yurok Tribe and Hoopa Valley Tribe as part of their lives, cultural traditions, ceremonies, and community health (Reclamation 2012). Fifty percent of the total available salmon in the Trinity River is the federally protected harvest for the Yurok and Hoopa Valley tribes (DOI 1993). Each tribe determines the use of the harvest. Historical landing data for the Yurok and Hoopa Valley tribes are presented in Table 19.52 (Reclamation 2012).

Table 19.52 Salmon Landings by the Yurok Tribe and Hoopa Valley Tribe

Year	Spring Run Chinook Salmon	Fall Run Chinook Salmon	Total
2001	19,640	39,044	58,684
2002	15,136	24,700	39,836
2003	9,065	30,078	39,143
2004	8,682	25,971	34,653
2005	7,302	8,087	15,389
2006	4,409	10,698	15,107
2007	5,849	27,594	33,443
2008	3,439	22,901	26,340
2009	3,562	28,565	32,127
2010	5,023	30,315	35,338
2011	5,005	28,084	33,089
2012	6,477	101,662	108,139
2013[a]	4,972	63,030	68,002

Source: PFMC 2014b (Table B-5)
Note:
a. 2013 data are preliminary.
Includes landings at the Klamath River estuary, along the Klamath River from the estuary to Weitchpec (at the confluence of the Klamath and Trinity rivers), and along the Trinity River.

19.4 Impact Analysis

This section describes the potential mechanisms and analytical methods for change in socioeconomic factors; results of the impact analysis; potential mitigation measures; and cumulative effects.

This Chapter includes the analysis of overall regional economic changes and economic changes related to changes in CVP and SWP water supplies for M&I water users. More detailed discussions of changes in agricultural production are presented in Chapter 12, Agricultural Resources.

19.4.1 Potential Mechanisms and Analytical Methods

As described in Chapter 4, Approach to Environmental Analysis, the impact assessment considers changes in socioeconomic factors related to changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison.

Changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison could change water supply availability for CVP and SWP water users, recreational opportunities at reservoirs that store CVP and SWP water, and salmon from the Delta watershed that are relied upon by commercial, sport, and tribal fisherman.

19.4.1.1 Regional Changes in Irrigated Agricultural Production Value

Changes in CVP and SWP operations could change the extent of total agricultural production value as compared to the No Action Alternative and the Second Basis of Comparison. As described in Chapter 12, Agricultural Resources, there was no changes in agricultural production in the Central Valley under long-term conditions (over the 81-year model simulation period). Therefore, this analysis only addresses regional economic changes during dry and critical dry years.

This analysis uses model output from the Statewide Agricultural Production (SWAP) model and the IMPLAN model. The SWAP model, **a**s described in Chapter 12, is a regional model of irrigated agricultural production and economics that simulates the decisions of producers (farmers) in the Central Valley Region. The model selects the crops, water supplies, and other inputs that maximize profit subject to constraints on water and land, and subject to economic conditions regarding prices, yields, and costs. The SWAP model incorporates CVP and SWP water supplies, other local water supplies represented in the CalSim II model, and groundwater. As conditions change within a SWAP subregion (e.g., the quantity of available project water supply declines), the model optimizes production by adjusting the crop mix, water sources and quantities used, and other inputs. The model also fallows land when that appears to be the most cost-effective response to resource conditions. The analysis only reduces groundwater withdrawals based upon an optimization of agricultural production costs. The analysis does not restrict groundwater withdrawals based upon groundwater overdraft or groundwater quality conditions.

As described in Chapter 7, Groundwater Resources and Groundwater Quality, The Sustainable Groundwater Management Act (SGMA) requires preparation of Groundwater Sustainability Plans (GSPs) by 2020 or 2022 for most of the groundwater basins. The GSPs will identify methods to implement measures that will achieve sustainable groundwater operations by 2040 or 2042. The analysis in this Chapter is focused on conditions that would occur in 2030. If local agencies fully implement GSPs prior to the regulatory deadline, increasing groundwater use would be less of an option for agricultural water users. However, to achieve sustainable conditions, some measures could require several years to design and construct new water supply facilities, and sustainable groundwater conditions are not required until the 2040s. Therefore, it was assumed that Central Valley agriculture water users would not reduce groundwater use by 2030, and that groundwater use would increase in response to reduced CVP and SWP water supplies.

As described in Chapter 12, the impact to irrigated acreage and agricultural production is relatively small. Most of the change in CVP or SWP irrigation supplies would be offset by changes in groundwater pumping, with only small changes in crop acreage in production. However, this is an aggregate result for the Central Valley. Individual growers that rely on CVP or SWP supply and have no access to groundwater would have their irrigated acreage affected by larger amounts. Some of their change in production can and would be offset by changes on other farms that have access to groundwater or other surface supplies. Over time, growers without the buffer of access to groundwater could be driven to sell to or merge with other farming operations. From the larger, regional perspective, total value of production is estimated to change relatively little.

The regional economic analysis was conducted using the results of the impact analysis on agricultural production and M&I water use. The incremental impact results, estimated by the SWAP and CWEST economic models, were input into the regional IMPLAN models as the direct change caused by each of Alternative as compared to the No Action Alternative and the Second Basis of Comparison. Changes in economic effects depend upon loss of production or expenditures for water supplies, interactions within the regional economy, and “leakage” of economic activity between regions. Economic linkages create multiplier effects in a regional economy in the IMPLAN input-output model based upon estimates of county-level final demands and final payments developed from published data, national average matrix of technical coefficients, and mathematical relationships. IMPLAN uses information from the U.S. Department of Commerce’s Bureau of Economic Analysis, U.S. Department of Labor’s Bureau of Labor Statistics, and other federal and state government agencies. Data is collected for 440 different industrial sectors of the national economy per the North American Industry Classification System based on the primary commodity or service produced. Data sets are provided for the IMPLAN model for each county in the United States. In this analysis counties were grouped into the Central Valley Region (does not include Contra Costa County), San Francisco Bay Area Region (does include Contra Costa County), Central Coast Region, and Southern California Region.

IMPLAN is a static model that estimates impacts for a snapshot in time when the impacts are expected to occur, based on the makeup of the economy at the time of the underlying IMPLAN data. IMPLAN measures the initial impact to the economy based on average expenditure patterns, but does not consider long-term adjustments if labor and capital move into alternative uses.

Irrigated acreage occurs in the San Francisco Bay Area, Central Coast, and Southern California regions that use CVP and SWP water. This irrigated acreage is not included in the SWAP model simulation; and therefore, is not evaluated quantitatively in this EIS. However, changes in irrigated acreage in response to reductions in CVP and SWP water deliveries are assumed to occur in a similar manner as projected for the Central Valley Region.

As described in this chapter, the SWAP and IMPLAN models are annual-time step models that use information from the monthly-time step model. The model results represent long-term responses and must be used in a comparative manner to reduce the effects of use of monthly assumptions and other assumptions that are indicative of real-time operations, but do not specific match real-time observations. The CalSim II model output includes minor fluctuations of up to 5 percent due to model assumptions and approaches. Therefore, if the quantitative changes between a specific alternative and the No Action Alternative and/or Second Basis of Comparison are 5 percent or less, the conditions under the specific alternative would be considered to be "similar" to conditions under the No Action Alternative and/or Second Basis of Comparison.

19.4.1.2 Regional Changes in Municipal and Industrial Water Supplies and Water Supply Costs

Changes in CVP and SWP operations could change availability of water supplies for M&I water in the study area, related costs of additional supplies or shortages, and changes in regional economics as compared to the No Action Alternative and the Second Basis of Comparison. The quantitative analyses of regional changes related to changes in M&I water supplies and associated costs, employment, and economic output are analyzed using the California Water Economics Spreadsheet Tool (CWEST) model and the IMPLAN model.

Changes in M&I water supplies were evaluated using a regional economic model that was specifically modified to address water supply and cost changes to CVP and SWP M&I water users. The CWEST is a regional model that considers the economic costs to M&I water users including the cost of CVP and SWP water supplies, regional surface water supplies (including recycled water), conveyance costs, shortage costs, and changes in groundwater pumping costs. The model operations on an annual time step. Annual supplies are calculated for each water user based upon annual CVP and/or SWP water supplies, local surface water and groundwater supplies, surface water and groundwater storage, wastewater effluent and stormwater recycling water treatment, and desalination water treatment.

CVP and SWP water supply inputs are provided for the 81-year hydrologic period from the CalSim II model. The CWEST model analyzes the changes in annual conditions over the 81-long-term condition, and averages the overall costs for each Alternative over the 81-long-term condition. The CWEST model evaluates responses to changes in CVP and SWP water supplies differently for wet, above normal, and below normal water year types as compared to dry and critical dry water year types.

The goal of the CWEST model is to minimize the cost for the water providers and end-users to meet 2030 water demand. In years when the combination of average existing water supplies (either for the wetter or drier conditions) are greater than the 2030 water demand, the CWEST model assumes any overage water amount would be placed into surface water or groundwater storage, if available. If storage is not available, groundwater pumping would be reduced so that the other available supplies can be utilized. The CWEST model assumes that local surface water, other imported water supplies, recycled water use, and desalinated water use would not be reduced. However, during wet years, total CVP and SWP water deliveries may not be delivered if groundwater pumping is reduced to zero and local storage facilities are full.

In years when annual supplies are less than the 2030 water demand, the model assumes that water users with local surface water and groundwater storage would first fully utilize those supplies, and participate in temporary water transfers or a similar annual option if necessary. If shortage and transfer costs occur frequently, the model can select to purchase additional fixed-yield supplies, such as additional recycled water, desalination water treatment, or groundwater capacity. The model optimizes these long-term supply decisions to provide the lowest-cost water supply portfolio to meet 2030 demands throughout the 81-year hydrologic period.

The CWEST model local supply amounts and costs for this EIS are primarily based upon information presented in 2010 Urban Water Management Plans (UWMPs) developed by the CVP and SWP contractors (see Appendix 5D, Municipal and Industrial Water Demands and Supplies). The assumptions related to future water supplies presented in the UWMPs were evaluated to determine if the projects were reasonable and certain to occur by 2030. Projects that had undergone environmental review, were under design, or under construction were considered to exist in 2030 water supply assumptions in the CWEST model. Projects described in the UWMPs were considered as options to increase fixed-yield supplies. Existing and future water supplies considered for municipalities by 2030 are presented in Appendix 5B, Future Municipal Water Supplies for CVP and SWP Water Users. For smaller water users that are not addressed in an UWMP, information was obtained from water master plans and integrated regional water management plans.

CWEST calculates the change in the cost of water supplies plus end-user shortage costs. It does not calculate the total cost of water supplies. To provide a basis for understanding the relative importance of a change in costs, annual operating expenses were obtained from the fiscal year 2011-12 reports for special districts, counties, and cities published by the State Controllers' office (2013, 2014, 2014a). These operating expenses were updated to 2014 dollars using the California urban consumer price index. The cost change from CWEST, divided by the operating expense, provides a reasonable indication of the relative importance of cost changes for urban water providers.

The level of 2014 operating expense for each region includes:

- Central Valley Region
  - Sacramento Valley - $257 million
  - San Joaquin Valley - $297 million
- San Francisco Bay Area Region - $415 million
- Central Coast Region - $38 million

- Southern California Region (also known as "South Coast") - $1,613 million

The CWEST model assumes that groundwater pumping would occur up to the amounts included in the UWMPs for wetter and drier conditions. As described above for agricultural production, it is assumed that full implementation of SGMA would not occur by 2030. Therefore, it was assumed that water users that are not currently operating groundwater resources in accordance with adjudication or other types of agreements, would not reduce groundwater use by 2030.

The IMPLAN model, described above, also is used to analyze changes in regional economics related to M&I water supplies. Increased costs of water supply are estimated from CWEST results. It is assumed that these costs must be passed on to regional water users. Regional water users are assumed to reduce their spending by an amount equal to the water supply cost increase. This reduced spending is distributed over regional industries according to coefficients provided by IMPLAN.

As described in this chapter, the CWEST and IMPLAN models are annual-time step models that use information from the monthly-time step model. The model results represent long-term responses and must be used in a comparative manner to reduce the effects of use of monthly assumptions and other assumptions that are indicative of real-time operations, but do not specific match real-time observations. The CalSim II model output includes minor fluctuations of up to 5 percent due to model assumptions and approaches. Therefore, if the quantitative changes between a specific alternative and the No Action Alternative and/or Second Basis of Comparison are 5 percent or less, the conditions under the specific alternative would be considered to be "similar" to conditions under the No Action Alternative and/or Second Basis of Comparison.

19.4.1.3 Changes in Local Government Finances

Changes in CVP and SWP operations would not result in major changes in land use, as described in Chapter 13, Land Use. Therefore, changes to collection of local taxes and fees are not anticipated under the alternatives as compared to the No Action Alternative and the Second Basis of Comparison. Therefore, changes in local government finances are not evaluated in this EIS.

19.4.1.4 Changes in Recreational Economics

Reservoirs that store CVP and SWP water provide a wide diversity of recreational experiences on the water surface, as described in Chapter 15, Recreational Resources. However, changes to recreational economic opportunities under the alternatives primarily would occur due to changes in surface water elevations at San Luis Reservoir and reduced Striped Bass fishing opportunities under Alternatives 3 and 4.

This EIS does not quantitatively analyze potential changes in recreation user days or recreation spending because specific projects or responses to the changes in reservoir elevations are not considered under the purpose and need of this EIS. The qualitative analysis presented in this Chapter is based upon potential changes in recreational use related to changes under the alternatives as compared to the No

Action Alternative and the Second Basis of Comparison, as described in Chapter 15, Recreational Resources.

19.4.1.5 Changes in Commercial, Sport, and Tribal Salmon Fishing Opportunities

Changes in CVP and SWP operations under the alternatives could change the salmon population as compared to the No Action Alternative and the Second Basis of Comparison. Commercial, sport, and tribal fishing primarily relies upon Fall-run Chinook Salmon because the populations of other runs of salmon are substantially lower. Specific population changes for Fall-run Chinook Salmon are not projected in this EIS. Therefore, this Chapter presents a qualitative analysis of potential changes in socioeconomic factors under the alternatives as compared to the No Action Alternative and the Second Basis of Comparison.

19.4.1.6 Effects of Cross Delta Water Transfers

Historically water transfer programs have been developed on an annual basis. The demand for water transfers is dependent upon the availability of water supplies to meet water demands. Water transfer transactions have increased over time as CVP and SWP water supply availability has decreased, especially during drier water years.

Parties seeking water transfers generally acquire water from sellers who have available surface water who can make the water available through releasing previously stored water, pump groundwater instead of using surface water (groundwater substitution); idle crops; or substitute crops that uses less water in order to reduce normal consumptive use of surface water.

Water transfers using CVP and SWP Delta pumping plants and south of Delta canals generally occur when there is unused capacity in these facilities. These conditions generally occur drier water year types when the flows from upstream reservoirs plus unregulated flows are adequate to meet the Sacramento Valley water demands and the CVP and SWP export allocations. In non-wet years, the CVP and SWP water allocations would be less than full contract amounts; therefore, capacity may be available in the CVP and SWP conveyance facilities to move water from other sources.

Projecting future socioeconomic conditions related to water transfer activities is difficult because specific water transfer actions required to make the water available, convey the water, and/or use the water would change each year due to changing hydrological conditions, CVP and SWP water availability, specific local agency operations, and local cropping patterns. Reclamation recently prepared a long-term regional water transfer environmental document which evaluated potential changes in conditions related to water transfer actions (Reclamation 2014c). Results from this analysis were used to inform the impact assessment of potential effects of water transfers under the alternatives as compared to the No Action Alternative and the Second Basis of Comparison.

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

This EIS includes two bases of comparison, as described in Chapter 3, Description of Alternatives: the No Action Alternative and the Second Basis of Comparison. Both of these bases are evaluated at 2030 conditions. Changes that would occur over the next 15 years without implementation of the alternatives are not analyzed in this EIS. However, the changes to socioeconomics that are assumed to occur by 2030 under the No Action Alternative and the Second Basis of Comparison are summarized in this section. Many of the changed conditions would occur in the same manner under both the No Action Alternative and the Second Basis of Comparison.

19.4.2.1 Common Changes in Conditions under the No Action Alternative and Second Basis of Comparison

Conditions in 2030 would be different than existing conditions due to:

- Climate change and sea level rise
- General plan development throughout California, including increased water demands in portions of Sacramento Valley
- Implementation of reasonable and foreseeable water resources management projects to provide water supplies

It is anticipated that climate change would result in more short-duration high-rainfall events and less snowpack in the winter and early spring months. The reservoirs would be full more frequently by the end of April or May by 2030 than in recent historical conditions. However, as the water is released in the spring, there would be less snowpack to refill the reservoirs. This condition would reduce reservoir storage and available water supplies to downstream uses in the summer. The reduced end of September storage also would reduce the ability to release stored water to downstream regional reservoirs. These conditions would occur for all reservoirs in the California foothills and mountains, including non-CVP and SWP reservoirs.

These changes would result in a decline of the long-term average CVP and SWP water supply deliveries by 2030 as compared to recent historical long-term average deliveries under the No Action Alternative and the Second Basis of Comparison. However, the CVP and SWP water deliveries would be less under the No Action Alternative as compared to the Second Basis of Comparison, as described in Chapter 5, Surface Water Resources and Water Supplies, which could result in more crop idling.

Under the No Action Alternative and the Second Basis of Comparison, land uses in 2030 would occur in accordance with adopted general plans.

The No Action Alternative and the Second Basis of Comparison assumes completion of water resources management and environmental restoration projects that would have occurred without implementation of Alternatives 1 through 5, including regional and local recycling projects, surface water and groundwater storage projects, conveyance improvement projects, and desalination projects, as described in Chapter 3, Description of Alternatives. The No Action Alternative and the Second Basis of Comparison also assumes implementation of actions included in the 2008 U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BO) and 2009 National Marine Fisheries Service (NMFS) BO that would have been implemented without the BOs by 2030, as described in Chapter 3, Description of Alternatives.

19.4.2.2 Population Projections under the No Action Alternative and Second Basis of Comparison

The 2030 population projections for each region addressed in this EIS are presented in Tables 19.53 through 19.59.

Table 19.53 Population Projections in Trinity River Region

Area	Population		Average Annual Growth Rate (percent)
	2012	2030	2012-2030
Trinity County	13,471	15,309	0.7
Humboldt County	134,728	143,811	0.4
Del Norte County	28,527	31,252	0.5
Total Trinity River Region	176,726	190,373	0.4
STATE OF CALIFORNIA	**37,427,946**	**44,574,756**	**0.9**

Sources: DOF 2013a, 2013b, 2014

Table 19.54 Population Projections in Central Valley Region – Sacramento Valley

Area	Population		Average Annual Growth Rate (percent)
	2012	2030	2012-2030
Shasta County	177,516	210,997	0.9
Plumas County	19,901	20,390	0.1
Tehama County	62,985	75,522	1.0
Glenn County	28,105	33,318	0.9
Colusa County	21,552	28,112	1.4
Butte County	220,465	276,009	1.2
Yuba County	72,642	97,037	1.6
Nevada County	97,366	111,836	0.8
Sutter County	94,620	131,390	1.7
Placer County	351,463	454,124	1.4
El Dorado County	180,483	230,503	1.3
Sacramento Valley Subtotal	1,333,615	1,669,238	1.3
Total Central Valley Region	7,408,750	9,677,315	1.5
STATE OF CALIFORNIA	**37,668,804**	**44,574,756**	**0.9**

Sources: DOF 2013a, 2013b, 2014

Table 19.55 Population Projections in Central Valley – San Joaquin Valley

Area	Population		Average Annual Growth Rate (percent)
	2012	2030	2012-2030
Stanislaus County	519,339	666,446	1.4
Madera County	152,325	219,908	2.1
Merced County	260,029	359,798	1.8
Fresno County	943,493	1,232,151	1.5
Tulare County	451,540	636,606	1.9
Kings County	151,774	209,440	1.8
Kern County	849,977	1,276,155	2.3
San Joaquin Valley Subtotal	3,328,477	4,600,505	1.8
Total Central Valley Region	7,238,742	9,468,443	1.5
STATE OF CALIFORNIA	**37,668,804**	**44,574,756**	**0.9**

Sources: DOF 2013a, 2013b, 2014

Table 19.56 Population Projections in Central Valley Region – Delta and Suisun Marsh

Area	Population		Average Annual Growth Rate (percent)
	2012	2030	2012-2030
Sacramento County	1,433,525	1,731,061	1.1
Yolo County	204,349	250,420	1.1
Solano County	415,787	490,381	0.9
San Joaquin County	692,997	935,709	1.7
Contra Costa County	1,066,602	1,263,049	0.9
Delta and Suisun Marsh Subtotal	3,813,260	4,670,621	1.1
Total Central Valley Region	7,238,742	9,468,443	1.5
STATE OF CALIFORNIA	**37,668,804**	**44,574,756**	**0.9**

Sources: DOF 2013a, 2013b, 2014

Table 19.57 Population Projections in San Francisco Bay Area Region

Area	Population		Average Annual Growth Rate (percent)
	2012	2030	2012-2030
Alameda County	1,530,176	1,650,596	0.4
Santa Clara County	1,813,696	2,048,021	0.7
San Benito County	56,137	59,259	0.3
Napa County	137,731	158,538	0.8
Total San Francisco Bay Area Region	3,537,740	3,916,413	0.6
STATE OF CALIFORNIA	**37,668,804**	**44,574,756**	**0.9**

Sources: DOF 2013a, 2013b, 2014

Table 19.58 Population Projections in Central Coast Region

Area	Population		Average Annual Growth Rate (percent)
	2000	2030	2012-2030
San Luis Obispo County	271,502	311,388	0.8
Santa Barbara County	426,351	469,070	0.5
Total Central Coast Region	697,853	780,457	0.6
STATE OF CALIFORNIA	**37,668,804**	**44,574,756**	**0.9**

Sources: DOF 2013a, 2013b, 2014

Table 19.59 Population Projections in Southern California Region

Area	Population		Average Annual Growth Rate (percent)
	2012	2030	2012-2030
Ventura County	829,065	956,324	0.8
Los Angeles County	9,889,520	11,138,280	0.7
Orange County	3,057,879	3,385,762	0.6
San Diego County	3,128,734	3,665,358	0.9
Riverside County	2,234,193	3,145,948	1.9
San Bernardino County	2,059,699	2,588,990	1.3
Total Southern California Region	21,199,090	24,880,663	0.9
STATE OF CALIFORNIA	**37,668,804**	**44,574,756**	**0.9**

Sources: DOF 2013a, 2013b, 2014

19.4.3 Evaluation of Alternatives

Alternatives 1 through 5 have been compared to the No Action Alternative; and the No Action Alternative and Alternatives 1 through 5 have been compared to the Second Basis of Comparison.

During review of the numerical modeling analyses used in this EIS, an error was determined in the CalSim II model assumptions related to the Stanislaus River operations for the Second Basis of Comparison, Alternative 1, and Alternative 4 model runs. Appendix 5C includes a comparison of the CalSim II model run results presented in this Chapter and CalSim II model run results with the error corrected. Appendix 5C also includes a discussion of changes in the comparison of groundwater conditions for the following Alternative analyses.

- No Action Alternative compared to the Second Basis of Comparison
- Alternative 1 compared to the No Action Alternative
- Alternative 3 compared to the Second Basis of Comparison
- Alternative 5 compared to the Second Basis of Comparison.

19.4.3.1 No Action Alternative

The No Action Alternative is compared to the Second Basis of Comparison.

19.4.3.1.1 Trinity River Region

Regional Changes to Irrigated Agriculture

There are no agricultural lands irrigated with CVP and SWP water supplies in the Trinity River Region. Therefore, there would be no changes in irrigated lands under the No Action Alternative as compared to the Second Basis of Comparison.

Regional Changes to Municipal and Industrial Water Supplies

The CVP would continue to release water in Trinity River for downstream beneficial uses, including water supplies under the No Action Alternative and the Second Basis of Comparison. There are no municipal and industrial CVP or SWP water service contractors in the Trinity River Region.

Regional Changes to Recreational Opportunities

Recreational opportunities would be similar in the Trinity River Region under the No Action Alternative as compared to the Second Basis of Comparison as described in Chapter 15, Recreational Resources.

Regional Changes related to Changes in Salmon Fishing

Trinity River flows would be similar under the No Action Alternative as compared to the Second Basis of Comparison. This could result in similar salmon harvest conditions by the Yurok and Hoopa Valley tribes.

19.4.3.1.2 Central Valley Region

Regional Changes to Irrigated Agriculture

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under the No Action Alternative than under the Second Basis of Comparison. It is anticipated that groundwater use would increase in response to reduced CVP and SWP water supplies in 2030 because sustainable groundwater management plans would not be fully implemented until the 2040s, as discussed in Chapter 12, Agricultural Resources.

The agricultural production value under long-term average conditions would be reduced by less than 1 percent ($1.6 million/year in the Sacramento Valley and $0.5 million/year in the San Joaquin Valley) primarily due to an increase in groundwater pumping of approximately 6 percent. The agricultural production value under dry and critical dry conditions also would be reduced by less than 1 percent ($11.3 million/year in the Sacramento Valley and $20.3 million/year in the San Joaquin Valley) primarily due to an increase in groundwater pumping.

The overall reduction in agricultural production values are less than 0.05 percent under long-term conditions; and, changes in employment and regional economic output would be minimal. Therefore, the analysis of employment and regional economic output is focused on dry and critical dry years.

The direct changes in agricultural production would result in changes to employment and regional economic output in the Sacramento and San Joaquin valleys, as summarized in Tables 19.60 and 19.61, respectively.

Table 19.60 Changes in Agricultural-Related Employment and Regional Economic Output for the Sacramento Valley under the No Action Alternative as Compared to the Second Basis of Comparison in Dry and Critical Dry Years

Economic Sectors	Employment				Economic Output ($ millions)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	-87	-21	0	-108	-11.3	-1.3	0.0	-12.7
Mining & Logging	0	0	0	0	0.0	0.0	0.0	0.0
Construction	0	-1	0	-1	0.0	-0.1	0.0	-0.2
Manufacturing	0	0	0	0	0.0	-0.1	0.0	-0.1
Transportation, Warehousing & Utilities	0	-1	0	-2	0.0	-0.4	-0.1	-0.5
Wholesale Trade	0	-1	-1	-2	0.0	-0.2	-0.1	-0.3
Retail Trade	0	0	-4	-4	0.0	0.0	-0.3	-0.3
Information	0	0	0	0	0.0	0.0	-0.1	-0.1
Financial Activities	0	-7	-2	-9	0.0	-1.6	-0.8	-2.5
Services	0	-3	-12	-15	0.0	-0.3	-1.0	-1.3
Government	0	0	0	0	0.0	-0.1	0.0	-0.1
Total	**-87**	**-36**	**-19**	**-142**	**-11.3**	**-4.2**	**-2.5**	**-18.1**

Table 19.61 Changes in Agricultural-Related Employment and Regional Economic Output for the San Joaquin Valley under the No Action Alternative as Compared to the Second Basis of Comparison in Dry and Critical Dry Years

Economic Sectors	Employment				Economic Output ($ millions)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	-139	-53	0	-192	-20.3	-2.3	-0.1	-22.7
Mining & Logging	0	-1	0	-1	0.0	-0.3	0.0	-0.3
Construction	0	-2	0	-2	0.0	-0.2	0.0	-0.2
Manufacturing	0	-1	0	-2	0.0	-1.8	-0.3	-2.1
Transportation, Warehousing & Utilities	0	-3	-1	-4	0.0	-0.8	-0.2	-1.0
Wholesale Trade	0	-2	-1	-3	0.0	-0.4	-0.2	-0.5
Retail Trade	0	0	-7	-8	0.0	0.0	-0.6	-0.6
Information	0	0	0	-1	0.0	-0.1	-0.1	-0.2
Financial Activities	0	-12	-3	-15	0.0	-2.7	-1.5	-4.1
Services	0	-5	-21	-26	0.0	-0.5	-1.7	-2.2
Government	0	-1	0	-1	0.0	-0.2	-0.1	-0.3
Total	**-139**	**-79**	**-35**	**-254**	**-20.3**	**-9.2**	**-4.9**	**-34.4**

As described in Chapter 11, Geology and Soils Resources, increased groundwater pumping under the long-term average conditions may result in an additional increment of subsidence in those areas within the Central Valley. The additional amount of subsidence and the economic costs associated with it have not been quantified in this EIS. However, total subsidence-related costs have been shown to be substantial, as reported by Borchers et al. (2014) who estimated that the cost of subsidence in San Joaquin Valley between 1955 and 1972 was more than $1.3 billion (in 2013 dollars). These estimates are based on the impacts to major infrastructure in the region including the San Joaquin River, Delta Mendota Canal, Friant-Kern Canal and San Luis Canal in addition to privately owned infrastructure. The incremental subsidence-related costs, expressed on an annual basis, could be an unknown fraction of that cumulative cost.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under the No Action Alternative than under the Second Basis of Comparison. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis are described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies (e.g., cities of Huron and Coalinga) and would utilize water transfers.

The average annual water supply costs over the 81-year hydrologic period for M&I water supplies are presented in Tables 19.62 and 19.63 for the Sacramento and San Joaquin Valley, respectively.

Table 19.62 Changes in Municipal and Industrial Water Supply Costs for the Sacramento Valley under the No Action Alternative as Compared to the Second Basis of Comparison

Differences in Total	No Action Alternative	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	447	463	-16
Delivery Cost ($1,000)	$8,031	$8,317	-$287
Assumed New Supply Deliveries (TAF)	0	0	0
Annualized New Supply Costs ($1,000)	$0	$0	$0
Water Storage Costs ($1,000)	$0	$0	$0
Lost Water Sales Revenues ($1,000)	$213	$207	$6
Transfer Costs ($1,000)	$739	$517	$222
Shortage Costs ($1,000)	$69	$68	$1
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$3,858	-$3,916	$58
Excess Water Savings ($1,000)	-$2,275	-$2,563	$288
Average Annual Changes in Water Supply Costs ($1,000)	**$2,919**	**$2,630**	**$288**

Note: In 2012 dollars

Table 19.63 Changes in Municipal and Industrial Water Supply Costs for the San Joaquin Valley under the No Action Alternative as Compared to the Second Basis of Comparison

Differences in Total	No Action Alternative	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	214	237	-23
Delivery Cost ($1,000)	$3,460	$3,854	-$394
Assumed New Supply Deliveries (TAF)	2	0	2
Annualized New Supply Costs ($1,000)	$429	$15	$414
Water Storage Costs ($1,000)	$942	$820	$122
Lost Water Sales Revenues ($1,000)	$361	$322	$39
Transfer Costs ($1,000)	$2,673	$2,623	$50
Shortage Costs ($1,000)	$115	$102	$13
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$15,377	-$16,011	$634
Excess Water Savings ($1,000)	-$1,029	-$1,318	$289
Average Annual Changes in Water Supply Costs ($1,000)	**-$8,427**	**-$9,593**	**$1,166**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output in the Sacramento and San Joaquin valleys, as summarized in Tables 19.64 and 19.65, respectively. The M&I average annual water supply operating expenses would increase by 0.11 and 0.39 percent in the Sacramento Valley and the San Joaquin Valley, respectively; and therefore, the results would be similar.

Table 19.64 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Sacramento Valley under the No Action Alternative as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.1	-1.7	-1.6
Mining & Logging	0	0	0	0	0.0	0.4	-0.3	0.1
Construction	0	0	0	0	0.0	29.0	-2.5	26.5
Manufacturing	0	0	0	0	0.0	3.1	-22.2	-19.1
Transportation, Warehousing & Utilities	1	0	0	1	286.4	2.8	-18.0	271.2
Wholesale Trade	0	0	0	0	0.0	1.0	-27.1	-26.1
Retail Trade	0	0	-1	-1	0.0	0.9	-46.6	-45.6
Information	0	0	0	0	0.0	3.4	-20.6	-17.2
Financial Activities	0	0	0	0	0.0	13.0	-147.7	-134.6
Services	0	0	-2	-1	0.0	30.8	-154.7	-123.9
Government	0	0	0	0	0.0	0.2	-3.8	-3.7
Total	**1**	**1**	**-3**	**-1**	**286.4**	**84.8**	**-445.2**	**-74.0**

Note: In 2012 dollars

Table 19.65 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the San Joaquin Valley under the No Action Alternative as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.0	-6.7	-6.7
Mining & Logging	0	0	0	0	0.0	-0.4	-6.4	-6.8
Construction	0	0	0	0	0.0	-13.3	-5.6	-18.9
Manufacturing	0	0	0	0	0.0	-1.4	-46.4	-47.8
Transportation, Warehousing & Utilities	-1	0	0	-1	-140.8	-1.4	-44.7	-186.9
Wholesale Trade	0	0	0	0	0.0	-0.4	-39.0	-39.3
Retail Trade	0	0	-1	-1	0.0	-0.4	-97.4	-97.8
Information	0	0	0	0	0.0	-1.0	-27.0	-28.0
Financial Activities	0	0	-1	-1	0.0	-4.3	-263.7	-268.0
Services	0	0	-3	-3	0.0	-11.7	-292.3	-303.9
Government	0	0	0	0	0.0	-0.1	-12.9	-13.0
Total	**-1**	**0**	**-6**	**-7**	**-140.8**	**-34.3**	**-842.0**	**-1,017.2**

Note:
In 2012 dollars

Regional Changes to Recreational Opportunities

Recreational opportunities would decrease at San Luis Reservoir by 6 percent under the No Action Alternative as compared to the Second Basis of Comparison, as described in Chapter 15, Recreation Resources. Therefore, it is anticipated that recreational economic factors would be reduced under the No Action Alternative as compared to the Second Basis of Comparison.

Effects Related to Cross Delta Water Transfers

Potential effects to socioeconomic factors could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c). Potential effects to socioeconomic factors were identified as adverse in the seller's service area related to loss of income to farm workers and the associated agriculturally-related businesses and retail enterprises if crop idling methods were used to provide transfer water. The analysis also identified that local sales taxes could decline due to the loss of household income. If groundwater substitution was used to provide transfer water, agricultural production values could decline due to additional cost of pumping. However, income from the water transfer could increase operating income for the sellers. The regional impact would depend upon the extent of lands involved in the water transfer program in any specific year.

Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Under the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be less under the No Action Alternative than under the Second Basis of Comparison.

19.4.3.1.3 San Francisco Bay Area Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, reductions in CVP and SWP water supplies within the San Francisco Bay Area Region would not result in reductions in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be a reduction in irrigated acreage in dry and critical dry years under the No Action Alternative as compared to the Second Basis of Comparison.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under the No Action Alternative than under the Second Basis of Comparison. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would increase by $7.276 million, or 1.75 percent, as presented in Table 19.66; and therefore, the results would be similar under the No Action Alternative and Second Basis of Comparison.

Table 19.66 Changes in Municipal and Industrial Water Supply Costs for the San Francisco Bay Area Region under the No Action Alternative as Compared to the Second Basis of Comparison

Differences in Total	No Action Alternative	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	396	445	-48
Delivery Cost ($1,000)	$11,044	$12,515	-$1,471
Assumed New Supply Deliveries (TAF)	18	16	2
Annualized New Supply Costs ($1,000)	$599	$234	$365
Water Storage Costs ($1,000)	$1,577	$1,963	-$386
Lost Water Sales Revenues ($1,000)	$4,286	$1,595	$2,691
Transfer Costs ($1,000)	$5,722	$1,154	$4,568
Shortage Costs ($1,000)	$1,410	$523	$887
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$493	-$792	$298
Excess Water Savings ($1,000)	-$225	-$549	$324
Average Annual Changes in Water Supply Costs ($1,000)	**$23,919**	**$16,643**	**$7,276**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.67.

Table 19.67 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the San Francisco Bay Area Region under the No Action Alternative as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.1	-7.9	-7.8
Mining & Logging	0	0	0	0	0.0	1.6	-5.0	-3.4
Construction	0	1	0	1	0.0	158.8	-37.1	121.7
Manufacturing	0	0	0	0	0.0	28.8	-478.0	-449.1
Transportation, Warehousing & Utilities	5	0	-1	4	1,492.4	11.2	-183.5	1,320.1
Wholesale Trade	0	0	-1	-1	0.0	5.0	-350.6	-345.7
Retail Trade	0	0	-6	-6	0.0	4.2	-567.2	-563.0
Information	0	0	-1	-1	0.0	16.8	-306.6	-289.8
Financial Activities	0	0	-5	-4	0.0	55.8	-1,740.5	-1,684.7
Services	0	1	-20	-19	0.0	133.7	-2,162.8	-2,029.1
Government	0	0	0	0	0.0	0.7	-55.1	-54.4
Total	**5**	**3**	**-35**	**-27**	**1,492.4**	**416.7**	**-5,894.3**	**-3,985.2**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under the No Action Alternative as compared to the Second Basis of Comparison generally would result in lower reservoir elevations in reservoirs (up to 10 to 18 percent) that store CVP and SWP water; and would result in reduced recreational economic factors under the No Action Alternative as compared to the Second Basis of Comparison.

Regional Changes to Salmon Fishing

Changes in commercial and sport ocean salmon fishing primarily would be related to the presence of fall-run Chinook Salmon from Central Valley hatcheries. It is assumed that the production of hatchery fish would be similar under the No Action Alternative and the Second Basis of Comparison. However, survival of the fall-run Chinook Salmon hatchery fish to the Pacific Ocean could be related to changes in CVP and SWP operations. As described in Chapter 9, Fish and Aquatic Resources, there would be little change in through-Delta survival by emigrating natural juvenile fall-run Chinook Salmon under the No Action Alternative as compared to the Second Basis of Comparison. It is assumed that the survival of the hatchery juvenile fall-run Chinook Salmon would be similar to the survival of the natural juvenile fall-run Chinook Salmon. Therefore, the availability of fish for commercial and sport ocean salmon fishing and the associated economic conditions for the fishing industry would be similar under the No Action Alternative and the Second Basis of Comparison.

19.4.3.1.4 Central Coast Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, reductions in CVP and SWP water supplies within the Central Coast Region would not result in reductions in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be a reduction in irrigated acreage in dry and critical dry years under the No Action Alternative as compared to the Second Basis of Comparison.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under the No Action Alternative than under the Second Basis of Comparison. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would increase by 0.7 percent, as presented in Table 19.68; and therefore, the results would be similar under the No Action Alternative and Second Basis of Comparison.

Table 19.68 Changes in Municipal and Industrial Water Supply Costs for the Central Coast Region under the No Action Alternative as Compared to the Second Basis of Comparison

Differences in Total	No Action Alternative	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	44	54	-10
Delivery Cost ($1,000)	$6,663	$8,174	-$1,510
Assumed New Supply Deliveries (TAF)	0	0	0
Annualized New Supply Costs ($1,000)	$0	$0	$0
Water Storage Costs ($1,000)	$0	$0	$0
Lost Water Sales Revenues ($1,000)	$0	$0	$0
Transfer Costs ($1,000)	$0	$0	$0
Shortage Costs ($1,000)	$0	$0	$0
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$8,068	-$8,643	$575
Excess Water Savings ($1,000)	-$2,970	-$4,176	$1,206
Average Annual Changes in Water Supply Costs ($1,000)	**-$4,374**	**-$4,645**	**$271**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.69.

Table 19.69 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Central Coast Region under the No Action Alternative as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.6	-4.0	-3.4
Mining & Logging	0	0	0	0	0.0	6.4	-9.3	-2.9
Construction	0	2	0	2	0.0	201.9	-9.7	192.2
Manufacturing	0	0	0	0	0.0	26.8	-51.8	-25.0
Transportation, Warehousing & Utilities	6	0	0	6	1,510.8	17.0	-56.2	1,471.6
Wholesale Trade	0	0	0	0	0.0	4.8	-58.6	-53.8
Retail Trade	0	0	-1	-1	0.0	6.1	-118.5	-112.4
Information	0	0	0	0	0.0	12.0	-39.0	-27.0
Financial Activities	0	0	-1	-1	0.0	68.9	-352.0	-283.2
Services	0	2	-5	-3	0.0	167.1	-447.4	-280.3
Government	0	0	0	0	0.0	0.9	-13.2	-12.3
Total	**6**	**4**	**-8**	**2**	**1,510.8**	**512.7**	**-1,159.9**	**863.6**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under the No Action Alternative as compared to the Second Basis of Comparison generally would result in lower reservoir elevations in reservoirs that store CVP and SWP water (up to 10 to 18 percent) that store CVP and SWP water; and would result in reduced recreational economic factors under the No Action Alternative as compared to the Second Basis of Comparison..

19.4.3.1.5 Southern California Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, reductions in CVP and SWP water supplies within the Southern California Region would not result in reductions in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be a reduction in irrigated acreage in dry and critical dry years under the No Action Alternative as compared to the Second Basis of Comparison.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under the No Action Alternative than under the Second Basis of Comparison. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply costs over the 81-year hydrologic period for M&I water supplies would increase by 2.14 percent, as presented in Table 19.70; and therefore, the results would be similar under the No Action Alternative and Second Basis of Comparison.

Table 19.70 Changes in Municipal and Industrial Water Supply Costs for the Southern California Region under the No Action Alternative as Compared to the Second Basis of Comparison

Differences in Total	No Action Alternative	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	1,932	2,394	-461
Delivery Cost ($1,000)	$239,692	$296,795	-$57,103
Assumed New Supply Deliveries (TAF)	47	11	35
Annualized New Supply Costs ($1,000)	$12,688	$4,032	$8,656
Water Storage Costs ($1,000)	$7,598	$2,824	$4,774
Lost Water Sales Revenues ($1,000)	$14,614	$1,119	$13,495
Transfer Costs ($1,000)	$11,484	$3,705	$7,779
Shortage Costs ($1,000)	$17,319	$353	$16,966
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$57,474	-$91,507	$34,033
Excess Water Savings ($1,000)	-$4,629	-$10,573	$5,944
Average Annual Changes in Water Supply Costs ($1,000)	**$241,291**	**$206,749**	**$34,542**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.71.

Table 19.71 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Southern California Region under the No Action Alternative as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	2	0	0.0	-12.5	272.7	260.2
Mining & Logging	0	-1	1	0	0.0	-164.2	369.0	204.8
Construction	0	-43	3	0	0.0	-5,205.5	395.5	-4,810.0
Manufacturing	0	-2	10	0	0.0	-1,452.6	6,814.5	5,361.9
Transportation, Warehousing & Utilities	-175	-2	12	-175	-43,673.4	-592.0	2,602.9	-41,662.5
Wholesale Trade	0	-1	20	0	0.0	-275.3	4,339.0	4,063.8
Retail Trade	0	-2	58	0	0.0	-170.6	5,106.3	4,935.7
Information	0	-1	6	0	0.0	-637.5	2,962.1	2,324.6
Financial Activities	0	-9	52	0	0.0	-2,528.7	17,797.9	15,269.1
Services	0	-46	212	0	0.0	-5,542.2	20,430.6	14,888.4
Government	0	0	3	0	0.0	-29.8	587.3	557.5
Total	**-175**	**-108**	**378**	**-175**	**-43,673.4**	**-16,611.0**	**61,677.8**	**1,393.5**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under the No Action Alternative as compared to the Second Basis of Comparison generally would result in lower reservoir elevations in reservoirs that store CVP and SWP water, (up to 10 to 18 percent) that store CVP and SWP water; and would result in reduced recreational economic factors under the No Action Alternative as compared to the Second Basis of Comparison..

19.4.3.2 Alternative 1

As described in Chapter 3, Description of Alternatives, Alternative 1 is identical to the Second Basis of Comparison. As described in Chapter 4, Approach to Environmental Analysis, Alternative 1 as compared to the No Action Alternative and the Second Basis of Comparison. However, because socioeconomic factors under Alternative 1 are identical to socioeconomic factors under the Second Basis of Comparison; Alternative 1 is only compared to the No Action Alternative.

19.4.3.2.1 Alternative 1 Compared to the No Action Alternative

Trinity River Region

Regional Changes to Irrigated Agriculture

There are no agricultural lands irrigated with CVP and SWP water supplies in the Trinity River Region. Therefore, there would be no changes in irrigated lands under Alternative 1 as compared to the No Action Alternative.

Regional Changes to Municipal and Industrial Water Supplies

The CVP would continue to release water in Trinity River for downstream beneficial uses, including water supplies under Alternative 1 as compared to the No Action Alternative. There are no CVP or SWP water contractors in the Trinity River Region.

Regional Changes to Recreational Opportunities

Recreational opportunities would be similar in the Trinity River Region under Alternative 1 as compared to the No Action Alternative as described in Chapter 15, Recreational Resources.

Regional Changes to Salmon Fishing

Trinity River flows would be similar under Alternative 1 as compared to the No Action Alternative. This could result in similar salmon harvest conditions by the Yurok and Hoopa Valley tribes.

Central Valley Region

Regional Changes to Irrigated Agriculture

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be greater under Alternative 1 as compared to the No Action Alternative. It is anticipated that groundwater use would decrease in response to increased CVP and SWP water supplies in 2030; and sustainable groundwater management plans would not be fully implemented until the 2040s, as discussed in Chapter 12, Agricultural Resources.

The agricultural production value under long-term average conditions would be increased by less than 1 percent ($1.6 million/year in the Sacramento Valley and $0.5 million/year in the San Joaquin Valley) primarily due to a decrease in groundwater pumping of approximately 7 percent. The agricultural production value under dry and critical dry conditions also would be increased by less than 1 percent ($11.3 million/year in the Sacramento Valley and $20.3 million/year in the San Joaquin Valley) primarily due to a decrease in groundwater pumping.

The overall increase in agricultural production values are less than 0.05 percent under long-term conditions; and, changes in employment and regional economic output would be minimal. Therefore, the analysis of employment and regional economic output is focused on dry and critical dry years.

The direct changes in agricultural production would result in changes to employment and regional economic output in the Sacramento and San Joaquin valleys, as summarized in Tables 19.72 and 19.73, respectively.

1 **Table 19.72 Changes in Agricultural-Related Employment and Regional Economic**
2 **Output for the Sacramento Valley under Alternative 1 as compared to the No**
3 **Action Alternative in Dry and Critical Dry Years**

Economic Sectors	Employment				Economic Output ($ millions)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	87	21	0	108	11.3	1.3	0	12.7
Mining & Logging	0	0	0	0	0	0	0	0
Construction	0	1	0	1	0	0.1	0	0.2
Manufacturing	0	0	0	0	0	0.1	0	0.1
Transportation, Warehousing & Utilities	0	1	0	2	0	0.4	0.1	0.5
Wholesale Trade	0	1	1	2	0	0.2	0.1	0.3
Retail Trade	0	0	4	4	0	0	0.3	0.3
Information	0	0	0	0	0	0	0.1	0.1
Financial Activities	0	7	2	9	0	1.6	0.8	2.5
Services	0	3	12	15	0	0.3	1	1.3
Government	0	0	0	0	0	0.1	0	0.1
Total	**87**	**36**	**19**	**142**	**11.3**	**4.2**	**2.5**	**18.1**

4 Note: In 2012 dollars.

5 **Table 19.73 Changes in Agricultural-Related Employment and Regional Economic**
6 **Output for the San Joaquin Valley under Alternative 1 as compared to the No**
7 **Action Alternative in Dry and Critical Dry Years**

Economic Sectors	Employment				Economic Output ($ millions)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	139	53	0	192	20.3	2.3	0.1	22.7
Mining & Logging	0	1	0	1	0	0.3	0	0.3
Construction	0	2	0	2	0	0.2	0	0.2
Manufacturing	0	1	0	2	0	1.8	0.3	2.1
Transportation, Warehousing & Utilities	0	3	1	4	0	0.8	0.2	1
Wholesale Trade	0	2	1	3	0	0.4	0.2	0.5
Retail Trade	0	0	7	8	0	0	0.6	0.6
Information	0	0	0	1	0	0.1	0.1	0.2
Financial Activities	0	12	3	15	0	2.7	1.5	4.1
Services	0	5	21	26	0	0.5	1.7	2.2
Government	0	1	0	1	0	0.2	0.1	0.3
Total	**139**	**79**	**35**	**254**	**20.3**	**9.2**	**4.9**	**34.4**

8 Note: In 2012 dollars.

As described in Chapter 11, Geology and Soils Resources, increased groundwater pumping under the long-term average conditions may result in an additional increment of subsidence in those areas within the Central Valley. The additional amount of subsidence and the economic costs associated with it have not been quantified in this EIS. However, total subsidence-related costs have been shown to be substantial, as reported by Borchers et al. (2014) who estimated that the cost of subsidence in San Joaquin Valley between 1955 and 1972 was more than $1.3 billion (in 2013 dollars). These estimates are based on the impacts to major infrastructure in the region including the San Joaquin River, Delta Mendota Canal, Friant-Kern Canal and San Luis Canal in addition to privately owned infrastructure. The incremental subsidence-related costs, expressed on an annual basis, could be an unknown fraction of that cumulative cost.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would increase under Alternative 1 as compared to the No Action Alternative. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis are described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply costs over the 81-year hydrologic period for M&I water supplies are presented in Tables 19.74 and 19.75 for the Sacramento and San Joaquin Valley, respectively. The average annual water supply operating expenses would decrease by 0.11 and 0.39 percent in the Sacramento Valley and the San Joaquin Valley, respectively; and therefore, the results would be similar under Alternative 1 and the No Action Alternative.

Table 19.74 Changes in Municipal and Industrial Water Supply Costs for the Sacramento Valley under Alternative 1 as compared to the No Action Alternative

Differences in Total	Alternative 1	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	463	447	16
Delivery Cost ($1,000)	$8,317	$8,031	$287
Assumed New Supply Deliveries (TAF)	0	0	0
Annualized New Supply Costs ($1,000)	$0	$0	$0
Water Storage Costs ($1,000)	$0	$0	$0
Lost Water Sales Revenues ($1,000)	$207	$213	-$6
Transfer Costs ($1,000)	$517	$739	-$222
Shortage Costs ($1,000)	$68	$69	-$1
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$3,916	-$3,858	-$58
Excess Water Savings ($1,000)	-$2,563	-$2,275	-$288
Average Annual Changes in Water Supply Costs ($1,000)	**$2,630**	**$2,919**	**-$288**

Note: In 2012 dollars

Table 19.75 Changes in Municipal and Industrial Water Supply Costs for the San Joaquin Valley under Alternative 1 as compared to the No Action Alternative

Differences in Total	Alternative 1	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	237	214	23
Delivery Cost ($1,000)	$3,854	$3,460	$394
Assumed New Supply Deliveries (TAF)	0	2	-2
Annualized New Supply Costs ($1,000)	$15	$429	-$414
Water Storage Costs ($1,000)	$820	$942	-$122
Lost Water Sales Revenues ($1,000)	$322	$361	-$39
Transfer Costs ($1,000)	$2,623	$2,673	-$50
Shortage Costs ($1,000)	$102	$115	-$13
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$16,011	-$15,377	-$634
Excess Water Savings ($1,000)	-$1,318	-$1,029	-$289
Average Annual Changes in Water Supply Costs ($1,000)	**-$9,593**	**-$8,427**	**-$1,166**

The changes in M&I water supply costs would result in changes to employment and regional economic output in the Sacramento and San Joaquin valleys, as summarized in Tables 19.76 and 19.77, respectively.

Table 19.76 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Sacramento Valley under Alternative 1 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	-0.1	1.7	1.6
Mining & Logging	0	0	0	0	0.0	-0.4	0.3	-0.1
Construction	0	0	0	0	0.0	-29.0	2.5	-26.5
Manufacturing	0	0	0	0	0.0	-3.1	22.2	19.1
Transportation, Warehousing & Utilities	-1	0	0	-1	-286.4	-2.8	18.0	-271.2
Wholesale Trade	0	0	0	0	0.0	-1.0	27.1	26.1
Retail Trade	0	0	1	1	0.0	-0.9	46.6	45.6
Information	0	0	0	0	0.0	-3.4	20.6	17.2
Financial Activities	0	0	0	0	0.0	-13.0	147.7	134.6
Services	0	0	2	-1	0.0	-30.8	154.7	123.9
Government	0	0	0	0	0.0	-0.2	3.8	3.7
Total	**-1**	**-1**	**3**	**-1**	**-286.4**	**-84.8**	**445.2**	**74.0**

Note: In 2012 dollars

Table 19.77 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the San Joaquin Valley under Alternative 1 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.0	6.7	6.7
Mining & Logging	0	0	0	0	0.0	0.4	6.4	6.8
Construction	0	0	0	0	0.0	13.3	5.6	18.9
Manufacturing	0	0	0	0	0.0	1.4	46.4	47.8
Transportation, Warehousing & Utilities	1	0	0	1	140.8	1.4	44.7	186.9
Wholesale Trade	0	0	0	0	0.0	0.4	39.0	39.3
Retail Trade	0	0	1	1	0.0	0.4	97.4	97.8
Information	0	0	0	0	0.0	1.0	27.0	28.0
Financial Activities	0	0	1	1	0.0	4.3	263.7	268.0
Services	0	0	3	3	0.0	11.7	292.3	303.9
Government	0	0	0	0	0.0	0.1	12.9	13.0
Total	**1**	**0**	**6**	**7**	**140.8**	**34.3**	**842.0**	**1,017.2**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Recreational opportunities would increase at San Luis Reservoir by 6 percent under Alternative 1 as compared to the No Action Alternative, as described in Chapter 15, Recreation Resources. Therefore, it is anticipated that recreational economic factors would be increased under Alternative 1 as compared to the No Action Alternative.

Effects Related to Cross Delta Water Transfers

Potential effects to socioeconomic factors could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 1 and the No Action Alternative, and that impacts on socioeconomic factors could be adverse in the seller's service area.

Under Alternative 1, water could be transferred throughout the year without an annual volumetric limit. Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be increased under Alternative 1 as compared to the No Action Alternative.

San Francisco Bay Area Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, increases in CVP and SWP water supplies within the San Francisco Bay Area Region would not result in changes in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be an increase in irrigated acreage in dry and critical dry years under Alternative 1 as compared to the No Action Alternative.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would increase under Alternative 1 as compared to the No Action Alternative. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would decrease by 1.75 percent, as presented in Table 19.78; and therefore, the results would be similar under Alternative 1 and the No Action Alternative.

Table 19.78 Changes in Municipal and Industrial Water Supply Costs for the San Francisco Bay Area Region under Alternative 1 as compared to the No Action Alternative

Differences in Total	Alternative 1	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	445	396	48
Delivery Cost ($1,000)	$12,515	$11,044	$1,471
Assumed New Supply Deliveries (TAF)	16	18	-2
Annualized New Supply Costs ($1,000)	$234	$599	-$365
Water Storage Costs ($1,000)	$1,963	$1,577	$386
Lost Water Sales Revenues ($1,000)	$1,595	$4,286	-$2,691
Transfer Costs ($1,000)	$1,154	$5,722	-$4,568
Shortage Costs ($1,000)	$523	$1,410	-$887
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$792	-$493	-$298
Excess Water Savings ($1,000)	-$549	-$225	-$324
Average Annual Changes in Water Supply Costs ($1,000)	**$16,643**	**$23,919**	**-$7,276**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.79.

Table 19.79 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the San Francisco Bay Area Region under Alternative 1 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	-0.1	7.9	7.8
Mining & Logging	0	0	0	0	0.0	-1.6	5.0	3.4
Construction	0	-1	0	-1	0.0	-158.8	37.1	-121.7
Manufacturing	0	0	0	0	0.0	-28.8	478.0	449.1
Transportation, Warehousing & Utilities	-5	0	1	-4	-1,492.4	-11.2	183.5	-1,320.1
Wholesale Trade	0	0	1	1	0.0	-5.0	350.6	345.7
Retail Trade	0	0	6	6	0.0	-4.2	567.2	563.0
Information	0	0	1	1	0.0	-16.8	306.6	289.8
Financial Activities	0	0	5	4	0.0	-55.8	1,740.5	1,684.7
Services	0	-1	20	19	0.0	-133.7	2,162.8	2,029.1
Government	0	0	0	0	0.0	-0.7	55.1	54.4
Total	**-5**	**-3**	**35**	**27**	**-1,492.4**	**-416.7**	**5,894.3**	**3,985.2**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 1 as compared to the No Action Alternative generally would result in higher reservoir elevations in reservoirs that store CVP and SWP water (up to 11 to 21 percent); and would result in increased recreational economic factors under Alternative 1 as compared to the No Action Alternative.

Regional Changes to Salmon Fishing

Changes in commercial and sport ocean salmon fishing primarily would be related to the presence of fall-run Chinook Salmon from Central Valley hatcheries. It is assumed that the production of hatchery fish would be similar under Alternative 1 and the No Action Alternative. However, survival of the fall-run Chinook Salmon hatchery fish to the Pacific Ocean could be related to changes in CVP and SWP operations. As described in Chapter 9, Fish and Aquatic Resources, there would be little change in through-Delta survival by emigrating natural juvenile fall-run Chinook Salmon under Alternative 1 and the No Action Alternative. It is assumed that the survival of the hatchery juvenile fall-run Chinook Salmon would be similar to the survival of the natural juvenile fall-run Chinook Salmon. Therefore, the availability of fish for commercial and sport ocean salmon fishing and the associated economic conditions for the fishing industry would be similar under Alternative 1 and the No Action Alternative.

Central Coast Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, increases in CVP and SWP water supplies within the Central Coast Region would not result in increases in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be increased irrigated acreage in dry and critical dry years under Alternative 1 as compared to the No Action Alternative.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be higher under Alternative 1 as compared to the No Action Alternative. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would increase 0.7 percent, as presented in Table 19.80; and therefore, the results would be similar under Alternative 1 and the No Action Alternative.

Table 19.80 Changes in Municipal and Industrial Water Supply Costs for the Central Coast Region under Alternative 1 as compared to the No Action Alternative

Differences in Total	Alternative 1	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	54	44	10
Delivery Cost ($1,000)	$8,174	$6,663	$1,510
Assumed New Supply Deliveries (TAF)	0	0	0
Annualized New Supply Costs ($1,000)	$0	$0	$0
Water Storage Costs ($1,000)	$0	$0	$0
Lost Water Sales Revenues ($1,000)	$0	$0	$0
Transfer Costs ($1,000)	$0	$0	$0
Shortage Costs ($1,000)	$0	$0	$0
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$8,643	-$8,068	-$575
Excess Water Savings ($1,000)	-$4,176	-$2,970	-$1,206
Average Annual Changes in Water Supply Costs ($1,000)	**-$4,645**	**-$4,374**	**-$271**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.81.

Table 19.81 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Central Coast Region under Alternative 1 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	-0.6	4.0	3.4
Mining & Logging	0	0	0	0	0.0	-6.4	9.3	2.9
Construction	0	-2	0	-2	0.0	-201.9	9.7	-192.2
Manufacturing	0	0	0	0	0.0	-26.8	51.8	25.0
Transportation, Warehousing & Utilities	-6	0	0	-6	-1,510.8	-17.0	56.2	-1,471.6
Wholesale Trade	0	0	0	0	0.0	-4.8	58.6	53.8
Retail Trade	0	0	1	1	0.0	-6.1	118.5	112.4
Information	0	0	0	0	0.0	-12.0	39.0	27.0
Financial Activities	0	0	1	1	0.0	-68.9	352.0	283.2
Services	0	-2	5	3	0.0	-167.1	447.4	280.3
Government	0	0	0	0	0.0	-0.9	13.2	12.3
Total	**-6**	**-4**	**8**	**-2**	**-1,510.8**	**-512.7**	**1,159.9**	**-863.6**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 1 as compared to the No Action Alternative generally would result in higher reservoir elevations in reservoirs that store CVP and SWP water (up to 11 to 21 percent); and would result in increased recreational economic factors under Alternative 1 as compared to the No Action Alternative.

Southern California Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, increases in CVP and SWP water supplies within the Southern California Region would not result in increases in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be increased irrigated acreage in dry and critical dry years under Alternative 1 as compared to the No Action Alternative.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be higher under Alternative 1 as compared to the No Action Alternative. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would decrease 2.14 percent, as presented in Table 19.82; and therefore, the results would be similar under Alternative 1 and the No Action Alternative.

Table 19.82 Changes in Municipal and Industrial Water Supply Costs for the Southern California Region under Alternative 1 as compared to the No Action Alternative

Differences in Total	Alternative 1	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	2,394	1,932	461
Delivery Cost ($1,000)	$296,795	$239,692	$57,103
Assumed New Supply Deliveries (TAF)	11	47	-35
Annualized New Supply Costs ($1,000)	$4,032	$12,688	-$8,656
Water Storage Costs ($1,000)	$2,824	$7,598	-$4,774
Lost Water Sales Revenues ($1,000)	$1,119	$14,614	-$13,495
Transfer Costs ($1,000)	$3,705	$11,484	-$7,779
Shortage Costs ($1,000)	$353	$17,319	-$16,966
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$91,507	-$57,474	-$34,033
Excess Water Savings ($1,000)	-$10,573	-$4,629	-$5,944
Average Annual Changes in Water Supply Costs ($1,000)	**$206,749**	**$241,291**	**-$34,542**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.83.

Table 19.83 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Southern California Region under Alternative 1 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	-2	-1	0.0	12.5	-272.7	-260.2
Mining & Logging	0	1	-1	-1	0.0	164.2	-369.0	-204.8
Construction	0	43	-3	40	0.0	5,205.5	-395.5	4,810.0
Manufacturing	0	2	-10	-8	0.0	1,452.6	-6,814.5	-5,361.9
Transportation, Warehousing & Utilities	175	2	-12	166	43,673.4	592.0	-2,602.9	41,662.5
Wholesale Trade	0	1	-20	-19	0.0	275.3	-4,339.0	-4,063.8
Retail Trade	0	2	-58	-56	0.0	170.6	-5,106.3	-4,935.7
Information	0	1	-6	-5	0.0	637.5	-2,962.1	-2,324.6
Financial Activities	0	9	-52	-43	0.0	2,528.7	-17,797.9	-15,269.1
Services	0	46	-212	-166	0.0	5,542.2	-20,430.6	-14,888.4
Government	0	0	-3	-3	0.0	29.8	-587.3	-557.5
Total	**175**	**108**	**-378**	**-95**	**43,673.4**	**16,611.0**	**-61,677.8**	**-1,393.5**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 1 as compared to the No Action Alternative generally would result in higher reservoir elevations in reservoirs that store CVP and SWP water (up to 11 to 21 percent); and would result in increased recreational economic factors under Alternative 1 as compared to the No Action Alternative.

19.4.3.2.2 Alternative 1 Compared to the Second Basis of Comparison

As described in Chapter 3, Description of Alternatives, Alternative 1 is identical to the Second Basis of Comparison.

19.4.3.3 Alternative 2

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative, therefore, Alternative 2 is only compared to the Second Basis of Comparison.

19.4.3.3.1 Alternative 2 Compared to the Second Basis of Comparison

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative. Therefore, changes to socioeconomic factors under Alternatives 2 as compared to the Second Basis of Comparison would be the same as the impacts described in Section 12.4.3.1, No Action Alternative.

19.4.3.4 Alternative 3

As described in Chapter 3, Description of Alternatives, CVP and SWP operations under Alternative 3 are similar to the Second Basis of Comparison with modified Old and Middle River flow criteria and New Melones Reservoir operations and reductions in Striped Bass fishing opportunities. As described in Chapter 4, Approach to Environmental Analysis, Alternative 3 is compared to the No Action Alternative and the Second Basis of Comparison.

19.4.3.4.1 Alternative 3 Compared to the No Action Alternative

Trinity River Region

Regional Changes to Irrigated Agriculture

There are no agricultural lands irrigated with CVP and SWP water supplies in the Trinity River Region. Therefore, there would be no changes in irrigated lands under Alternative 3 as compared to the No Action Alternative.

Regional Changes to Municipal and Industrial Water Supplies

The CVP would continue to release water in Trinity River for downstream beneficial uses, including water supplies under Alternative 3 as compared to the No Action Alternative. There are no CVP or SWP water contractors in the Trinity River Region.

Regional Changes to Recreational Opportunities

Recreational opportunities would be similar in the Trinity River Region under Alternative 3 as compared to the No Action Alternative as described in Chapter 15, Recreational Resources.

Regional Changes to Salmon Fishing

Trinity River flows would be similar under Alternative 3 as compared to the No Action Alternative. This could result in similar salmon harvest conditions by the Yurok and Hoopa Valley tribes.

Central Valley Region

Regional Changes to Irrigated Agriculture

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be greater under Alternative 3 as compared to the No Action Alternative. It is anticipated that groundwater use would decrease in response to increased CVP and SWP water supplies in 2030; and sustainable groundwater management plans would not be fully implemented until the 2040s, as discussed in Chapter 12, Agricultural Resources.

The agricultural production value under long-term average conditions would be increased by less than 1 percent ($1.2 million/year in the Sacramento Valley and $0.3 million/year in the San Joaquin Valley) primarily due to a decrease in groundwater pumping of approximately 4 percent. The agricultural production value under dry and critical dry conditions also would be increased by less than 1 percent ($9.2 million/year in the Sacramento Valley and $11.4 million/year in the San Joaquin Valley), primarily due to a decrease in groundwater pumping.

The overall increase in agricultural production values are less than 0.05 percent under long-term conditions; and, changes in employment and regional economic output would be minimal. Therefore, the analysis of employment and regional economic output is focused on dry and critical dry years.

The direct changes in agricultural production would result in changes to employment and regional economic output in the Sacramento and San Joaquin valleys, as summarized in Tables 19.84 and 19.85, respectively.

Table 19.84 Changes in Agricultural-Related Employment and Regional Economic Output for the Sacramento Valley under Alternative 3 as compared to the No Action Alternative in Dry and Critical Dry Years

Economic Sectors	Employment				Economic Output ($ millions)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	69	18	0	86	9.2	1.1	0.0	10.3
Mining & Logging	0	0	0	0	0.0	0.0	0.0	0.0
Construction	0	1	0	1	0.0	0.1	0.0	0.1
Manufacturing	0	0	0	0	0.0	0.1	0.0	0.1
Transportation, Warehousing & Utilities	0	1	0	1	0.0	0.3	0.1	0.4
Wholesale Trade	0	1	0	1	0.0	0.2	0.1	0.3
Retail Trade	0	0	3	3	0.0	0.0	0.3	0.3
Information	0	0	0	0	0.0	0.0	0.1	0.1
Financial Activities	0	5	2	7	0.0	1.3	0.7	2.0
Services	0	3	10	13	0.0	0.2	0.9	1.1
Government	0	0	0	0	0.0	0.1	0.0	0.1
Total	**69**	**29**	**17**	**115**	**9.2**	**3.4**	**2.2**	**14.8**

Note: In 2012 dollars

Table 19.85 Changes in Agricultural-Related Employment and Regional Economic Output for the San Joaquin Valley under Alternative 3 as compared to the No Action Alternative in Dry and Critical Dry Years

Economic Sectors	Employment				Economic Output ($ millions)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	103	26	0	130	11.4	1.2	0.0	12.7
Mining & Logging	0	1	0	1	0.0	0.2	0.0	0.2
Construction	0	1	0	1	0.0	0.1	0.0	0.1
Manufacturing	0	1	0	1	0.0	1.2	0.1	1.3
Transportation, Warehousing & Utilities	0	2	0	2	0.0	0.5	0.1	0.6
Wholesale Trade	0	1	0	1	0.0	0.2	0.1	0.3
Retail Trade	0	0	3	3	0.0	0.0	0.3	0.3
Information	0	0	0	0	0.0	0.0	0.1	0.1
Financial Activities	0	8	1	10	0.0	1.8	0.6	2.5
Services	0	3	9	12	0.0	0.3	0.7	1.0
Government	0	0	0	1	0.0	0.1	0.0	0.1
Total	103	44	15	161	11.4	5.7	2.1	19.1

Note: In 2012 dollars

As described in Chapter 11, Geology and Soils Resources, increased groundwater pumping under the long-term average conditions may result in an additional increment of subsidence in those areas within the Central Valley. The additional amount of subsidence and the economic costs associated with it have not been quantified in this EIS. However, total subsidence-related costs have been shown to be substantial, as reported by Borchers et al. (2014) who estimated that the cost of subsidence in San Joaquin Valley between 1955 and 1972 was more than $1.3 billion (in 2013 dollars). These estimates are based on the impacts to major infrastructure in the region including the San Joaquin River, Delta Mendota Canal, Friant-Kern Canal and San Luis Canal in addition to privately owned infrastructure. The incremental subsidence-related costs, expressed on an annual basis, could be an unknown fraction of that cumulative cost.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would increase under Alternative 3 as compared to the No Action Alternative. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply costs over the 81-year hydrologic period for M&I water supplies are presented in Tables 19.86 and 19.87 for the Sacramento and San Joaquin Valley, respectively. Average annual water supply operating expenses would decrease by 0.07 and 0.5 percent in the Sacramento Valley and the San Joaquin Valley, respectively; and therefore, the results would be similar under Alternative 3 and the No Action Alternative.

Table 19.86 Changes in Municipal and Industrial Water Supply Costs for the Sacramento Valley under Alternative 3 as compared to the No Action Alternative

Differences in Total	Alternative 3	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	461	447	13
Delivery Cost ($1,000)	$8,285	$8,031	$255
Assumed New Supply Deliveries (TAF)	0	0	0
Annualized New Supply Costs ($1,000)	$0	$0	$0
Water Storage Costs ($1,000)	$0	$0	$0
Lost Water Sales Revenues ($1,000)	$243	$213	$30
Transfer Costs ($1,000)	$601	$739	-$138
Shortage Costs ($1,000)	$77	$69	$8
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$3,938	-$3,858	-$81
Excess Water Savings ($1,000)	-$2,517	-$2,275	-$241
Average Annual Changes in Water Supply Costs ($1,000)	**$2,750**	**$2,919**	**-$169**

Note: In 2012 dollars

Table 19.87 Changes in Municipal and Industrial Water Supply Costs for the San Joaquin Valley under Alternative 3 as compared to the No Action Alternative

Differences in Total	Alternative 3	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	241	214	27
Delivery Cost ($1,000)	$3,896	$3,460	$436
Assumed New Supply Deliveries (TAF)	0	2	-2
Annualized New Supply Costs ($1,000)	$13	$429	-$417
Water Storage Costs ($1,000)	$465	$942	-$477
Lost Water Sales Revenues ($1,000)	$284	$361	-$78
Transfer Costs ($1,000)	$2,104	$2,673	-$568
Shortage Costs ($1,000)	$89	$115	-$26
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$15,660	-$15,377	-$283
Excess Water Savings ($1,000)	-$1,378	-$1,029	-$349
Average Annual Changes in Water Supply Costs ($1,000)	**-$10,187**	**-$8,427**	**-$1,761**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output in the Sacramento and San Joaquin valleys, as summarized in Tables 19.88 and 19.89, respectively.

Table 19.88 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Sacramento Valley under Alternative 3 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.1	-1.2	-1.1
Mining & Logging	0	0	0	0	0.0	0.4	-0.2	0.2
Construction	0	0	0	0	0.0	25.8	-1.8	23.9
Manufacturing	0	0	0	0	0.0	2.8	-16.2	-13.5
Transportation, Warehousing & Utilities	1	0	0	1	254.4	2.5	-13.1	243.7
Wholesale Trade	0	0	0	0	0.0	0.9	-20.0	-19.1
Retail Trade	0	0	0	0	0.0	0.8	-33.8	-33.0
Information	0	0	0	0	0.0	3.0	-15.1	-12.1
Financial Activities	0	0	0	0	0.0	11.6	-107.7	-96.1
Services	0	0	-1	-1	0.0	27.4	-112.8	-85.4
Government	0	0	0	0	0.0	0.1	-2.8	-2.7
Total	**1**	**1**	**-2**	**0**	**254.4**	**75.3**	**-324.8**	**4.9**

Note: In 2012 dollars

Table 19.89 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the San Joaquin Valley under Alternative 3 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	-0.2	-8.9	-9.1
Mining & Logging	0	0	0	0	0.0	-1.2	-8.5	-9.7
Construction	0	0	0	0	0.0	-43.3	-7.4	-50.7
Manufacturing	0	0	0	0	0.0	-4.4	-62.0	-66.3
Transportation, Warehousing & Utilities	-2	0	0	-2	-457.3	-4.4	-59.6	-521.3
Wholesale Trade	0	0	0	0	0.0	-1.2	-51.6	-52.8
Retail Trade	0	0	-2	-2	0.0	-1.3	-130.7	-132.0
Information	0	0	0	0	0.0	-3.2	-36.0	-39.2
Financial Activities	0	0	-1	-1	0.0	-14.1	-352.2	-366.3
Services	0	0	-5	-5	0.0	-38.0	-391.1	-429.1
Government	0	0	0	0	0.0	-0.3	-17.2	-17.5
Total	**-2**	**-1**	**-8**	**-11**	**-457.3**	**-111.6**	**-1,125.2**	**-1,694.1**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Recreational opportunities would be similar at San Luis Reservoir under Alternative 3 as compared to the No Action Alternative, as described in Chapter 15, Recreation Resources. Recreational opportunities related to Striped Bass fishing would initially be increased when Alternative 3 is implemented.

However, by 2030, Striped Bass fishing opportunities would be reduced under Alternative 3 as compared to the Second Basis of Comparison due to actions to reduce predation. Therefore, it is anticipated that recreational economic factors would be reduced under Alternative 3 as compared to the No Action Alternative.

Effects Related to Cross Delta Water Transfers

Potential effects to socioeconomic factors could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 3 and the No Action Alternative, and that impacts on socioeconomic factors could be adverse in the seller's service area.

Under Alternative 3, water could be transferred throughout the year without an annual volumetric limit. Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be increased under Alternative 3 as compared to the No Action Alternative.

San Francisco Bay Area Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, increases in CVP and SWP water supplies within the San Francisco Bay Area Region would not result in changes in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be an increase in irrigated acreage in dry and critical dry years under Alternative 3 as compared to the No Action Alternative.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would increase under Alternative 3 as compared to the No Action Alternative. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would decrease by 1.23 percent, as presented in Table 19.90; and therefore, the results would be similar under Alternative 3 and the No Action Alternative.

Table 19.90 Changes in Municipal and Industrial Water Supply Costs for the San Francisco Bay Area Region under Alternative 3 as compared to the No Action Alternative

Differences in Total	Alternative 3	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	431	396	34
Delivery Cost ($1,000)	$12,096	$11,044	$1,052
Assumed New Supply Deliveries (TAF)	18	18	0
Annualized New Supply Costs ($1,000)	$575	$599	-$24
Water Storage Costs ($1,000)	$2,303	$1,577	$726
Lost Water Sales Revenues ($1,000)	$2,381	$4,286	-$1,905
Transfer Costs ($1,000)	$1,826	$5,722	-$3,896
Shortage Costs ($1,000)	$743	$1,410	-$667
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$726	-$493	-$232
Excess Water Savings ($1,000)	-$393	-$225	-$167
Average Annual Changes in Water Supply Costs ($1,000)	**$18,806**	**$23,919**	**-$5,113**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.91.

Table 19.91 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the San Francisco Bay Area Region under Alternative 3 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.1	-6.0	-5.9
Mining & Logging	0	0	0	0	0.0	1.9	-3.8	-1.9
Construction	0	1	0	1	0.0	186.7	-28.2	158.6
Manufacturing	0	0	0	0	0.0	33.9	-363.5	-329.6
Transportation, Warehousing & Utilities	6	0	-1	5	1,754.5	13.2	-139.1	1,628.6
Wholesale Trade	0	0	-1	-1	0.0	5.8	-268.7	-262.9
Retail Trade	0	0	-5	-5	0.0	4.9	-428.6	-423.7
Information	0	0	0	0	0.0	19.8	-233.1	-213.4
Financial Activities	0	0	-3	-3	0.0	65.6	-1,320.3	-1,254.7
Services	0	1	-15	-14	0.0	157.2	-1,639.6	-1,482.4
Government	0	0	0	0	0.0	0.8	-41.8	-41.0
Total	**6**	**3**	**-26**	**-17**	**1,754.5**	**489.9**	**-4,472.7**	**-2,228.3**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 3 as compared to the No Action Alternative generally would result in higher reservoir elevations in reservoirs that store CVP and SWP water (up to 9 to 17 percent);

and would result in increased recreational economic factors under Alternative 3 as compared to the No Action Alternative.

Regional Changes to Salmon Fishing

Commercial and sport ocean salmon fishing would be reduced under Alternative 3 and the No Action Alternative due to increased commercial and sport ocean salmon harvests limits.

Central Coast Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, increases in CVP and SWP water supplies within the Central Coast Region would not result in increases in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be increased irrigated acreage in dry and critical dry years under Alternative 3 as compared to the No Action Alternative.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be higher under Alternative 3 as compared to the No Action Alternative. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would decrease by $125,000, or 0.33 percent, as presented in Table 19.92; and therefore, the results would be similar under Alternative 3 and the No Action Alternative.

Table 19.92 Changes in Municipal and Industrial Water Supply Costs for the Central Coast Region under Alternative 3 as compared to the No Action Alternative

Differences in Total	Alternative 3	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	51	44	8
Delivery Cost ($1,000)	$7,814	$6,663	$1,151
Assumed New Supply Deliveries (TAF)	0	0	0
Annualized New Supply Costs ($1,000)	$0	$0	$0
Water Storage Costs ($1,000)	$0	$0	$0
Lost Water Sales Revenues ($1,000)	$0	$0	$0
Transfer Costs ($1,000)	$0	$0	$0
Shortage Costs ($1,000)	$0	$0	$0
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$8,333	-$8,068	-$265
Excess Water Savings ($1,000)	-$3,980	-$2,970	-$1,010
Average Annual Changes in Water Supply Costs ($1,000)	**-$4,499**	**-$4,374**	**-$125**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.93.

Table 19.93 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Central Coast Region under Alternative 3 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.4	-2.8	-2.4
Mining & Logging	0	0	0	0	0.0	4.9	-6.5	-1.7
Construction	0	1	0	1	0.0	153.8	-6.8	147.0
Manufacturing	0	0	0	0	0.0	20.4	-36.5	-16.0
Transportation, Warehousing & Utilities	5	0	0	5	1,150.6	13.0	-39.5	1,124.0
Wholesale Trade	0	0	0	0	0.0	3.7	-41.4	-37.8
Retail Trade	0	0	-1	-1	0.0	4.7	-83.0	-78.4
Information	0	0	0	0	0.0	9.1	-27.4	-18.3
Financial Activities	0	0	-1	0	0.0	52.5	-247.3	-194.8
Services	0	1	-3	-2	0.0	127.3	-314.2	-186.9
Government	0	0	0	0	0.0	0.7	-9.3	-8.6
Total	**5**	**3**	**-6**	**2**	**1,150.6**	**390.4**	**-814.8**	**726.2**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 3 as compared to the No Action Alternative generally would result in higher reservoir elevations in reservoirs that store CVP and SWP water (up to 9 to 17 percent); and would result in increased recreational economic factors under Alternative 3 as compared to the No Action Alternative.

Southern California Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, increases in CVP and SWP water supplies within the Southern California Region would not result in increases in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be increased irrigated acreage in dry and critical dry years under Alternative 3 as compared to the No Action Alternative.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be higher under Alternative 3 as compared to the No Action Alternative. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply costs over the 81-year hydrologic period for M&I water supplies would be $4.94 million, or 0.31 percent, as presented in Table 19.94; and therefore, the results would be similar under Alternative 3 and the No Action Alternative.

Table 19.94 Changes in Municipal and Industrial Water Supply Costs for the Southern California Region under Alternative 3 as compared to the No Action Alternative

Differences in Total	Alternative 3	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	2,241	1,932	308
Delivery Cost ($1,000)	$278,085	$239,692	$38,393
Assumed New Supply Deliveries (TAF)	40	47	-7
Annualized New Supply Costs ($1,000)	$10,584	$12,688	-$2,104
Water Storage Costs ($1,000)	$8,154	$7,598	$556
Lost Water Sales Revenues ($1,000)	$11,409	$14,614	-$3,205
Transfer Costs ($1,000)	$6,181	$11,484	-$5,303
Shortage Costs ($1,000)	$12,632	$17,319	-$4,687
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$81,693	-$57,474	-$24,218
Excess Water Savings ($1,000)	-$9,005	-$4,629	-$4,376
Average Annual Changes in Water Supply Costs ($1,000)	**$236,347**	**$241,291**	**-$4,944**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.95.

Table 19.95 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Southern California under Alternative 3 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	-1	-1	0.0	10.5	-146.4	-135.8
Mining & Logging	0	1	-1	0	0.0	138.6	-199.8	-61.2
Construction	0	37	-2	35	0.0	4,391.6	-211.9	4,179.8
Manufacturing	0	2	-6	-3	0.0	1,225.5	-3,662.5	-2,437.0
Transportation, Warehousing & Utilities	148	2	-6	143	36,845.0	499.5	-1,389.7	35,954.8
Wholesale Trade	0	1	-11	-10	0.0	232.2	-2,405.6	-2,173.3
Retail Trade	0	2	-31	-29	0.0	143.9	-2,688.1	-2,544.2
Information	0	1	-3	-2	0.0	537.8	-1,595.7	-1,057.9
Financial Activities	0	7	-28	-20	0.0	2,133.4	-9,496.1	-7,362.8
Services	0	39	-113	-74	0.0	4,675.7	-10,892.2	-6,216.5
Government	0	0	-2	-1	0.0	25.1	-314.7	-289.6
Total	148	91	-202	37	36,845.0	**14,013.9**	**-33,002.7**	**17,856.2**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 3 as compared to the No Action Alternative generally would result in higher reservoir elevations in reservoirs that store CVP and SWP water (up to 9 to 17 percent); and would result in increased recreational economic factors under Alternative 3 as compared to the No Action Alternative.

19.4.3.4.2 Alternative 3 Compared to the Second Basis of Comparison

Trinity River Region

Regional Changes to Irrigated Agriculture

There are no agricultural lands irrigated with CVP and SWP water supplies in the Trinity River Region. Therefore, there would be no changes in irrigated lands under Alternative 3 as compared to the Second Basis of Comparison.

Regional Changes to Municipal and Industrial Water Supplies

The CVP would continue to release water in Trinity River for downstream beneficial uses, including water supplies under Alternative 3 and the Second Basis of Comparison. There are no CVP or SWP water contractors in the Trinity River Region.

Regional Changes to Recreational Opportunities

Recreational opportunities would be similar in the Trinity River Region under Alternative 3 as compared to the Second Basis of Comparison as described in Chapter 15, Recreational Resources.

Regional Changes to Salmon Fishing

Trinity River flows would be similar under Alternative 3 as compared to the Second Basis of Comparison. This could result in similar salmon harvest conditions by the Yurok and Hoopa Valley tribes.

Central Valley Region

Regional Changes to Irrigated Agriculture

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under Alternative 3 than under the Second Basis of Comparison. It is anticipated that groundwater use would increase in response to reduced CVP and SWP water supplies in 2030 because sustainable groundwater management plans would not be fully implemented until the 2040s, as discussed in Chapter 12, Agricultural Resources.

The agricultural production value under long-term average conditions would be reduced by less than 1 percent ($0.3 million/year in the Sacramento Valley and $0.3 million/year in the San Joaquin Valley) primarily due to an increase in groundwater pumping of approximately 2 percent. The agricultural production value under dry and critical dry conditions also would be reduced by less than 1 percent ($2.1 million/year in the Sacramento Valley and $8.9 million/year in the San Joaquin Valley) primarily due to an increase in groundwater pumping.

The overall reduction in agricultural production values are less than 0.05 percent under long-term conditions; and, changes in employment and regional economic output would be minimal. Therefore, the analysis of employment and regional economic output is focused on dry and critical dry years.

The direct changes in agricultural production would result in changes to employment and regional economic output in the Sacramento and San Joaquin valleys, as summarized in Tables 19.96 and 19.97, respectively.

Table 19.96 Changes in Agricultural-Related Employment and Regional Economic Output for the Sacramento Valley under Alternative 3 as Compared to the Second Basis of Comparison in Dry and Critical Dry Years

Economic Sectors	Employment				Economic Output ($ millions)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	-18	-4	0	-22	-2.1	-0.2	0.0	-2.3
Mining & Logging	0	0	0	0	0.0	0.0	0.0	0.0
Construction	0	0	0	0	0.0	0.0	0.0	0.0
Manufacturing	0	0	0	0	0.0	0.0	0.0	0.0
Transportation, Warehousing & Utilities	0	0	0	0	0.0	-0.1	0.0	-0.1
Wholesale Trade	0	0	0	0	0.0	0.0	0.0	-0.1
Retail Trade	0	0	0	-1	0.0	0.0	0.0	0.0
Information	0	0	0	0	0.0	0.0	0.0	0.0
Financial Activities	0	-2	0	-2	0.0	-0.4	-0.1	-0.5
Services	0	-1	-1	-2	0.0	-0.1	-0.1	-0.2
Government	0	0	0	0	0.0	0.0	0.0	0.0
Total	**-18**	**-7**	**-2**	**-27**	**-2.1**	**-0.9**	**-0.3**	**-3.3**

Note: In 2012 dollars

Table 19.97 Changes in Agricultural-Related Employment and Regional Economic Output for the San Joaquin Valley under Alternative 3 as Compared to the Second Basis of Comparison in Dry and Critical Dry Years

Economic Sectors	Employment				Economic Output ($ millions)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	-36	-26	0	-63	-8.9	-1.1	0.0	-10.0
Mining & Logging	0	0	0	0	0.0	-0.1	0.0	-0.1
Construction	0	-1	0	-1	0.0	-0.1	0.0	-0.1
Manufacturing	0	0	0	-1	0.0	-0.7	-0.2	-0.8
Transportation, Warehousing & Utilities	0	-1	-1	-2	0.0	-0.3	-0.1	-0.5
Wholesale Trade	0	-1	-1	-1	0.0	-0.1	-0.1	-0.2
Retail Trade	0	0	-4	-4	0.0	0.0	-0.4	-0.4
Information	0	0	0	0	0.0	0.0	-0.1	-0.1
Financial Activities	0	-4	-2	-5	0.0	-0.8	-0.9	-1.7
Services	0	-2	-12	-14	0.0	-0.2	-1.0	-1.2
Government	0	0	0	0	0.0	-0.1	0.0	-0.1
Total	**-36**	**-36**	**-20**	**-92**	**-8.9**	**-3.5**	**-2.8**	**-15.3**

Note: In 2012 dollars

As described in Chapter 11, Geology and Soils Resources, increased groundwater pumping under the long-term average conditions may result in an additional increment of subsidence in those areas within the Central Valley. The additional amount of subsidence and the economic costs associated with it have not been quantified in this EIS. However, total subsidence-related costs have been shown to be substantial, as reported by Borchers et al. (2014) who estimated that the cost of subsidence in San Joaquin Valley between 1955 and 1972 was more than $1.3 billion (in 2013 dollars). These estimates are based on the impacts to major infrastructure in the region including the San Joaquin River, Delta Mendota Canal, Friant-Kern Canal and San Luis Canal in addition to privately owned infrastructure. The incremental subsidence-related costs, expressed on an annual basis, could be an unknown fraction of that cumulative cost.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be similar in the Sacramento Valley and greater in the San Joaquin Valley under Alternative 3 than under the Second Basis of Comparison. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies are presented in Tables 19.98 and 19.99 for the Sacramento and San Joaquin Valley, respectively. Average annual water supply operating costs would increase in the Sacramento Valley by 0.05 percent, decrease in the San Joaquin Valley by 0.2 percent; and therefore, the results would be similar under Alternative 3 and the Second Basis of Comparison.

Table 19.98 Changes in Municipal and Industrial Water Supply Costs for the Sacramento Valley under Alternative 3 as Compared to the Second Basis of Comparison

Differences in Total	Alternative 3	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	461	463	-2
Delivery Cost ($1,000)	$8,285	$8,317	-$32
Assumed New Supply Deliveries (TAF)	0	0	0
Annualized New Supply Costs ($1,000)	$0	$0	$0
Water Storage Costs ($1,000)	$0	$0	$0
Lost Water Sales Revenues ($1,000)	$243	$207	$35
Transfer Costs ($1,000)	$601	$517	$84
Shortage Costs ($1,000)	$77	$68	$9
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$3,938	-$3,916	-$23
Excess Water Savings ($1,000)	-$2,517	-$2,563	$46
Average Annual Changes in Water Supply Costs ($1,000)	**$2,750**	**$2,630**	**$119**

Note: In 2012 dollars

Table 19.99 Changes in Municipal and Industrial Water Supply Costs for the San Joaquin Valley under Alternative 3 as Compared to the Second Basis of Comparison

Differences in Total	Alternative 3	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	241	237	4
Delivery Cost ($1,000)	$3,896	$3,854	$42
Assumed New Supply Deliveries (TAF)	0	0	0
Annualized New Supply Costs ($1,000)	$13	$15	-$3
Water Storage Costs ($1,000)	$465	$820	-$355
Lost Water Sales Revenues ($1,000)	$284	$322	-$39
Transfer Costs ($1,000)	$2,104	$2,623	-$518
Shortage Costs ($1,000)	$89	$102	-$13
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$15,660	-$16,011	$351
Excess Water Savings ($1,000)	-$1,378	-$1,318	-$59
Average Annual Changes in Water Supply Costs ($1,000)	**-$10,187**	**-$9,593**	**-$595**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output in the Sacramento and San Joaquin valleys, as summarized in Tables 19.100 and 19.101, respectively.

Table 19.100 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Sacramento Valley under Alternative 3 as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.0	0.5	0.5
Mining & Logging	0	0	0	0	0.0	0.0	0.1	0.0
Construction	0	0	0	0	0.0	-3.5	0.7	-2.8
Manufacturing	0	0	0	0	0.0	-0.4	6.4	6.0
Transportation, Warehousing & Utilities	0	0	0	0	-34.6	-0.3	5.2	-29.7
Wholesale Trade	0	0	0	0	0.0	-0.1	7.7	7.6
Retail Trade	0	0	0	0	0.0	-0.1	13.6	13.5
Information	0	0	0	0	0.0	-0.4	6.0	5.5
Financial Activities	0	0	0	0	0.0	-1.6	42.9	41.3
Services	0	0	0	0	0.0	-3.7	45.0	41.2
Government	0	0	0	0	0.0	0.0	1.1	1.1
Total	**0**	**0**	**1**	**1**	**-34.6**	**-10.2**	**129.2**	**84.4**

Note: In 2012 dollars

Table 19.101 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the San Joaquin Valley under Alternative 3 as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	-0.1	-2.3	-2.4
Mining & Logging	0	0	0	0	0.0	-0.8	-2.1	-3.0
Construction	0	0	0	0	0.0	-29.9	-1.9	-31.8
Manufacturing	0	0	0	0	0.0	-3.0	-15.5	-18.6
Transportation, Warehousing & Utilities	-1	0	0	-1	-315.8	-3.0	-14.9	-333.7
Wholesale Trade	0	0	0	0	0.0	-0.8	-12.7	-13.5
Retail Trade	0	0	0	0	0.0	-0.9	-33.4	-34.3
Information	0	0	0	0	0.0	-2.2	-9.0	-11.2
Financial Activities	0	0	0	0	0.0	-9.7	-88.6	-98.4
Services	0	0	-1	-1	0.0	-26.2	-99.0	-125.2
Government	0	0	0	0	0.0	-0.2	-4.3	-4.5
Total	**-1**	**-1**	**-2**	**-4**	**-315.8**	**-77.0**	**-283.5**	**-676.3**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Recreational opportunities would be similar at San Luis Reservoir under Alternative 3 as compared to the Second Basis of Comparison, as described in Chapter 15, Recreation Resources. Recreational opportunities related to Striped Bass fishing would initially be increased when Alternative 3 is implemented. However, by 2030, Striped Bass fishing opportunities would be reduced under Alternative 3 as compared to the Second Basis of Comparison due to actions to reduce predation. Therefore, it is anticipated that recreational economic factors would be reduced under Alternative 3 as compared to the Second Basis of Comparison.

Effects Related to Cross Delta Water Transfers

Potential effects to socioeconomic factors could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 3 and the Second Basis of Comparison, and that impacts on socioeconomic factors could be adverse in the seller's service area.

Under Alternative 3 and Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be similar under Alternative 3 as compared to the Second Basis of Comparison.

San Francisco Bay Area Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, reductions in CVP and SWP water supplies within the San Francisco Bay Area Region would not result in reductions in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be a reduction in irrigated acreage in dry and critical dry years under Alternative 3 as compared to the Second Basis of Comparison.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under Alternative 3 than under the Second Basis of Comparison. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would increase by $2.16 million, or 0.52 percent, as presented in Table 19.102; and therefore, the results would be similar under Alternative 3 and the Second Basis of Comparison.

Table 19.102 Changes in Municipal and Industrial Water Supply Costs for the San Francisco Bay Area Region under Alternative 3 as Compared to the Second Basis of Comparison

Differences in Total	Alternative 3	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	431	445	-14
Delivery Cost ($1,000)	$12,096	$12,515	-$419
Assumed New Supply Deliveries (TAF)	18	16	2
Annualized New Supply Costs ($1,000)	$575	$234	$342
Water Storage Costs ($1,000)	$2,303	$1,963	$340
Lost Water Sales Revenues ($1,000)	$2,381	$1,595	$786
Transfer Costs ($1,000)	$1,826	$1,154	$672
Shortage Costs ($1,000)	$743	$523	$221
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$726	-$792	$66
Excess Water Savings ($1,000)	-$393	-$549	$156
Average Annual Changes in Water Supply Costs ($1,000)	**$18,806**	**$16,643**	**$2,163**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.103.

Table 19.103 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the San Francisco Bay Area Region under Alternative 3 as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.0	1.9	1.9
Mining & Logging	0	0	0	0	0.0	0.3	1.2	1.5
Construction	0	0	0	0	0.0	28.0	9.0	36.9
Manufacturing	0	0	0	0	0.0	5.1	114.4	119.5
Transportation, Warehousing & Utilities	1	0	0	1	262.6	2.0	44.3	308.9
Wholesale Trade	0	0	0	0	0.0	0.9	81.9	82.8
Retail Trade	0	0	2	2	0.0	0.7	138.5	139.3
Information	0	0	0	0	0.0	3.0	73.5	76.4
Financial Activities	0	0	1	1	0.0	9.8	420.2	430.0
Services	0	0	5	5	0.0	23.5	523.1	546.7
Government	0	0	0	0	0.0	0.1	13.3	13.4
Total	**1**	**0**	**8**	**10**	**262.6**	**73.3**	**1,421.3**	**1,757.2**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 3 as compared to the Second Basis of Comparison generally would result in similar reservoir elevations in reservoirs that store CVP and SWP water and similar recreational economic factors under Alternative 3 as compared to the Second Basis of Comparison.

Regional Changes to Salmon Fishing

Commercial and sport ocean salmon fishing would be reduced under Alternative 3 and the Second Basis of Comparison due to increased commercial and sport ocean salmon harvests limits.

Central Coast Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, reductions in CVP and SWP water supplies within the Central Coast Region would not result in reductions in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be a reduction in irrigated acreage in dry and critical dry years under Alternative 3 as compared to the Second Basis of Comparison.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under Alternative 3 than under the Second Basis of Comparison. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would increase by $146,000, or 0.38 percent, as presented in Table 19.104; and therefore, the results would be similar under Alternative 3 and the Second Basis of Comparison.

Table 19.104 Changes in Municipal and Industrial Water Supply Costs for the Central Coast Region under Alternative 3 as Compared to the Second Basis of Comparison

Differences in Total	Alternative 3	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	51	54	-2
Delivery Cost ($1,000)	$7,814	$8,174	-$360
Assumed New Supply Deliveries (TAF)	0	0	0
Annualized New Supply Costs ($1,000)	$0	$0	$0
Water Storage Costs ($1,000)	$0	$0	$0
Lost Water Sales Revenues ($1,000)	$0	$0	$0
Transfer Costs ($1,000)	$0	$0	$0
Shortage Costs ($1,000)	$0	$0	$0
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$8,333	-$8,643	$310
Excess Water Savings ($1,000)	-$3,980	-$4,176	$196
Average Annual Changes in Water Supply Costs ($1,000)	**-$4,499**	**-$4,645**	**$146**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.105.

Table 19.105 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Central Coast Region under Alternative 3 as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	-0.1	1.2	1.0
Mining & Logging	0	0	0	0	0.0	-1.5	2.8	1.2
Construction	0	0	0	0	0.0	-48.1	2.9	-45.2
Manufacturing	0	0	0	0	0.0	-6.4	15.4	9.0
Transportation, Warehousing & Utilities	-2	0	0	-2	-359.9	-4.1	16.7	-347.2
Wholesale Trade	0	0	0	0	0.0	-1.2	17.2	16.1
Retail Trade	0	0	0	0	0.0	-1.5	35.5	34.1
Information	0	0	0	0	0.0	-2.9	11.6	8.8
Financial Activities	0	0	0	0	0.0	-16.4	104.9	88.5
Services	0	0	1	1	0.0	-39.8	133.4	93.6
Government	0	0	0	0	0.0	-0.2	3.9	3.7
Total	**-2**	**-1**	**2**	**0**	**-359.9**	**-122.1**	**345.5**	**-136.5**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 3 as compared to the Second Basis of Comparison generally would result in similar reservoir elevations in reservoirs that store CVP and SWP water and similar recreational economic factors under Alternative 3 as compared to the Second Basis of Comparison.

Southern California Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, reductions in CVP and SWP water supplies within the Southern California Region would not result in reductions in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be a reduction in irrigated acreage in dry and critical dry years under Alternative 3 as compared to the Second Basis of Comparison.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under Alternative 3 than under the Second Basis of Comparison. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply costs over the 81-year hydrologic period for M&I water supplies would increase by 1.83 percent, as presented in Table 19.106; and therefore, the results would be similar under Alternative 3 and the Second Basis of Comparison.

Table 19.106 Changes in Municipal and Industrial Water Supply Costs for the Southern California Region under Alternative 3 as Compared to the Second Basis of Comparison

Differences in Total	Alternative 3	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	2,241	2,394	-153
Delivery Cost ($1,000)	$278,085	$296,795	-$18,710
Assumed New Supply Deliveries (TAF)	40	11	28
Annualized New Supply Costs ($1,000)	$10,584	$4,032	$6,552
Water Storage Costs ($1,000)	$8,154	$2,824	$5,330
Lost Water Sales Revenues ($1,000)	$11,409	$1,119	$10,289
Transfer Costs ($1,000)	$6,181	$3,705	$2,476
Shortage Costs ($1,000)	$12,632	$353	$12,279
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$81,693	-$91,507	$9,814
Excess Water Savings ($1,000)	-$9,005	-$10,573	$1,568
Average Annual Changes in Water Supply Costs ($1,000)	**$236,347**	**$206,749**	**$29,598**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.107.

Table 19.107 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Southern California Region under Alternative 3 as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	1	1	0.0	-2.0	126.3	124.4
Mining & Logging	0	0	1	0	0.0	-25.7	169.2	143.5
Construction	0	-7	1	-5	0.0	-813.9	183.7	-630.2
Manufacturing	0	0	5	4	0.0	-227.1	3,152.0	2,924.9
Transportation, Warehousing & Utilities	-27	0	5	-22	-6,828.3	-92.6	1,213.1	-5,707.8
Wholesale Trade	0	0	9	9	0.0	-43.0	1,933.5	1,890.4
Retail Trade	0	0	27	27	0.0	-26.7	2,418.2	2,391.5
Information	0	0	3	3	0.0	-99.7	1,366.4	1,266.7
Financial Activities	0	-1	24	23	0.0	-395.4	8,301.7	7,906.3
Services	0	-7	99	92	0.0	-866.5	9,538.4	8,671.9
Government	0	0	1	1	0.0	-4.7	272.6	268.0
Total	**-27**	**-17**	**177**	**132**	**-6,828.3**	**-2,597.1**	**28,675.1**	**19,249.7**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 3 as compared to the Second Basis of Comparison generally would result in similar reservoir elevations in reservoirs that store CVP and SWP water and similar recreational economic factors under Alternative 3 as compared to the Second Basis of Comparison.

19.4.3.5 Alternative 4

The CVP and SWP operations under Alternative 4 are identical to the CVP and SWP operations under the Second Basis of Comparison and Alternative 1, as described in Chapter 3, Description of Alternatives. In addition, Alternative 4 includes Striped Bass predation control which would reduce recreational opportunities. The non-recreational socioeconomic factors under Alternative 4 would be identical to the conditions under the Second Basis of Comparison. Alternative 4 is compared to the No Action Alternative and the Second Basis of Comparison.

19.4.3.5.1 Alternative 4 Compared to the No Action Alternative

The CVP and SWP operations under Alternative 4 are identical to the CVP and SWP operations under the Second Basis of Comparison and Alternative 1. Therefore, changes in non-recreational socioeconomic factors under Alternative 4 as compared to the No Action Alternative would be the similar to impacts described in Section 12.4.3.2.1, Alternative 1 Compared to the No Action

Alternative. Recreational opportunities related to Striped Bass fishing would initially be increased when Alternative 4 is implemented. However, by 2030, Striped Bass fishing opportunities would be reduced under Alternative 4 as compared to the No Action Alternative due to actions to reduce predation. Commercial and sport ocean salmon fishing opportunities would be reduced under Alternative 4 as compared to the No Action Alternative due to increased harvest limitations.

19.4.3.5.2 Alternative 4 Compared to the Second Basis of Comparison

As described in Chapter 3, Description of Alternatives, socioeconomic factors under Alternative 4 are the same as non-recreational socioeconomic factors under the Second Basis of Comparison. Recreational opportunities related to Striped Bass fishing would initially be increased when Alternative 4 is implemented. However, by 2030, Striped Bass fishing opportunities would be reduced under Alternative 4 as compared to the Second Basis of Comparison due to actions to reduce predation. Commercial and sport ocean salmon fishing opportunities would be reduced under Alternative 4 as compared to the Second Basis of Comparison due to increased harvest limitations.

19.4.3.6 Alternative 5

As described in Chapter 3, Description of Alternatives, CVP and SWP operations under Alternative 5 are similar to the No Action Alternative with modified Old and Middle River flow criteria and New Melones Reservoir operations. As described in Chapter 4, Approach to Environmental Analysis, Alternative 5 is compared to the No Action Alternative and the Second Basis of Comparison.

19.4.3.6.1 Alternative 5 Compared to the No Action Alternative

Trinity River Region

Regional Changes to Irrigated Agriculture

There are no agricultural lands irrigated with CVP and SWP water supplies in the Trinity River Region. Therefore, there would be no changes in irrigated lands under Alternative 5 as compared to the No Action Alternative.

Regional Changes to Municipal and Industrial Water Supplies

The CVP would continue to release water in Trinity River for downstream beneficial uses, including water supplies under Alternative 5 as compared to the No Action Alternative. There are no CVP or SWP water contractors in the Trinity River Region.

Regional Changes to Recreational Opportunities

Recreational opportunities would be similar in the Trinity River Region under Alternative 5 as compared to the No Action Alternative as described in Chapter 15, Recreational Resources.

Regional Changes to Salmon Fishing

Trinity River flows would be similar under Alternative 5 as compared to the No Action Alternative. This could result in similar salmon harvest conditions by the Yurok and Hoopa Valley tribes.

Central Valley Region

Regional Changes to Irrigated Agriculture

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be similar under Alternative 5 and the No Action Alternative. It is anticipated that groundwater use would be similar and sustainable groundwater management plans would not be fully implemented until the 2040s, as discussed in Chapter 12, Agricultural Resources.

The agricultural production value under long-term average conditions would be the same under Alternative 5 as the No Action Alternative. The agricultural production value under dry and critical dry conditions also would be reduced by less than 1 percent ($0.8 million/year increase in the Sacramento Valley and $2.7 million/year decrease in the San Joaquin Valley), although groundwater pumping is not anticipated to change.

The overall decrease in agricultural production values are less than 0.05 percent under long-term conditions; and, changes in employment and regional economic output would be minimal. Therefore, the analysis of employment and regional economic output is focused on dry and critical dry years.

The direct changes in agricultural production would result in changes to employment and regional economic output in the Sacramento and San Joaquin valleys, as summarized in Tables 19.108 and 19.109, respectively.

Table 19.108 Changes in Agricultural-Related Employment and Regional Economic Output for the Sacramento Valley under Alternative 5 as compared to the No Action Alternative in Dry and Critical Dry Years

Economic Sectors	Employment				Economic Output ($ millions)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	3	2	0	4	0.8	0.1	0.0	0.9
Mining & Logging	0	0	0	0	0.0	0.0	0.0	0.0
Construction	0	0	0	0	0.0	0.0	0.0	0.0
Manufacturing	0	0	0	0	0.0	0.0	0.0	0.0
Transportation, Warehousing & Utilities	0	0	0	0	0.0	0.0	0.0	0.0
Wholesale Trade	0	0	0	0	0.0	0.0	0.0	0.0
Retail Trade	0	0	0	0	0.0	0.0	0.0	0.0
Information	0	0	0	0	0.0	0.0	0.0	0.0
Financial Activities	0	0	0	0	0.0	0.1	0.1	0.2
Services	0	0	1	2	0.0	0.0	0.1	0.1
Government	0	0	0	0	0.0	0.0	0.0	0.0
Total	**3**	**2**	**2**	**7**	**0.8**	**0.2**	**0.3**	**1.3**

Note: In 2012 dollars

Table 19.109 Changes in Agricultural-Related Employment and Regional Economic Output for the San Joaquin Valley under Alternative 5 as compared to the No Action Alternative in Dry and Critical Dry Years

Economic Sectors	Employment				Economic Output ($ millions)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	-5	-9	0	-14	-2.7	-0.4	0.0	-3.0
Mining & Logging	0	0	0	0	0.0	0.0	0.0	0.0
Construction	0	0	0	0	0.0	0.0	0.0	0.0
Manufacturing	0	0	0	0	0.0	-0.2	-0.1	-0.2
Transportation, Warehousing & Utilities	0	0	0	-1	0.0	-0.1	0.0	-0.1
Wholesale Trade	0	0	0	0	0.0	0.0	0.0	-0.1
Retail Trade	0	0	-2	-2	0.0	0.0	-0.1	-0.1
Information	0	0	0	0	0.0	0.0	0.0	0.0
Financial Activities	0	-1	-1	-1	0.0	-0.2	-0.3	-0.5
Services	0	-1	-4	-5	0.0	-0.1	-0.4	-0.4
Government	0	0	0	0	0.0	0.0	0.0	0.0
Total	**-5**	**-11**	**-7**	**-24**	**-2.7**	**-0.9**	**-1.0**	**-4.6**

Note: In 2012 dollars

As described in Chapter 11, Geology and Soils Resources, increased groundwater pumping under the long-term average conditions may result in an additional increment of subsidence in those areas within the Central Valley. The additional amount of subsidence and the economic costs associated with it have not been quantified in this EIS. However, total subsidence-related costs have been shown to be substantial, as reported by Borchers et al. (2014) who estimated that the cost of subsidence in San Joaquin Valley between 1955 and 1972 was more than $1.3 billion (in 2013 dollars). These estimates are based on the impacts to major infrastructure in the region including the San Joaquin River, Delta Mendota Canal, Friant-Kern Canal and San Luis Canal in addition to privately owned infrastructure. The incremental subsidence-related costs, expressed on an annual basis, could be an unknown fraction of that cumulative cost.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be similar in the Sacramento Valley and lower in the San Joaquin Valley under Alternative 5 and the No Action Alternative. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply costs over the 81-year hydrologic period for M&I water supplies are presented in Tables 19.110 and 19.111 for the Sacramento and San Joaquin Valley, respectively. Average annual water supply operating expenses would be similar (within 0.05 percent change) for the Sacramento Valley, and increase by 0.07 percent in the San Joaquin Valley; and therefore, the results would be similar under Alternative 5 and the No Action Alternative.

Table 19.110 Changes in Municipal and Industrial Water Supply Costs for the Sacramento Valley under Alternative 5 as compared to the No Action Alternative

Differences in Total	Alternative 5	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	447	447	-1
Delivery Cost ($1,000)	$8,022	$8,031	-$8
Assumed New Supply Deliveries (TAF)	0	0	0
Annualized New Supply Costs ($1,000)	$0	$0	$0
Water Storage Costs ($1,000)	$0	$0	$0
Lost Water Sales Revenues ($1,000)	$204	$213	-$9
Transfer Costs ($1,000)	$752	$739	$12
Shortage Costs ($1,000)	$68	$69	-$2
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$3,856	-$3,858	$1
Excess Water Savings ($1,000)	-$2,266	-$2,275	$10
Average Annual Changes in Water Supply Costs ($1,000)	**$2,924**	**$2,919**	**$5**

Note: In 2012 dollars

Table 19.111 Changes in Municipal and Industrial Water Supply Costs for the San Joaquin Valley under Alternative 5 as compared to the No Action Alternative

Differences in Total	Alternative 5	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	211	214	-3
Delivery Cost ($1,000)	$3,411	$3,460	-$49
Assumed New Supply Deliveries (TAF)	2	2	1
Annualized New Supply Costs ($1,000)	$601	$429	$171
Water Storage Costs ($1,000)	$966	$942	$24
Lost Water Sales Revenues ($1,000)	$361	$361	$0
Transfer Costs ($1,000)	$2,661	$2,673	-$12
Shortage Costs ($1,000)	$115	$115	$0
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$15,329	-$15,377	$49
Excess Water Savings ($1,000)	-$996	-$1,029	$33
Average Annual Changes in Water Supply Costs ($1,000)	**-$8,211**	**-$8,427**	**$215**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output in the Sacramento and San Joaquin valleys, as summarized in Tables 19.112 and 19.113, respectively.

Table 19.112 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Sacramento Valley under Alternative 5 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.0	0.0	0.0
Mining & Logging	0	0	0	0	0.0	0.0	0.0	0.0
Construction	0	0	0	0	0.0	-0.8	0.1	-0.7
Manufacturing	0	0	0	0	0.0	-0.1	0.6	0.5
Transportation, Warehousing & Utilities	0	0	0	0	-7.8	-0.1	0.5	-7.4
Wholesale Trade	0	0	0	0	0.0	0.0	0.7	0.7
Retail Trade	0	0	0	0	0.0	0.0	1.2	1.1
Information	0	0	0	0	0.0	-0.1	0.5	0.4
Financial Activities	0	0	0	0	0.0	-0.4	3.7	3.4
Services	0	0	0	0	0.0	-0.8	3.9	3.0
Government	0	0	0	0	0.0	0.0	0.1	0.1
Total	**0**	**0**	**0**	**0**	**-7.8**	**-2.3**	**11.2**	**1.1**

Note: In 2012 dollars

Table 19.113 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the San Joaquin Valley under Alternative 5 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.1	0.7	0.8
Mining & Logging	0	0	0	0	0.0	0.4	0.7	1.0
Construction	0	0	0	0	0.0	13.9	0.6	14.5
Manufacturing	0	0	0	0	0.0	1.4	4.8	6.2
Transportation, Warehousing & Utilities	1	0	0	1	146.6	1.4	4.6	152.6
Wholesale Trade	0	0	0	0	0.0	0.4	3.9	4.3
Retail Trade	0	0	0	0	0.0	0.4	10.6	11.0
Information	0	0	0	0	0.0	1.0	2.8	3.8
Financial Activities	0	0	0	0	0.0	4.5	27.7	32.3
Services	0	0	0	0	0.0	12.2	31.1	43.3
Government	0	0	0	0	0.0	0.1	1.3	1.5
Total	**1**	**0**	**1**	**1**	**146.6**	**35.8**	**88.8**	**271.2**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Recreational opportunities at San Luis Reservoir would be similar under Alternative 5 as compared to the No Action Alternative, as described in Chapter 15, Recreation Resources. Therefore, it is anticipated that recreational economic factors would be similar under Alternative 5 as compared to the No Action Alternative.

Effects Related to Cross Delta Water Transfers

Potential effects to socioeconomic factors could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 5 and the No Action Alternative, and that impacts on socioeconomic factors could be adverse in the seller's service area.

Under Alternative 5 and the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be similar under Alternative 5 and the No Action Alternative.

San Francisco Bay Area Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, CVP and SWP water supplies within the San Francisco Bay Area Region would be similar under Alternative 5 and the No Action Alternative, and would not result in changes in irrigated acreage or land use changes due to the use of other water supplies.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be lower under Alternative 5 and the No Action Alternative. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would be increase by 0.1 percent, as presented in Table 19.114; and therefore, the results would be similar under Alternative 5 and the No Action Alternative.

Table 19.114 Changes in Municipal and Industrial Water Supply Costs for the San Francisco Bay Area Region under Alternative 5 as compared to the No Action Alternative

Differences in Total	Alternative 5	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	394	396	-3
Delivery Cost ($1,000)	$10,962	$11,044	-$82
Assumed New Supply Deliveries (TAF)	18	18	0
Annualized New Supply Costs ($1,000)	$599	$599	$0
Water Storage Costs ($1,000)	$1,495	$1,577	-$81
Lost Water Sales Revenues ($1,000)	$4,360	$4,286	$74
Transfer Costs ($1,000)	$6,156	$5,722	$434
Shortage Costs ($1,000)	$1,450	$1,410	$40
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$470	-$493	$24
Excess Water Savings ($1,000)	-$225	-$225	$0
Average Annual Changes in Water Supply Costs ($1,000)	**$24,328**	**$23,919**	**$409**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.115.

Table 19.115 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the San Francisco Bay Area Region under Alternative 5 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.0	0.5	0.5
Mining & Logging	0	0	0	0	0.0	-0.2	0.3	0.1
Construction	0	0	0	0	0.0	-17.4	2.4	-15.0
Manufacturing	0	0	0	0	0.0	-3.2	30.9	27.8
Transportation, Warehousing & Utilities	-1	0	0	-1	-163.1	-1.2	11.8	-152.5
Wholesale Trade	0	0	0	0	0.0	-0.5	22.9	22.4
Retail Trade	0	0	0	0	0.0	-0.5	36.4	35.9
Information	0	0	0	0	0.0	-1.8	19.8	18.0
Financial Activities	0	0	0	0	0.0	-6.1	112.3	106.2
Services	0	0	1	1	0.0	-14.6	139.4	124.8
Government	0	0	0	0	0.0	-0.1	3.6	3.5
Total	**-1**	**0**	**2**	**1**	**-163.1**	**-45.5**	**380.3**	**171.7**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 5 as compared to the No Action Alternative generally would result in similar reservoir elevations in reservoirs that store CVP and SWP water and similar recreational economic factors under Alternative 5 as compared o the No Action Alternative.

Regional Changes to Salmon Fishing

Changes in commercial and sport ocean salmon fishing primarily would be related to the presence of fall-run Chinook Salmon from Central Valley hatcheries. It is assumed that the production of hatchery fish would be similar under Alternative 15 and the No Action Alternative. However, survival of the fall-run Chinook Salmon hatchery fish to the Pacific Ocean could be related to changes in CVP and SWP operations. As described in Chapter 9, Fish and Aquatic Resources, there would be little change in through-Delta survival by emigrating natural juvenile fall-run Chinook Salmon under Alternative 5 and the No Action Alternative. It is assumed that the survival of the hatchery juvenile fall-run Chinook Salmon would be similar to the survival of the natural juvenile fall-run Chinook Salmon. Therefore, the availability of fish for commercial and sport ocean salmon fishing and the associated economic conditions for the fishing industry would be similar under Alternative 5 and the No Action Alternative.

Central Coast Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, increases in CVP and SWP water supplies within the Central Coast Region would be lower under Alternative 5 and the No Action Alternative, and would not result in changes in irrigated acreage or land use changes due to the use of other water supplies.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be similar under Alternative 5 and the No Action Alternative. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would increase by 0.06 percent, as presented in Table 19.116; and therefore, the results would be similar under Alternative 5 and the No Action Alternative.

Table 19.116 Changes in Municipal and Industrial Water Supply Costs for the Central Coast Region under Alternative 5 as compared to the No Action Alternative

Differences in Total	Alternative 5	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	43	44	-1
Delivery Cost ($1,000)	$6,567	$6,663	-$97
Assumed New Supply Deliveries (TAF)	0	0	0
Annualized New Supply Costs ($1,000)	$0	$0	$0
Water Storage Costs ($1,000)	$0	$0	$0
Lost Water Sales Revenues ($1,000)	$0	$0	$0
Transfer Costs ($1,000)	$0	$0	$0
Shortage Costs ($1,000)	$0	$0	$0
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$8,018	-$8,068	$50
Excess Water Savings ($1,000)	-$2,899	-$2,970	$70
Average Annual Changes in Water Supply Costs ($1,000)	**-$4,350**	**-$4,374**	**$23**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.117.

Table 19.117 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Central Coast Region under Alternative 5 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.0	0.3	0.2
Mining & Logging	0	0	0	0	0.0	-0.4	0.6	0.2
Construction	0	0	0	0	0.0	-13.0	0.7	-12.3
Manufacturing	0	0	0	0	0.0	-1.7	3.5	1.8
Transportation, Warehousing & Utilities	0	0	0	0	-97.1	-1.1	3.9	-94.3
Wholesale Trade	0	0	0	0	0.0	-0.3	4.0	3.7
Retail Trade	0	0	0	0	0.0	-0.4	8.1	7.8
Information	0	0	0	0	0.0	-0.8	2.7	1.9
Financial Activities	0	0	0	0	0.0	-4.4	24.1	19.7
Services	0	0	0	0	0.0	-10.7	30.7	19.9
Government	0	0	0	0	0.0	-0.1	0.9	0.8
Total	**0**	**0**	**1**	**0**	**-97.1**	**-32.9**	**79.5**	**-50.5**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 5 as compared to the No Action Alternative generally would result in similar reservoir elevations in reservoirs that store CVP and SWP water and similar recreational economic factors under Alternative 5 as compared to the No Action Alternative.

Southern California Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, increases in CVP and SWP water supplies within the Southern California Region would be similar under Alternative 5 and the No Action Alternative, and would not result in changes in irrigated acreage or land use changes due to the use of other water supplies.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be lower under Alternative 5 and the No Action Alternative. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would be increase by 0.37 percent, as presented in Table 19.118; and therefore, the results would be similar under Alternative 5 and the No Action Alternative.

Table 19.118 Changes in Municipal and Industrial Water Supply Costs for the Southern California Region under Alternative 5 as compared to the No Action Alternative

Differences in Total	Alternative 5	No Action Alternative	Changes
Average Annual CVP/SWP Deliveries (TAF)	1,912	1,932	-20
Delivery Cost ($1,000)	$237,118	$239,692	-$2,575
Assumed New Supply Deliveries (TAF)	81	47	34
Annualized New Supply Costs ($1,000)	$24,191	$12,688	$11,503
Water Storage Costs ($1,000)	$7,474	$7,598	-$124
Lost Water Sales Revenues ($1,000)	$14,206	$14,614	-$408
Transfer Costs ($1,000)	$10,505	$11,484	-$979
Shortage Costs ($1,000)	$16,662	$17,319	-$657
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$58,323	-$57,474	-$849
Excess Water Savings ($1,000)	-$4,588	-$4,629	$41
Average Annual Changes in Water Supply Costs ($1,000)	**$247,243**	**$241,291**	**$5,952**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes t9o employment and regional economic output, as summarized in Table 19.119.

Table 19.119 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Southern California under Alternative 5 as compared to the No Action Alternative

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	2.5	3.3	5.9
Mining & Logging	0	0	0	0	0.0	33.1	3.3	36.4
Construction	0	9	0	9	0.0	1,049.4	5.1	1,054.5
Manufacturing	0	0	0	1	0.0	292.8	80.2	373.0
Transportation, Warehousing & Utilities	35	0	0	36	8,804.2	119.3	37.0	8,960.5
Wholesale Trade	0	0	0	0	0.0	55.5	-0.2	55.3
Retail Trade	0	0	1	2	0.0	34.4	99.3	133.7
Information	0	0	0	0	0.0	128.5	32.2	160.8
Financial Activities	0	2	1	2	0.0	509.8	257.7	767.4
Services	0	9	3	13	0.0	1,117.3	301.8	1,419.1
Government	0	0	0	0	0.0	6.0	7.6	13.6
Total	**35**	**22**	**6**	**63**	**8,804.2**	**3,348.6**	**827.3**	**12,980.1**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 5 as compared to the No Action Alternative generally would result in similar reservoir elevations in reservoirs that store CVP and SWP water and similar recreational economic factors under Alternative 5 as compared to the No Action Alternative.

19.4.3.6.2 Alternative 5 Compared to the Second Basis of Comparison

Trinity River Region

Regional Changes to Irrigated Agriculture

There are no agricultural lands irrigated with CVP and SWP water supplies in the Trinity River Region. Therefore, there would be no changes in irrigated lands under Alternative 5 as compared to the Second Basis of Comparison.

Regional Changes to Municipal and Industrial Water Supplies

The CVP would continue to release water in Trinity River for downstream beneficial uses, including water supplies under Alternative 5 and the Second Basis of Comparison. There are no CVP or SWP water contractors in the Trinity River Region.

Regional Changes to Recreational Opportunities

Recreational opportunities would be similar in the Trinity River Region under Alternative 5 as compared to the Second Basis of Comparison as described in Chapter 15, Recreational Resources.

Regional Changes to Salmon Fishing

Trinity River flows would be similar under Alternative 5 as compared to the Second Basis of Comparison. This could result in similar salmon harvest conditions by the Yurok and Hoopa Valley tribes.

Central Valley Region

Regional Changes to Irrigated Agriculture

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under Alternative 5 than under the Second Basis of Comparison. It is anticipated that groundwater use would increase in response to reduced CVP and SWP water supplies in 2030 because sustainable groundwater management plans would not be fully implemented until the 2040s, as discussed in Chapter 12, Agricultural Resources.

The agricultural production value under long-term average conditions would be reduced by less than 1 percent ($1.5 million/year in the Sacramento Valley and $0.7 million/year in the San Joaquin Valley) primarily due to an increase in groundwater pumping of approximately 6 percent. The agricultural production value under dry and critical dry conditions also would be reduced by less than 1 percent ($10.5 million/year in the Sacramento Valley and $22.9 million/year in the San Joaquin Valley) primarily due to an increase in groundwater pumping.

The overall reduction in agricultural production values are less than 0.05 percent under long-term conditions; and, changes in employment and regional economic output would be minimal. Therefore, the analysis of employment and regional economic output is focused on dry and critical dry years.

The direct changes in agricultural production would result in changes to employment and regional economic output in the Sacramento and San Joaquin valleys, as summarized in Tables 19.120 and 19.121, respectively.

Table 19.120 Changes in Agricultural-Related Employment and Regional Economic Output for the Sacramento Valley under Alternative 5 as Compared to the Second Basis of Comparison in Dry and Critical Dry Years

Economic Sectors	Employment				Economic Output ($ millions)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	-84	-20	0	-104	-10.5	-1.2	0.0	-11.8
Mining & Logging	0	0	0	0	0.0	0.0	0.0	0.0
Construction	0	-1	0	-1	0.0	-0.1	0.0	-0.1
Manufacturing	0	0	0	0	0.0	-0.1	0.0	-0.1
Transportation, Warehousing & Utilities	0	-1	0	-2	0.0	-0.3	-0.1	-0.5
Wholesale Trade	0	-1	0	-1	0.0	-0.2	-0.1	-0.3
Retail Trade	0	0	-3	-4	0.0	0.0	-0.3	-0.3
Information	0	0	0	0	0.0	0.0	-0.1	-0.1
Financial Activities	0	-7	-2	-8	0.0	-1.6	-0.7	-2.3
Services	0	-3	-10	-13	0.0	-0.3	-0.9	-1.1
Government	0	0	0	0	0.0	-0.1	0.0	-0.1
Total	**-84**	**-34**	**-17**	**-135**	**-10.5**	**-4.0**	**-2.2**	**-16.8**

Note: In 2012 dollars

Table 19.121 Changes in Agricultural-Related Employment and Regional Economic Output for the San Joaquin Valley under Alternative 5 as Compared to the Second Basis of Comparison in Dry and Critical Dry Years

Economic Sectors	Employment				Economic Output ($ millions)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	-145	-61	0	-206	-22.9	-2.7	-0.1	-25.7
Mining & Logging	0	-1	0	-1	0.0	-0.3	0.0	-0.4
Construction	0	-2	0	-2	0.0	-0.2	0.0	-0.2
Manufacturing	0	-1	-1	-2	0.0	-2.0	-0.4	-2.4
Transportation, Warehousing & Utilities	0	-3	-1	-4	0.0	-0.9	-0.3	-1.2
Wholesale Trade	0	-2	-1	-3	0.0	-0.4	-0.2	-0.6
Retail Trade	0	0	-9	-9	0.0	0.0	-0.7	-0.8
Information	0	0	0	-1	0.0	-0.1	-0.2	-0.2
Financial Activities	0	-13	-4	-16	0.0	-2.8	-1.8	-4.6
Services	0	-6	-25	-31	0.0	-0.6	-2.1	-2.7
Government	0	-1	0	-1	0.0	-0.2	-0.1	-0.3
Total	**-145**	**-90**	**-42**	**-277**	**-22.9**	**-10.2**	**-5.9**	**-39.0**

Note: In 2012 dollars

As described in Chapter 11, Geology and Soils Resources, increased groundwater pumping under the long-term average conditions may result in an additional increment of subsidence in those areas within the Central Valley. The additional amount of subsidence and the economic costs associated with it have not been quantified in this EIS. However, total subsidence-related costs have been shown to be substantial, as reported by Borchers et al. (2014) who estimated that the cost of subsidence in San Joaquin Valley between 1955 and 1972 was more than $1.3 billion (in 2013 dollars). These estimates are based on the impacts to major infrastructure in the region including the San Joaquin River, Delta Mendota Canal, Friant-Kern Canal and San Luis Canal in addition to privately owned infrastructure. The incremental subsidence-related costs, expressed on an annual basis, could be an unknown fraction of that cumulative cost.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under Alternative 5 than under the Second Basis of Comparison. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply costs over the 81-year hydrologic period for M&I water supplies are presented in Tables 19.122 and 19.123 for the Sacramento and San Joaquin Valley, respectively. Average annual water supply operating expenses would increase by 0.11 and 0.47 percent in the Sacramento Valley and the San Joaquin Valley, respectively; and therefore, the results would be similar under Alternative 5 and the Second Basis of Comparison.

Table 19.122 Changes in Municipal and Industrial Water Supply Costs for the Sacramento Valley under Alternative 5 as Compared to the Second Basis of Comparison

Differences in Total	Alternative 5	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	447	463	-16
Delivery Cost ($1,000)	$8,022	$8,317	-$295
Assumed New Supply Deliveries (TAF)	0	0	0
Annualized New Supply Costs ($1,000)	$0	$0	$0
Water Storage Costs ($1,000)	$0	$0	$0
Lost Water Sales Revenues ($1,000)	$204	$207	-$3
Transfer Costs ($1,000)	$752	$517	$235
Shortage Costs ($1,000)	$68	$68	-$1
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$3,856	-$3,916	$60
Excess Water Savings ($1,000)	-$2,266	-$2,563	$298
Average Annual Changes in Water Supply Costs ($1,000)	**$2,924**	**$2,630**	**$293**

Note: In 2012 dollars

Table 19.123 Changes in Municipal and Industrial Water Supply Costs for the San Joaquin Valley under Alternative 5 as Compared to the Second Basis of Comparison

Differences in Total	Alternative 5	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	211	237	-26
Delivery Cost ($1,000)	$3,411	$3,854	-$443
Assumed New Supply Deliveries (TAF)	2	0	2
Annualized New Supply Costs ($1,000)	$601	$15	$585
Water Storage Costs ($1,000)	$966	$820	$146
Lost Water Sales Revenues ($1,000)	$361	$322	$39
Transfer Costs ($1,000)	$2,661	$2,623	$38
Shortage Costs ($1,000)	$115	$102	$13
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$15,329	-$16,011	$683
Excess Water Savings ($1,000)	-$996	-$1,318	$322
Average Annual Changes in Water Supply Costs ($1,000)	**-$8,211**	**-$9,593**	**$1,381**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output in the Sacramento and San Joaquin valleys, as summarized in Tables 19.124 and 19.125, respectively.

Table 19.124 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Sacramento Valley under Alternative 5 as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	-0.1	1.7	1.6
Mining & Logging	0	0	0	0	0.0	-0.4	0.3	-0.1
Construction	0	0	0	0	0.0	-29.9	2.6	-27.3
Manufacturing	0	0	0	0	0.0	-3.2	22.7	19.5
Transportation, Warehousing & Utilities	-1	0	0	-1	-295.2	-2.9	18.4	-279.6
Wholesale Trade	0	0	0	0	0.0	-1.0	27.8	26.8
Retail Trade	0	0	1	1	0.0	-0.9	47.7	46.8
Information	0	0	0	0	0.0	-3.5	21.1	17.6
Financial Activities	0	0	0	0	0.0	-13.4	151.3	137.9
Services	0	0	2	1	0.0	-31.8	158.5	126.8
Government	0	0	0	0	0.0	-0.2	3.9	3.8
Total	**-1**	**-1**	**3**	**1**	**-295.2**	**-87.3**	**456.1**	**73.6**

Note: In 2012 dollars

Table 19.125 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the San Joaquin Valley under Alternative 5 as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	0.1	7.4	7.5
Mining & Logging	0	0	0	0	0.0	0.8	7.1	7.8
Construction	0	0	0	0	0.0	27.2	6.1	33.4
Manufacturing	0	0	0	0	0.0	2.8	51.3	54.1
Transportation, Warehousing & Utilities	1	0	0	1	287.4	2.8	49.4	339.5
Wholesale Trade	0	0	0	0	0.0	0.7	42.9	43.6
Retail Trade	0	0	1	1	0.0	0.8	107.9	108.7
Information	0	0	0	0	0.0	2.0	29.8	31.8
Financial Activities	0	0	1	1	0.0	8.9	291.4	300.3
Services	0	0	4	4	0.0	23.9	323.4	347.2
Government	0	0	0	0	0.0	0.2	14.2	14.5
Total	**1**	**1**	**6**	**8**	**287.4**	**70.1**	**930.8**	**1,288.4**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Recreational opportunities would decrease by 6 to 9 percent under Alternative 5 as compared to the Second Basis of Comparison, depending upon water year type, , as described in Chapter 15, Recreation Resources. Therefore, it is anticipated that recreational economic factors would be reduced under Alternative 5 as compared to the Second Basis of Comparison.

Effects Related to Cross Delta Water Transfers

Potential effects to socioeconomic factors could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 5 and the Second Basis of Comparison, and that impacts on socioeconomic factors could be adverse in the seller's service area.

Under Alternative 5, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Under Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be decreased under Alternative 5 as compared to the Second Basis of Comparison.

San Francisco Bay Area Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, reductions in CVP and SWP water supplies within the San Francisco Bay Area Region would not result in reductions in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be a reduction in irrigated acreage in dry and critical dry years under Alternative 5 as compared to the Second Basis of Comparison.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under Alternative 5 than under the Second Basis of Comparison. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis.

The average annual water supply costs over the 81-year hydrologic period for M&I water supplies would increase by 1.85 percent, as presented in Table 19.126; and therefore, the results would be similar under Alternative 5 and the Second Basis of Comparison.

Table 19.126 Changes in Municipal and Industrial Water Supply Costs for the San Francisco Bay Area Region under Alternative 5 as Compared to the Second Basis of Comparison

Differences in Total	Alternative 5	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	394	445	-51
Delivery Cost ($1,000)	$10,962	$12,515	-$1,553
Assumed New Supply Deliveries (TAF)	18	16	2
Annualized New Supply Costs ($1,000)	$599	$234	$365
Water Storage Costs ($1,000)	$1,495	$1,963	-$467
Lost Water Sales Revenues ($1,000)	$4,360	$1,595	$2,765
Transfer Costs ($1,000)	$6,156	$1,154	$5,002
Shortage Costs ($1,000)	$1,450	$523	$927
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$470	-$792	$322
Excess Water Savings ($1,000)	-$225	-$549	$324
Average Annual Changes in Water Supply Costs ($1,000)	**$24,328**	**$16,643**	**$7,686**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.127.

Table 19.127 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the San Francisco Bay Area Region under Alternative 5 as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	-0.1	8.4	8.3
Mining & Logging	0	0	0	0	0.0	-1.7	5.3	3.5
Construction	0	-1	0	-1	0.0	-176.1	39.5	-136.6
Manufacturing	0	0	1	0	0.0	-32.0	509.0	477.0
Transportation, Warehousing & Utilities	-6	0	1	-5	-1,654.5	-12.4	195.3	-1,471.6
Wholesale Trade	0	0	2	1	0.0	-5.5	373.6	368.1
Retail Trade	0	0	7	7	0.0	-4.7	603.7	599.0
Information	0	0	1	1	0.0	-18.6	326.5	307.9
Financial Activities	0	0	5	5	0.0	-61.9	1,853.1	1,791.2
Services	0	-1	22	20	0.0	-148.2	2,302.6	2,154.4
Government	0	0	0	0	0.0	-0.7	58.7	57.9
Total	**-6**	**-3**	**37**	**29**	**-1,654.5**	**-462.0**	**6,275.6**	**4,159.1**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 5 as compared to the Second Basis of Comparison generally would result in lower reservoir elevations in reservoirs that store CVP and SWP water (up to 10 to 18 percent); and would result in decreased recreational economic factors under Alternative 5 as compared to the Second Basis of Comparison.

Regional Changes to Salmon Fishing

Changes in commercial and sport ocean salmon fishing primarily would be related to the presence of fall-run Chinook Salmon from Central Valley hatcheries. It is assumed that the production of hatchery fish would be similar under Alternative 5 and the Second Basis of Comparison. However, survival of the fall-run Chinook Salmon hatchery fish to the Pacific Ocean could be related to changes in CVP and SWP operations. As described in Chapter 9, Fish and Aquatic Resources, there would be little change in through-Delta survival by emigrating natural juvenile fall-run Chinook Salmon under Alternative 5 as compared to the Second Basis of Comparison. It is assumed that the survival of the hatchery juvenile fall-run Chinook Salmon would be similar to the survival of the natural juvenile fall-run Chinook Salmon. Therefore, the availability of fish for commercial and sport ocean salmon fishing and the associated economic conditions for the fishing industry would be similar under Alternative 5 and the Second Basis of Comparison.

Central Coast Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, reductions in CVP and SWP water supplies within the Central Coast Region would not result in reductions in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be a reduction in irrigated acreage in dry and critical dry years under Alternative 5 as compared to the Second Basis of Comparison.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under Alternative 5 than under the Second Basis of Comparison. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would increase by 0.77 percent, as presented in Table 19.128; and therefore, the results would be similar under Alternative 5 and the Second Basis of Comparison.

Table 19.128 Changes in Municipal and Industrial Water Supply Costs for the Central Coast Region under Alternative 5 as Compared to the Second Basis of Comparison

Differences in Total	Alternative 5	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	43	54	-11
Delivery Cost ($1,000)	$6,567	$8,174	-$1,607
Assumed New Supply Deliveries (TAF)	0	0	0
Annualized New Supply Costs ($1,000)	$0	$0	$0
Water Storage Costs ($1,000)	$0	$0	$0
Lost Water Sales Revenues ($1,000)	$0	$0	$0
Transfer Costs ($1,000)	$0	$0	$0
Shortage Costs ($1,000)	$0	$0	$0
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$8,018	-$8,643	$625
Excess Water Savings ($1,000)	-$2,899	-$4,176	$1,277
Average Annual Changes in Water Supply Costs ($1,000)	**-$4,350**	**-$4,645**	**$295**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.129.

Table 19.129 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Central Coast Region under Alternative 5 as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	0	0	0.0	-0.6	4.3	3.7
Mining & Logging	0	0	0	0	0.0	-6.8	9.9	3.1
Construction	0	-2	0	-2	0.0	-214.8	10.4	-204.4
Manufacturing	0	0	0	0	0.0	-28.6	55.4	26.8
Transportation, Warehousing & Utilities	-7	0	0	-7	-1,606.9	-18.1	60.1	-1,565.0
Wholesale Trade	0	0	0	0	0.0	-5.1	62.7	57.5
Retail Trade	0	0	1	1	0.0	-6.5	126.7	120.2
Information	0	0	0	0	0.0	-12.8	41.7	29.0
Financial Activities	0	0	1	1	0.0	-73.3	376.2	303.0
Services	0	-2	5	3	0.0	-177.8	478.2	300.4
Government	0	0	0	0	0.0	-1.0	14.1	13.1
Total	**-7**	**-4**	**9**	**-2**	**-1,606.9**	**-545.3**	**1,239.6**	**-912.6**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 5 as compared to the Second Basis of Comparison generally would result in lower reservoir elevations in reservoirs that store CVP and SWP water (up to 10 to 18 percent); and would result in decreased recreational economic factors under Alternative 5 as compared to the Second Basis of Comparison.

Southern California Region

Regional Changes to Irrigated Agriculture

It is anticipated that as in the Central Valley Region, reductions in CVP and SWP water supplies within the Southern California Region would not result in reductions in long-term irrigated acreage or land use changes due to the use of other water supplies. However, there could be a reduction in irrigated acreage in dry and critical dry years under Alternative 5 as compared to the Second Basis of Comparison.

Regional Changes to Municipal and Industrial Water Supplies

As described in Chapter 5, Surface Water Resources and Water Supplies, CVP and SWP water supplies would be less under Alternative 5 than under the Second Basis of Comparison. The analysis assumed CVP and SWP water deliveries, as described in Chapter 5, and determined the need for new water supplies, changes in water storage and groundwater pumping, water transfers, water shortage costs, and excess water savings. The factors and basis of the analysis is described in detail in Appendix 19A, CWEST Model. The analysis assumes that no new annual transfer supplies would be implemented until shortages were greater than 5 percent. The costs of these shortages are included in the analysis. It is assumed that some communities that do not have alternative water supplies would utilize water transfers.

The average annual water supply operating expenses over the 81-year hydrologic period for M&I water supplies would increase by 2.5 percent, as presented in Table 19.130; and therefore, the results would be similar under Alternative 5 and the Second Basis of Comparison.

Table 19.130 Changes in Municipal and Industrial Water Supply Costs for the Southern California Region under Alternative 5 as Compared to the Second Basis of Comparison

Differences in Total	Alternative 5	Second Basis of Comparison	Changes
Average Annual CVP/SWP Deliveries (TAF)	1,912	2,394	-482
Delivery Cost ($1,000)	$237,118	$296,795	-$59,677
Assumed New Supply Deliveries (TAF)	81	11	70
Annualized New Supply Costs ($1,000)	$24,191	$4,032	$20,159
Water Storage Costs ($1,000)	$7,474	$2,824	$4,649
Lost Water Sales Revenues ($1,000)	$14,206	$1,119	$13,087
Transfer Costs ($1,000)	$10,505	$3,705	$6,800
Shortage Costs ($1,000)	$16,662	$353	$16,309
Groundwater Pumping Savings (due to reductions in Groundwater Pumping) ($1,000)	-$58,323	-$91,507	$33,183
Excess Water Savings ($1,000)	-$4,588	-$10,573	$5,985
Average Annual Changes in Water Supply Costs ($1,000)	**$247,243**	**$206,749**	**$40,495**

Note: In 2012 dollars

The changes in M&I water supply costs would result in changes to employment and regional economic output, as summarized in Table 19.131.

Table 19.131 Changes in Municipal and Industrial Water Supply Related Employment and Regional Economic Output for the Southern California Region under Alternative 5 as Compared to the Second Basis of Comparison

Economic Sectors	Employment				Economic Output ($ thousands)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Agriculture	0	0	2	1	0.0	-10.0	276.1	266.1
Mining & Logging	0	0	1	1	0.0	-131.1	372.3	241.2
Construction	0	-35	3	-32	0.0	-4,156.1	400.7	-3,755.4
Manufacturing	0	-2	10	9	0.0	-1,159.8	6,894.7	5,734.9
Transportation, Warehousing & Utilities	-140	-2	12	-130	-34,869.2	-472.7	2,639.9	-32,702.0
Wholesale Trade	0	-1	20	19	0.0	-219.8	4,338.8	4,119.1
Retail Trade	0	-2	59	58	0.0	-136.2	5,205.5	5,069.3
Information	0	-1	7	6	0.0	-509.0	2,994.4	2,485.4
Financial Activities	0	-7	52	45	0.0	-2,019.0	18,055.5	16,036.5
Services	0	-37	215	178	0.0	-4,424.9	20,732.4	16,307.5
Government	0	0	3	3	0.0	-23.8	594.9	571.1
Total	**-140**	**-86**	**384**	**158**	**-34,869.2**	**-13,262.4**	**62,505.2**	**14,373.6**

Note: In 2012 dollars

Regional Changes to Recreational Opportunities

Changes in CVP and SWP water supplies and operations under Alternative 5 as compared to the Second Basis of Comparison generally would result in lower reservoir elevations in reservoirs that store CVP and SWP water (up to 10 to 18 percent); and would result in decreased recreational economic factors under Alternative 5 as compared to the Second Basis of Comparison.

19.4.3.7 Summary of Environmental Consequences

The results of the environmental consequences of implementation of Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison are presented in Tables 19.132 and 19.133.

Table 19.132 Comparison of Alternatives 1 through 5 to No Action Alternative

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 1	Agricultural and M&I water-related employment would be similar. M&I water supply operating expenses would be similar. Recreational economic factors would increase or be similar related to use of reservoirs that store CVP and SWP water.	None needed
Alternative 2	No effects on socioeconomic factors.	None needed
Alternative 3	Agricultural and M&I water-related employment would be similar. M&I water supply operating expenses would be similar. Recreational economic factors would increase or be similar related to use of reservoirs that store CVP and SWP water. Reduced recreational economic factors related to Striped Bass fishing. Reduced commercial and sport ocean salmon fishing due to increased harvest limitations.	None identified at this time to reduce economic effects of reduced Striped Bass fishing and ocean salmon.
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. Reduced commercial and sport ocean salmon fishing due to increased harvest limitations.	None identified at this time to reduce economic effects of reduced Striped Bass fishing or ocean salmon fishing.
Alternative 5	Agricultural and M&I water-related employment would be similar. M&I water supply operating expenses would be similar. Recreational economic factors would be similar related to use of reservoirs that store CVP and SWP water.	None needed

Note: Due to the limitations and uncertainty in the CalSim II monthly model and other analytical tools, incremental differences of 5 percent or less between alternatives and the No Action Alternative are considered to be "similar."

Table 19.133 Comparison of No Action Alternative and Alternatives 1 through 5 to Second Basis of Comparison

Alternative	Potential Change	Consideration for Mitigation Measures
No Action Alternative	Agricultural and M&I water-related employment would be similar. M&I water supply operating expenses would be similar. Recreational economic factors would decrease at San Luis Reservoir and at of reservoirs that store CVP and SWP water in the San Francisco Bay Area and Central Coast regions.	Not considered for this comparison.
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	Agricultural and M&I water-related employment would be similar. M&I water supply operating expenses would be similar. Recreational economic factors would be similar related to use of reservoirs that store CVP and SWP water. Reduced recreational economic factors related to Striped Bass fishing. Reduced commercial and sport ocean salmon fishing due to increased harvest limitations. 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. Reduced commercial and sport ocean salmon fishing due to increased harvest limitations.	Not considered for this comparison.
Alternative 5	Agricultural and M&I water-related employment would be similar. M&I water supply operating expenses would be similar. Recreational economic factors would decrease at San Luis Reservoir and at of reservoirs that store CVP and SWP water in the San Francisco Bay Area, Central Coast, and Southern California regions. Reduced recreational economic factors related to Striped Bass fishing. Reduced commercial and sport ocean salmon fishing due to increased harvest limitations.	Not considered for this comparison.

Note: Due to the limitations and uncertainty in the CalSim II monthly model and other analytical tools, incremental differences of 5 percent or less between alternatives and the No Action Alternative are considered to be “similar.”

19.4.3.8 Potential Mitigation Measures

Mitigation measures are presented in this section to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse environmental effects of Alternatives 1 through 5 as compared to the No Action Alternative. Mitigation measures were not included to address adverse impacts under the alternatives as compared to the Second Basis of Comparison because this analysis was included in this EIS for information purposes only.

Changes in CVP and SWP operations under Alternatives 1 through 5 as compared to the No Action Alternative would not result in adverse changes in socioeconomic factors related to the average annual agricultural production or M&I water supply operating expenses as compared to the No Action Alternative. However, implementation of Alternatives 3 and 4 would result in adverse changes in recreational Striped Bass and sport ocean salmon fishing opportunities.

19.4.3.8.1 Recreational Fishing Opportunities

Under Alternatives 3 and 4, fishing opportunities for Striped Bass and commercial and sport ocean salmon fishing would be reduced as compared to the No Action Alternative. Mitigation measures are not identified at this time to reduce the impact to the Striped Bass and ocean salmon fishing opportunities.

19.4.3.9 Cumulative Effects Analysis

As described in Chapter 3, the cumulative effects analysis considers projects, programs, and policies that are not speculative; and are based upon known or reasonably foreseeable long-range plans, regulations, operating agreements, or other information that establishes them as reasonably foreseeable.

The cumulative effects analysis Alternatives 1 through 5 for Socioeconomics are summarized in Table 19.134.

Table 19.134 Summary of Cumulative Effects on Socioeconomics of Alternatives 1 through 5 as Compared to the No Action Alternative

Scenarios	Actions	Cumulative Effects of Actions
Past & Present, and Future Actions included in the No Action Alternative and in all Alternatives in Year 2030	Consistent with Affected Environment conditions plus: Actions in the 2008 USFWS BO and 2009 NMFS BO that would have occurred without implementation of the Biological Opinions, as described in Section 3.3.1.2 (of Chapter 3, Descriptions of Alternatives), including climate change and sea level rise Actions not included in the 2008 USFWS BO and 2009 NMFS BO that would have occurred without implementation of the Biological Opinions, as described in Section 3.3.1.3 (of Chapter 3, Descriptions of Alternatives): • Implementation of Federal and state policies and programs, including Clean Water Act (e.g., Total Maximum Daily Loads); Safe Drinking Water Act; Clean Air Act; and flood management programs • General plans for 2030. • Trinity River Restoration Program. • Central Valley Project Improvement Act programs • Folsom Dam Water Control Manual Update • FERC Relicensing for the Middle Fork of the American River Project • San Joaquin River Restoration Program • Contra Loma Recreation Resource Management Plan • San Luis Reservoir State Recreation Area Resource Management Plan/General Plan	These effects would be the same in all alternatives. Climate change and sea level rise and development under the general plans are anticipated to reduce carryover storage in reservoirs in a manner that would reduce CVP and SWP water supply availability and recreational opportunities at some reservoirs that store CVP and SWP water, and could reduce the opportunities for ocean salmon fishing. Other actions, including restoration projects, FERC relicensing projects, and some future projects to improve water quality and/or habitat are anticipated to improve recreational opportunities and salmon populations that could improve ocean salmon fishing.
Future Actions considered as Cumulative Effects Actions in all Alternatives in Year 2030	Actions as described in Section 3.5 (of Chapter 3, Descriptions of Alternatives): • Bay-Delta Water Quality Control Plan Update • FERC Relicensing Projects • Bay Delta Conservation Plan (including the California WaterFix alternative) • Shasta Lake Water Resources, North-of-the-Delta Offstream Storage, Los Vaqueros Reservoir Expansion Phase 2, and Upper San Joaquin River Basin Storage Investigations	These effects would be the same in all alternatives. Some of the future reasonably foreseeable actions to improve water quality and FERC Relicensing projects could improve recreational opportunities and salmon populations that could improve ocean salmon fishing. Other actions, such as expanded or new reservoirs would improve water supply availability and recreational opportunities.

Scenarios	Actions	Cumulative Effects of Actions
	• El Dorado Water and Power Authority Supplemental Water Rights Project • Semitropic Water Storage District Delta Wetlands • North Bay Aqueduct Alternative Intake • Irrigated Lands Regulatory Program	
No Action Alternative with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO	Implementation of No Action Alternative would result in changes stream flows. Changes in stream flows would in turn in changes in water supply availability, recreational opportunities, and salmon populations. Changes in salmon populations would affect ocean salmon fishing as compared to historical conditions prior to the BOs.
Alternative 1 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant)	Implementation of Alternative 1 with reasonably foreseeable actions would result in similar agricultural and M&I water supply economics, and similar or improved reservoir recreational opportunities compared to the No Action Alternative with these added actions.
Alternative 2 with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO CVP and SWP operational actions No implementation of structural improvements or other actions that require further study to develop a more detailed action description.	Implementation of Alternative 2 with reasonably foreseeable actions for recreational opportunities would be the same as for the No Action Alternative with these added actions.
Alternative 3 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant) Slight increase in positive Old and Middle River flows in the winter and spring months Increased bag limits for Striped Bass and Pikeminnow Increased ocean salmon fishing harvest limitations	Implementation of Alternative 3 with reasonably foreseeable actions would result in similar agricultural and M&I water supply economics, and similar or improved reservoir recreational opportunities as for the No Action Alternative with tjese added actions. Recreational opportunities related to Striped Bass fishing would initially be increased; however by 2030 recreational fishing related to Striped Bass would be reduced. Opportunities related to commercial and sport ocean salmon fishing would be reduced.

Scenarios	Actions	Cumulative Effects of Actions
Alternative 4 with Associated Cumulative Effects in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant) Increased bag limits for Striped Bass and Pikeminnow Increased ocean salmon fishing harvest limitations	Implementation of Alternative with these reasonably foreseeable actions would result in similar agricultural and M&I water supply economics, and similar or improved reservoir recreational opportunities as for the No Action Alternative with these added actions. Recreational opportunities related to Striped Bass fishing would initially be increased; however by 2030 recreational fishing related to Striped Bass would be reduced. Opportunities related to commercial and sport ocean salmon fishing would be reduced.
Alternative 5 with Associated Cumulative Effects in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO Positive Old and Middle River flows and increased Delta outflow in spring months	Implementation of Alternative 5 with reasonably foreseeable actions would result in similar agricultural and M&I water supply economics, and similar reservoir recreational opportunities as for the No Action Alternative with these added actions.

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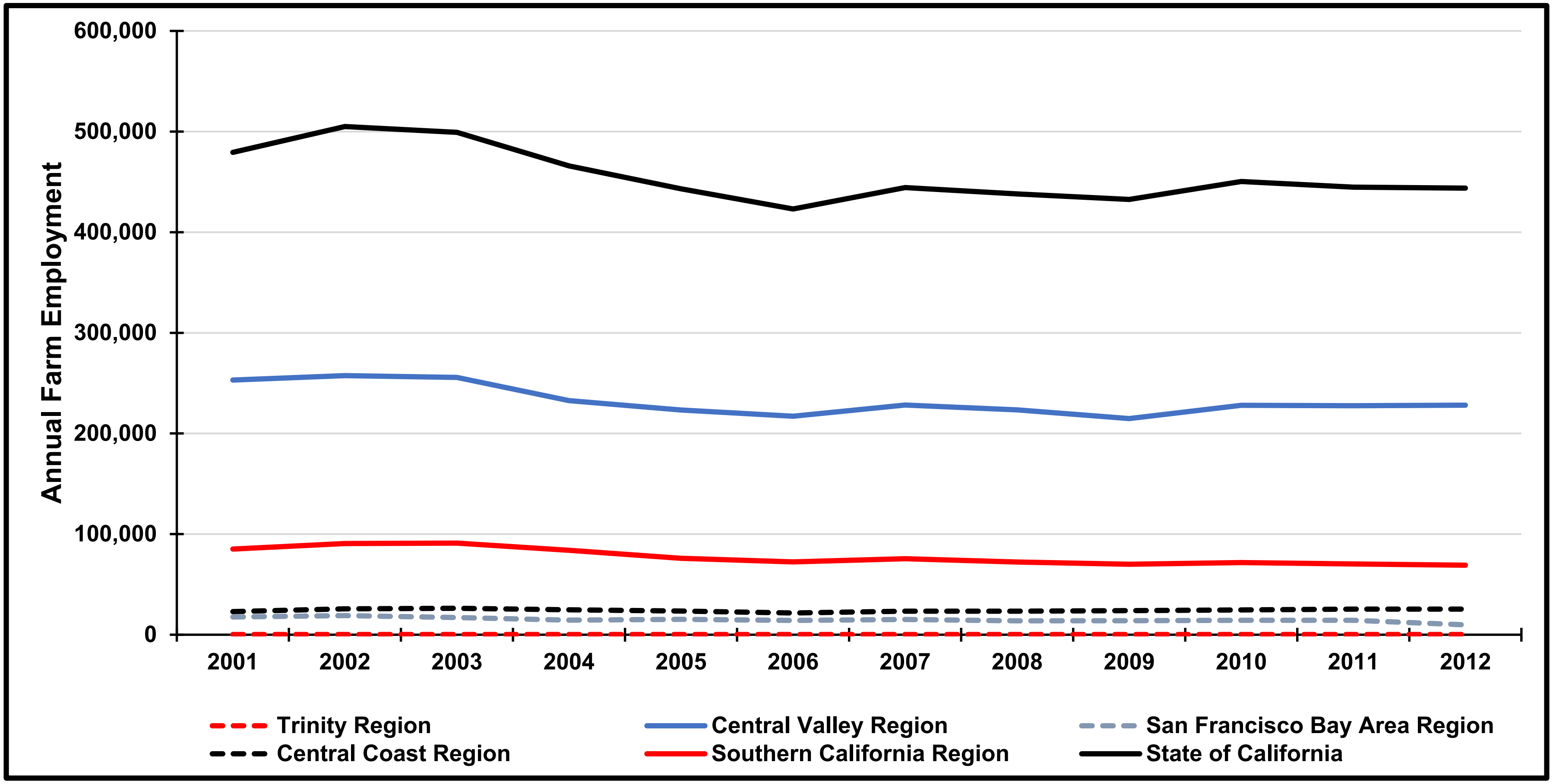

Figure 19.1 Farm Employment in Counties within the Study Area

Source: BEA 2014a

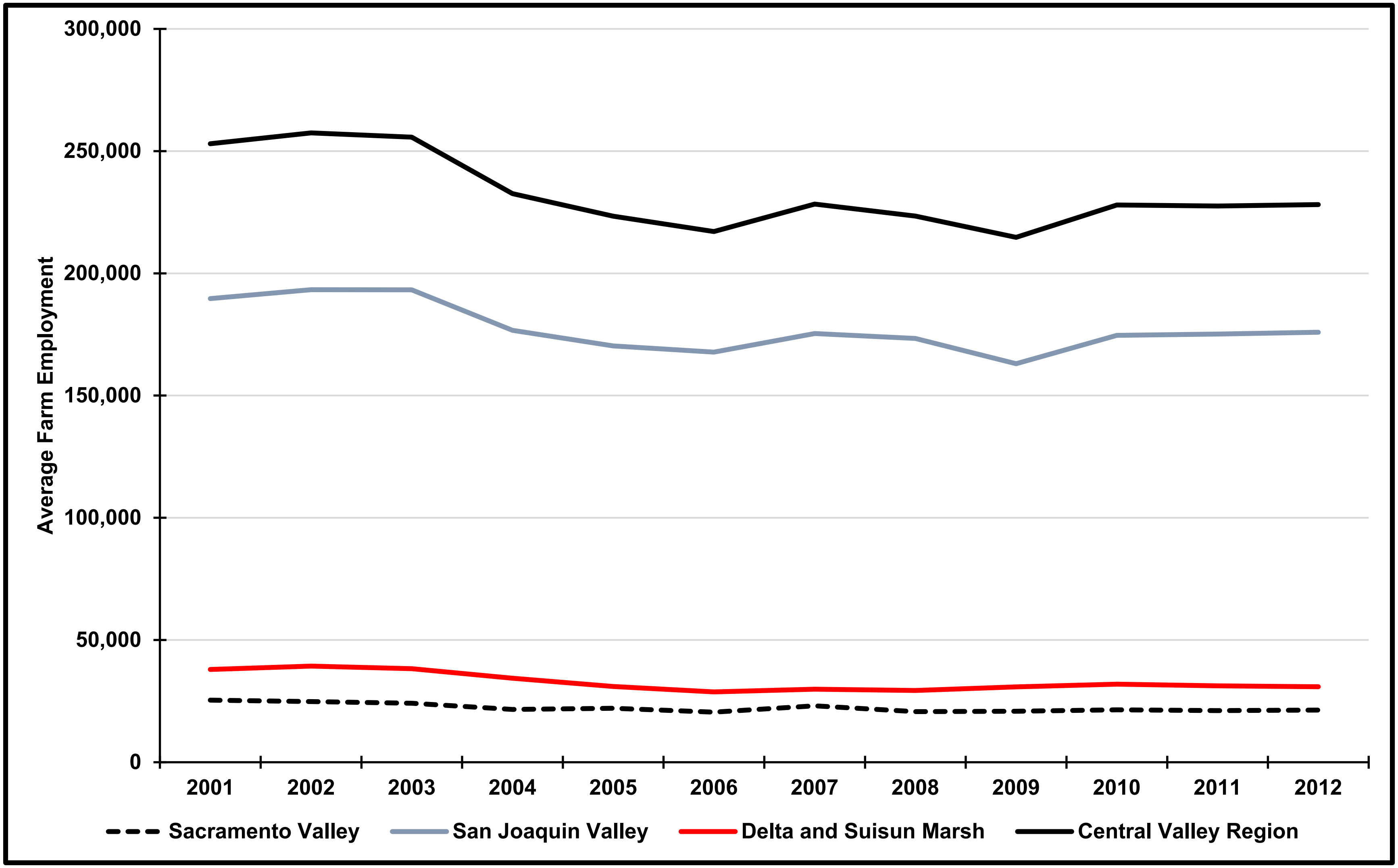

Figure 19.2 Farm Employment in Counties within the Central Valley Region

Source: BEA 2014a

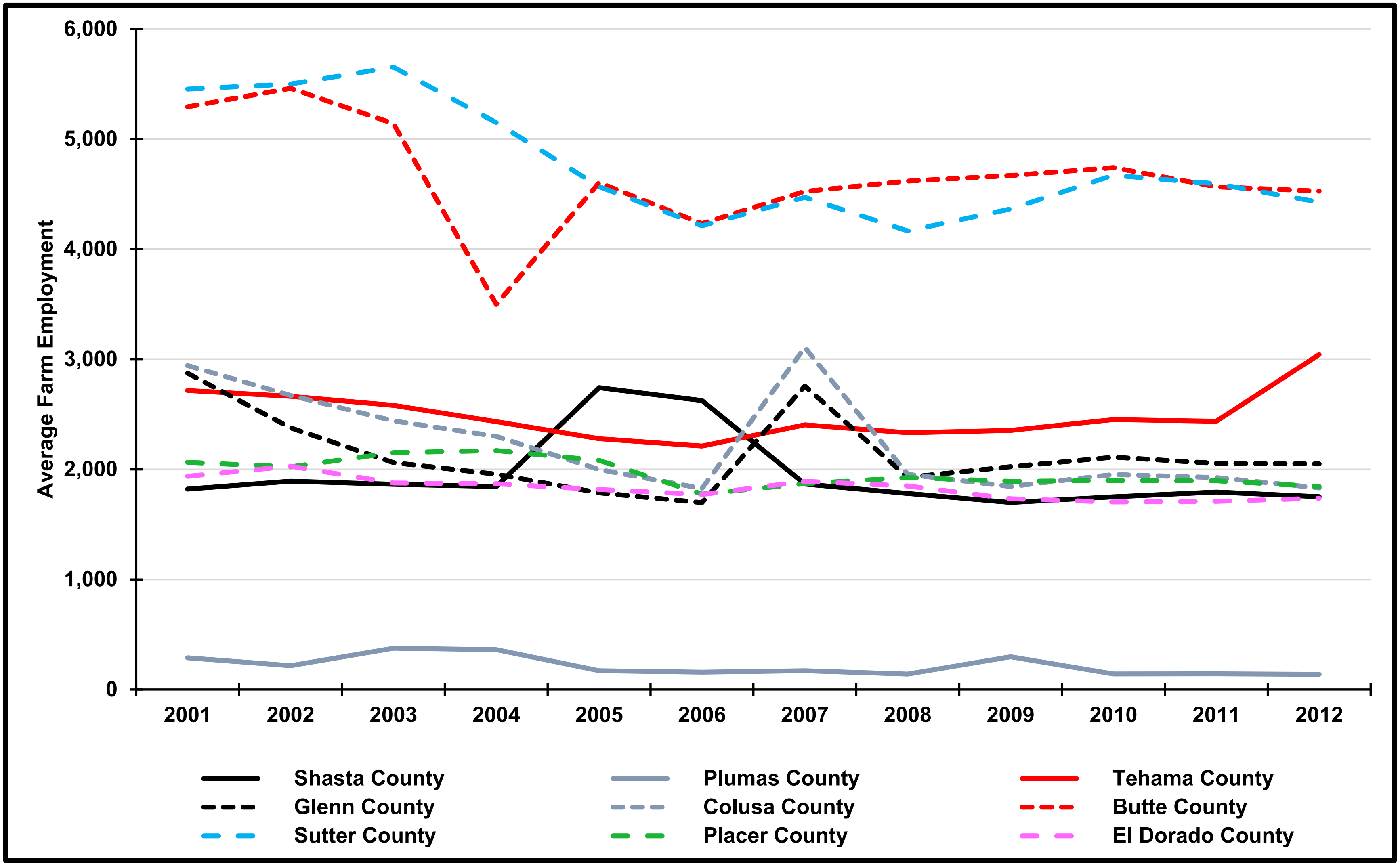

Figure 19.3 Farm Employment in Counties within the Sacramento Valley Portion of the Central Valley Region

Source: BEA 2014a

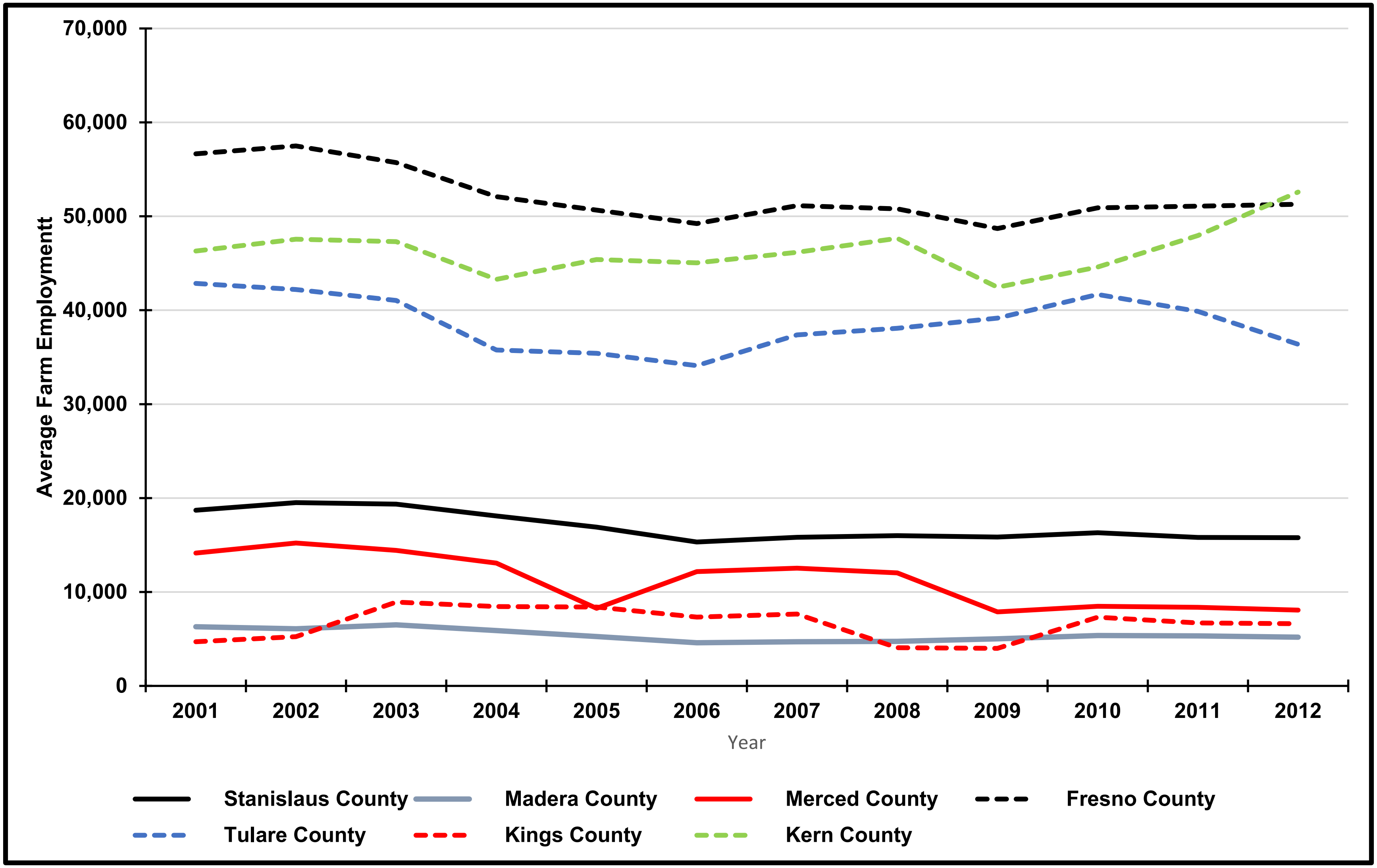

Figure 19.4 Farm Employment in Counties within the San Joaquin Valley Portion of the Central Valley Region

Source: BEA 2014a

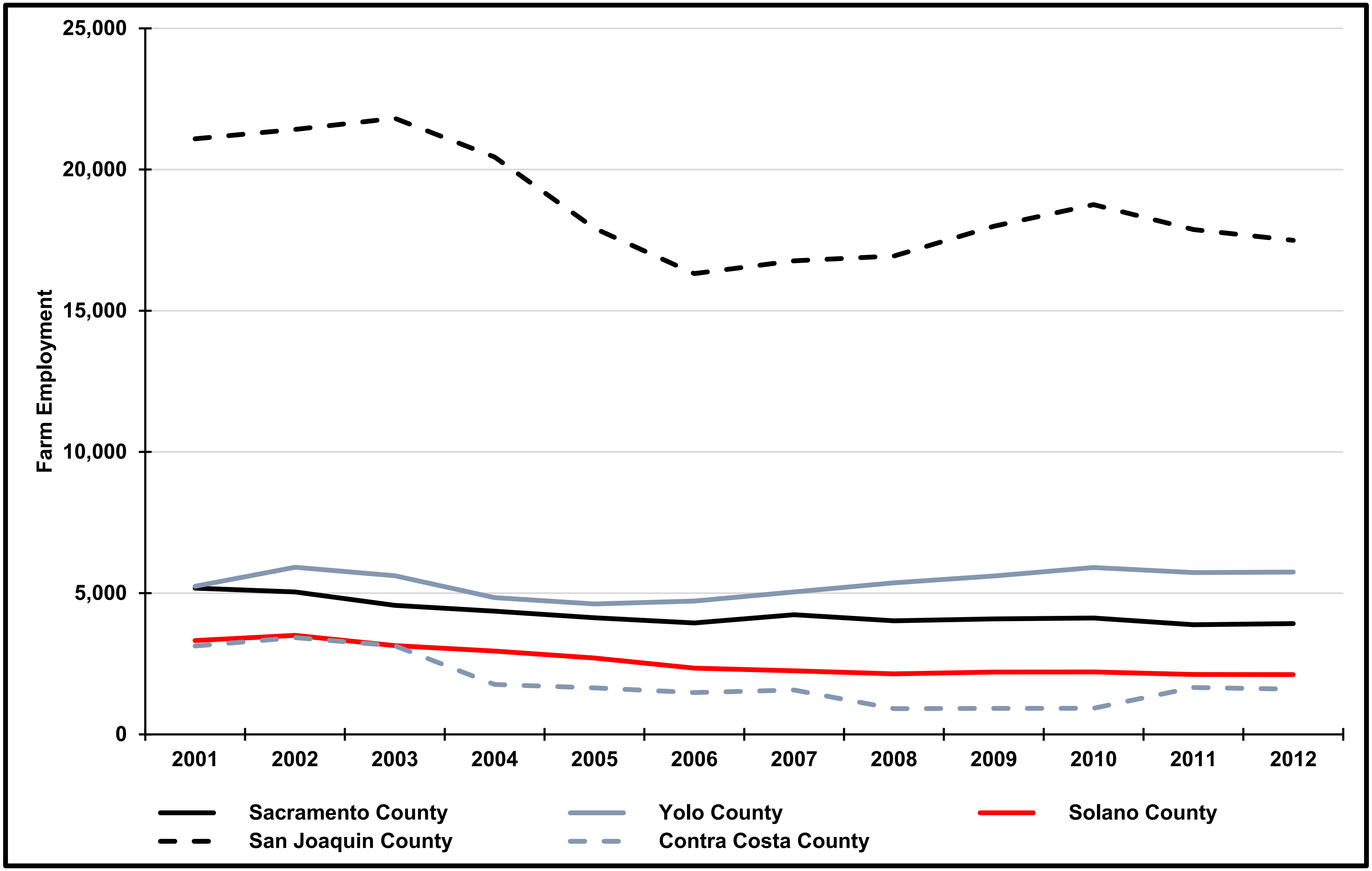

Figure 19.5 Farm Employment in Counties within the Delta and Suisun Marsh Portion of the Central Valley Region

Source: BEA 2014a

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Chapter 20

Indian Trust Assets

20.1 Introduction

This chapter describes Indian Trust Assets (ITAs) in the study area and potential changes that could occur as a result of implementing the alternatives evaluated in this Environmental Impact Statement (EIS). Implementation of the alternatives could affect ITAs through potential changes to the operation of the Central Valley Project (CVP) and State Water Project (SWP) and ecosystem restoration.

20.2 Regulatory Environment and Compliance Requirements

Potential actions that could be implemented under the alternatives evaluated in this EIS could affect ITAs in the areas along the rivers and reservoirs directly impacted by changes in the operation of CVP or SWP reservoirs and in the vicinity of lands served by CVP and SWP water supplies. Actions located on public agency lands, or implemented, funded, or approved by Federal and state agencies, would need to be compliant with appropriate Federal and state agency policies and regulations, as summarized in Chapter 4, Approach to Environmental Analyses.

The Federal Indian Trust Asset policies, summarized below and in Chapter 4, have been used to identify potential areas of change to ITAs that could occur due to changes in long-term operation of the CVP and/or SWP facilities.

The ITAs are legal interests in property held in trust by the U.S. for federally-recognized Indian tribes or individual Indians. An Indian trust has three components: (1) the trustee, (2) the beneficiary, and (3) the trust asset. ITAs can include land, minerals, federally-reserved hunting and fishing rights, federally-reserved water rights, and in-stream flows associated with trust land. Beneficiaries of the Indian trust relationship are federally-recognized Indian tribes with trust land; the U.S. is the trustee. By definition, ITAs cannot be sold, leased, or otherwise encumbered without approval of the U.S. The characterization and application of the U.S. trust relationship have been defined by case law that interprets Congressional acts, executive orders, and historic treaty provisions.

The federal government, through treaty, statute or regulation, may take on specific, enforceable fiduciary obligations that give rise to a trust responsibility to federally recognized tribes and individual Indians possessing trust assets. Courts have recognized an enforceable federal fiduciary duty with respect to federal supervision of Indian money or natural resources, held in trust by the federal government, where specific treaties, statutes or regulations create such a fiduciary duty.

Consistent with President William J. Clinton's 1994 memorandum, "Government-to-Government Relations with Native American Tribal Governments," Bureau of Reclamation (Reclamation) assesses the effect of its programs on tribal trust resources and federally-recognized tribal governments. Reclamation is tasked to actively engage federally-recognized tribal governments and consult with such tribes on government-to-government level when its actions affect ITAs (Federal Register, Vol. 59, No. 85, May 4, 1994, pages 22951-22952). The U.S. Department of the Interior (DOI) Departmental Manual Part 512.2 ascribes the responsibility for ensuring protection of ITAs to the heads of bureaus and offices. DOI is required to carry out activities in a manner that protects ITAs and avoids adverse effects whenever possible.

20.3 Affected Environment

The U.S. Government's trust responsibility for Indian resources requires Reclamation and other agencies to take measures to protect and maintain trust resources. These responsibilities include taking reasonable actions to preserve and restore tribal resources.

In compliance with 36 Code of Federal Register 800.4(a) (4), Reclamation sent letters to the federally-recognized Indian tribes in the study area, including most of the tribes listed in Table 20.1, to request their input regarding the identification of any properties to which they might attach religious and cultural significance to within the area of potential effect.

Table 20.1 Federally Recognized Tribes in the Vicinity of the Study Area

Federally Recognized Tribe	EIS Geographical Region	County	In the Vicinity of this Community
Hoopa Valley Tribal Council	Trinity River	Trinity and Humboldt	Hoopa
Resighini Rancheria Tribe	Trinity River	Del Norte	Klamath
Yurok Tribe of the Yurok Reservation	Trinity River	Trinity, Humboldt, and Del Norte	Klamath
Pit River Tribe	Central Valley	Shasta	Burney
Redding Rancheria Tribe	Central Valley	Shasta	Redding
Paskenta Band of Nomlaki Indians of California	Central Valley	Tehama and Glenn	Corning and Orland
Grindstone Indian Rancheria of Wintun-Wailaki Indians of California	Central Valley	Glenn	Elk Creek

Federally Recognized Tribe	EIS Geographical Region	County	In the Vicinity of this Community
Cachil Dehe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria	Central Valley	Colusa	Colusa
Cortina Indian Rancheria of Wintun Indians of California	Central Valley	Colusa	Williams
Tyme Maidu of Berry Creek Rancheria	Central Valley	Butte	Oroville
Konkow Maidu of Mooretown Rancheria	Central Valley	Butte	Oroville
Enterprise Rancheria of Maidu Indians of California	Central Valley	Butte	Oroville
Mechoopda Indian Tribe of Chico Rancheria	Central Valley	Butte	Chico
Miwok Maidu United Auburn Indian Community of the Auburn Rancheria	Central Valley	Placer	Placer
United Auburn Indian Community of the Auburn Rancheria of California	Central Valley	Placer	Rocklin
Shingle Springs Band of Miwok Indians, including Shingle Springs Rancheria	Central Valley	El Dorado and Nevada County	Shingle Springs
Buena Vista Rancheria of Me-Wuk	Central Valley	Sacramento	Sacramento
Wilton Miwok Indians of the Wilton Rancheria	Central Valley	Sacramento	Elk Grove
Yocha Dehe Wintun Nation	Central Valley	Yolo	Brooks
Northfork Rancheria of Mono Indians of California	Central Valley	Madera	North Fork
Picayune Rancheria of Chukchansi Indians of California	Central Valley	Madera	Coarsegold
California Valley Miwok Tribe	Central Valley	San Joaquin	Stockton
Big Sandy Rancheria of Mono Indians of California	Central Valley	Fresno	Auberry

Federally Recognized Tribe	EIS Geographical Region	County	In the Vicinity of this Community
Table Mountain Rancheria	Central Valley	Fresno	Friant
Santa Rosa Indian Community of Santa Rosa Rancheria	Central Valley	Kings	Lemoore
Tule River Indian Tribe of the Tule River Reservation of the Yokut Indians	Central Valley	Tulare	Porterville
Santa Ynez Band of Chumash Mission Indians of Santa Ynez Reservation	Central Coast	Santa Barbara	Santa Ynez
Cahuilla Band of Mission Indians of the Cahuilla Reservation	Southern California	San Diego	Anza
Campo Band of Diegueno Mission Indians of the Campo Indian Reservation	Southern California	San Diego	Campo
Capitan Grande Band of Diegueno Mission Indians of California (Barona Reservation and Viejas Reservation)	Southern California	San Diego	Alpine
Ewiiaapaayp Band of Kumeyaay Indians	Southern California	San Diego	Alpine
Iipay Nation of Santa Ysabel	Southern California	San Diego	Santa Ysabel
Inaja Band of Diegueno Mission Indians of the Inaja and Cosmit Reservation	Southern California	San Diego	Escondido
Jamul Indian Village of California	Southern California	San Diego	Jamul
La Jolla Band of Luiseño Indians	Southern California	San Diego	Pauma Valley
La Posta Band of Diegueno Mission Indians of the La Posta Indian Reservation	Southern California	San Diego	Boulevard
Los Coyotes Band of Cahuilla and Cupeno Indians	Southern California	San Diego	Warner Springs

Federally Recognized Tribe	EIS Geographical Region	County	In the Vicinity of this Community
Manzanita Band of Diegueno Mission Indians of the Manzanita Reservation	Southern California	San Diego	Boulevard
Mesa Grande Band of Diegueno Mission Indians of the Mesa Grande Reservation	Southern California	San Diego	Santa Ysabel
Pala Band of Luiseño Mission Indians of the Pala Reservation	Southern California	San Diego	Pala
Pauma Band of Luiseño Mission Indians of the Pauma & Yuima Reservation	Southern California	San Diego	Pauma Valley
Rincon Band of Luiseño Mission Indians of the Rincon Reservation	Southern California	San Diego	Valley Center
San Pasqual Band of Diegueno Mission Indians of California	Southern California	San Diego	Valley Center
Sycuan Band of the Kumeyaay Nation	Southern California	San Diego	El Cajon
Agua Caliente Band of Cahuilla Indians of the Agua Caliente Indian Reservation	Southern California	Riverside	Palm Springs
Augustine Band of Cahuilla Indians	Southern California	Riverside	Coachella
Cabazon Band of Mission Indians	Southern California	Riverside	Indio
Morongo Band of Mission Indians	Southern California	Riverside	Banning
Pechanga Band of Luiseño Mission Indians of the Pechanga Reservation	Southern California	Riverside	Temecula
Ramona Band of Cahuilla	Southern California	Riverside	Anza
Santa Rosa Band of Cahuilla Indians	Southern California	Riverside	Mountain Center
Soboba Band of Luiseño Indians	Southern California	Riverside	San Jacinto

Federally Recognized Tribe	EIS Geographical Region	County	In the Vicinity of this Community
Torres-Martinez Desert Cahuilla Indians	Southern California	Riverside	Thermal
Twenty-Nine Palms Band of Mission Indians of California	Southern California	Riverside and San Bernardino	Coachella
Chemehuevi Indian Tribe of the Chemehuevi Reservation	Southern California	San Bernardino	Needles
San Manuel Band of Mission Indians	Southern California	San Bernardino	Highland
Big Lagoon Rancheria	Not within study area	Humboldt	Arcata
Blue Lake Rancheria	Not within study area	Humboldt	Blue Lake
Karuk Tribe	Not within study area	Siskiyou	Happy Camp
Greenville Rancheria of Maidu Indians	Not within study area	Plumas and Tehama	Greenville
Susanville Indian Rancheria	Not within study area	Lassen	Susanville
Lytton Rancheria	Not within study area	Sonoma	Santa Rosa
Chicken Ranch Rancheria of Me-Wuk Indians of California	Not within study area	Tuolumne	Jamestown
Cold Springs Rancheria of Mono Indians	Not within study area	Fresno	Tollhouse
Colorado River Indian Tribes of the Colorado River Indian Reservation	Not within study area	Riverside	Parker, Arizona

20.4 Impact Analysis

This section describes the potential mechanisms for change to ITAs, quantitative and qualitative analytical methods, effects of the analyses, potential mitigation measures, and cumulative effects.

20.4.1 Potential Mechanisms for Change and Analytical Tools

As described in Chapter 4, Approach to Environmental Analysis, the environmental consequences assessment considers changes in conditions related to changes in CVP and SWP operation under the alternatives as compared to the No Action Alternative and Second Basis of Comparison.

Changes in CVP and SWP operation under the alternatives as compared to the No Action Alternative and Second Basis of Comparison could change water elevations within the CVP and SWP reservoirs, flow patterns in the rivers downstream of CVP and SWP reservoirs, and CVP and SWP water deliveries. Impacts to existing ITAs would be considered adverse if the action:

- Interfered with the exercise of a federally reserved water right, or degrade water quality where there is a federally reserved water right
- Interfered with the use, value, occupancy, character or enjoyment of an ITA
- Failed to protect ITAs from loss, damage, waste, depletion, or other negative effects

20.4.1.1 Changes in CVP and SWP Reservoir Elevation

There are no ITAs within any of the reservoir inundation areas (DWR 2005; Reclamation 2010, 2012, 2013a, 2014a; Reclamation et al. 2011; USACE et al. 2012). Therefore, the changes in reservoir elevations would not affect ITAs and are not analyzed in this EIS.

20.4.1.2 Changes in Rivers Downstream of CVP and SWP Reservoirs

There are no ITAs within the rivers downstream of CVP and SWP reservoirs (DWR 2005; Reclamation 2010, 2012, 2013a, 2014a; Reclamation et al. 2011; USACE et al. 2012). Therefore, changes in river flow patterns would not directly affect any ITAs. However, changes in river flow patterns in the Trinity River could indirectly affect several ITAs, including the Hoopa Valley Tribe, Resighini Rancheria Tribe, and Yurok Tribe of the Yurok Reservation. Changes in the river flow patterns could affect use of the Trinity River for boats, access to adjacent lands, and fish in the Trinity River that are important to the tribes.

As described in Chapter 5, Surface Water Resources and Water Supplies, implementation of Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison, and the No Action Alternative as compared to the Second Basis of Comparison could affect change river flow patterns in the Trinity River.

20.4.1.3 Changes due to CVP and SWP Water Deliveries

There are no ITAs that directly receive CVP or SWP water. As described in Chapter 19, Socioeconomics, municipalities that use CVP or SWP water supplies, including agencies that serve ITAs, would continue to meet water demands in 2030 if CVP and SWP water supplies are reduced through the increased use of non-CVP and SWP water supplies. Therefore, changes in CVP and SWP water deliveries would not affect water supplies to ITAs and are not analyzed in this EIS.

20.4.1.4 Effects Related to Cross Delta Water Transfers

Cross Delta water transfers involving the CVP and SWP facilities or water supplies would be required to be implemented in accordance with all existing regulations and requirements, including not causing adverse impacts to other water users in accordance with the requirements of Reclamation, California Department of Water Resources (DWR), and the State Water Resources Control Board (SWRCB).

Reclamation recently prepared a long-term regional water transfer environmental document which evaluated potential changes in surface water conditions related to water transfer actions (Reclamation 2014d). Results from this analysis were used to inform the impact assessment of potential effects of water transfers under the alternatives as compared to the No Action Alternative and the Second Basis of Comparison.

The transfers could change flow patterns in rivers downstream of CVP and SWP reservoirs. Surface water elevations in CVP and SWP reservoirs due to transfer programs under the alternatives and Second Basis of Comparison could be affected for a short-time during a water year; however, because the transferred water would have been released for the seller’s use, the end of September storage elevations would be similar with or without the transfer.

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

The impact analysis in this EIS is based upon the comparison of the alternatives to the No Action Alternative and the Second Basis of Comparison in the Year 2030. Many of the changed conditions would occur in the same manner under both the No Action Alternative and the Second Basis of Comparison (e.g., climate change, sea-level rise, general plan development, and implementation of reasonable and foreseeable projects). Due to these changes, especially climate change and sea-level rise, it is anticipated that reservoir elevations at the end of September would be lower and flows patterns in the rivers downstream of the reservoirs would be different than under recent condition, as described in Chapter 5, Surface Water Resources and Water Supplies.

20.4.3 Evaluation of Alternatives

As described in Chapter 4, Approach to Environmental Analysis, Alternatives 1 through 5 have been compared to the No Action Alternative, and the No Action Alternative and Alternatives 1 through 5 have been compared to the Second Basis of Comparison. The evaluation of alternatives is focused on the Trinity River Region because, as discussed above, potential changes that could affect ITAs are located along the Trinity River.

During review of the numerical modeling analyses used in this EIS, an error was determined in the CalSim II model assumptions related to the Stanislaus River operation for the Second Basis of Comparison, Alternative 1, and Alternative 4 model runs. Appendix 5C includes a comparison of the CalSim II model run results presented in this chapter and CalSim II model run results with the error corrected. Appendix 5C also includes a discussion of changes in the comparison of four alternative analyses:

- No Action Alternative compared to the Second Basis of Comparison
- Alternative 1 compared to the No Action Alternative
- Alternative 3 compared to the Second Basis of Comparison
- Alternative 5 compared to the Second Basis of Comparison

20.4.3.1 No Action Alternative

As described in Chapter 4, Approach to Environmental Analysis, the No Action Alternative is compared to the Second Basis of Comparison.

20.4.3.1.1 Potential Changes in Trinity River downstream of Lewiston Dam

As described in Chapter 5, Surface Water Resources and Water Supplies, the following changes would occur on the Trinity River under the No Action Alternative as compared to the Second Basis of Comparison.

- Over long-term conditions (over the 82-year analysis period), flows would be similar (within 5 percent) from March through November, and reduced from December through February (up to 9.5 percent; 70 cubic feet per second [cfs]).
- In wet years, flows would be similar from April through November, and reduced from December through March (up to 11.2 percent; 160 cfs).
- In above normal years, flows would be similar from March through November, and reduced in January and February (up to 19.9 percent; 74 cfs).
- In below normal years, flows would be similar from March through January, and reduced in February (30.4 percent, 192 cfs).
- In dry and Critical dry years, flows would be similar all months.

The changes in river flows would occur in the winter months of wetter years when potential use of the rivers would be less for transportation and ceremonies (USFWS et al. 1999). As described in Chapter 9, Fish and Aquatic Resources, these changes in river flows would result in similar conditions for salmonids using Trinity River. Therefore, there would be no effect the ITAs.

20.4.3.1.2 Effects Related to Cross Delta Water Transfers

As described in Chapter 5, Surface Water Resources and Water Supplies, and Chapter 7, Groundwater Resources and Groundwater Quality, potential effects on surface water resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento Valley to San Joaquin Valley (Reclamation 2014d). Potential effects were identified as reduced surface water storage in upstream reservoirs; changes in flow patterns in rivers downstream of the reservoirs if water was released from the reservoirs in patterns that were different than would have been used by the sellers; and groundwater elevation reductions if groundwater substitution was used to provide the water for the transfers. All water transfers would be required to avoid adverse impacts on other water users and biological resources; and water transfer programs would include groundwater mitigation and monitoring plans (see Section 3.A.6.3, Transfers). Therefore, water transfer programs would need to be implemented in a manner that would avoid impacts associated with changes in Trinity Lake storage, Trinity River flow patterns, and groundwater elevation reductions in the Central Valley that could affect ITAs. For the purposes of this EIS, it is anticipated that similar conditions would occur due to cross Delta water transfers under the No Action Alternative as compared to the Second Basis of Comparison, and there would be no effect on the ITAs due to cross Delta water transfers.

20.4.3.2 Alternative 1

Alternative 1 is identical to the Second Basis of Comparison. Alternative 1 is compared to the No Action Alternative and the Second Basis of Comparison. However, because conditions under Alternative 1 are identical to conditions under the Second Basis of Comparison, Alternative 1 is only compared to the No Action Alternative.

20.4.3.2.1 Alternative 1 Compared to the No Action Alternative

Potential Changes in Trinity River downstream of Lewiston Dam

As described in Chapter 5, Surface Water Resources and Water Supplies, the following changes would occur on the Trinity River under Alternative 1 and the No Action Alternative.

- Over long-term conditions, flows would be similar from March through November, and increased from December through February (up to 10.5 percent, 86 cfs).
- In wet years, flows would be similar from April through November, and increased from December through March (up to 12.6 percent, 160 cfs).
- In above normal years, flows would be similar from March through November, and increased in January and February (up to 24.8 percent; 74 cfs).
- In below normal years, flows would be similar from March through January, and increased in February (30.4 percent, 192 cfs).
- In dry and critical dry years, flows would be similar all months.

The changes in river flows would increase flows in the Trinity River under Alternative 1 as compared to the No Action Alternative. As described in Chapter 9, Fish and Aquatic Resources, these changes in river flows would result in similar conditions for salmonids using Trinity River. Therefore, there would be no effect on the ITAs.

Effects Related to Cross Delta Water Transfers

As described in Chapter 5, Surface Water Resources and Water Supplies, and Chapter 7, Groundwater Resources and Groundwater Quality, potential effects on surface water resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014d). Potential effects were identified as reduced surface water storage in upstream reservoirs; changes in flow patterns in rivers downstream of the reservoirs if water was released from the reservoirs in patterns that were different than would have been used by the seller; and groundwater elevation reductions if groundwater substitution was used to provide the water for the transfers. All water transfers would be required to avoid adverse impacts on other water users and biological resources; and water transfer programs would include groundwater mitigation and monitoring plans (see Section 3.A.6.3, Transfers). Therefore, water transfer programs would need to be implemented in a manner that would avoid impacts associated with changes in Trinity Lake storage, Trinity River flow patterns, and groundwater elevation reductions in the Central Valley that could affect ITAs. For the purposes of this EIS, it is anticipated that similar conditions would occur due to cross Delta water transfers under Alternative 1 as compared to the No Action Alternative, and there would be no effect on the ITAs due to cross Delta water transfers.

20.4.3.2.2 Alternative 1 Compared to the Second Basis of Comparison

Alternative 1 is identical to the Second Basis of Comparison.

20.4.3.3 Alternative 2

The ITA conditions under Alternative 2 would be identical to the conditions under the No Action Alternative; therefore, Alternative 2 is only compared to the Second Basis of Comparison.

20.4.3.3.1 Alternative 2 Compared to the Second Basis of Comparison

Changes to ITAs under Alternative 2 as compared to the Second Basis of Comparison would be the same as the impacts described in Section 20.4.3.1, No Action Alternative.

20.4.3.4 Alternative 3

CVP and SWP operation under Alternative 3 are similar to the Second Basis of Comparison with modified Old and Middle River flow criteria and New Melones Reservoir operation.

Alternative 3 would include changed water demands for American River water supplies as compared to the No Action Alternative and Second Basis of Comparison. Alternative 3 would provide water supplies of up to 17 thousand acre feet (TAF)/year under a Warren Act Contract for El Dorado Irrigation District and 15 TAF/year under a CVP water service contract for El Dorado County Water Agency. These demands are not included in the analysis presented in this section of the EIS. A sensitivity analysis comparing the results of the analysis with and without these demands is presented in Appendix 5B of this EIS.

20.4.3.4.1 Alternative 3 Compared to the No Action Alternative

Potential Changes in Trinity River downstream of Lewiston Dam

As described in Chapter 5, Surface Water Resources and Water Supplies, the following changes would occur on the Trinity River under Alternative 3 as compared to the No Action Alternative.

- Over long-term conditions, flows would be similar from March through November, and increased from December through February (up to 11.8 percent, 79 cfs).
- In wet years, flows would be similar from April through October, reduced in November (7.0 percent, 36 cfs), and increased from December through March (up to 15.0 percent, 193 cfs).
- In above normal years, flows would be similar from March through November, and increased in January and February (up to 24.8 percent; 74 cfs).
- In dry years, flows would be similar in all months.

However, as described in Chapter 9, Fish and Aquatic Resources, these changes in river flows would result in similar conditions for salmonids using Trinity River, and there would be no effect on the ITAs.

- In above normal years, flows would be similar from March through December, and increased in January and February (up to 22.5 percent; 67 cfs).
- In below normal years, flows would be similar from March through January, and increased in February (43.3 percent, 192 cfs).
- In dry years, flows would be similar all months.
- In Critical dry years, flows would be similar from December through October, and increased in November (20.0 percent, 50 cfs).

The changes in river flows would increase flows in the Trinity River under Alternative 3 as compared to the No Action Alternative. As described in Chapter 9, Fish and Aquatic Resources, these changes in river flows would result in similar conditions for salmonids using Trinity River. Therefore, there would be no effect on the ITAs.

Effects Related to Cross Delta Water Transfers

As described in Chapter 5, Surface Water Resources and Water Supplies, and Chapter 7, Groundwater Resources and Groundwater Quality, potential effects on surface water resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014d). Potential effects were identified as: reduced surface water storage in upstream reservoirs; changes in flow patterns in river downstream of the reservoirs if water was released from the reservoirs in patterns that were different than would have been used by the sellers; and groundwater elevation reductions if groundwater substitution was used to provide the water for the transfers. All water transfers would be required to avoid adverse impacts on other water users and biological resources; and water transfer programs would include groundwater mitigation and monitoring plans (see Section 3.A.6.3, Transfers). Therefore, water transfer programs would need to be implemented in a manner that would avoid impacts associated with changes in Trinity Lake storage, Trinity River flow patterns, and groundwater elevation reductions in the Central Valley that could affect ITAs. For the purposes of this EIS, it is anticipated that similar conditions would occur due to cross Delta water transfers under Alternative 3 as compared to the No Action Alternative, and there would be no effect on the ITAs due to cross Delta water transfers.

20.4.3.4.2 Alternative 3 Compared to the Second Basis of Comparison

Potential Changes in Trinity River downstream of Lewiston Dam

As described in Chapter 5, Surface Water Resources and Water Supplies, under Alternative 3 as compared to the Second Basis of Comparison, flows would be similar under long-term conditions and all water year types. As described in Chapter 9, Fish and Aquatic Resources, there would be similar conditions for salmonids using Trinity River. Therefore, there would be no effect on the ITAs.

Effects Related to Cross Delta Water Transfers

As described in Chapter 5, Surface Water Resources and Water Supplies, and Chapter 7, Groundwater Resources and Groundwater Quality, potential effects on surface water resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014d). Potential effects were identified as: reduced surface water storage in upstream reservoirs; changes in flow patterns in river downstream of the reservoirs if water was released from the reservoirs in patterns that were different than would have been used by the sellers; and groundwater elevation reductions if groundwater substitution was used to provide the water for the transfers. All water transfers would be required to avoid adverse impacts on other water users and biological resources; and water transfer programs would include groundwater mitigation and monitoring plans (see Section 3.A.6.3, Transfers). Therefore, water transfer programs would need to be implemented in a manner that would avoid impacts associated with changes in Trinity Lake storage, Trinity River flow patterns, and groundwater elevation reductions in the Central Valley that could affect ITAs. For the purposes of this EIS, it is anticipated that similar conditions would occur due to cross Delta water transfers under Alternative 3 as compared to the Second Basis of Comparison, and there would be no effect on the ITAs due to cross Delta water transfers.

20.4.3.5 Alternative 4

The ITA conditions under Alternative 4 would be identical to the ITA conditions under the Second Basis of Comparison; therefore, Alternative 4 is only compared to the No Action Alternative.

20.4.3.5.1 Alternative 4 Compared to the No Action Alternative

Changes in ITA conditions under Alternative 4 as compared to the No Action Alternative would be the same as the impacts described in Section 20.4.3.2.1, Alternative 1 Compared to the No Action Alternative.

20.4.3.6 Alternative 5

The CVP and SWP operation under Alternative 5 are similar to the No Action Alternative with modified Old and Middle River flow criteria and New Melones Reservoir operation. Alternative 5 would include changed water demands for American River water supplies as compared to the No Action Alternative or Second Basis of Comparison. Alternative 5 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 CVP water service contract for El Dorado County Water Agency. These demands are not included in the analysis presented in this section of the EIS. A sensitivity analysis comparing the results of the analysis with and without these demands is presented in Appendix 5B of this EIS.

20.4.3.6.1 Alternative 5 Compared to the No Action Alternative

Potential Changes in Trinity River downstream of Lewiston Dam

As described in Chapter 5, Surface Water Resources and Water Supplies, flows under Alternative 5 and the No Action Alternative would be similar under long-term conditions and all water year types. As described in Chapter 9, Fish and Aquatic Resources, there would be similar conditions for salmonids using Trinity River. Therefore, there would be no effect on the ITAs.

Effects Related to Cross Delta Water Transfers

As described in Chapter 5, Surface Water Resources and Water Supplies, and Chapter 7, Groundwater Resources and Groundwater Quality, potential effects on surface water resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014d). Potential effects were identified as: reduced surface water storage in upstream reservoirs; changes in flow patterns in river downstream of the reservoirs if water was released from the reservoirs in patterns that were different than would have been used by the sellers; and groundwater elevation reductions if groundwater substitution was used to provide the water for the transfers. All water transfers would be required to avoid adverse impacts on other water users and biological resources; and water transfer programs would include groundwater mitigation and monitoring plans (see Section 3.A.6.3, Transfers). Therefore, water transfer programs would need to be implemented in a manner that would avoid impacts associated with changes in Trinity Lake storage, Trinity River flow patterns, and groundwater elevation reductions in the Central Valley that could affect ITAs. For the purposes of this EIS, it is anticipated that similar conditions would occur due to cross Delta water transfers under Alternative 5 as compared to the No Action Alternative, and there would be no effect on the ITAs due to cross Delta water transfers.

20.4.3.6.2 Alternative 5 Compared to the Second Basis of Comparison

Potential Changes in Trinity River downstream of Lewiston Dam

As described in Chapter 5, Surface Water Resources and Water Supplies, the following changes would occur on the Trinity River flows under Alternative 5 and Second Basis of Comparison

- Over long-term conditions, flows would be similar from March through November and January, and reduced in December and February (up to 9.6 percent, 200 cfs).
- In wet years, flows would be similar from April through November, and reduced in December through March (up to 13.9 percent).
- In above normal years, flows would be similar from April through December, and reduced in January and February (up to 19.9 percent, 74 cfs).
- In below normal years, flows would be similar from March through January, and reduced in February (up to 21.5 percent, 135 cfs).
- In dry and critical dry years, flows would be similar in all months.

However, as described in Chapter 9, Fish and Aquatic Resources, these changes in river flows would result in similar conditions for salmonids using Trinity River; and there would be no effect the ITAs.

Effects Related to Cross Delta Water Transfers

As described in Chapter 5, Surface Water Resources and Water Supplies, and Chapter 7, Groundwater Resources and Groundwater Quality, potential effects on surface water resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014d). Potential effects were identified as reduced surface water storage in upstream reservoirs and changes in flow patterns in river downstream of the reservoirs if water was released from the reservoirs in patterns that were different than would have been used by the water seller's; and groundwater elevation reductions if groundwater substitution was used to provide the water for the transfers. All water transfers would be required to avoid adverse impacts on other water users and biological resources; and water transfer programs would include groundwater mitigation and monitoring plans (see Section 3.A.6.3, Transfers). Therefore, water transfer programs would need to be implemented in a manner that would avoid impacts associated with changes in Trinity Lake storage, Trinity River flow patterns, and groundwater elevation reductions in the Central Valley that could affect ITAs. For the purposes of this EIS, it is anticipated that similar conditions would occur due to cross Delta water transfers under Alternative 5 as compared to the Second Basis of Comparison, and there would be no effect on the ITAs due to cross Delta water transfers.

20.4.3.7 Summary of Impact Analysis

The results of the impact analysis of implementation of Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison are presented in Tables 20.2 and 20.3.

Table 20.2 Comparison of Alternatives 1 through 5 to No Action Alternative

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 1	No effects to ITAs	None needed
Alternative 2	No effects to ITAs	None needed
Alternative 3	No effects to ITAs	None needed
Alternative 4	No effects to ITAs	None needed
Alternative 5	No effects to ITAs	None needed

Table 20.3 Comparison of No Action Alternative and Alternatives 1 through 5 to Second Basis of Comparison

Alternative	Potential Change	Consideration for Mitigation Measures
No Action Alternative	No effects to ITAs	None needed
Alternative 1	No effects to ITAs	None needed
Alternative 2	No effects to ITAs	None needed
Alternative 3	No effects to ITAs	None needed
Alternative 4	No effects to ITAs	None needed
Alternative 5	No effects to ITAs	None needed

20.4.3.8 Potential Mitigation Measures

Mitigation measures are presented in this section to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse environmental effects of Alternatives 1 through 5 as compared to the No Action Alternative. Mitigation measures were not included to address adverse impacts under the alternatives as compared to the Second Basis of Comparison because this analysis was included in this EIS for information purposes only.

Changes under Alternatives 1 through 5 as compared to the No Action Alternative would result in similar or increased flows in the Trinity River, and implementation of cross Delta water transfers would not result in adverse impacts to ITAs. Therefore, there would be no adverse impacts to ITAs, and no mitigation measures are needed.

20.4.3.9 Cumulative Effects Analysis

As described in Chapter 3, the cumulative effects analysis considers projects, programs, and policies that are not speculative, and are based upon known or reasonably foreseeable long-range plans, regulations, operating agreements, or other information that establishes them as reasonably foreseeable.

The cumulative effects analysis for Alternatives 1 through 5 to Indian Trust Assets are summarized in Table 20.4. As described in this chapter, potential changes to Indian Trust Assets would be associated with changes in flows in the Trinity River.

Table 20.4 Summary of Cumulative Effects on Indian Trust Assets with Implementation of Alternatives 1 through 5 as Compared to the No Action Alternative

Scenarios	Actions	Cumulative Effects of Actions
Past & Present, and Future Actions included in the No Action Alternative and All Alternatives in Year 2030	Consistent with Affected Environment conditions plus: Actions in the 2008 USFWS BO and 2009 NMFS BO that would have occurred without implementation of the BOs, as described in Section 3.3.1.2 (of Chapter 3, Descriptions of Alternatives), including climate change and sea level rise Actions not included in the 2008 USFWS BO and 2009 NMFS BO that would have occurred without implementation of the BOs, as described in Section 3.3.1.3 (of Chapter 3, Descriptions of Alternatives): - Trinity River Restoration Program. - Central Valley Project Improvement Act programs	These effects would be the same under all alternatives. Climate change and sea level rise are anticipated to reduce carryover storage in reservoirs, including Trinity Lake, and changes in stream flow patterns, including Trinity River, in a manner that would change beneficial use of the Trinity River, including salmon fishing. Other ongoing actions, including Trinity River Restoration Program, would improve water quality and/or habitat along the Trinity River.
Future Actions considered as Cumulative Effects Actions in All Alternatives in Year 2030	Actions as described in Section 3.5 (of Chapter 3, Descriptions of Alternatives): - Bay-Delta Water Quality Control Plan Update - FERC Relicensing Projects - Bay Delta Conservation Plan (including the California WaterFix alternative) - Shasta Lake Water Resources, North-of-the-Delta Offstream Storage, Los Vaqueros Reservoir Expansion Phase 2, and Upper San Joaquin River Basin Storage Investigations - El Dorado Water and Power Authority Supplemental Water Rights Project - Semitropic Water Storage District Delta Wetlands - North Bay Aqueduct Alternative Intake	These effects would be the same under all alternatives. Based upon environmental documents prepared for these programs, changes to the Trinity River flows are not anticipated due to implementation of these programs.

Scenarios	Actions	Cumulative Effects of Actions
No Action Alternative with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO	Implementation of No Action Alternative with reasonably foreseeable actions would result in changes Trinity Lake carryover storage and Trinity River flows which would result in changes to beneficial use opportunities for Indian Trust Assets as compared to historical conditions prior to the BOs.
Alternative 1 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant)	Implementation of Alternative 1 with reasonably foreseeable actions would result in similar conditions for Indian Trust Assets as for the No Action Alternative with the added actions.
Alternative 2 with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO CVP and SWP operational actions No implementation of structural improvements or other actions that require further study to develop a more detailed action description.	Implementation of Alternative 2 with reasonably foreseeable actions would result in similar conditions for Indian Trust Assets as for the No Action Alternative with the added actions.
Alternative 3 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant) Slight increase in positive Old and Middle River flows in the winter and spring months	Implementation of Alternative 3 with reasonably foreseeable actions would result in similar conditions for Indian Trust Assets as for the No Action Alternative with the added actions.
Alternative 4 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant)	Implementation of Alternative 4 with reasonably foreseeable actions would result in similar conditions for Indian Trust Assets as for the No Action Alternative with the added actions.
Alternative 5 with Associated Cumulative Effects Actions in Year 20530	Full implementation of the 2008 USFWS BO and 2009 NMFS BO Positive Old and Middle River flows and increased Delta outflow in spring months	Implementation of Alternative 5 with reasonably foreseeable actions would result in similar conditions for Indian Trust Assets as for the No Action Alternative with the added actions.

20.5 References

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Chapter 21

Environmental Justice

21.1 Introduction

This chapter describes the presence of environmental justice populations in the study area and potential changes that could have disproportionately high and adverse human health or environmental effects on minority and/or low-income populations as a result of implementing the alternatives evaluated in this Environmental Impact Statement (EIS). Implementation of the alternatives could affect conditions through potential changes in operation of the Central Valley Project (CVP) and State Water Project (SWP) and ecosystem restoration.

21.2 Regulatory Environment and Compliance Requirements

This chapter was prepared in compliance with Presidential Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, dated February 11, 1994 and Title VI of the Civil Rights Act of 1964.

Potential actions that could be implemented under the alternatives evaluated in this EIS could have disproportionately high and adverse human health or environmental effects on minority and/or low-income populations. Actions located on public agency lands; or implemented, funded, or approved by Federal and state agencies would need to be compliant with appropriate Federal and state agency policies and regulations, as summarized in Chapter 4, Approach to Environmental Analyses.

21.3 Affected Environment

This section describes changes that could result in disproportionately high and adverse human health or environmental effects on minority and/or low-income populations due to changes in CVP and SWP operations. The conditions described in this chapter are related to the distribution of minority populations and populations below poverty levels.

21.3.1 Area of Analysis

A summary of conditions are described in this section of the EIS for the following regions that could be affected by implementation of alternatives analyzed in this EIS, as described in Chapter 4, Approach to Environmental Analysis.

- Trinity River Region
- Central Valley Region

- San Francisco Bay Area Region
- Central Coast Region
- Southern California Region

21.3.2 Characterization of Conditions Considered in the Environmental Justice Analysis

Characterization of the conditions within the Study Area is based upon publically available data from government websites and other data sources. The data sources used include the 2010 U.S. Census Bureau data on minority populations and the 2010 American Community Survey (ACS) 5-year population estimates on populations below the poverty level.

21.3.2.1 Determination of Minority Populations

The U.S. Census Bureau provides a total population value for each county, which are also used by the State Department of Finance, as presented in Chapter 14, Socioeconomics. The U.S. Census Bureau also provides a definition of minority and low income populations. Minority populations are defined by the U.S. Census as racial and ethnic minorities. Racial minorities, as defined by the U.S. Census, include people who identified themselves in the census as belonging to one of the following categories:

- Single Race
  - Black/African American
  - American Indian and Alaskan Native
  - Asian
  - Native Hawaiian and Other Pacific Islander
  - Some Other Race
- Two or More Races (inclusive the races listed above and White).

Ethnic minorities, as defined by the U.S. Census, include individuals who identified themselves as being of Hispanic or Latino origin by responding to one of the following categories in the census:

- Mexican
- Mexican American
- Chicano
- Puerto Rican
- Cuban
- Other Spanish/Hispanic/Latino

Individuals who identified themselves of Hispanic or Latino origin maybe of one or more races according to the U.S. Census.

21.3.2.2 Determination of Populations below the Poverty Level

Populations below the Federal poverty level can be identified using several methodologies. The information presented in this chapter has been developed in ACS reports by the U.S. Census Bureau based upon 48 different sets of dollar value thresholds related to family size and ages. The poverty level is assigned at the family-level and affects every member of the family. The thresholds are consistent throughout the United States and do not consider geographic differentials. The thresholds are updated each year based on the Consumer Price Index. For the five-year ACS reporting period used in this chapter, separate thresholds are applied to each year in this continuous survey. Other federal agencies rely upon different poverty statistics including the Current Population Survey Annual Social and Economic Supplement and the U.S. Department of Health and Human Services poverty guidelines.

The population for whom poverty level is estimated by ACS is smaller value than the total population values presented in Chapter 14, Socioeconomics, for each county and the equivalent population values used for the distribution of the population by race and ethnicity. The population values to determine poverty rates do not include institutionalized individuals (e.g., military personnel that live in group quarters, students that live in college dormitories, and prison inmates. The U.S. Census Bureau designates geographical areas with poverty rates at and above 20 percent as "poverty areas."

21.3.2.3 Social Services

The need for and delivery of social services within each county is another indication of social conditions, including Federal grants to the state and local agencies for Medicaid, other health related activities, and nutrition and family welfare; and Federal direct payments made to individuals under the CalFresh (previously referred to as "Food Stamps") and supplemental social security income.

21.3.2.4 Limited English Proficiency

Another consideration related to environmental justice is the ability of the Federal government to provide access to federally conducted and assisted programs and activities to all people who, as a result of their national origin, are limited in their English proficiency (LEP). These individuals are not able to speak, read, write, or understand the English language at a level that permits them to interact effectively with Federal employees who provide Federal services. Therefore, these individuals are often excluded from Federal programs, do not receive all available Federal services, and/or experience delays when interacting with Federal programs. The Executive Order 13166 became effective on August 11, 2000 to ensure meaningful participation by individuals who have limited English proficiency in federally conducted and federally assisted programs and activities. This information is compiled and reported by the U.S. Census Bureau.

21.3.3 Trinity River Region

The Trinity River Region includes the area in Trinity County along the Trinity River from Trinity Lake to the confluence with the Klamath River; and in Humboldt and Del Norte counties along the Lower Klamath River from the confluence with the Trinity River to the Pacific Ocean. Tribal lands along the Trinity or Lower Klamath River within the Trinity River Region include the

Hoopa Valley Indian Reservation, Yurok Indian Reservation, and Resighini Rancheria.

21.3.3.1 Minority Populations

As recorded in the 2010 Census, the Trinity River Region had a total population of 177,019 (U.S. Census 2014a). About 24.3 percent of this population identified themselves as a racial minority and/or of Hispanic or Latino origin, regardless of race, as presented in Table 21.1 (U.S. Census 2014a, 2014b, 2014c, 2014d). There are fewer minorities in the Trinity River Region than in the entire State of California.

21.3.3.2 Poverty Levels

Poverty levels presented in Table 21.2 are calculated on a subset of the total population of a county, as described above in section 21.3.2, Characterization of Conditions Considered in the Environmental Justice Analysis. Of the total population for whom poverty is determined in the Trinity River Region, 167,987 individuals (or 18.2 percent) were below the poverty level based on the 2006–2010 ACS 5-year dataset (U.S. Census 2014e). The U.S. Census Bureau defines geographical areas with more than 20 percent of the population below the poverty level as a "poverty areas." Both Humboldt and Del Norte counties are defined as poverty areas.

Poverty rates based upon the 2000 census were reported as 40 percent for Indians on the Yurok Indian Reservation, 34 percent of the Indians on the Hoopa Valley Indian Reservation, and 54 percent of the Indians on and off Karuk Reservation trust lands (NMFS 2012a, 2012b, 2012c). The Yurok Tribe has reported an average poverty rate of 80 percent of the Indians on the Yurok Indian Reservation (Yurok Tribe 2014a). Average per capita income of residents on the Resighini Rancheria (not limited to Resighini Rancheria members) in 1999 was reported to be approximately 46 percent of the average per capita income in Del Norte County (NMFS 2012d).

21.3.3.3 Social Services

Federal grants to the state and local agencies for Medicaid, other health related activities, and nutrition and family welfare; and Federal direct payments made to individuals under the CalFresh (previously referred to as "Food Stamps") and supplemental social security income within counties in the Trinity River Region are summarized in Table 21.3.

Social services to tribal members are funded by the tribe and/or the federal government (DOI and DFG 2012). The Hoopa Valley Tribe provides food distribution and other social services, including Temporary Assistance for Needy Families (TANF) which receives some assistance from Humboldt County social services to provide cash assistance, utility billing assistance, childcare, educational assistance, job development, substance abuse assistance, and family assistance (Hoopa Tribe 2014 a, 2014b). The Yurok Tribe provides a wide range of services, including general assistance, food distribution, Indian Child welfare, low income energy assistance, Yurok Youth Program, emergency and temporary assistance, and Yurok Domestic Violence/Sexual Assault Project (Yurok Tribe 2014b).

21.3.3.4 Limited English Proficiency

The percent of the population that speaks English and other languages at home and the percent of the population that speak English “less than very well” based on the language they speak at home are presented in Tables 21.4 and 21.5.

21.3.4 Central Valley Region

The Central Valley Region includes the Sacramento Valley, San Joaquin Valley, and Delta and Suisun Marsh subregions.

21.3.4.1 Sacramento Valley

The Sacramento Valley includes the counties of Shasta, Plumas, Tehama, Glenn, Colusa, Butte, Sutter, Yuba, Nevada, Placer, and El Dorado counties. Sacramento, Yolo, and Solano counties also are located within the Sacramento Valley; however, these counties are discussed below as part of the Delta and Suisun Marsh subsection. Other counties in this region are not anticipated to be affected by changes in CVP and SWP operations, and are not discussed here, including: Alpine, Sierra, Lassen, and Amador counties.

21.3.4.1.1 Minority Populations

As recorded in the 2010 U.S. Census, the Sacramento Valley portion of the Central Valley Region had a total population of 1,325,380 in 2010. About 25.8 percent of this population identified themselves as a racial minority and/or of Hispanic or Latino origin, regardless of race, as presented in Table 21.6. The table also shows the minority population distribution for the entire Central Valley Region and the State of California.

Table 21.1 Minority Population Distribution in Trinity River Region in 2010

Areas	Total Population	Races							Hispanic or Latino Origin	Total Minority[a]
		White	Black/ African American	American Indian and Native Alaskan	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races		
Trinity County	13,786	87.3%	0.4%	4.8%	0.7%	0.1%	1.6%	5.2%	7.0%	16.5%
Humboldt County	134,623	81.7%	1.1%	5.7%	2.2%	0.3%	3.7%	5.3%	9.8%	22.8%
Del Norte County	28,610	73.7%	3.5%	7.8%	3.4%	0.1%	6.9%	4.5%	17.8%	35.3%
Trinity River Region	177,019	80.8%	1.4%	6.0%	2.3%	0.2%	4.1%	5.2%	10.9%	24.3%
STATE OF CALIFORNIA	**37,253,956**	**57.6%**	**6.2%**	**1.0%**	**13.0%**	**0.4%**	**17.0%**	**4.9%**	**40.1%**	**59.9%**

Sources: U.S. Census 2014a, 2014b, 2014c, 2014d

Note:

a. Total Minority is an aggregation of all non-white racial groups and includes all individuals of Hispanic or Latino origin, regardless of race.

Table 21.2 Population below Poverty Level in Trinity River Region, 2006–2010

Areas	Total Population[a]	Population Below Poverty Level	Percent of Population Below Poverty Level
Trinity County	13,225	1,993	15.1%
Humboldt County	129,592	22,973	17.7%
Del Norte County	25,170	5,526	22.0%
Trinity River Region	167,987	30,492	18.2%
STATE OF CALIFORNIA	**35,877,036**	**4,919,945**	**13.7%**

Source: U.S. Census 2014e

Note: a. Population numbers are only those for whom poverty status was determined and exclude institutionalized individuals

Table 21.3 Federal Funds Distributed for Social Programs in Trinity River Region in 2010

Areas	Grants (millions of dollars)		Distributed to Individuals (millions of dollars)
	Medicaid and Other Health-Related Items	Nutrition and Family Welfare	CalFresh Benefits and Supplemental Security Income
Trinity County	$12.5	$4.9	$6.6
Humboldt County	$167.8	$36.0	$65.6
Del Norte County	$28.8	$10.1	$19.1
Trinity River Region	$209.1	$51.0	$91.3
STATE OF CALIFORNIA	**$41,931.1**	**$11,743.7**	**$12,469.4**

Source: Gaquin and Ryan 2013

Table 21.4 Top Five Non-English Languages Spoken at Home as a Proportion of the Total Population Five Years and Older in the Trinity River Region, 2006–2010

Areas	Only English	Spanish/ Spanish Creole	Portuguese/ Portuguese Creole	German	Tagalog	Hmong	Total Excluding English
Trinity County	93.9%	3.8%	0.0%	0.3%	0.1%	0.0%	4.2%
Humboldt County	90.8%	5.7%	0.4%	0.3%	0.3%	0.0%	6.8%
Del Norte County	83.3%	11.6%	0.1%	0.5%	0.5%	1.6%	14.2%
Trinity River Region	89.8%	6.5%	0.4%	0.3%	0.3%	0.3%	7.8%
STATE OF CALIFORNIA	**57.0%**	**28.5%**	**0.2%**	**0.3%**	**2.2%**	**0.2%**	**31.4%**

Source: U.S. Census 2014f

Table 21.5 Percent of Population Speaking One of the Top Five Non-English Languages Spoken at Home in the Trinity River Region that Speaks English "Less than Very Well" as a Proportion of the Total Population Five Years and Older, 2006–2010

Areas	Spanish/ Spanish Creole	Portuguese/ Portuguese Creole	German	Tagalog	Hmong
Trinity County	1.4%	0.0%	0.0%	0.0%	0.0%
Humboldt County	2.3%	0.2%	0.1%	0.1%	0.0%
Del Norte County	3.1%	0.0%	0.1%	0.1%	0.6%
Trinity River Region	2.4%	0.1%	0.1%	0.1%	0.1%
STATE OF CALIFORNIA	**13.6%**	**0.1%**	**0.05%**	**0.7%**	**0.1%**

Source: U.S. Census 2014f

Table 21.6 Minority Population Distribution in the Central Valley Region–Sacramento Valley in 2010

Areas	Total Population	Races							Hispanic or Latino Origin	Total Minority[a]
		White	Black/ African American	American Indian and Native Alaskan	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races		
Shasta County	177,223	86.7%	0.9%	2.8%	2.5%	0.2%	2.5%	4.4%	8.4%	17.6%
Plumas County	20,007	89.0%	1.0%	2.7%	0.7%	0.1%	3.0%	3.6%	8.0%	15.0%
Tehama County	63,463	81.5%	0.6%	2.6%	1.0%	0.1%	9.9%	4.3%	21.9%	28.1%
Glenn County	28,122	71.1%	0.8%	2.2%	2.6%	0.1%	19.6%	3.6%	37.5%	44.1%
Colusa County	21,419	64.7%	0.9%	2.0%	1.3%	0.3%	27.3%	3.6%	55.1%	60.2%
Butte County	220,000	81.9%	1.6%	2.0%	4.1%	0.2%	5.5%	4.7%	14.1%	24.8%
Yuba County	72,155	68.4%	3.3%	2.3%	6.7%	0.4%	11.8%	7.1%	25.0%	41.2%
Nevada County	98,764	91.4%	0.4%	1.1%	1.2%	0.1%	2.7%	3.2%	8.5%	13.5%
Sutter County	94,737	61.0%	2.0%	1.4%	14.4%	0.3%	15.3%	5.6%	28.8%	49.6%
Placer County	348,432	83.5%	1.4%	0.9%	5.9%	0.2%	3.8%	4.3%	12.8%	23.9%
El Dorado County	181,058	86.6%	0.8%	1.1%	3.5%	0.2%	4.0%	3.8%	12.1%	20.1%
Sacramento Valley Subtotal	1,325,380	81.7%	1.3%	1.6%	4.7%	0.2%	6.1%	4.5%	23.1%	25.8%
Central Valley Region	8,379,045	61.4%	6.3%	1.3%	9.5%	0.4%	15.7%	5.4%	42.6%	53.5%
STATE OF CALIFORNIA	**37,253,956**	**57.6%**	**6.2%**	**1.0%**	**13.0%**	**0.4%**	**17.0%**	**4.9%**	**37.6%**	**59.9%**

Sources: U.S. Census 2014a, 2014g, 2014h, 2014i, 2014j, 2014k, 2014l, 2014m, 2014n, 2014o, 2014p, 2014q

Note:

a. Total Minority is an aggregation of all non-white racial groups and includes all individuals of Hispanic or Latino origin, regardless of race.

21.3.4.1.2 Poverty Levels

Poverty levels presented in Table 21.7 are calculated on a subset of the total population of a county, as described above in section 21.3.2, Characterization of Conditions Considered in the Environmental Justice Analysis. Of the total population for whom poverty status is determined within the Sacramento Valley portion of the Central Valley Region, 1,288,594 individuals, 12.6 percent were below the poverty level based on the 2006–2010 ACS 5-year dataset (U.S. Census 2014e).

The U.S. Census Bureau defines geographical areas with more than 20 percent of the population below the poverty level as a "poverty areas." There are no counties in this area defined as poverty areas; although, 20 percent of the populations in Tehama and Yuba counties are below the poverty level.

21.3.4.1.3 Social Services

Federal grants to the state and local agencies for Medicaid, other health related activities, and nutrition and family welfare; and Federal direct payments made to individuals under the CalFresh and supplemental social security income within counties in the Sacramento Valley portion of the Central Valley Region are summarized in Table 21.8.

21.3.4.1.4 Limited English Proficiency

The percent of the population that speaks English and other languages at home and the percent of the population that speak English "less than very well" based on the language they speak at home are presented in Tables 21.9 and 21.10.

21.3.4.2 San Joaquin Valley

The San Joaquin Valley includes the counties of Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern counties. San Joaquin County also is located within the San Joaquin Valley; however, this county is discussed below as part of the Delta and Suisun Marsh subsection. Other counties in this region are not anticipated to be affected by changes in CVP and SWP operations, and are not discussed here, including: Calaveras, Mariposa, and Tuolumne counties.

21.3.4.2.1 Minority Populations

As recorded in the 2010 U.S. Census, the San Joaquin Valley portion of the Central Valley Region had a total population of 3,286,353 in 2010. About 63.3 percent of this population identified themselves as a racial minority and/or of Hispanic or Latino origin, regardless of race, as presented in Table 21.11. The table also shows the minority population distribution for the entire Central Valley Region and the State of California.

Table 21.7 Population below Poverty Level in the Central Valley Region–Sacramento Valley, 2006–2010

Areas	Total Population[a]	Population Below Poverty Level	Percent of Population Below Poverty Level
Shasta County	174,180	28,772	16.5%
Plumas County	20,179	2,437	12.1%
Tehama County	61,201	12,397	20.3%
Glenn County	27,853	4,875	17.5%
Colusa County	20,768	3,107	15.0%
Butte County	213,501	39,290	18.4%
Yuba County	68,848	13,760	20.0%
Nevada County	97,209	8,740	9.0%
Sutter County	92,477	13,194	14.3%
Placer County	334,718	22,090	6.6%
El Dorado County	177,660	14,003	7.9%
Sacramento Valley Subtotal	1,288,594	162,665	12.6%
Central Valley Region	8,025,054	1,268,984	15.8%
STATE OF CALIFORNIA	**35,877,036**	**4,919,945**	**13.7%**

Source: U.S. Census 2014e

Note: a. Population numbers are only those for whom poverty status was determined and exclude institutionalized individuals

Table 21.8 Federal Funds Distributed for Social Programs in the Central Valley Region – Sacramento Valley in 2010

	Grants (millions of dollars)		Distributed to Individuals (millions of dollars)
Areas	**Medicaid and Other Health-Related Items**	**Nutrition and Family Welfare**	**CalFresh Benefits and Supplemental Security Income**
Shasta County	$199.0	$50.8	$93.5
Plumas County	$19.3	$7.9	$5.9
Tehama County	$61.6	$17.5	$23.1
Glenn County	$25.3	$10.6	$11.3
Colusa County	$18.6	$8.2	$6.5
Butte County	$263.4	$44.7	$104.9
Yuba County	$125.0	$21.8	$45.2
Nevada County	$53.8	$15.4	$16.1
Sutter County	$76.4	$20.1	$28.8
Placer County	$139.2	$44.8	$43.2
El Dorado County	$62.5	$32.4	$29.0
Sacramento Valley Subtotal	$1,044.1	$274.2	$407.5
Central Valley Region	$8,759.9	$4,308.9	$3,179.8
STATE OF CALIFORNIA	**$41,931.1**	**$11,743.7**	**$12,469.4**

Source: Gaquin and Ryan 2013

Table 21.9 Top Five Non-English Languages Spoken at Home as a Proportion of the Total Population Five Years and Older in the Central Valley Region – Sacramento Valley, 2006–2010

Areas	Only English	Spanish/ Spanish Creole	Tagalog	German	Chinese	Hmong	Total Excluding English
Shasta County	91.5%	4.6%	0.3%	0.6%	0.3%	0.01%	5.7%
Plumas County	92.4%	5.9%	0.1%	0.4%	0.6%	0.0%	7.0%
Tehama County	80.4%	16.9%	0.1%	0.4%	0.2%	0.02%	17.7%
Glenn County	67.4%	29.6%	0.1%	0.2%	0.0%	0.0%	29.8%
Colusa County	54.3%	44.1%	0.4%	0.1%	0.3%	0.0%	44.8%
Butte County	85.4%	9.3%	0.3%	0.3%	0.5%	1.3%	11.7%
Yuba County	74.4%	17.8%	0.8%	0.4%	0.3%	3.1%	22.3%
Nevada County	93.4%	4.1%	0.1%	0.8%	0.1%	0.0%	5.1%
Sutter County	65.5%	20.5%	0.5%	0.4%	0.5%	0.1%	21.9%
Placer County	86.1%	6.3%	1.3%	0.4%	0.7%	0.1%	8.7%
El Dorado County	88.2%	7.3%	0.4%	0.6%	0.5%	0.02%	9.0%
Sacramento Valley Subtotal	84.4%	9.7%	0.6%	0.5%	0.5%	0.4%	11.6%
Central Valley Region	66.2%	23.1%	1.7%	0.3%	1.2%	0.8%	27.1%
STATE OF CALIFORNIA	**57.0%**	**28.5%**	**2.2%**	**0.3%**	**2.9%**	**0.2%**	**34.1%**

Source: U.S. Census 2014f

Table 21.10 Percent of Population Speaking One of the Top Five Non-English Languages Spoken at Home in the Central Valley Region – Sacramento Valley that Speaks English "Less than Very Well" as a Proportion of the Total Population Five Years and Older, 2006–2010

Areas	Spanish/ Spanish Creole	Tagalog	German	Chinese	Hmong
Shasta County	1.4%	0.1%	0.05%	0.1%	0.01%
Plumas County	1.8%	0.0%	0.00%	0.6%	0.0%
Tehama County	8.0%	0.1%	0.04%	0.1%	0.0%
Glenn County	13.3%	0.0%	0.1%	0.0%	0.0%
Colusa County	24.7%	0.0%	0.02%	0.3%	0.0%
Butte County	3.8%	0.1%	0.04%	0.4%	0.8%
Yuba County	9.2%	0.2%	0.1%	0.2%	2.1%
Nevada County	2.1%	0.1%	0.1%	0.06%	0.0%
Sutter County	12.3%	0.1%	0.02%	0.2%	0.03%
Placer County	2.7%	0.4%	0.05%	0.3%	0.07%
El Dorado County	3.3%	0.1%	0.1%	0.2%	0.0%
Sacramento Valley Subtotal	4.6%	0.2%	0.06%	0.2%	0.3%
Central Valley Region	10.8%	0.5%	0.04%	0.06%	0.4%
STATE OF CALIFORNIA	**13.6%**	**0.7%**	**0.04%**	**1.6%**	**0.1%**

Source: U.S. Census 2014f

Table 21.11 Minority Population Distribution in the Central Valley Region – San Joaquin Valley in 2010

Areas	Total Population	Races							Hispanic or Latino Origin	Total Minority[a]
		White	Black/ African American	American Indian and Native Alaskan	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races		
Stanislaus County	514,453	65.6%	2.9%	1.1%	5.1%	0.7%	19.3%	5.4%	41.9%	53.3%
Madera County	150,865	62.6%	3.7%	2.7%	1.9%	0.1%	24.8%	4.2%	53.7%	62.0%
Merced County	255,793	58.0%	3.9%	1.4%	7.4%	0.2%	24.5%	4.7%	54.9%	68.1%
Fresno County	930,450	55.4%	5.3%	1.7%	9.6%	0.2%	23.3%	4.5%	50.3%	67.3%
Tulare County	442,179	60.1%	1.6%	1.6%	3.4%	0.1%	29.0%	4.2%	60.6%	67.4%
Kings County	152,982	54.3%	7.2%	1.7%	3.7%	0.2%	28.1%	4.9%	50.9%	64.8%
Kern County	839,631	59.5%	5.8%	1.5%	4.2%	0.1%	24.3%	4.5%	49.2%	61.4%
San Joaquin Valley Subtotal	3,286,353	59.1%	4.5%	1.6%	5.9%	0.2%	24.1%	4.6%	50.6%	63.3%
Central Valley Region	8,379,045	61.4%	6.3%	1.3%	9.5%	0.4%	15.7%	5.4%	42.6%	53.5%
STATE OF CALIFORNIA	37,253,956	57.6%	6.2%	1.0%	13.0%	0.4%	17.0%	4.9%	37.6%	59.9%

Sources: U.S. Census 2014a, 2014r, 2014s, 2014t, 2014u, 2014v, 2014w, 2014x

Note:

a. Total Minority is an aggregation of all non-white racial groups and includes all individuals of Hispanic or Latino origin, regardless of race.

21.3.4.2.2 Poverty Levels

Poverty levels presented in Table 21.12 are calculated on a subset of the total population of a county, as described above in section 21.3.2, Characterization of Conditions Considered in the Environmental Justice Analysis. Of the total population for whom poverty status is determined within the San Joaquin Valley portion of the Central Valley Region, 3,111,943 individuals, 20.8 percent, were below the poverty level based on the 2006–2010 ACS 5-year dataset (U.S. Census 2014e). The U.S. Census Bureau defines geographical areas with more than 20 percent of the population below the poverty level as a "poverty areas." Merced, Fresno, Tulare, and Kern counties are defined as poverty areas because more than 20 percent of the populations in these counties are below the poverty level.

21.3.4.2.3 Social Services

Distribution of social services varies for each county. Federal grants to the state and local agencies for Medicaid, other health related activities, and nutrition and family welfare; and Federal direct payments made to individuals under the CalFresh and supplemental social security income within counties in the San Joaquin Valley portion of the Central Valley Region are summarized in Table 21.13.

21.3.4.2.4 Limited English Proficiency

The percent of the population that speaks English and other languages at home and the percent of the population that speak English "less than very well" based on the language they speak at home are presented in Tables 21.14 and 21.15.

21.3.4.2.5 Effects of Recent Drought in Two San Joaquin Valley Communities

The San Joaquin Valley portion of the Central Valley Region includes about 8.8 percent of the state's total population, 9.3 percent of the state's population that identified themselves as a racial minority and/or of Hispanic or Latino origin, and about 13.1 percent of the state's population below the poverty level. Merced, Fresno, and Tulare counties had the highest concentration of total minority populations and the highest concentration of individuals living below the poverty level. There are communities within these counties that have higher concentrations of minority populations and/or populations below the poverty level. These communities are mainly farming communities that have been impacted by loss in agricultural employment, as described in Chapter 12, Agricultural Resources, and Chapter 19, Socioeconomics. The impacts have increased recently during the current drought.

Table 21.12 Population below Poverty Level in the Central Valley Region – San Joaquin Valley, 2006–2010

Areas	Total Population[a]	Population Below Poverty Level	Percent of Population Below Poverty Level
Stanislaus County	502,108	82,480	16.4%
Madera County	138,151	26,656	19.3%
Merced County	246,260	53,738	21.8%
Fresno County	890,694	200,288	22.5%
Tulare County	423,902	97,012	22.9%
Kings County	133,206	25,713	19.3%
Kern County	777,622	159,967	20.6%
San Joaquin Valley Subtotal	3,111,943	645,854	20.8%
Central Valley Region	8,025,054	1,268,984	15.8%
STATE OF CALIFORNIA	**35,877,036**	**4,919,945**	**13.7%**

Source: U.S. Census 2014e

Note:

a. Population numbers are only those for whom poverty status was determined and exclude institutionalized individuals

Table 21.13 Federal Funds Distributed for Social Programs in the Central Valley Region – San Joaquin Valley in 2010

Areas	Grants (millions of dollars)		Distributed to Individuals (millions of dollars)
	Medicaid and Other Health-Related Items	Nutrition and Family Welfare	CalFresh Benefits and Supplemental Security Income
Stanislaus County	$535.9	$145.3	$198.7
Madera County	$144.3	$33.6	$45.6
Merced County	$260.0	$73.7	$126.0
Fresno County	$992.0	$274.8	$468.5
Tulare County	$569.1	$116.0	$196.5
Kings County	$129.2	$37.8	$49.3
Kern County	$712.0	$203.4	$328.6
San Joaquin Valley Subtotal	$3,342.5	$884.6	$1,413.2
Central Valley Region	$8,759.9	$4,308.9	$3,179.8
STATE OF CALIFORNIA	**$41,931.1**	**$11,743.7**	**$12,469.4**

Source: Gaquin and Ryan 2013

Table 21.14 Top Five Non-English Languages Spoken at Home as a Proportion of the Total Population Five Years and Older in the Central Valley Region – San Joaquin Valley, 2006–2010

Areas	Speaks Only English	Spanish and Spanish Creole	Tagalog	Chinese	Portuguese/ Portuguese Creole	Hmong	Total Excluding English
Stanislaus County	59.8%	30.6%	0.7%	0.4%	0.9%	0.1%	32.8%
Madera County	58.0%	38.6%	0.3%	0.1%	0.2%	0.3%	39.5%
Merced County	48.5%	41.5%	0.7%	0.5%	2.2%	2.5%	47.4%
Fresno County	57.4%	32.5%	0.7%	0.6%	0.1%	2.7%	36.6%
Tulare County	53.2%	42.5%	0.7%	0.2%	0.7%	0.2%	44.4%
Kings County	57.4%	37.9%	1.6%	0.4%	1.0%	0.0%	40.9%
Kern County	59.0%	36.4%	1.1%	0.3%	0.0%	0.0%	37.8%
San Joaquin Valley Subtotal	57.0%	35.8%	0.8%	0.4%	0.5%	1.0%	38.5%
Central Valley Region	66.2%	23.1%	1.7%	1.2%	0.3%	0.8%	27.1%
STATE OF CALIFORNIA	**57.0%**	**28.5%**	**2.2%**	**2.9%**	**0.2%**	**0.2%**	**34.0%**

Source: U.S. Census 2014f

Table 21.15 Percent of Population Speaking One of the Top Five Non-English Languages Spoken at Home in the Central Valley Region – San Joaquin Valley that Speaks English "Less than Very Well" as a Proportion of the Total Population Five Years and Older, 2006–2010

Areas	Spanish and Spanish Creole	Tagalog	Chinese	Portuguese/ Portuguese Creole	Hmong
Stanislaus County	13.1%	0.2%	0.3%	0.4%	0.0%
Madera County	17.7%	0.1%	0.0%	0.1%	0.1%
Merced County	19.4%	0.2%	0.2%	0.9%	1.2%
Fresno County	14.7%	0.2%	0.3%	0.0%	1.3%
Tulare County	21.4%	0.3%	0.1%	0.3%	0.1%
Kings County	19.4%	0.6%	0.3%	0.3%	0.0%
Kern County	16.4%	0.4%	0.2%	0.0%	0.0%
San Joaquin Valley Subtotal	16.5%	0.3%	0.2%	0.2%	0.5%
Central Valley Region	10.8%	0.5%	0.6%	0.1%	0.4%
STATE OF CALIFORNIA	**13.6%**	**0.7%**	**1.6%**	**0.1%**	**0.1%**

Source: U.S. Census 2014f

Conditions in this geographic area have been the focus of recent newspaper articles describing conditions in these communities. According to AgAlert (2014), a weekly newspaper for California agriculture, increased levels of land fallowing on irrigated cropland in the San Joaquin Valley has resulted in significant economic losses in small farming communities. Higher than typical unemployment rates has resulted in increased food insecurity. As a result, food banks are facing increased demand. Another article in the Fresno Bee Newspaper (2014) described the food insecurity issue in the City of Mendota, a community in Fresno County.

Although there are emergency programs such as those administered through the U.S. Department of Agriculture (USDA), many of these programs are specific in their targets, require a long time to implement, or are of limited duration. For example, the 2014 Farm Bill includes $100 million in livestock disaster assistance; $15 million in assistance to farmers and ranchers to implement water conservation practices; and $60 million for food banks in the State of California (USDA 2014a). The USDA February 14, 2014 news release announcing these programs acknowledges that previous implementation of assistance programs were hampered by long processing times and emphasizes that the USDA is committed to reduce the response times by more than 80 percent. The USDA also is working with California Department of Education to expand the number of Summer Food Service Program meal sites. The U.S. Department of Homeland Security also provides assistance with food and related expenses through the Emergency Food and Shelter National Board Program (USDHS 2014); however this assistance is limited to one month. There also are many California-based programs, including the California Department of Social Services that provided in 2014 up to $25 million in food assistance for counties affected by employment losses due to the drought that has reduced agriculturally-related jobs (CDSS 2014). This program is specifically targeted for counties where the unemployment rate in 2013 was higher than the statewide average, including Fresno, Merced, and Tulare counties. This aid includes pre-packaged food boxes to be delivered to local food banks. Families and individuals that expected to experience long-term impacts due to the drought also were provided assistance to apply for the CalFresh Program to supplement funding for the food budget.

Huron and Mendota

The cities of Huron and Mendota are both located in Fresno County. Economic activities in both cities and surrounding communities are based on agriculture. Of the 25 major employers in Fresno County, only one, Stamoules Produce Company, is located in the City of Mendota (CEDD 2013). None of the 25 major employers in Fresno County are located in Huron. Another major employer in the City of Mendota is a medium security Federal prison for men (BOP 2014).

In 2010, the number of people that identified themselves as a racial minority and/or of Hispanic or Latino origin and the portion of the population below the poverty level in these two cities were significantly higher than the distribution of these populations in Fresno County and the State of California, as presented in Tables 21.16 and 21.17. Although the two communities became more racially diverse in 2010 than they were in the 2000 Census, both communities became poorer. While Huron and Mendota have experienced increases in poverty levels, the proportion of the population below the poverty level has been relatively stable in Fresno County.

Table 21.16 Racial and Ethnic Minority Population in Huron and Mendota in 2010

Areas	Total Population	Racial Minority	Hispanic or Latino Origin	Below Poverty Level
Huron City	6,754	65.9%	96.6%	54.5%
Mendota City	11,014	47.1%	96.6%	44.6%
Fresno County	930,450	44.6%	50.3%	22.5%
State of California	**37,253,956**	**42.4%**	**37.6%**	**13.7%**

Source: U.S. Census Bureau, 2013a, 2013b, 2014e, 2014u

Table 21.17 Racial and Ethnic Minority Population in Huron and Mendota in 2000

Areas	Total Population	Racial Minority	Hispanic or Latino Origin	Below Poverty Level
Huron City	6,306	79.6%	98.3%	39.4%
Mendota City	7,890	72.7%	94.7%	41.9%
Fresno County	799,407	45.7%	44.0%	22.9%
State of California	**33,871,648**	**40.5%**	**32.4%**	**14.2%**

Sources: U.S. Census Bureau, 2013c, 2013d, 2013e, 2013f

Other Indicators of Economic Conditions

Other indicators of economic struggles within these communities are the number of individuals who are on poverty alleviation programs, including CalFresh, the Federal Supplemental Nutrition Assistance Program administered by the State of California, California Work Opportunity and Responsibility to Kids (CalWORKs), and National School Lunch Program (NSLP).

Both CalFresh and CalWORKs are administered by the California Department of Social Services. The CalFresh Program issues monthly electronic benefits that can be used to buy most foods. The program’s purpose is to help improve the health and well-being of qualified households and individuals. CalWORKs is a social welfare program that provides cash aid and services to eligible needy California families. Figure 21.1 shows the trend in the average annual population on public assistance (both the CalFresh Program and CalWORKs program) between 2006 and 2012, the years for which electronic data were available for the cities of Huron and Mendota. The populations in Huron and Mendota have higher levels of participations in the two public assistance programs compared to the levels in Fresno County and the state. Additionally, the rates of participation in the two communities have been growing at a faster rate than growth in these programs in Fresno County and the state. Eligibility in the CalFresh Program is based upon several factors, including a poverty threshold requirement and citizenship/immigration status. Eligibility for CalWORKs is determined on the basis of citizenship, age, income, resources, assets and other factors (CDSS 2013j).

The NSLP program includes students that are eligible for assistance under CalFresh and other federal assistance programs, such as the Temporary Assistance for Needy Families and the Food Distribution Program on Indian Reservations; and students who are eligible under the Other Source Categorically Eligible Programs. A student is eligible under the Other Source Categorically Eligible Programs if that student is: (1) homeless, runaway or migrant; (2) a foster child; or (3) enrolled in a Federally-funded Head Start Program or a comparable State-funded Head Start Program or pre-kindergarten programs, or in an Even Start Program (USDA 2014b). Students enrolled in the NSLP are eligible for either free or reduced price meals (FRPM). Figure 21.2 shows the proportion of students enrolled in the FRPM program in the two communities, Fresno County, and the state. Participation on FRPM in Fresno County is higher than in the entire state; and lower than within Huron and Mendota.

Relatively large participation in the social services programs is related to low employment in Huron and Mendota. Annual unemployment rates in Huron and Mendota between 2006 and 2012 have consistently remained higher than for Fresno County and the state, as presented in Figure 21.3. The pattern of unemployment has been similar to unemployment patterns in Fresno County, and increased following the economic recession that started in 2007. The increase in unemployment also occurred at a time when both agricultural cultivated acreage and farm employment in the area declined; and included five consecutive years with reduced water availability, as described in Chapter 12, Agricultural Resources, and Chapter 19, Socioeconomics.

21.3.4.3 Delta and Suisun Marsh

The Delta and Suisun Marsh portion of the Central Valley Region includes Sacramento, Yolo, Solano, San Joaquin, and Contra Costa counties.

21.3.4.3.1 Minority Populations

As recorded in the 2010 U.S. Census, the Delta and Suisun Marsh portion of the Central Valley Region had a total population of 2,718,287 in 2010. About 54.8 percent of this population identified themselves as a racial minority and/or of Hispanic or Latino origin, regardless of race, as presented in Table 21.18. The table also shows the minority population distribution for the entire Central Valley Region and the State of California.

21.3.4.3.2 Poverty Levels

Poverty levels presented in Table 21.19 are calculated on a subset of the total population of a county, as described above in section 21.3.2, Characterization of Conditions Considered in the Environmental Justice Analysis.

Table 21.18 Minority Population Distribution in the Central Valley Region – Delta and Suisun Marsh in 2010

Areas	Total Population	Races							Hispanic or Latino Origin	Total Minority[a]
		White	Black/ African American	American Indian and Native Alaskan	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races		
Sacramento County	1,418,788	57.5%	10.4%	1.0%	14.3%	1.0%	9.3%	6.6%	21.6%	51.6%
Yolo County	200,849	63.2%	2.6%	1.1%	13.0%	0.5%	13.9%	5.8%	30.3%	50.1%
Solano County	413,344	51.0%	14.7%	0.8%	14.6%	0.9%	10.5%	7.6%	24.0%	59.2%
San Joaquin County	685,306	51.0%	7.6%	1.1%	14.4%	0.5%	19.1%	6.4%	38.9%	64.1%
Contra Costa County	1,049,025	58.6%	9.3%	0.6%	14.4%	0.5%	10.7%	5.9%	24.4%	52.2%
Total Delta and Suisun Marsh Valley	3,767,312	56.2%	9.6%	0.9%	14.3%	0.7%	11.9%	6.4%	26.2%	54.8%
Central Valley Region	8,379,045	61.4%	6.3%	1.3%	9.5%	0.4%	15.7%	5.4%	42.6%	53.5%
STATE OF CALIFORNIA	37,253,956	57.6%	6.2%	1.0%	13.0%	0.4%	17.0%	4.9%	37.6%	59.9%

Sources: U.S. Census 2014a, 2014y, 2014z, 2014aa, 2014ab, 2014ac

Note:

a. Total Minority is an aggregation of all non-white racial groups and includes all individuals of Hispanic or Latino origin, regardless of race.

Table 21.19 Population below Poverty Level in the Central Valley Region – Delta and Suisun Marsh, 2006–2010

Areas	Total Population[a]	Population Below Poverty Level	Percent of Population Below Poverty Level
Sacramento County	1,368,693	190,768	13.9%
Yolo County	186,800	31,895	17.1%
Solano County	397,576	41,158	10.4%
San Joaquin County	657,594	105,502	16.0%
Contra Costa County	1,013,854	91,142	9.0%
Total Delta and Suisun Marsh Valley	3,624,517	460,465	12.7%
Central Valley Region	8,025,054	1,268,984	15.8%
STATE OF CALIFORNIA	**35,877,036**	**4,919,945**	**13.7%**

Source: U.S. Census 2014e

Note:

a. Population numbers are only those for whom poverty status was determined and exclude institutionalized individuals

Of the total population for whom poverty status is determined within the Delta and Suisun Marsh portion of the Central Valley Region, 3,624,517 individuals, 12.7 percent were below the poverty level based on the 2006–2010 ACS 5-year dataset (U.S. Census 2014e). The U.S. Census Bureau defines geographical areas with more than 20 percent of the population below the poverty level as a "poverty areas." None of the counties in this area are defined as poverty areas.

21.3.4.3.3 Social Services

Distribution of social services varies for each county. Federal grants to the state and local agencies for Medicaid, other health related activities, and nutrition and family welfare; and Federal direct payments made to individuals under the CalFresh and supplemental social security income within counties in the Delta and Suisun Marsh portion of the Central Valley Region are summarized in Table 21.20.

21.3.4.3.4 Limited English Proficiency

The percent of the population that speaks English and other languages at home and the percent of the population that speak English "less than very well" based on the language they speak at home are presented in Tables 21.21 and 21.22.

21.3.5 San Francisco Bay Area Region

The San Francisco Bay Area Region includes portions of Napa, Alameda, Santa Clara, and San Benito counties that are within the CVP and SWP service areas. Contra Costa County also is part of the San Francisco Bay Area Region. However, for this chapter, Contra Costa County is discussed under Section 14.3.4.3, Delta Suisun Marsh.

21.3.5.1 Minority Populations

As recorded in the 2010 U.S. Census, the San Francisco Bay Area Region had a total population of 3,483,666 in 2010. About 64.4 percent of this population identified themselves as a racial minority and/or of Hispanic or Latino origin, regardless of race, as presented in Table 21.23. The table also shows the minority population distribution for the State of California.

21.3.5.2 Poverty Levels

Poverty levels presented in Table 21.24 are calculated on a subset of the total population of a county, as described above in section 21.3.2, Characterization of Conditions Considered in the Environmental Justice Analysis. Of the total population for whom poverty status is determined within the San Francisco Bay Area Region, 3,344,994 individuals, 10.1 percent were below the poverty level based on the 2006–2010 ACS 5-year dataset (U.S. Census 2014e). The U.S. Census Bureau defines geographical areas with more than 20 percent of the population below the poverty level as a "poverty areas." None of the counties in the San Francisco Bay Area Region are defined as poverty areas.

Table 21.20 Federal Funds Distributed for Social Programs in the Central Valley Region – Delta and Suisun Marsh in 2010

	Grants (millions of dollars)		Distributed to Individuals (millions of dollars)
Areas	**Medicaid and Other Health-Related Items**	**Nutrition and Family Welfare**	**CalFresh Benefits and Supplemental Security Income**
Sacramento County	$2,115.5	$2,695.9	$659.1
Yolo County	$504.8	$39.7	$55.2
Solano County	$264.2	$71.7	$118.6
San Joaquin County	$739.1	$153.5	$287.4
Contra Costa County	$749.7	$189.3	$238.8
Total Delta and Suisun Marsh Valley	$4,373.3	$3,150.1	$1,359.1
Central Valley Region	$8,759.9	$4,308.9	$3,179.8
STATE OF CALIFORNIA	**$41,931.1**	**$11,743.7**	**$12,469.4**

Source: Gaquin and Ryan 2013

Table 21.21 Top Five Non-English Languages Spoken at Home as a Proportion of the Total Population Five Years and Older in the Central Valley Region – Delta and Suisun Marsh, 2006 – 2010

Areas	Speaks Only English	Spanish and Spanish Creole	Chinese	Tagalog	Vietnamese	Russian	Total Excluding English
Sacramento County	69.8%	13.2%	2.2%	2.0%	1.5%	1.6%	20.5%
Yolo County	65.8%	20.2%	3.3%	0.8%	0.9%	1.6%	26.9%
Solano County	70.6%	15.9%	0.8%	6.8%	0.6%	0.1%	24.1%
San Joaquin County	0.0%	25.1%	1.0%	2.8%	1.0%	0.0%	29.9%
Contra Costa County	67.6%	17.3%	2.9%	2.8%	0.6%	0.6%	24.2%
Total Delta and Suisun Marsh Valley	56.5%	17.2%	2.1%	2.8%	1.0%	0.9%	24.0%
Central Valley Region	66.2%	23.1%	1.2%	1.7%	0.6%	0.5%	27.1%
STATE OF CALIFORNIA	**57.0%**	**28.5%**	**2.9%**	**2.2%**	**1.4%**	**0.4%**	**35.4%**

Source: U.S. Census 2014f

Table 21.22 Percent of Population Speaking One of the Top Five Non-English Languages Spoken at Home in the Central Valley Region – Delta and Suisun Marsh that Speaks English "Less than Very Well" as a Proportion of the Total Population Five Years and Older, 2006–2010

Areas	Spanish and Spanish Creole	Chinese	Tagalog	Vietnamese	Russian
Sacramento County	6.0%	1.3%	0.7%	0.9%	0.9%
Yolo County	9.5%	1.5%	0.2%	0.3%	1.0%
Solano County	7.4%	0.4%	2.2%	0.3%	0.0%
San Joaquin County	12.3%	0.6%	1.0%	0.6%	0.0%
Contra Costa County	8.4%	1.3%	0.7%	0.3%	0.3%
Total Delta and Suisun Marsh Valley	8.1%	1.1%	0.9%	0.6%	0.5%
Central Valley Region	10.8%	0.6%	0.5%	0.3%	0.2%
STATE OF CALIFORNIA	**13.6%**	**1.6%**	**0.7%**	**0.9%**	**0.2%**

Source: U.S. Census 2014f

Table 21.23 Minority Population Distribution in the San Francisco Bay Area Region in 2010

Areas	Total Population	Races							Hispanic or Latino Origin	Total Minority[a]
		White	Black/ African American	American Indian and Native Alaskan	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races		
Alameda County	1,510,271	43.0%	12.6%	0.6%	26.1%	0.8%	10.8%	6.0%	22.5%	65.9%
Santa Clara County	1,781,642	47.0%	2.6%	0.7%	32.0%	0.4%	12.4%	4.9%	26.9%	64.8%
San Benito County	55,269	63.7%	0.9%	1.6%	2.6%	0.2%	26.2%	4.9%	56.4%	61.7%
Napa County	136,484	71.5%	2.0%	0.8%	6.8%	0.3%	14.7%	4.1%	32.2%	43.6%
San Francisco Bay Area Region	3,483,666	46.5%	6.9%	0.7%	28.0%	0.6%	12.0%	5.4%	25.7%	64.4%
STATE OF CALIFORNIA	**37,253,956**	**57.6%**	**6.2%**	**1.0%**	**13.0%**	**0.4%**	**17.0%**	**4.9%**	**37.6%**	**59.9%**

Sources: U.S. Census 2014a, 2014ad, 2014ae, 2014af, 2014ag

Note:

a. Total Minority is an aggregation of all non-white racial groups and includes all individuals of Hispanic or Latino origin, regardless of race.

Table 21.24 Population below Poverty Level in the San Francisco Bay Area Region, 2006–2010

Areas	Total Population[a]	Population Below Poverty Level	Percent of Population Below Poverty Level
Alameda County	1,450,546	165,417	11.4
Santa Clara County	1,710,231	152,066	8.9
San Benito County	54,160	6,323	11.7
Napa County	130,057	12,948	10.0
San Francisco Bay Area Region	3,344,994	336,754	10.1
STATE OF CALIFORNIA	**35,877,036**	**4,919,945**	**13.7%**

Source: U.S. Census 2014e

Note:

a. Population numbers are only those for whom poverty status was determined and exclude institutionalized individuals

21.3.5.3 Social Services

Distribution of social services varies for each county. Federal grants to the state and local agencies for Medicaid, other health related activities, and nutrition and family welfare; and Federal direct payments made to individuals under the CalFresh and supplemental social security income within counties in the San Francisco Bay Area Region are summarized in Table 21.25.

21.3.5.4 Limited English Proficiency

The percent of the population that speaks English and other languages at home and the percent of the population that speak English “less than very well” based on the language they speak at home are presented in Tables 21.26 and 21.27.

21.3.6 Central Coast Region

The Central Coast Region includes portions of San Luis Obispo and Santa Barbara counties served by the SWP. SWP water supplies are used directly by municipal and industrial water users, and as part of groundwater replenishment plans to meet municipal, industrial, and agricultural water demands.

21.3.6.1 Minority Populations

As recorded in the 2010 U.S. Census, the Central Coast Region had a total population of 693,532 in 2010. About 43.1 percent of this population identified themselves as a racial minority and/or of Hispanic or Latino origin, regardless of race, as presented in Table 21.28. The table also shows the minority population distribution for the State of California.

21.3.6.2 Poverty Levels

Poverty levels presented in Table 21.29 are calculated on a subset of the total population of a county, as described above in section 21.3.2, Characterization of Conditions Considered in the Environmental Justice Analysis. Of the total population for whom poverty status is determined within the Central Coast

Region, 649,348 individuals, 13.8 percent were below the poverty level based on the 2006–2010 ACS 5-year dataset (U.S. Census 2014e). The U.S. Census Bureau defines geographical areas with more than 20 percent of the population below the poverty level as a "poverty areas." None of the counties in the Central Coast Region are defined as poverty areas.

21.3.6.3 Social Services

Distribution of social services varies for each county. Federal grants to the state and local agencies for Medicaid, other health related activities, and nutrition and family welfare; and Federal direct payments made to individuals under the CalFresh and supplemental social security income within counties in the Central Coast Region are summarized in Table 21.30.

Table 21.25 Federal Funds Distributed for Social Programs in the San Francisco Bay Area Region in 2010

Areas	Grants (millions of dollars)		Distributed to Individuals (millions of dollars)
	Medicaid and Other Health-Related Items	Nutrition and Family Welfare	CalFresh Benefits and Supplemental Security Income
Alameda County	$2,556.4	$318.6	$529.6
Santa Clara County	$2,000.2	$334.3	$466.3
San Benito County	$27.1	$12.5	$8.2
Napa County	$102.5	$32.0	$21.3
San Francisco Bay Area Region	$4,686.2	$697.4	$1,025.4
STATE OF CALIFORNIA	**$41,931.1**	**$11,743.7**	**$12,469.4**

Source: Gaquin and Ryan 2013

Table 21.26 Top Five Non-English Languages Spoken at Home as a Proportion of the Total Population Five Years and Older in the San Francisco Bay Area Region, 2006–2010

Areas	Speaks Only English	Spanish and Spanish Creole	Chinese	Tagalog	Vietnamese	Hindi	Total Excluding English
Alameda County	57.4%	16.8%	8.2%	3.8%	1.8%	1.6%	32.2%
Santa Clara County	49.3%	19.1%	7.4%	3.3%	6.5%	1.5%	37.8%
San Benito County	60.1%	37.3%	0.1%	0.7%	0.2%	0.0%	38.3%
Napa County	66.5%	26.2%	0.4%	2.4%	0.2%	0.1%	29.3%
San Francisco Bay Area Region	53.7%	18.6%	7.3%	3.4%	4.1%	1.5%	35.0%
STATE OF CALIFORNIA	**57.0%**	**28.5%**	**2.9%**	**2.2%**	**1.4%**	**0.4%**	**35.4%**

Source: U.S. Census 2014f

Table 21.27 Percent of Population Speaking One of the Top Five Non-English Languages Spoken at Home in the San Francisco Bay Area Region that Speaks English "Less than Very Well" as a Proportion of the Total Population Five Years and Older, 2006–2010

Areas	Spanish and Spanish Creole	Chinese	Tagalog	Vietnamese	Hindi
Alameda County	8.2%	4.8%	1.1%	1.1%	0.3%
Santa Clara County	8.9%	3.6%	1.1%	4.0%	0.2%
San Benito County	20.4%	0.1%	0.3%	0.2%	0.0%
Napa County	14.6%	0.2%	0.9%	0.2%	0.04%
San Francisco Bay Area Region	9.0%	3.9%	1.1%	2.5%	0.2%
STATE OF CALIFORNIA	**13.6%**	**1.6%**	**0.7%**	**0.9%**	**0.1%**

Source: U.S. Census 2014f

Table 21.28 Minority Population Distribution in the Central Coast Region in 2010

Areas	Total Population	Races							Hispanic or Latino Origin	Total Minority[a]
		White	Black/ African American	American Indian and Native Alaskan	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races		
San Luis Obispo County	269,637	82.6%	2.1%	0.9%	3.2%	0.1%	7.3%	3.8%	20.8%	28.9%
Santa Barbara County	423,895	69.6%	2.0%	1.3%	4.9%	0.2%	17.4%	4.6%	42.8%	52.1%
Central Coast Region	693,532	74.7%	2.0%	1.2%	4.2%	0.2%	13.5%	4.3%	34.3%	43.1%
STATE OF CALIFORNIA	**37,253,956**	**57.6%**	**6.2%**	**1.0%**	**13.0%**	**0.4%**	**17.0%**	**4.9%**	**37.6%**	**59.9%**

Sources: U.S. Census 2014a, 2014ah, 2014ai

Note:

a. Total Minority is an aggregation of all non-white racial groups and includes all individuals of Hispanic or Latino origin, regardless of race.

Table 21.29 Population below Poverty Level in the Central Coast Region, 2006–2010

Areas	Total Population[a]	Population Below Poverty Level	Percent of Population Below Poverty Level
San Luis Obispo County	248,764	32,183	12.9%
Santa Barbara County	400,584	57,463	14.3%
Central Coast Region	649,348	89,646	13.8%
STATE OF CALIFORNIA	**35,877,036**	**4,919,945**	**13.7%**

Source: U.S. Census 2014e

Note:

a. Population numbers are only those for whom poverty status was determined and exclude institutionalized individuals

Table 21.30 Federal Funds Distributed for Social Programs in the Central Coast Region in 2010

Areas	Grants (millions of dollars)		Distributed to Individuals (millions of dollars)
	Medicaid and Other Health-Related Items	Nutrition and Family Welfare	CalFresh Benefits and Supplemental Security Income
San Luis Obispo County	$176.0	$70.7	$44.5
Santa Barbara County	$332.1	$93.3	$91.6
Central Coast Region	$508.1	$164.0	$136.1
STATE OF CALIFORNIA	$41,931.1	$11,743.7	$12,469.4

Source: Gaquin and Ryan 2013

21.3.6.4 Limited English Proficiency

The percent of the population that speaks English and other languages at home and the percent of the population that speak English "less than very well" based on the language they speak at home are presented in Tables 21.31 and 21.32.

21.3.7 Southern California Region

The Southern California Region includes portions of Ventura, Los Angeles, Orange, San Diego, Riverside, and San Bernardino counties served by the SWP.

21.3.7.1 Minority Populations

As recorded in the 2010 U.S. Census, the Southern California Region had a total population of 20,972,319 in 2010. About 64.2 percent of this population identified themselves as a racial minority and/or of Hispanic or Latino origin, regardless of race, as presented in Table 21.33. The table also shows the minority population distribution for the State of California.

21.3.7.2 Poverty Levels

Poverty levels presented in Table 21.34 are calculated on a subset of the total population of a county, as described above in section 21.3.2, Characterization of Conditions Considered in the Environmental Justice Analysis. Of the total population for whom poverty status is determined within the Southern California Region, 20,296,879 individuals, 13.8 percent, were below the poverty level based on the 2006–2010 ACS 5-year dataset (U.S. Census 2014e). The U.S. Census Bureau defines geographical areas with more than 20 percent of the population below the poverty level as a “poverty areas.” None of the counties in the Southern California Region are defined as poverty areas.

21.3.7.3 Social Services

Distribution of social services varies for each county. Federal grants to the state and local agencies for Medicaid, other health related activities, and nutrition and family welfare; and Federal direct payments made to individuals under the CalFresh and supplemental social security income within counties in the Southern California Region are summarized in Table 21.35.

21.3.7.4 Limited English Proficiency

The percent of the population that speaks English and other languages at home and the percent of the population that speak English “less than very well” based on the language they speak at home are presented in Tables 21.36 and 21.37.

Table 21.31 Top Five Non-English Languages Spoken at Home as a Proportion of the Total Population Five Years and Older in the Central Coast Region, 2006–2010

Areas	Speaks Only English	Spanish and Spanish Creole	Chinese	Tagalog	French (including Patois and Cajun)	German	Total Excluding English
San Luis Obispo County	83.3%	13.1%	0.3%	0.5%	0.3%	0.4%	14.7%
Santa Barbara County	61.3%	31.9%	0.8%	0.9%	0.6%	0.6%	34.7%
Central Coast Region	70.0%	24.5%	0.6%	0.8%	0.5%	0.5%	26.8%
STATE OF CALIFORNIA	**57.0%**	**28.5%**	**2.9%**	**2.2%**	**0.4%**	**0.3%**	**34.3%**

Source: U.S. Census 2014f

Table 21.32 Percent of Population Speaking One of the Top Five Non-English Languages Spoken at Home in the Central Coast Region that Speaks English "Less than Very Well" as a Proportion of the Total Population Five Years and Older, 2006–2010

Areas	Spanish and Spanish Creole	Chinese	Tagalog	French (including Patois and Cajun)	German
San Luis Obispo County	5.5%	0.1%	0.2%	0.04%	0.04%
Santa Barbara County	16.5%	0.4%	0.4%	0.1%	0.1%
Central Coast Region	12.2%	0.3%	0.4%	0.1%	0.1%
STATE OF CALIFORNIA	**13.6%**	**1.6%**	**0.7%**	**0.1%**	**0.04%**

Source: U.S. Census 2014f

Table 21.33 Minority Population Distribution in the Southern California Region in 2010

Areas	Total Population	Races							Hispanic or Latino Origin	Total Minority[a]
		White	Black/ African American	American Indian and Native Alaskan	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races		
Ventura County	823,318	68.7%	1.8%	1.0%	6.7%	0.2%	17.0%	4.5%	40.3%	51.3%
Los Angeles County	9,818,605	50.3%	8.7%	0.7%	13.7%	0.3%	21.8%	4.5%	47.7%	72.2%
Orange County	3,010,232	60.8%	1.7%	0.6%	17.9%	0.3%	14.5%	4.2%	33.7%	55.9%
San Diego County	3,095,313	64.0%	5.1%	0.9%	10.9%	0.5%	13.6%	5.1%	32.0%	51.5%
Riverside County	2,189,641	61.0%	6.4%	1.1%	6.0%	0.3%	20.5%	4.8%	45.5%	60.3%
San Bernardino County	2,035,210	56.7%	8.9%	1.1%	6.3%	0.3%	21.6%	5.0%	49.2%	66.7%
Southern California Region	20,972,319	56.3%	6.7%	0.8%	12.1%	0.3%	19.2%	4.6%	43.1%	64.2%
STATE OF CALIFORNIA	**37,253,956**	**57.6%**	**6.2%**	**1.0%**	**13.0%**	**0.4%**	**17.0%**	**4.9%**	**37.6%**	**59.9%**

Sources: U.S. Census 2014a, 2014aj, 2014ak, 2014al, 2014am, 2014an, 2014ao

Note:

a. Total Minority is an aggregation of all non-white racial groups and includes all individuals of Hispanic or Latino origin, regardless of race.

Table 21.34 Population below Poverty Level in the Southern California Region, 2006–2010

Areas	Total Population[a]	Population Below Poverty Level	Percent of Population Below Poverty Level
Ventura County	798,863	73,842	9.2%
Los Angeles County	9,604,871	1,508,618	15.7%
Orange County	2,925,244	296,846	10.1%
San Diego County	2,930,875	361,248	12.3%
Riverside County	2,075,782	278,358	13.4%
San Bernardino County	1,961,244	291,020	14.8%
Southern California Region	798,863	73,842	9.2%
STATE OF CALIFORNIA	**35,877,036**	**4,919,945**	**13.7%**

Source: U.S. Census 2014e

Note:

a. Population numbers are only those for whom poverty status was determined and exclude institutionalized individuals

Table 21.35 Federal Funds Distributed for Social Programs in the Southern California Region in 2010

	Grants (millions of dollars)		Distributed to Individuals (millions of dollars)
Areas	Medicaid and Other Health-Related Items	Nutrition and Family Welfare	CalFresh Benefits and Supplemental Security Income
Ventura County	$445.3	$153.9	$147.1
Los Angeles County	$13,950.6	$2,840.6	$4,259.6
Orange County	$1,678.3	$610.6	$633.2
San Diego County	$3,866.8	$677.8	$790.1
Riverside County	$966.4	$347.2	$488.0
San Bernardino County	$1,236.2	$390.1	$751.9
Southern California Region	$22,143.6	$5,020.2	$7,069.9
STATE OF CALIFORNIA	**$41,931.1**	**$11,743.7**	**$12,469.4**

Source: Gaquin and Ryan 2013

Table 21.36 Top Five Non-English Languages Spoken at Home as a Proportion of the Total Population Five Years and Older in the Southern California Region, 2006–2010

Areas	Speaks Only English	Spanish and Spanish Creole	Chinese	Tagalog	Vietnamese	Korean	Total Excluding English
Ventura County	62.6%	29.5%	1.0%	1.7%	0.4%	0.4%	33.1%
Los Angeles County	43.6%	39.4%	3.6%	2.5%	0.8%	2.0%	48.3%
Orange County	55.6%	26.2%	2.2%	1.5%	5.4%	2.5%	37.8%
San Diego County	63.7%	24.4%	1.4%	3.1%	1.3%	0.5%	30.6%
Riverside County	60.5%	33.2%	0.5%	1.4%	0.6%	0.4%	36.2%
San Bernardino County	59.5%	33.6%	1.0%	1.4%	0.6%	0.5%	37.1%
Southern California Region	52.3%	33.7%	2.4%	2.2%	1.5%	1.5%	41.3%
STATE OF CALIFORNIA	**57.0%**	**28.5%**	**2.9%**	**2.2%**	**1.4%**	**1.1%**	**36.1%**

Source: U.S. Census 2014f

Table 21.37 Percent of Population Speaking One of the Top Five Non-English Languages Spoken at Home in the Southern California Region that Speaks English "Less than Very Well" as a Proportion of the Total Population Five Years and Older, 2006–2010

Areas	Spanish and Spanish Creole	Chinese	Tagalog	Vietnamese	Korean
Ventura County	14.1%	0.5%	0.5%	0.2%	0.2%
Los Angeles County	19.0%	2.2%	0.8%	0.5%	1.3%
Orange County	13.4%	1.0%	0.4%	3.3%	1.5%
San Diego County	11.0%	0.7%	1.1%	0.8%	0.3%
Riverside County	14.5%	0.3%	0.4%	0.4%	0.2%
San Bernardino County	15.5%	0.5%	0.4%	0.4%	0.3%
Southern California Region	16.0%	1.4%	0.7%	0.9%	0.9%
STATE OF CALIFORNIA	**13.6%**	**1.6%**	**0.7%**	**0.9%**	**0.7%**

Source: U.S. Census 2014f

21.4 Impact Analysis

This section describes the potential mechanisms for change in conditions and analytical methods; results of impact analyses; potential mitigation measures; and cumulative effects.

21.4.1 Potential Mechanisms for Change and Analytical Methods

As described in Chapter 4, Approach to Environmental Analysis, the impact analysis considers changes in factors that affect environmental justice or minority and low-income populations specifically related to changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison.

The Council of Environmental Quality (CEQ) and U.S. Environmental Protection Agency (USEPA) established guidelines to assist federal agencies in the analysis of environmental justice defines minority and low-income areas summarized in Section 21.3, Affected Environment (CEQ, 1997). The following guidelines are used to determine if minority populations are present in a study area:

- The minority population of the affected area exceeds 50 percent, or
- The population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis.

The CEQ guidelines do not specifically state the percentage considered meaningful in the case of low-income populations. For this analysis, the assumptions set forth in the CEQ guidelines for identifying and evaluating impacts on minority populations also are used to identify and evaluate impacts on low-income populations, including a determination that a low-income population is present if the project area if 50 percent or more of the population is living below the poverty level.

The alternatives considered in this EIS do not include project-specific construction activities. In most portions of the study area, the availability of CVP and SWP water supplies directly or indirectly affects most of the population within a county. Therefore, the entire population of each counties within the study area is considered to determine whether minority or low-income areas could be affected by implementation of the alternatives. In the study area, populations below the poverty level do not include 50 percent or more of the population. The highest proportion of populations below the poverty level occurs in Fresno and Tulare counties in which approximately 23 percent of the populations are below the poverty level. However, minority populations contribute more than 50 percent of the total county populations in 24 of the 35 counties. The following counties have 50 percent or more of the total population as minority populations.

- Central Valley Region: Colusa, Sacramento, Solano, Sutter, Yolo, Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare counties

- Central Coast Region; Santa Barbara.
- Southern California Region: Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura.

Although, the majority of the populations in the Trinity River Region counties are not minority populations, these counties do include the Hoopa Valley Indian Reservation, Yurok Indian Reservation, and Resighini Rancheria. Therefore, the Trinity River Region counties are also included in the environmental justice analysis.

The CEQ guidance provides the following three factors to be considered for determination if disproportionately high and adverse impacts may accrue to minority or low-income populations.

The following criteria were used to evaluate the impacts to minority and low-income populations resulting from the operational changes following the implementation of each of the alternatives as compared to the No Action Alternative and the Second Basis of Comparison:

- Whether there is or would be an impact that results in a disproportionately high and adverse human health and environmental impact, including social and economic effects on environmental justice populations.
- Whether the environmental effects are significant and are, or may be, having an adverse impact on environmental justice populations that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group.
- Whether the environmental effects occur or would occur in an environmental justice population affected by cumulative or multiple adverse exposures from environmental hazards.

To determine whether the operational changes resulting from implementation of each of the alternatives as compared to the No Action Alternative and the Second Basis of Comparison will have a "disproportionately high and adverse impact" on minority and low-income populations, various factors were considered, including potential adverse impacts, mitigation, and enhancement measures that will be incorporated into the alternatives; and offsetting benefits.

The environmental justice guidance documents do not specifically define conditions that would result in "high and adverse human health and environmental impact." For this analysis, the potential changes in air quality, cultural resources, public health, and socioeconomics were considered within the counties that had a minority population of 50 percent or greater of the total population.

The changes were then determined if the impacts would be disproportionally high on the minority populations. Potential adverse impacts were evaluated with regard to air quality, public health, and socioeconomics.

Changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison could result in disproportionally high effects on minority or tribal populations related to changes in air quality, public health, and socioeconomics.

21.4.1.1 Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Changes in CVP and SWP operations under the alternatives could change the use of individual engines to operate groundwater wells. To evaluate the potential for changes in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants, results from the CVHM model that indicate changes in groundwater withdrawals due to changes in CVP and SWP operations were analyzed. However, it is not known how many of the groundwater pumps use electricity and how many use diesel engines. The diesel engines have the potential to emit criteria air pollutants and precursors, and toxic air contaminants, as described in Chapter 16, Air Quality and Greenhouse Gas Emissions.

Most of the groundwater wells in the Central Valley use electrical pumps. As reported in a recent environmental assessment, approximately 14 to 15 percent of the pumps used diesel fuel in 2003 (Reclamation 2013a). It is assumed for this EIS, that the portion of groundwater pumps that use electricity would remain approximately at 85 percent. Therefore, it is assumed that increases or decreases in groundwater pumping would be indicative of an increase or decrease in the use of diesel engines in the Central Valley as well as in the San Francisco Bay Area, Central Coast, and Southern California regions. Changes in CVP and SWP operations would not result in changes in groundwater pumping in the Trinity River Region; therefore, this analysis does not address Trinity River Region.

21.4.1.2 Changes in Public Health Related to Changes in Potential Exposure to Mercury in Fish Used in Human Consumption

Changes in CVP and SWP operations under the alternatives could change public health factors related to mercury concentrations in fish used for human consumption as compared to the No Action Alternative and Second Basis of Comparison, as described in Chapter 18, Public Health.

21.4.1.3 Changes in Socioeconomics

Changes in CVP and SWP operations under the alternatives could change socioeconomic factors related to employment related to irrigated agriculture and municipal and industrial (M&I) water supplies and tribal salmon harvest in the Trinity River Region as compared to the No Action Alternative and Second Basis of Comparison, as described in Chapter 19, Socioeconomics. However, changes in employment related to irrigated agriculture and M&I water supplies would be similar. Therefore, these changes are not analyzed in this EIS.

21.4.1.4 Effects due to Cross Delta Water Transfers

Historically water transfer programs have been developed on an annual basis. The demand for water transfers is dependent upon the availability of water supplies to meet water demands. Water transfer transactions have increased over time as CVP and SWP water supply availability has decreased, especially during drier water years.

Parties seeking water transfers generally acquire water from sellers who have available surface water who can make the water available through releasing previously stored water, pump groundwater instead of using surface water (groundwater substitution); idle crops; or substitute crops that uses less water in order to reduce normal consumptive use of surface water.

Water transfers using CVP and SWP Delta pumping plants and south of Delta canals generally occur when there is unused capacity in these facilities. These conditions generally occur during drier water year types when the flows from upstream reservoirs plus unregulated flows are adequate to meet the Sacramento Valley water demands and the CVP and SWP export allocations. In non-wet years, the CVP and SWP water allocations would be less than full contract amounts; therefore, capacity may be available in the CVP and SWP conveyance facilities to move water from other sources.

Projecting future environmental justice conditions related to water transfer activities is difficult because specific water transfer actions required to make the water available, convey the water, and/or use the water would change each year due to changing hydrological conditions, CVP and SWP water availability, specific local agency operations, and local cropping patterns. Reclamation recently prepared a long-term regional water transfer environmental document which evaluated potential changes in conditions related to water transfer actions (Reclamation 2014c). Results from this analysis were used to inform the impact assessment of potential effects of water transfers under the alternatives as compared to the No Action Alternative and the Second Basis of Comparison.

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

This EIS includes two bases of comparison, as described in Chapter 3, Description of Alternatives: the No Action Alternative and the Second Basis of Comparison. Both of these bases are evaluated at 2030 conditions.

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. Many of the changed conditions would occur in the same manner under both the No Action Alternative and the Second Basis of Comparison.

21.4.2.1 Common Changes in Conditions under the No Action Alternative and Second Basis of Comparison

Conditions in 2030 would be different than existing conditions due to:

- Climate change and sea level rise
- General plan development throughout California, including increased water demands in portions of Sacramento Valley
- Implementation of reasonable and foreseeable water resources management projects to provide water supplies

It is anticipated that climate change would result in more short-duration high-rainfall events and less snowpack in the winter and early spring months. The reservoirs would be full more frequently by the end of April or May by 2030 than in recent historical conditions. However, as the water is released in the spring, there would be less snowpack to refill the reservoirs. This condition would reduce reservoir storage and available water supplies to downstream uses in the summer. The reduced end of September storage also would reduce the ability to release stored water to downstream regional reservoirs. These conditions would occur for all reservoirs in the California foothills and mountains, including non-CVP and SWP reservoirs.

These changes would result in a decline of the long-term average CVP and SWP water supply deliveries by 2030 as compared to recent historical long-term average deliveries under the No Action Alternative and the Second Basis of Comparison. However, the CVP and SWP water deliveries would be less under the No Action Alternative as compared to the Second Basis of Comparison, as described in Chapter 5, Surface Water Resources and Water Supplies. Due to climate change and related lower snowfall, end of September low reservoir storage would be lower in critical dry years by 2030 as compared to recent historical conditions in Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir. Therefore, the potential for reduced reservoir water supplies for wildland firefighting would be greater under the No Action Alternative and Second Basis of Comparison as compared to recent historical conditions.

Under the No Action Alternative and the Second Basis of Comparison, land uses in 2030 would occur in accordance with adopted general plans.

The No Action Alternative and the Second Basis of Comparison assumes completion of water resources management and environmental restoration projects that would have occurred without implementation of Alternatives 1 through 5, including regional and local recycling projects, surface water and groundwater storage projects, conveyance improvement projects, and desalination projects, as described in Chapter 3, Description of Alternatives. The No Action Alternative and the Second Basis of Comparison also assumes implementation of actions included in the 2008 U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BO) and 2009 National Marine Fisheries Service (NMFS) BO that would have been implemented without the BOs by 2030, as described in Chapter 3, Description of Alternatives.

Under the No Action Alternative and Second Basis of Comparison, it is anticipated that mercury concentrations in fish tissue within the Delta will be either similar or greater than recent historical conditions. Phase 1 of the Delta Mercury Program mandated by the Central Valley Regional Water Quality Control Board (RWQCB) is currently being completed to protect people eating one meal per week of larger fish from the Delta, including Largemouth Bass. Phase 1 is focused on studies and pilot projects to develop and evaluate management practices to control methylmercury from mercury sources in the Delta and Yolo Bypass; and to reduce total mercury loading to the San Francisco Bay. Following completion of Phase 1 in 2019, Phase 2 will be implemented through 2030. Phase 2 will focus on methylmercury control programs and reduction programs for total inorganic mercury. Due to the extent of these studies, it is not anticipated that changes in methylmercury or total mercury concentrations in fish tissue will be reduced by 2030. Future mercury reduction and control programs will reduce mercury sources and related fish tissue concentrations; however, that will occur after 2030.

21.4.3 Evaluation of Alternatives

Alternatives 1 through 5 have been compared to the No Action Alternative; and the No Action Alternative and Alternatives 1 through 5 have been compared to the Second Basis of Comparison.

During review of the numerical modeling analyses used in this EIS, an error was determined in the CalSim II model assumptions related to the Stanislaus River operations for the Second Basis of Comparison, Alternative 1, and Alternative 4 model runs. Appendix 5C includes a comparison of the CalSim II model run results presented in this chapter and CalSim II model run results with the error corrected. Appendix 5C also includes a discussion of changes in the comparison of groundwater conditions for the following alternative analyses.

- No Action Alternative compared to the Second Basis of Comparison
- Alternative 1 compared to the No Action Alternative
- Alternative 3 compared to the Second Basis of Comparison
- Alternative 5 compared to the Second Basis of Comparison.

21.4.3.1 No Action Alternative

The No Action Alternative is compared to the Second Basis of Comparison.

21.4.3.1.1 Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would increase by 8 percent under the No Action Alternative as compared to the Second Basis of Comparison. It is not known if the additional groundwater pumping would rely upon electricity or diesel to drive the pump engines. Under the worst case analysis, it is assumed that the increased use of diesel engines would be proportional to the increased use of groundwater. Therefore, under the No Action Alternative, there would be a potential increase in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants as compared to the Second Basis of Comparison.

Changes in Public Health Factors Related to Mercury in Fish used for Human Consumption

Mercury concentrations in Largemouth Bass would be similar (within 5 percent change) in most locations in the Delta, except for Rock Slough, San Joaquin River near Antioch, and Montezuma Slough in Suisun Marsh. In these areas, the mercury concentrations would increase by 7 percent over long-term conditions under the No Action Alternative as compared to the Second Basis of Comparison. Under dry and critical dry years, mercury concentrations would increase by 7 to 8 percent at Rock Slough, intakes of the Banks and Jones pumping plants, and Victoria Canal. All values exceed the threshold of 0.24 mg/kg ww for mercury.

Effects Related to Cross Delta Water Transfers

Potential effects to environmental justice factors could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c). Potential effects to environmental justice were identified as loss of employment in the seller's service area if crop idling was used to provide transfer water. The analysis indicated that the proportion of crop idled acreage would be small as compared to the overall regional irrigated acreage, and that this change would not result in in disproportionately high or adverse effects. In addition, beneficial effects could occur in the purchaser's service area if more acreage was cultivated with the water transfer program than without the water transfer program.

Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Under the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be less under the No Action Alternative than under the Second Basis of Comparison.

21.4.3.1.2 San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies would be decreased by 10 percent and 18 percent, respectively, in the San Francisco Bay Area, Central

Coast, and Southern California regions under No Action Alternative as compared to the Second Basis of Comparison. The decrease in surface water supplies could result in additional use of groundwater pumps and emissions of air pollutants and contaminants if the use of diesel engines is also increased.

21.4.3.2 Alternative 1

As described in Chapter 3, Description of Alternatives, Alternative 1 is identical to the Second Basis of Comparison. As described in Chapter 4, Approach to Environmental Analysis, Alternative 1 is compared to the No Action Alternative and the Second Basis of Comparison. However, because CVP and SWP operations under Alternative 1 are identical to conditions under the Second Basis of Comparison; Alternative 1 is only compared to the No Action Alternative.

21.4.3.2.1 Alternative 1 Compared to the No Action Alternative

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would decrease by 8 percent under Alternative 1 as compared to the No Action Alternative. It is not known if the reduction in groundwater pumping would result in a reduction of the use of electricity or diesel to drive the pump engines. For this analysis, it is assumed that the decreased use of diesel engines would be proportional to the decreased use of groundwater. Therefore, under Alternative 1, there would be a potential decrease in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants as compared to the No Action Alternative.

Changes in Public Health Factors Related to Mercury in Fish used for Human Consumption

Mercury concentrations in Largemouth Bass would be similar in most locations in the Delta, except for Rock Slough, San Joaquin River near Antioch, and Montezuma Slough in Suisun Marsh. In these areas, the mercury concentrations would decrease by 6 percent over the long-term conditions under Alternative 1 as compared to the No Action Alternative. Under dry and critical dry years, mercury concentrations would decrease by 6 to 8 percent at Rock Slough, intakes of the Banks and Jones pumping plants, and Victoria Canal. All values exceed the threshold of 0.24 mg/kg ww for mercury.

Effects Related to Cross Delta Water Transfers

Potential effects to environmental justice conditions could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 1 and the No Action Alternative, and that impacts on environmental justice factors would not be substantial due to implementation requirements of the transfer programs.

Under Alternative 1, water could be transferred throughout the year without an annual volumetric limit. Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be increased under Alternative 1 as compared to the No Action Alternative.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies would be increased by 11 percent and 21 percent, respectively, in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 1 as compared to the No Action Alternative. The increase in surface water supplies could result in the reduction in use of groundwater pumps and emissions of air pollutants and contaminants if the use of diesel engines is also decreased.

21.4.3.2.2 Alternative 1 Compared to the Second Basis of Comparison

Alternative 1 is identical to the Second Basis of Comparison.

21.4.3.3 Alternative 2

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative, as described in Chapter 3, Description of Alternatives; therefore Alternative 2 is only compared to the Second Basis of Comparison.

21.4.3.3.1 Alternative 2 Compared to the Second Basis of Comparison

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative. Therefore, changes to environmental justice factors under Alternatives 2 as compared to the Second Basis of Comparison would be the same as the impacts described in Section 18.4.3.1, No Action Alternative.

21.4.3.4 Alternative 3

As described in Chapter 3, Description of Alternatives, CVP and SWP operations under Alternative 3 are similar to the Second Basis of Comparison with modified Old and Middle River flow criteria and New Melones Reservoir operations. As described in Chapter 4, Approach to Environmental Analysis, Alternative 3 is compared to the No Action Alternative and the Second Basis of Comparison.

21.4.3.4.1 Alternative 3 Compared to the No Action Alternative

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would decrease by 6 percent under Alternative 3 as compared to the No Action Alternative. It is not known if the reduction in groundwater pumping would result in a reduction of the use of electricity or diesel to drive the pump engines. For this analysis, it is assumed that the decreased use of diesel engines would be proportional to the decreased use of groundwater. Therefore, under Alternative 3, there would be a potential decrease in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants as compared to the No Action Alternative.

Changes in Public Health Factors Related to Mercury in Fish used for Human Consumption

Mercury concentrations in Largemouth Bass would be similar (within 5 percent change) in most locations in the Delta, except for San Joaquin River near Antioch and Montezuma Slough in Suisun Marsh. In these areas, the mercury concentrations would decrease by 6 percent over the long-term conditions under Alternative 3 as compared to the No Action Alternative. Mercury concentrations under the dry and critical dry years would be similar throughout the Delta. All values exceed the threshold of 0.24 mg/kg ww for mercury.

Effects Related to Cross Delta Water Transfers

Potential effects to environmental justice factors could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 3 and the No Action Alternative, and that impacts on environmental justice factors would not be substantial due to implementation requirements of the transfer programs.

Under Alternative 3, water could be transferred throughout the year without an annual volumetric limit. Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be increased under Alternative 3 as compared to the No Action Alternative.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies would be increased by 9 percent and 17 percent, respectively, in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 3 as compared to the No Action Alternative. The increase in surface water supplies could result in the reduction in use of groundwater pumps and emissions of air pollutants and contaminants if the use of diesel engines is also decreased.

21.4.3.4.2 Alternative 3 Compared to the Second Basis of Comparison

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would be similar (within a 5 percent change) under Alternative 3 as compared to the Second Basis of Comparison. Therefore, the emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants would be similar under Alternative 3 as compared to the Second Basis of Comparison.

Changes in Public Health Factors Related to Mercury in Fish Used for Human Consumption

Mercury concentrations in Largemouth Bass would be similar throughout the Delta under Alternative 3 as compared to the Second Basis of Comparison, as summarized in Chapter 6, Surface Water Quality. All values exceed the threshold of 0.24 mg/kg ww for mercury.

Effects Related to Cross Delta Water Transfers

Potential effects to environmental justice factors could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 3 and the Second Basis of Comparison, and that impacts on environmental justice factors would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 3 and the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be similar under Alternative 3 and the Second Basis of Comparison.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies and emissions from diesel engines used for groundwater pumping would be similar in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 3 as compared to the Second Basis of Comparison.

21.4.3.5 Alternative 4

The environmental justice conditions under Alternative 4 would be identical to the conditions under the Second Basis of Comparison; therefore, Alternative 4 is only compared to the No Action Alternative.

21.4.3.5.1 Alternative 4 Compared to the No Action Alternative

The CVP and SWP operations under Alternative 4 are identical to the CVP and SWP operations under the Second Basis of Comparison and Alternative 1. Therefore, changes in environmental justice conditions under Alternative 4 as compared to the No Action Alternative would be the same as the impacts described in Section 12.4.3.2.1, Alternative 1 Compared to the No Action Alternative.

21.4.3.6 Alternative 5

As described in Chapter 3, Description of Alternatives, CVP and SWP operations under Alternative 5 are similar to the No Action Alternative with modified Old and Middle River flow criteria and New Melones Reservoir operations. As described in Chapter 4, Approach to Environmental Analysis, Alternative 5 is compared to the No Action Alternative and the Second Basis of Comparison.

21.4.3.6.1 Alternative 5 Compared to the No Action Alternative

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would be similar under Alternative 5 as compared to the No Action Alternative. Therefore, the emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants would be similar under Alternative 5 as compared to the No Action Alternative.

Changes in Public Health Factors Related to Mercury in Fish used for Human Consumption

Mercury concentrations in Largemouth Bass would be similar throughout the Delta under Alternative 5 as compared to the No Action Alternative, as summarized in Chapter 6, Surface Water Quality. All values exceed the threshold of 0.24 mg/kg ww for mercury.

Effects Related to Cross Delta Water Transfers

Potential effects to environmental justice factors could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 5 and the No Action Alternative, and that impacts on environmental justice factors would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 5 and the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be similar under Alternative 5 and the No Action Alternative.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies and emissions from diesel engines used for groundwater pumping would be similar in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 5 as compared to the No Action Alternative.

21.4.3.6.2 Alternative 5 Compared to the Second Basis of Comparison

Central Valley Region

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

Groundwater pumping in the San Joaquin Valley portion of the Central Valley Region would increase by 8 percent under Alternative 5 as compared to the Second Basis of Comparison. It is not known if the additional groundwater pumping would rely upon electricity or diesel to drive the pump engines. Under the worst case analysis, it is assumed that the increased use of diesel engines would be proportional to the increased use of groundwater. Therefore, under Alternative 5, there would be a potential increase in emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants as compared to the Second Basis of Comparison.

Changes in Public Health Factors Related to Mercury in Fish used for Human Consumption

Mercury concentrations in Largemouth Bass would be similar in most locations in the Delta, except for Rock Slough, San Joaquin River near Antioch, and Montezuma Slough in Suisun Marsh. In these areas, the mercury concentrations would increase by 7 to 8 percent over long-term conditions under Alternative 5 as compared to the Second Basis of Comparison. During dry and critical dry years, mercury concentrations also would increase by 7 percent at intakes to Banks Pumping Plant and Jones Pumping Plant; and 13 percent at Rock Slough. All values exceed the threshold of 0.24 mg/kg ww for mercury.

Effects Related to Cross Delta Water Transfers

Potential effects to environmental justice factors could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c) as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under Alternative 5 and the Second Basis of Comparison, and that impacts on environmental justice factors would not be substantial in the seller's service area due to implementation requirements of the transfer programs.

Under Alternative 5, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Under the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be reduced under Alternative 5 as compared to the Second Basis of Comparison.

San Francisco Bay Area, Central Coast, and Southern California Regions

Changes in Emissions of Criteria Air Pollutants and Precursors, and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants Related to Changes in Groundwater Pumping

It is anticipated that CVP and SWP water supplies would be decreased by 10 percent and 18 percent, respectively, in the San Francisco Bay Area, Central Coast, and Southern California regions under Alternative 5 as compared to the Second Basis of Comparison. The decrease in surface water supplies could result in increased use of groundwater pumps and emissions of air pollutants and contaminants if the use of diesel engines is also increased.

21.4.3.7 Summary of Environmental Consequences

The results of the environmental consequences of implementation of Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison are presented in Tables 21.38 and 21.39.

Table 21.38 Comparison of Alternatives 1 through 5 to No Action Alternative

Alternative	Potential Change	Consideration for Mitigation Measures
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 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. Similar mercury concentrations in Largemouth Bass throughout the Delta.	None needed

Note: Due to the limitations and uncertainty in the CalSim II monthly model and other analytical tools, incremental differences of 5 percent or less between alternatives and the Second Basis of Comparison are considered to be "similar."

Table 21.39 Comparison of Alternatives 1 through 5 to Second Basis of Comparison

Alternative	Potential Change	Consideration for Mitigation Measures
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 conditions.	Not considered for this comparison.
Alternative 1	No effects on environmental justice factors.	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	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.

Note: Due to the limitations and uncertainty in the CalSim II monthly model and other analytical tools, incremental differences of 5 percent or less between alternatives and the Second Basis of Comparison are considered to be “similar.”

21.4.3.8 Potential Mitigation Measures

Mitigation measures are presented in this section to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse environmental effects of Alternatives 1 through 5 as compared to the No Action Alternative. Mitigation measures were not included to address adverse impacts under the alternatives as compared to the Second Basis of Comparison because this analysis was included in this EIS for information purposes only.

Changes in CVP and SWP operations under Alternatives 1 through 5 as compared to the No Action Alternative would not result in changes in air quality or public health that are related to environmental justice factors. Therefore, there would be no disproportionately high or adverse environmental justice effects; and no mitigation measures are required.

21.4.3.9 Cumulative Effects Analysis

As described in Chapter 3, the cumulative effects analysis considers projects, programs, and policies that are not speculative; and are based upon known or reasonably foreseeable long-range plans, regulations, operating agreements, or other information that establishes them as reasonably foreseeable.

The cumulative effects analysis Alternatives 1 through 5 for Environmental Justice are summarized in Table 21.40.

Table 21.4 Summary of Cumulative Effects on Environmental Justice of Alternatives 1 through 5 as Compared to the No Action Alternative

Scenarios	Actions	Cumulative Effects of Actions
Past & Present, and Future Actions included in the No Action Alternative and in all Alternatives in Year 2030	Consistent with Affected Environment conditions plus: Actions in the 2008 USFWS BO and 2009 NMFS BO that Would Have Occurred without Implementation of the Biological Opinions, as described in Section 3.3.1.2 (of Chapter 3, Descriptions of Alternatives), including climate change and sea level rise Actions not included in the 2008 USFWS BO and 2009 NMFS BO that Would Have Occurred without Implementation of the Biological Opinions, as described in Section 3.3.1.3 (of Chapter 3, Descriptions of Alternatives): • Implementation of Federal and state policies and programs, including Clean Water Act (e.g., Total Maximum Daily Loads); Safe Drinking Water Act; Clean Air Act; and flood management programs • General plans for 2030. • Trinity River Restoration Program. • Central Valley Project Improvement Act programs • Folsom Dam Water Control Manual Update • FERC Relicensing for the Middle Fork of the American River Project • Lower Mokelumne River Spawning Habitat Improvement Project • Dutch Slough Tidal Marsh Restoration • Suisun Marsh Habitat Management, Preservation, and Restoration Plan Implementation • Tidal Wetland Restoration: Yolo Ranch, Northern Liberty Island Fish Restoration Project, Prospect Island Restoration Project, and Calhoun Cut/Lindsey Slough Tidal Habitat Restoration Project • San Joaquin River Restoration Program • Future water supply projects, including water recycling, desalination, groundwater banks and wellfields, and conveyance facilities (projects with completed environmental documents)	These effects would be the same in all alternatives. Climate change and sea level rise, development under the general plans, FERC relicensing projects, and some future projects to improve water quality and/or habitat are anticipated to reduce the availability of surface water, including CVP and SWP water supplies. This could result in increased groundwater withdrawals; and a portion of those groundwater pumps would rely upon diesel engines. Therefore, there would be an increased potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors that could cause a disproportionately high and adverse impact on minority and low-income populations. Mercury concentrations in fish tissue within the Delta will be either similar or greater than recent historical conditions because Phases 1 and 2 of the Delta Mercury Program would be completed by 2030, as mandated by the Central Valley RWQCB, including methylmercury control programs and reduction programs for total inorganic mercury. Due to the extent of these programs, it is anticipated that the programs would be initiated; however, future reductions in mercury sources and related reductions of mercury and methylmercury concentrations in fish tissue would actually occur after 2030.

Scenarios	Actions	Cumulative Effects of Actions
Future Actions considered as Cumulative Effects Actions in with all Alternatives in Year 2030	Actions as described in Section 3.5 (of Chapter 3, Descriptions of Alternatives): • Bay-Delta Water Quality Control Plan Update • FERC Relicensing Projects • Bay Delta Conservation Plan (including the California WaterFix alternative) • Shasta Lake Water Resources, North-of-the-Delta Offstream Storage, Los Vaqueros Reservoir Expansion Phase 2, and Upper San Joaquin River Basin Storage Investigations • El Dorado Water and Power Authority Supplemental Water Rights Project • Sacramento River Water Reliability Project • Semitropic Water Storage District Delta Wetlands • North Bay Aqueduct Alternative Intake • San Luis Reservoir Low Point Improvement Project • Future water supply projects, including water recycling, desalination, groundwater banks and wellfields, and conveyance facilities (projects that did not have completed environmental documents during preparation of the EIS)	These effects would be the same in all alternatives. Future reasonably foreseeable storage and water supply projects would improve surface water reliability. These actions would reduce the potential for increased groundwater withdrawals; and reduce the potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors that could cause a disproportionately high and adverse impact on minority and low-income populations.
No Action Alternative with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO	Climate change and sea level rise, FERC relicensing projects, and some future projects to improve water quality and/or habitat are anticipated to reduce the availability of surface water, including CVP and SWP water supplies. This could result in increased groundwater withdrawals; and a portion of those groundwater pumps would rely upon diesel engines. Therefore, there would be an increased potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors that could cause a disproportionately high and adverse impact on minority and low-income populations. Mercury concentrations in fish tissue within the Delta will be

Scenarios	Actions	Cumulative Effects of Actions
		either similar or greater than recent historical conditions because Phases 1 and 2 of the Delta Mercury Program would be completed by 2030, as mandated by the Central Valley RWQCB, including methylmercury control programs and reduction programs for total inorganic mercury. Due to the extent of these programs, it is anticipated that the programs would be initiated; however, future reductions in mercury sources and related reductions of mercury and methylmercury concentrations in fish tissue would actually occur after 2030.
Alternative 1 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant)	Implementation of Alternative 1 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with these added actions.
Alternative 2 with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO CVP and SWP operational actions No implementation of structural improvements or other actions that require further study to develop a more detailed action description.	Implementation of Alternative 2 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with these added actions.
Alternative 3 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant) Slight increase in positive Old and Middle River flows in the winter and spring months	Implementation of Alternative 3 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with these added actions.
Alternative 4 with Associated Cumulative Effects Actions in Year 2030	No implementation of the 2008 USFWS BO and 2009 NMFS BO actions unless the actions would have been implemented without the BO (e.g., Red Bluff Pumping Plant)	Implementation of Alternative 4 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with these added actions.
Alternative 5 with Associated Cumulative Effects Actions in Year 2030	Full implementation of the 2008 USFWS BO and 2009 NMFS BO Positive Old and Middle River flows and increased Delta outflow in spring months	Implementation of Alternative 5 with reasonably foreseeable actions would result in similar changes as under the No Action Alternative with these added actions.

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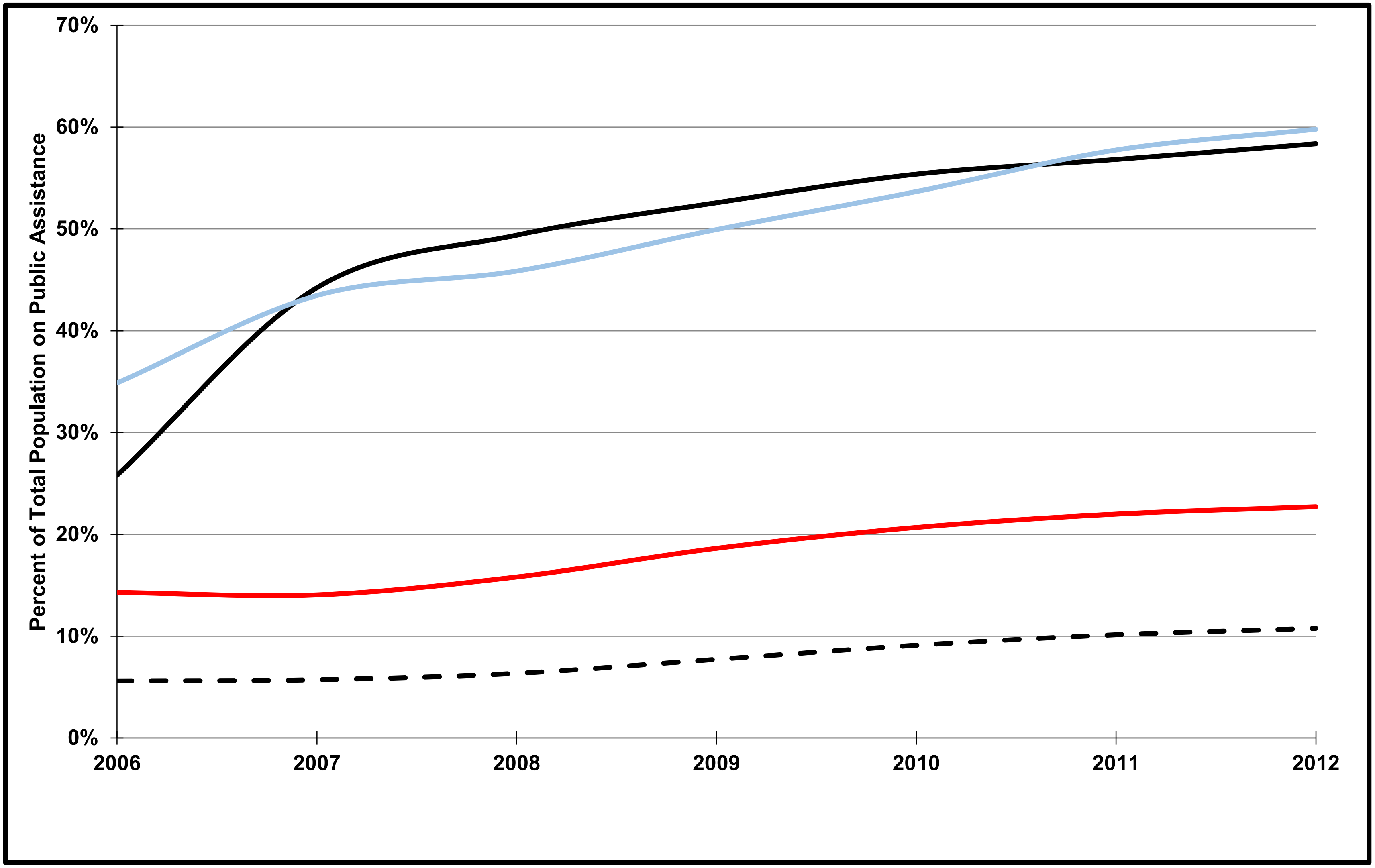

Figure 21.1 Population on CalFresh Program and CalWORKs Program in Huron and Mendota in 2006 through 2012

Source: CDSS 2008a –2008y, 2009a – 2009n, 2012a -2012a, 2013a – 2013i; Fresno County 2013

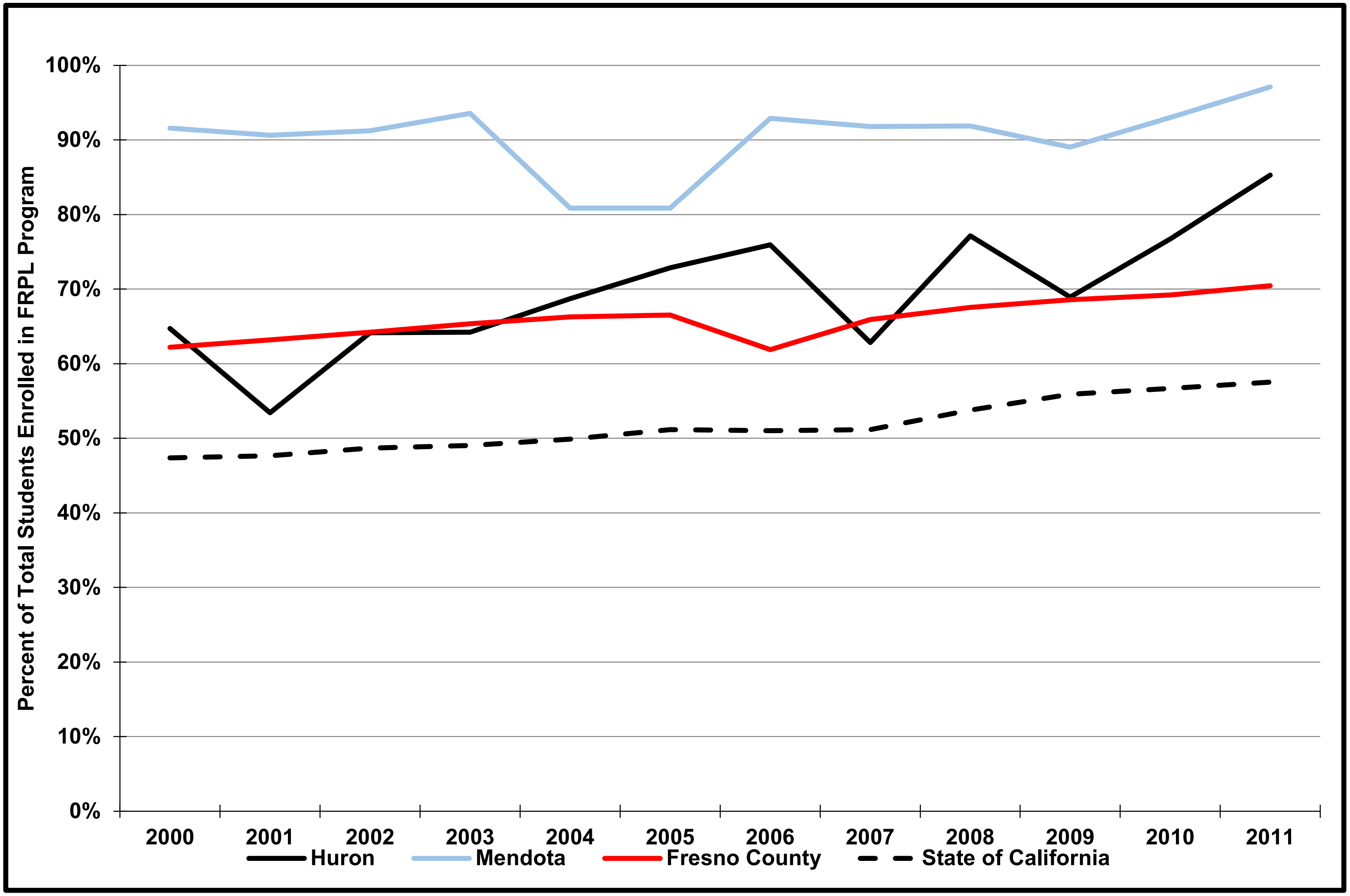

Figure 21.2 Enrollment in Free or Reduced Price Meals Program in Huron and Mendota in 2000 through 2011

Source: CDE 2013

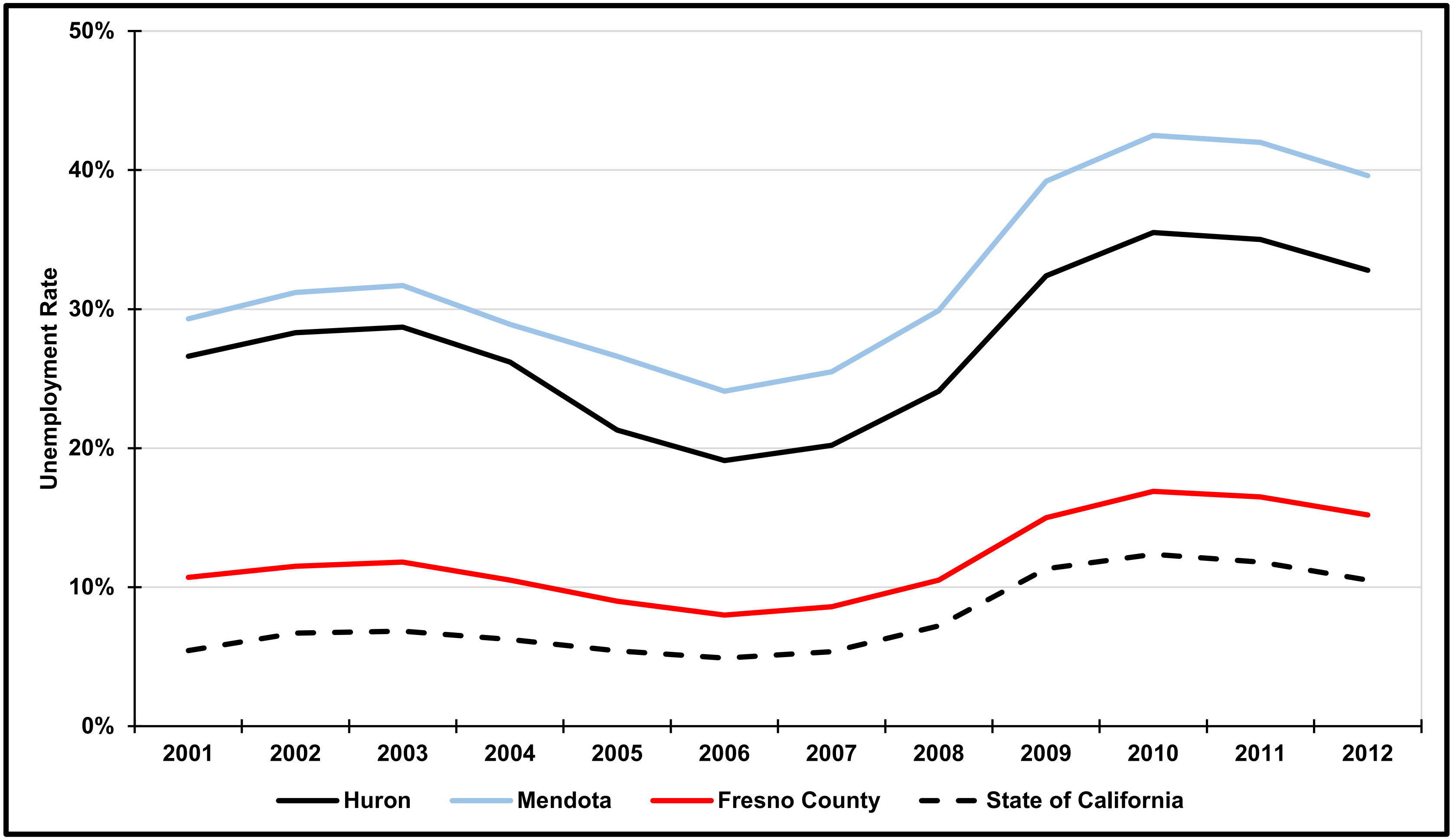

Figure 21.3 Unemployment in Huron and Mendota in 2001 through 2012

Source: BLS 2014; CEDD 2014

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Chapter 22

Other NEPA Requirements

22.1 Introduction

In addition to the factors described in Chapters 5 through 21, the National Environmental Policy Act (NEPA) requires consideration of the relationship of short-term uses and long-term productivity, consideration of irreversible and irretrievable commitments of resources, and growth-inducing impacts as compared to the No Action Alternative (40 Code of Federal Regulations [CFR] 1508.8). These considerations are described in the following sections of this chapter.

22.2 Relationship between Short-term Uses and Long-term Productivity

NEPA requires that an Environmental Impact Statement (EIS) prepared by Federal agencies disclose "…the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity…" (40 CFR 1502.16). As discussed in Chapter 1, Introduction, this EIS evaluates long-term potential direct, indirect, and cumulative impacts on the environment that could result from implementation of alternatives for the continued long-term operation of the Central Valley Project (CVP) and State Water Project (SWP) and implementation of ecosystem restoration. This EIS does not evaluate short-term impacts related to implementing project-specific actions, such as impacts during construction and/or start-up periods for actions that are not fully defined at this time and that may be implemented by Reclamation or other agencies as part of the alternatives. It is recognized that numerous projects would be planned, designed, and constructed under the No Action Alternative and the Second Basis of Comparison, including tidal wetlands and floodplain restoration, as described in Chapter 3, Description of Alternatives. It also recognized that facilities to implement fish passage at CVP reservoirs would be implemented under the No Action Alternative and Alternative 5; and facilities to implement a trap and haul program for steelhead from the San Joaquin River under Alternative 4. Project-specific construction impacts would be addressed in project-specific environmental documents prepared at the time the projects are proposed for approval. At this time, however, the need for, and the nature, magnitude, and extent of specific impacts are not known.

Potential long-term effects (beneficial and adverse) of implementation of Alternatives 1 through 5 as compared to the No Action Alternative with respect to each environmental resource are summarized in Table 22.1.

There would be no long-term effects related to geology and soils resources, agricultural resources, land use, cultural resources, and Indian Trust Assets because the conditions under Alternatives 1 through 5 would be similar to conditions under the No Action Alternative and to the Second Basis of Comparison.

A complete listing of the effects of implementation of Alternatives 1 through 5 as compared to the No Action Alternative and to the Second Basis of Comparison are included Chapter 3, Description of Alternatives.

Table 22.1 Long-term Effects of Implementation of the No Action Alternative and Alternatives 1 through 5

Environmental Resources	Comparison of Alternatives 1 through 5 and the No Action Alternative
Surface Water	
Trinity Lake	Water surface elevations similar in Alternatives 1 through 5 and the No Action Alternative. Storage under Alternatives 1, 3, and 4 is higher than under Alternatives 2 and 5 and the No Action Alternative.
Trinity River at Lewiston Dam	Flows similar or higher in November-December under Alternatives 1, 3, and 4 than under Alternatives 2 and 5 and the No Action Alternative. Similar flows in other months.
Shasta Lake	Water surface elevations similar in Alternatives 1 through 5 and the No Action Alternative. Storage under Alternatives 1, 3, and 4 is higher than under Alternatives 2 and 5 and the No Action Alternative.
Sacramento River at Keswick Dam	Flows similar or higher in December-August under Alternatives 1, 3, and 4 than under Alternatives 2 and 5 and the No Action Alternative. Flows higher in September-November under Alternatives 2 and 5 and the No Action Alternative than under Alternatives 1, 3, and 4.
Sacramento River at Freeport	Flows similar or higher under Alternatives 1 and 4 than under Alternative 3; and flows higher under Alternative 3 than under Alternatives 2 and 5 and the No Action Alternative in May-June. Flows higher in July-December under Alternatives 2 and 5 and the No Action Alternative than under Alternative 3; and flows higher under Alternative 3 than under Alternatives 1 and 4.
Clear Creek near Igo	Flows are similar under Alternatives 1 through 5 and the No Action Alternative in June-April. Flows under Alternatives 2 and 5 and the No Action Alternative are higher in May than under Alternatives 1, 3, and 4.
Lake Oroville	Water surface elevations similar in Alternatives 1 through 5 and the No Action Alternative. Storage under Alternatives 1, 3, and 4 is higher than under Alternatives 2 and 5 and the No Action Alternative.
Feather River downstream of Thermalito Complex	Flows under Alternatives 1, 3, and 4 similar or higher than under Alternatives 2 and 5 and the No Action Alternative.

Environmental Resources	Comparison of Alternatives 1 through 5 and the No Action Alternative
Folsom Lake	Water surface elevations similar in Alternatives 1 through 5 and the No Action Alternative. Storage under Alternatives 1, 3, and 4 is higher in October-January than under Alternatives 2 and 5 and the No Action Alternative. Storage under Alternatives 2 and 5 and the No Action Alternative are higher in August-September than under Alternatives 1, 3, and 4. Storage similar under February-July in Alternatives 1 through 5 and the No Action Alternative.
American River at Nimbus Dam	Flows under Alternatives 1, 3, and 4 similar or higher than under Alternatives 2 and 5 and the No Action Alternative.
New Melones Reservoir	Water surface elevations similar in Alternatives 1 through 5 and the No Action Alternative. Storage under Alternative 3 is higher than under Alternatives 1 and 4; and storage under Alternatives 1 and 4 are higher than under Alternatives 2 and 5 and the No Action Alternative.
Stanislaus River at Goodwin Dam	Flows higher under Alternatives 1 and 4 than under Alternative 3; and flows under Alternative 3 are higher than under Alternative 5 and the No Action Alternative. Flows under Alternative 5 higher than under the No Action Alternative in April-May.
San Joaquin River at Vernalis	Flows higher in October under the Alternatives 2 and 5 and the No Action Alternative than under Alternatives 1, 3, and 4. Flows higher in April under Alternative 5 than under all other alternatives. Flows higher in May under Alternatives 1 and 4 than under Alternatives 3 and 5 and the No Action Alternative. Flows similar during other months.
San Luis Reservoir	Water surface elevations similar in Alternatives 1 through 5 and the No Action Alternative. Storage under Alternatives 1 and 4 higher than under Alternative 3; and storage under Alternatives 2 and 5 and the No Action Alternative. Storage under Alternatives 2 and the No Action Alternative higher than under Alternative 5 in dry and critical dry years.
Flows into Yolo Bypass	Flows entering the Yolo Bypass at Fremont Weir higher under Alternatives 1, 3, and 4 than under Alternatives 2 and 5 and the No Action Alternative.
Delta Outflow	Delta outflow higher under Alternatives 2 and 5 and the No Action Alternative than under Alternatives 1, 3, and 4.
Reverse Flows in Old and Middle Rivers	Old and Middle River flows in April-May more positive under Alternative 5 than under Alternative 2 and the No Action Alternative. Old and Middle River flows in July more positive under Alternatives 1 and 4 than under Alternative 3; and under Alternative 3 than under Alternatives 2 and 5 and the No Action Alternative. Old and Middle River flows in other months higher under Alternatives 2 and 5 and the No Action Alternative than Alternative 3; and higher under Alternative 3 than under Alternatives 1 and 4.
Water Supplies	
Non-CVP and Non-SWP Deliveries	Water deliveries under Alternatives 1 through 5 and the No Action Alternative.
CVP Water Deliveries	Water deliveries higher under Alternatives 1 and 4 than under Alternative 3; and higher under Alternative 3 than under Alternatives 2 and 5 and the No Action Alternative.

Environmental Resources	Comparison of Alternatives 1 through 5 and the No Action Alternative
SWP Water Deliveries	Water deliveries higher under Alternatives 1 and 4 than under Alternative 3; and higher under Alternative 3 than under Alternatives 2 and 5 and the No Action Alternative.
Surface Water Quality	
Salinity in Northern Delta (near Emmaton)	Salinity in September-January under Alternatives 1, 3, and 4 than under Alternatives 2 and 5 and the No Action Alternative. Salinity in February-August under Alternatives 2 and 5 and the No Action Alternative higher than under Alternatives 1, 3, and 4.
Salinity in Western Delta (near Port Chicago)	Salinity in September-January under Alternatives 1, 3, and 4 than under Alternatives 2 and 5 and the No Action Alternative. Salinity in February-August under Alternatives 2 and 5 and the No Action Alternative higher than under Alternatives 1, 3, and 4.
Salinity in Western Central Delta (near Antioch)	Salinity in September-January under Alternatives 1, 3, and 4 than under Alternatives 2 and 5 and the No Action Alternative. Salinity in February-August under Alternatives 2 and 5 and the No Action Alternative higher than under Alternatives 1, 3, and 4.
Salinity in Western Central Delta (near Contra Costa Water District Intakes)	Salinity in September-January under Alternatives 1, 3, and 4 than under Alternatives 2 and 5 and the No Action Alternative. Salinity in February-August under Alternatives 2 and 5 and the No Action Alternative higher than under Alternatives 1, 3, and 4.
Salinity in Southern Delta (near CVP and SWP intakes)	Salinity under Alternatives 1 and 4 higher than under Alternative 3; and salinity under Alternative 3 higher than under Alternatives 2 and 5 and the No Action Alternative.
Mercury in Delta Fish	Mercury concentrations in fish tissue of large fish in the Delta used for human consumption would exceed guidelines established by the State of California under Alternatives 1 through 5 and the No Action Alternative. In the interior Delta along the San Joaquin River and at the CVP Contra Costa Canal Pumping Plant, mercury concentrations in the tissue of large fish used for human consumption would be the higher under Alternative 5 than under Alternative 3. Mercury under Alternative 3 would be higher than under Alternative 2 and the No Action Alternative. Mercury under Alternative 2 and the No Action Alternative would be higher than under Alternatives 1 and 4. Near Suisun Marsh and Cache Slough, mercury concentrations would be higher under Alternative 2 and the No Action Alternative than under Alternatives 1 and 4. Mercury under Alternatives 1 and 4 would be higher than under Alternative 5; and concentrations under Alternative 5 would be higher than under Alternative 3. Along Old River near Clifton Court, mercury concentrations in the tissue of large fish used for human consumption would be higher under Alternative 2 and the No Action Alternative than under Alternative 5. Mercury under Alternative 5 would be higher than under Alternative 3. Mercury under Alternative 3 would be higher than under Alternatives 1 and 4. Near the CVP Jones Pumping Plant intake, mercury concentrations in the tissue of large fish used for human consumption would be higher under Alternative 2 and the No Action Alternative than under Alternative 3. Mercury under Alternative 3 would be higher than under Alternatives 1 and 4. Mercury under Alternatives 1 and 4 would be higher than under Alternative 5.
Selenium in Delta and Delta Fish	Selenium concentrations similar under Alternatives 1 through 5 and the No Action Alternative.

Environmental Resources	Comparison of Alternatives 1 through 5 and the No Action Alternative
Groundwater Resources	
Trinity River Region	Similar groundwater conditions under Alternatives 1 through 5 and the No Action Alternative.
Central Valley Region: Sacramento Valley	Similar groundwater conditions under Alternatives 1 through 5 and the No Action Alternative.
Central Valley Region: San Joaquin Valley	Groundwater pumping would be higher under Alternative 5 than under Alternative 2 and the No Action Alternative. Pumping would be higher under Alternative 2 and the No Action Alternative than under Alternative 3. Pumping would be higher under Alternative 3 than under Alternatives 1 and 4. Increased groundwater pumping would result in lower groundwater elevations and increased subsidence potential.
San Francisco Bay Area, Central Coast, and Southern California Region	Groundwater pumping would be higher under Alternative 5 than under Alternative 2 and the No Action Alternative. Pumping would be higher under Alternative 2 and the No Action Alternative than under Alternative 3. Pumping would be higher under Alternative 3 than under Alternatives 1 and 4. Increased groundwater pumping would result in lower groundwater elevations and increased subsidence potential.
CVP and SWP Energy Resources	
Energy Generated and Used by CVP and SWP Water Users	CVP net energy generation would be higher under Alternative 2 and the No Action Alternative than under Alternatives 1 and 4. Net energy generation would be higher under Alternatives 1 and 4 than under Alternative 3. Net energy generation would be higher under Alternative 3 than under Alternative 5. SWP net energy generation would be higher under Alternative 2 and the No Action Alternative than under Alternative 5. Net energy generation would be higher under Alternative 5 than under Alternative 3. Net energy generation would be higher under Alternative 3 than under Alternatives 1 and 4. Energy use by CVP and SWP water users for alternative water supplies would be higher under Alternative 5 than under Alternative 2 and the No Action Alternative. Energy use would be higher under Alternative 2 and the No Action Alternative than under Alternative 3. Energy use would be higher under Alternative 3 than under Alternatives 1 and 4.
Aquatic Resources	
Trinity River: Coho Salmon	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Trinity River: Spring-run Chinook Salmon	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Trinity River: Fall-run Chinook Salmon	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Trinity River: Steelhead	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Trinity River: Green Sturgeon	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Trinity Lake and Lewiston Reservoir: Reservoir Fish	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Trinity River: Pacific Lamprey	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Trinity River: Eulachon	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.

Environmental Resources	Comparison of Alternatives 1 through 5 and the No Action Alternative
Sacramento River System: Winter-run Chinook Salmon	Habitat conditions would be better under Alternative 5 and the No Action Alternative than under Alternative 2. Conditions under Alternative 2 would be better than under Alternatives 3 and 4. Conditions under Alternative 3 and 4 would be better than under Alternative 1.
Sacramento River System: Spring-run Chinook Salmon	Habitat conditions would be better under Alternative 5 and the No Action Alternative than under Alternative 2. Conditions under Alternative 2 would be better than under Alternatives 3 and 4. Conditions under Alternative 3 and 4 would be better than under Alternative 1.
Sacramento River System: Fall-run Chinook Salmon	Habitat conditions under Alternatives 1, 3, 4, and 5 and the No Action Alternative would be better than under Alternative 2.
Sacramento River System: Late Fall-run Chinook Salmon	Habitat conditions under Alternatives 1, 3, 4, and 5 and the No Action Alternative would be better than under Alternative 2.
Sacramento River System: Steelhead	Habitat conditions would be better under Alternative 5 and the No Action Alternative than under Alternative 2. Conditions under Alternative 2 would be better than under Alternatives 3 and 4. Conditions under Alternative 3 and 4 would be better than under Alternative 1.
Sacramento River System: Green Sturgeon and White Sturgeon	Habitat conditions would be better under Alternative 3 than under Alternatives 1 and 4. Conditions under Alternative 4 would be better than under Alternatives 2 and 5 and the No Action Alternative.
Delta: Delta Smelt	Habitat conditions would better under Alternatives 2 and 5 and the No Action Alternative than under Alternatives 1, 3, and 4.
Delta: Longfin Smelt	Habitat conditions would better under Alternatives 2 and 5 and the No Action Alternative than under Alternatives 1, 3, and 4.
Delta: Sacramento Splittail	Habitat conditions would better under Alternatives 2 and 5 and the No Action Alternative than under Alternatives 1, 3, and 4.
Sacramento River System: Reservoir Fish	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Sacramento River System: Pacific Lamprey	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Sacramento River System: Striped Bass, American Shad, and Hardhead	Habitat conditions for Hardhead and American Shad would be similar under Alternatives 1 through 5 and the No Action Alternative. Habitat conditions for Striped Bass would better under Alternatives 1, 2, and 5 and the No Action Alternative than under Alternatives 3 and 4 due to increased harvest limits.
Stanislaus River: Fall-run Chinook Salmon	Habitat conditions better under Alternatives 3 and 4 than under Alternatives 1, 2, and 5 and the No Action Alternative.
Stanislaus River: Steelhead	Habitat conditions better under Alternative 5 and the No Action Alternative than under Alternatives 3 and 4. Conditions under Alternatives 3 and 4 are better than under Alternatives 1 and 2.
Stanislaus River: White Sturgeon	Habitat conditions better under Alternatives 2 and 5 and the No Action Alternative than under Alternatives 1, 3, and 4.
New Melones Reservoir; Reservoir Fish	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Stanislaus River: Other Fish	Habitat conditions for Hardhead and American Shad would be similar under Alternatives 1 through 5 and the No Action Alternative. Habitat conditions for Striped Bass would better under Alternatives 1, 2, and 5 and the No Action Alternative than under Alternatives 3 and 4 due to increased harvest limits.

Environmental Resources	Comparison of Alternatives 1 through 5 and the No Action Alternative
Pacific Ocean: Killer Whale	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Terrestrial Resources	
Terrestrial Resources along Shoreline of CVP and SWP Reservoirs	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Terrestrial Resources along Rivers Downstream of CVP and SWP Reservoirs	Habitat conditions along Trinity, Sacramento, American, and Feather rivers would be similar under Alternatives 1 through 5 and the No Action Alternative. Habitat conditions along the Stanislaus River would be better under Alternatives 2 and 5 and the No Action Alternative than under Alternatives 1, 3, and 4.
Terrestrial Resources in Yolo Bypass	Habitat conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Terrestrial Resources in Western Delta	Freshwater habitat in the western Delta would be better under Alternatives 2 and 5 and the No Action Alternative than under Alternatives 1, 3, and 4.
Geology and Soils Resources	
Geology and Soils Resources	Geology and soils conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Agricultural Resources	
Agricultural Production and Employment	Agricultural production and employment conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Land Use	
Municipal and Industrial Land Use	Municipal and industrial land use conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Visual Resources	
Visual Resources of Land Irrigated with CVP and SWP Water	Visual resource conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Visual Resources at Reservoirs that Store CVP and SWP Water	Visual resource conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Recreation Resources	
Recreation Resources at Reservoirs that Store CVP and SWP Water	Recreational resource conditions at the reservoirs would be similar under Alternatives 1 through 5 and the No Action Alternative.
Recreation Resources in Rivers downstream of CVP and SWP Reservoirs	Recreational resource conditions at the along the rivers would be similar under Alternatives 1 through 5 and the No Action Alternative. Recreational resource conditions related to Striped Bass fishing and sport ocean salmon fishing would be better under Alternatives 1, 2, and 5 and the No Action Alternative than under Alternatives 3 and 4 due to increased harvest limitations.

Environmental Resources	Comparison of Alternatives 1 through 5 and the No Action Alternative
Air Quality and Greenhouse Gas Emissions	
Emissions of Criteria Air Pollutants and Precursors and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants from Diesel Engines at Groundwater Wells	In the San Joaquin Valley and the San Francisco Bay Area, Central Coast, and Southern California regions, potential emissions from diesel engines used for groundwater pumping would be higher under Alternative 5 than under Alternative 2 and the No Action Alternative. Emissions would be higher under Alternative 2 and the No Action Alternative than under Alternative 3. Emissions would be higher under Alternative 3 than under Alternatives 1 and 4.
Increased Greenhouse Gas Emissions (GHG) due to Changes in Energy Resources Related to CVP and SWP Water Use	Overall changes are not known at this time due to complexity of energy demands associated with alternative water supplies. However, GHG emissions could increase due to energy use related to alternative water supplies. Energy use by CVP and SWP water users for alternative water supplies would be higher under Alternative 5 than under Alternative 2 and the No Action Alternative. Energy use would be higher under Alternative 2 and the No Action Alternative than under Alternative 3. Energy use would be higher under Alternative 3 than under Alternatives 1 and 4.
Cultural Resources	
Potential for Disturbance of Cultural Resources	Cultural resource conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Public Health	
Water Supply Availability for Wildland Firefighting	Water supply conditions for fighting wildland firefighting would be similar under Alternatives 1 through 5 and the No Action Alternative.
Potential Exposure to Mercury in Fish in Delta	Mercury concentrations in fish tissue of large fish in the Delta used for human consumption would exceed guidelines established by the State of California under Alternatives 1 through 5 and the No Action Alternative. In the interior Delta along the San Joaquin River and at the CVP Contra Costa Canal Pumping Plant, mercury concentrations in the tissue of large fish used for human consumption would be the higher under Alternative 5 than under Alternative 3. Mercury under Alternative 3 would be higher than under Alternative 2 and the No Action Alternative. Mercury under Alternative 2 and the No Action Alternative would be higher than under Alternatives 1 and 4. Near Suisun Marsh and Cache Slough, mercury concentrations would be higher under Alternative 2 and the No Action Alternative than under Alternatives 1 and 4. Mercury under Alternatives 1 and 4 would be higher than under Alternative 5; and concentrations under Alternative 5 would be higher than under Alternative 3. Along Old River near Clifton Court, mercury concentrations in the tissue of large fish used for human consumption would be higher under Alternative 2 and the No Action Alternative than under Alternative 5. Mercury under Alternative 5 would be higher than under Alternative 3. Mercury under Alternative 3 would be higher than under Alternatives 1 and 4. Near the CVP Jones Pumping Plant intake, mercury concentrations in the tissue of large fish used for human consumption would be higher under Alternative 2 and the No Action Alternative than under Alternative 3. Mercury under Alternative 3 would be higher than under Alternatives 1 and 4. Mercury under Alternatives 1 and 4 would be higher than under Alternative 5.
Socioeconomics	
Agricultural and Municipal and Industrial Employment	Agricultural, municipal, and industrial employment would be similar under Alternatives 1 through 5 and the No Action Alternative.

Environmental Resources	Comparison of Alternatives 1 through 5 and the No Action Alternative
Municipal and Industrial Water Supply Operating Expenses	Municipal and industrial water supply operating expenses would be similar under Alternatives 1 through 5 and the No Action Alternative.
Recreational Economics CVP and SWP Reservoirs	Recreational economic conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Recreational Economics Related to Striped Bass Fishing in Delta	Recreational economic conditions related to Striped Bass fishing would be better under Alternatives 1, 2, and 5 and the No Action Alternative than under Alternatives 3 and 4 due to changes in harvest limitations.
Commercial and Sport Ocean Salmon Fishing	Recreational economic conditions related to commercial and sport ocean salmon fishing would be better under Alternatives 1, 2, and 5 and the No Action Alternative than under Alternatives 3 and 4 due to changes in harvest limitations.
Indian Trust Assets	
Potential for Disturbance of Indian Trust Assets	Indian Trust Asset conditions would be similar under Alternatives 1 through 5 and the No Action Alternative.
Environmental Justice	
Emissions of Criteria Air Pollutants and Precursors and/or Exposure of Sensitive Receptors to Substantial Concentrations of Air Contaminants from Diesel Engines at Groundwater Wells	In the San Joaquin Valley, potential emissions from diesel engines used for groundwater pumping would be higher under Alternative 5 than under Alternative 2 and the No Action Alternative. Emissions would be higher under Alternative 2 and the No Action Alternative than under Alternative 3. Emissions would be higher under Alternative 3 than under Alternatives 1 and 4.
Potential Exposure to Mercury in Fish in Delta	Mercury concentrations in fish tissue of large fish in the Delta used for human consumption would exceed guidelines established by the State of California under Alternatives 1 through 5 and the No Action Alternative. In the interior Delta along the San Joaquin River and at the CVP Contra Costa Canal Pumping Plant, mercury concentrations in the tissue of large fish used for human consumption would be the higher under Alternative 5 than under Alternative 3. Mercury under Alternative 3 would be higher than under Alternative 2 and the No Action Alternative. Mercury under Alternative 2 and the No Action Alternative would be higher than under Alternatives 1 and 4. Near Suisun Marsh and Cache Slough, mercury concentrations would be higher under Alternative 2 and the No Action Alternative than under Alternatives 1 and 4. Mercury under Alternatives 1 and 4 would be higher than under Alternative 5; and concentrations under Alternative 5 would be higher than under Alternative 3. Along Old River near Clifton Court, mercury concentrations in the tissue of large fish used for human consumption would be higher under Alternative 2 and the No Action Alternative than under Alternative 5. Mercury under Alternative 5 would be higher than under Alternative 3. Mercury under Alternative 3 would be higher than under Alternatives 1 and 4. Near the CVP Jones Pumping Plant intake, mercury concentrations in the tissue of large fish used for human consumption would be higher under Alternative 2 and the No Action Alternative than under Alternative 3. Mercury under Alternative 3 would be higher than under Alternatives 1 and 4. Mercury under Alternatives 1 and 4 would be higher than under Alternative 5.

22.3 Irreversible and Irretrievable Commitments of Resources

NEPA requires that an EIS prepared by Federal agencies disclose "…any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented…" (40 CFR 1502.16). An irreversible and irretrievable commitment of resources includes use of natural or depletable resources, including consumption of construction materials and nonrenewable energy sources, and permanent conversion of land uses or habitat.

As described in Chapter 3, Description of Alternatives, there are several ongoing projects that are assumed to be implemented by 2030, such as Grasslands Bypass Project which is currently under construction. It is assumed that these projects would be included in the No Action Alternative, all other alternatives, and Second Basis of Comparison. The 2030 conditions assume the projected long-term conditions for each ongoing project as described in their respective environmental documents. This analysis does not address the construction activities of each ongoing project because those impacts were addressed in separate environmental documents for each project.

The alternatives include several future actions that would require construction, such as implementation of tidal wetlands and floodplains, fish passage facilities, or temperature control devices at CVP dams. Specific details for location and construction of these future projects are not identified at this time and are not addressed in this EIS. Future environmental documents would be prepared to analyze potential environmental consequences related to specific construction and operations. This EIS analyzes implementation of the alternatives with the assumption that these projects would be implemented by 2030; however, this EIS does not address irreversible and irretrievable commitment of resources associated with consumption of construction materials and permanent conversion of land uses or habitat.

Changes in nonrenewable energy resources would occur through implementation of the No Action Alternative and Alternatives 1 through 5. Under the alternatives, energy would be generated by CVP and SWP operations and used to convey water in CVP and SWP facilities. As discussed in Chapter 8, Energy, changes in CVP and SWP energy generation and use would result in the ability to provide additional energy for use by others or the need to purchase additional energy from others to operate the CVP and SWP facilities. Under both long-term average conditions and dry/critical dry water years, Alternative 5 would result in the least demand for electrical generation by others which would generally be produced using fossil fuels. The No Action Alternative and Alternative 2 would require more electrical generation by non-CVP and SWP facilities than Alternative 5; and less electrical generation than under Alternatives 1, 3, and 4. Alternative 1 would require the most electrical generation as compared to other alternatives.

22.4 Growth-Inducing Impacts

NEPA requires that an EIS prepared by Federal agencies evaluate indirect growth-inducing effects (40 CFR 1508.8). A project could result in growth-inducing impacts through several measures, including the removal of obstacles to population growth, or actions that encourage and facilitate other activities beyond those proposed by the project. The availability of adequate water supplies, employment opportunities, and improved cultural amenities are examples of actions that could be growth-inducing impacts. Growth inducement may or may not be detrimental, beneficial, or significant. However, if the induced growth impacted the environment, or the ability of agencies to provide public services to an extent not envisioned due to the project actions, the impacts would be considered to be adverse.

As described in Chapter 13, Land Use, and Chapter 19, Socioeconomics, land use and growth projections are not anticipated to change under Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison. Municipal and industrial water users that use CVP and SWP water have prepared Urban Water Management Plans (UWMPs) that project water demand and future water supplies to meet the demands by 2030, including water conservation measures. Projects that had undergone environmental review, were under design, or under construction were considered to exist in 2030 water supply assumptions in the No Action Alternative, Alternatives 1 through 5, and the Second Basis of Comparison. Future projects described in the UWMPs that are under evaluation are considered as options to increase fixed-yield supplies, including additional groundwater pumping, water transfers, recycling water treatment, and desalination water treatment. Existing and future water supplies considered for municipalities by 2030 are presented in Appendix 5B, Future Municipal Water Supplies for CVP and SWP Water Users. For smaller water users that are not addressed in a UWMP, information was obtained from water master plans and integrated regional water management plans. The analysis presented in Chapter 19, indicated that use of the existing and planned future projects would be adequate to meet the water demands in 2030 with or without the CVP and SWP water supply availability under the alternatives considered in this EIS.

Alternatives 1, 3, and 4 would result in higher CVP and SWP water deliveries than the No Action Alternative and Alternatives 2 and 5. However, the additional water supplies under Alternatives 1, 3, and 4 would result in less groundwater pumping and less water transfers which could result in less potential for groundwater overdraft and soil subsidence, and less potential impacts in the service area of the seller for the transfer water. None of the alternatives considered in this EIS would increase the total water supplies to meet 2030 water demands; and therefore, none of the alternatives considered in this EIS are considered to be growth inducing.

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Chapter 23

Consultation and Coordination

23.1 Introduction

This chapter summarizes completed, ongoing, and anticipated public outreach and agency involvement efforts related to preparation of the Environmental Impact Statement (EIS) for the coordinated long-term operation of the Central Valley Project (CVP) and State Water Project (SWP).

23.2 Consultation with the Public and Interested Parties

Consultation activities were initiated in 2012 with the scoping process and continued through the preparation of the Final EIS. In this section, the term "interested parties" includes representatives from agencies, utilities, agencies, organizations, and other entities.

23.2.1 Scoping Process

As described in Chapters 1 and 3, the scoping process was initiated on March 28, 2012, with the publication of the Notice of Intent (NOI) in the Federal Register and continued through June 28, 2012. Initially the public scoping process was to be completed on May 29, 2012. During the public scoping process, other agencies and interested persons requested an extension of the public scoping process to allow additional opportunities to provide scoping comments. In response to these requests, U.S. Department of the Interior, Bureau of Reclamation (Reclamation) published a notice on May 25, 2012, to extend the public scoping period through June 28, 2012.

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 the following locations and resulted in the following level of public participation:

- Madera, California on April 25, 2012 (6 participants)
- Diamond Bar, California on April 26, 2012 (3 participants)
- Sacramento, California on May 2, 2012 (15 participants)
- Marysville, California on May 3, 2012 (2 participants)
- Los Banos, California on May 22, 2012 (230 participants)

Reclamation posted the scoping notices in the Federal Register, on its website, and in newspapers that served areas where the scoping meetings were held. Reclamation also published press releases to news organizations and others that have requested notifications for all press releases.

Each participant in the scoping meetings was invited to sign an attendance sheet and provided with an agenda, fact sheet, comment card, and speaker card. The agenda, fact sheet, and comment card were available in both English and Spanish.

Each scoping meeting began with a presentation by Reclamation. The presentation described the purpose of the meeting and the public scoping process, an overview of the reasons that Reclamation was preparing the EIS, description of the process and schedule that Reclamation will use to complete the EIS, and methods to provide comments at the scoping meeting and subsequently until the end of the public scoping period. The participants were encouraged to submit written comments by mail, email, or fax until the close of the public scoping comment period. During the presentation, Reclamation responded to questions as they arose from the meeting participants. Following the presentation, Reclamation heard testimony from those who presented oral comments. Oral comments were recorded by a transcriber. Reclamation offered to provide Spanish translation of the presentation and oral comments at each scoping meeting; however, the translation service was only requested and provided at the scoping meeting in Los Banos, California.

The scoping comments included suggestions related to:

- Purpose and need for the action.
- Geographical extent of the Project Area.
- Definition and assumptions of the No Action Alternative.
- Definition and assumptions of the action alternatives.
- Important considerations either for description of the affected environment or for the methods of analyses for the following resources:
  - Water resources.
  - Biological resources.
  - Land use and socioeconomics.
  - Air quality.
  - Recreation and visual resources.

Scoping comments were used in the development of a reasonable range of alternatives and identification of key issues that would require analysis in the Environmental Consequences sections of this EIS, as described in Chapters 3.

Scoping comments also were used in development of the level of detail and methods of analyses for water resources, biological resources, land use, socioeconomics, recreation, air quality, and visual resources. These resources are discussed in Chapters 5 through 10, 12 through 17, and 19 through 21.

Reclamation also posted on its website an initial range of alternatives discussed at the meeting on October 19, 2012 of invited stakeholders. As described in Chapter 3, Description of Alternatives, comments received during that process were used to refine the description of the alternatives.

Project status meetings were held with cooperating agencies and other stakeholders during preparation of the Draft EIS, including meetings in Sacramento, California on January 16, May 29, and November 5, 2014; February 20, 2015; and June 24, 2015.

The scoping report is included in Appendix 23A, Scoping Report.

23.2.2 Other Activities

Reclamation established a website which includes the background material related to the purpose and need for the action, materials used in the scoping process, scoping comments, and information related to meetings with invited stakeholders and interest groups to discuss assumptions to be considered in the development of the No Action Alternative and action alternatives. As described in Chapter 3, comments received on the information posted on Reclamation's website during that process were used to refine the description of the alternatives.

23.2.3 Stakeholder and Public Involvement during Preparation of the Final EIS

The Draft EIS was published for public review in July 2015. The Notice of Availability was published by Reclamation in the Federal Register on July 31, 2015 (Federal Register, Vol 80, No. 147, 45681). A copy of the Notice of Availability is included in Appendix 23B, Public Review of Draft Environmental Impact Statement.

Newspaper advertisements providing the dates and locations of the public meetings for the Draft EIS were published in the following newspapers on the specified dates.

- Sacramento Bee, Sacramento, California – August 26, 2015
- Oakland Tribune, Oakland, California – August 26, 2015
- San Jose Mercury, San Jose, California – August 26, 2015
- Contra Costa Times, Walnut Creek, California – August 26, 2015
- Record Searchlight, Redding, California – August 27, 2015
- Los Banos Enterprise, Los Banos, California – August 28, 2015
- Fresno Bee, Fresno, California – September 1, 2015
- Los Angeles Times, California – September 3, 2015

The distribution list for the Draft EIS is included in Chapter 24, Environmental Impact Statement Distribution List. Reclamation posted notification of the availability of the Draft EIS and the location and timing of public meetings on its website and through press releases.

Four public meetings were held during the public review period for the Draft EIS in the following locations, with the following level of public participation:

- Sacramento, California on September 9, 2015 (9 participants)
- Red Bluff, California on September 10, 2015 (9 participants)
- Los Banos, California on Tuesday, September 15, 2015 (9 participants)
- Irvine, California on September 17, 2015 (2 participants)

The public meetings included an open house preceding a presentation by Reclamation. The open house portion of the meetings included several project information stations staffed by project team members available to respond to attendee's questions. The open house stations included:

- Welcome Station with display boards that described the public meeting format
- Purpose and Need of the Project
- Surface Water and Groundwater Resources
- Aquatic, Wildlife, and Botanical Resources
- Socioeconomics
- Comments with a court reporter to record verbal comments

Fact sheets were provided at each of the open house stations.

Following the open house portion of the public meeting, Reclamation staff led a brief presentation. The open house portion of the public meeting was resumed after the presentation.

Copies of the display boards, fact sheets, and the presentation are included in Appendix 23B, Public Review of Draft Environmental Impact Statement.

Only attendees at the meeting in Red Bluff chose to provide verbal comments to the court reporter. The transcript of those comments also is included in Appendix 23B. Responses to those comments are included in Appendix 1E.

Approximately 860 written and verbal comments were received on the Draft EIS. All of the comments received on the Draft EIS were considered in preparation of the Final EIS. Written responses to all substantial comments received are included in Appendices 1A through 1E of the Final EIS.

23.3 Consultation with U.S. Fish and Wildlife Service and National Marine Fisheries Service

As described in Chapter 1, federal agencies also have an obligation pursuant to the Endangered Species Act (ESA) to "…ensure that any discretionary action authorized, funded, or carried out by such an agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification…" of such species' designated "critical habitat," "…unless such agency has been granted an exemption for such action…" by the Endangered Species Committee which the ESA creates (16 United States Code (U.S.C.) section 1536 (a)(2). A discretionary agency action jeopardizes the continued existence of a listed species if it "reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 Code of Federal Regulations [CFR] section 402.02). Such action results in the destruction or adverse modification of designated critical habitat if there is "… a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species" (50 CFR section 402.02).

In carrying out its obligations, Reclamation must consult with the appropriate regulatory agency or agencies (e.g., U.S. Fish and Wildlife Service [USFWS] and National Marine Fisheries Service [NMFS]). At the conclusion of this consultation process, those agencies render written statements (known as biological opinions) setting forth their opinion as to how an action being proposed by Reclamation would affect a listed species and its designated critical habitat. If these agencies conclude that an action will jeopardize the continued existence of a listed species or result in the destruction or adverse modification of their designated critical habitat, then they must suggest a reasonable and prudent alternative to the action being proposed by Reclamation.

Pursuant to ESA Section 7(a)(1), Reclamation also considers which it could take under its existing authorities to benefit listed species. However, Section 7(a)(1) does not give Reclamation additional authority to undertake any particular action, regardless of its potential benefit for threatened and endangered species.

The Fish and Wildlife Coordination Act requires that Reclamation consult with fish and wildlife agencies (federal and state) on all water development projects that could affect biological resources. As part of this project, Reclamation has been in continuous consultation with USFWS and NMFS. This continuous consultation also satisfies any applicable requirements of the Fish and Wildlife Coordination Act.

23.4 Consultation with Cooperating Agencies and Other Entities

In accordance with requirements of the National Environmental Policy Act (NEPA), Reclamation invited eligible governmental agencies to participate as a cooperating agency. The federal cooperating agencies include the USFWS, NMFS, U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers (USACE), and Bureau of Indian Affairs (BIA).

Reclamation also provided non-federal agencies with the opportunity to participate in the NEPA process if they qualified under NEPA (as described above) as a cooperating agency. In August of 2012, Reclamation mailed invitations to 747 non-federal entities to be cooperating agencies for this EIS, including:

- California Department of Water Resources

- State Water Resources Control Board
- California Department of Fish and Wildlife
- Agencies that have contracts with the CVP or SWP for water delivery, water service repayment, exchange or settlement, or use of CVP or SWP facilities for conveyance
- State and Federal Contractors Water Agency
- Cities and counties within the CVP and SWP service areas
- Federally-recognized tribes within the CVP and SWP service area or areas affected by CVP or SWP operations

Non-federal entities that meet the specified criteria for cooperating agencies are required to enter into a Memorandum of Understanding (MOU) with Reclamation to memorialize their participation as a cooperating agency.

Reclamation has signed cooperating agency MOUs with the following entities:

- Anderson-Cottonwood Irrigation District
- California Department of Water Resources
- California Valley Miwok Tribe
- City of Hesperia
- Contra Costa Water District
- Friant Water Authority
- Glenn-Colusa Irrigation District
- Metropolitan Water District of Southern California
- Oakdale Irrigation District
- Reclamation District 108
- San Diego County Water Authority
- San Juan Water District
- San Luis & Delta-Mendota Water Authority
- Stockton East Water District
- Sutter Mutual Water District
- Tehama Colusa Canal Authority
- Zone 7 Water Agency

These agencies have participated in preliminary review of written materials that were used to prepare this Draft EIS.

Reclamation also received a request from an interested party to include the Federal Emergency Management Agency (FEMA) as a cooperating agency. However, Reclamation concluded that FEMA does not have special expertise related to environmental issue that would not be addressed by other cooperating federal agencies.

Reclamation also received a request from the State Water Contractors, a non-profit association of 27 public agencies from northern, central, and southern California that purchase water under contract from the SWP (SWC 2015).

However, Reclamation concluded that the State Water Contractors was not a public agency; and therefore, could not be cooperating agency. However, this group and several other non-profit groups (including the Natural Resources Defense Council and The Bay Institute) have participated in preliminary review of written materials that were used to prepare this Draft EIS.

23.5 Consultation with Other Federal, State, and Local Agencies

This EIS was prepared in accordance with policies and regulations adopted by federal and state agencies. Brief discussions of relevant policies and regulations for each resource are included in Appendix 4A, Federal and State Policies and Regulations. Reclamation considered the requirements of these policies and regulations during preparation of the EIS and consultation with the related agencies, including the major regulations summarized below.

23.5.1 Federal Water Pollution Control Act Amendments of 1972 (Clean Water Act)

The Federal Water Pollution Control Act Amendments of 1972, also known as the Clean Water Act (CWA), established the institutional structure for the U.S. Environmental Protection Agency (USEPA) to regulate discharges of pollutants into the waters of the United States, establish water quality standards, conduct planning studies, and provide funding for specific grant projects. The Clean Water Act was further amended through the Clean Water Act of 1977 and the Water Quality Act of 1987. The California State Water Resources Control Board (SWRCB) has been designated by the USEPA along with the nine Regional Water Quality Control Boards (RWQCBs) to develop and enforce water quality objectives and implementation plans in California. The provisions of the Clean Water Act which affect water resources in the project area are described below.

- Section 401 of the Clean Water Act requires water discharges into navigable waters of the United States to apply for a Federal license or permit and to certify that the discharge will be in compliance with specified provisions of the Clean Water Act. Federal permits that are issued related to disturbance of waters of the United States (such as streams and wetlands) also require a Water Quality Certification in accordance with Clean Water Act section 401.

- Section 402 established the National Pollutant Discharge Elimination System (NPDES) permit program to regulate point source and non-point source discharges of pollutants into waters of the United States. An NPDES permit sets specific discharge limits for point and non-point sources discharging pollutants into waters of the United States and establishes monitoring and reporting requirements. The NPDES permits are issued for long-term discharges, including discharges from treatment plants, and temporary discharges, such as discharges during construction activities (e.g., General Permit for Storm Water Discharges Associated with Construction Activities).

- Section 404 requires the U.S. Army Corps of Engineers (USACE) to issue permits for discharge of dredge or fill material into navigable waters, their tributaries, and associated wetlands. Activities regulated by 404 permits include, but are not limited to, dredging, bridge construction, flood control actions, and some fishing operations.
- Section 303 requires preparation of basins plans. The SWRCB has approved water quality control plans (basin plans) for each watershed basin in the State. The basin plans designate the beneficial uses of waters within each watershed basin, and water quality objectives designed to protect those uses pursuant to Section 303 of the Clean Water Act. The beneficial uses together with the water quality objectives that are contained in the basin plans constitute State water quality standards.
- Under the CWA section 303(d), the SWRCB and USEPA identifies and ranks water bodies for which existing pollution controls are insufficient to attain or maintain water quality standards based upon information prepared by all states, territories, and authorized Indian tribes. Each state must establish priority rankings and develop Total Maximum Daily Loads (TMDLs) for all impaired waters. TMDLs calculate the greatest pollutant load that a waterbody can receive and still meet water quality standards and designated beneficial uses.

23.5.2 Rivers and Harbors Act

The navigable waters of the United States in the Study Area, including the major rivers in Sacramento and San Joaquin rivers watersheds and waterways in these watersheds affected by tidal action, are subject to the requirements of the Rivers and Harbors Act. “Navigable waters of the United States” are defined as those waters subject to the ebb and flow of the tide shoreward to the mean high-water mark or those that are used, have been used in the past, or may be susceptible to use in interstate or foreign commerce. Sections 9 and 10 of the River and Harbors Act are applicable to the coordinated long-term operation of the CVP and SWP.

Under the reauthorization of the Rivers and Harbor Act of 1937, Reclamation took responsibility for the operation of the CVP.

23.5.2.1 Section 9 of the Rivers and Harbors Act

Section 9 of the Rivers and Harbors Act prohibits construction of any dike or dam across any navigable waters without approvals from the Chief of Engineers and the Secretary of the Army.

23.5.2.2 Section 10 of the Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act of 1899 prohibits alterations of any navigable waters, including construction of structures in, over, or under; excavation of material from; and deposition of material into navigable waters of the United States without permission from the USACE. The approval process generally is completed simultaneously with the approval process under the Clean Water Act Section 404.

23.5.3 Federal Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) protects public health by regulating the nation's public drinking water supply. The SDWA authorizes USEPA to set national health-based standards for drinking water to protect against both naturally occurring and human-made contaminants that may be found in drinking water and its sources, including rivers, lakes, reservoirs, springs, and groundwater wells.

23.5.4 Wild and Scenic Rivers Act

Congress created the National Wild and Scenic Rivers Act in 1968 (Public Law 90-542; USC 1271 et seq.) to preserve rivers and outstanding natural, cultural, or recreational features in a free-flowing condition. High priority is place on visual resource management of these rivers to preserve or restore their scenic characteristics. Under this act, a Federal agency may not assist the construction of a water resources project that would have a direct and adverse effect on the free-flowing, scenic, and natural values of a wild or scenic river. If the project would affect the free-flowing characteristics of a designated river or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the area, such activities should be undertaken in a manner that would minimize adverse impacts and should be developed in consultation with the National Park Service.

Within the study area, the following portions of the rivers have been designated as Wild and Scenic Rivers.

- The Klamath River from the confluence with the Trinity River to the Pacific Ocean was designated to be part of the National Wild and Scenic Rivers System on January 19, 1981.
- The Middle Fork Feather River (from Beckwourth downstream of Lake Davis to Lake Oroville) was designated to be part of the National Wild and Scenic Rivers System on October 2, 1968.
- The American River between Nimbus Dam and the confluence with the Sacramento River was designated to be part of the National Wild and Scenic Rivers System on January 19, 1981.

23.5.5 Fish and Wildlife Coordination Act (16 USC Section 651 et seq.)

The Fish and Wildlife Coordination Act, as amended in 1964, was enacted to protect fish and wildlife when federal actions result in the control or modification of a natural stream or body of water. The statute requires federal agencies to take into consideration the effect that water-related projects would have on fish and wildlife resources. Consultation and coordination with USFWS and State fish and game agencies are required to address ways to prevent loss of and damage to fish and wildlife resources and to further develop and improve these resources.

23.5.6 Marine Mammal Protection Act (16 USC 1361-1421h)

The Marine Mammal Protection Act (MMPA) was enacted in 1972. All marine mammals are protected under the MMPA. The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. It defines "take" to mean "to hunt harass, capture, or kill" any marine mammal or attempt to do so. Exceptions to the moratorium can be made through permitting actions for take incidental to commercial fishing and other nonfishing activities; for scientific research; and for public display at licensed institutions such as aquaria and science centers.

23.5.7 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) implements a series of international treaties that provide migratory bird protection. The MBTA authorizes the Secretary of the Interior to regulate the taking of migratory birds, and the act provides that it shall be unlawful, except as permitted by regulations, "to pursue, take, or kill any migratory bird, or any part, nest or egg of any such bird" (16 USC section 703). This prohibition includes both direct and indirect acts, although harassment and habitat modification are not included unless they result in direct loss of birds, nests, or eggs. The current list of species protected by the MBTA was published in the March 10, 2010 *Federal Register* (*Federal Register*, Volume 75, page 9282 [75 FR 9282]).

23.5.8 Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds

Executive Order 13186 (January 10, 2001) directs federal agencies that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement a Memorandum of Understanding with USFWS to promote the conservation of migratory bird populations. The Memorandum of Understanding should include implementation actions and reporting procedures that would be followed through each agency's formal planning process, such as resource management plans and fisheries management plans.

23.5.9 Executive Order 11990: Protection of Wetlands

Executive Order 11990 (May 24, 1977) established the protection of wetlands and riparian systems as the official policy of the federal government. It requires all federal agencies to consider wetland protection as an important part of their policies and take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.

23.5.10 Federal Clean Air Act

National air quality policies are regulated through the Federal Clean Air Act (FCAA) of 1970 and its 1977 and 1990 amendments. Basic elements of the FCAA include national ambient air quality standards for criteria air pollutants, hazardous air pollutants standards, state attainment plans, motor vehicle emissions standards, stationary source emissions standards and permits, acid rain control measures, stratospheric ozone protection, and enforcement provisions.

23.5.11 National Historic Preservation Act of 1966

Section 106 of the NHPA and its implementing regulations (36 Code of Federal Regulations (CFR) Part 800) require Federal agencies to consider the effects of their undertakings on cultural resources that are, or that may be, eligible for listing in the National Register of Historic Places (NRHP) and to afford the Advisory Council on Historic Preservation an opportunity to comment. NRHP-eligible resources are considered to be "significant." The criteria used to evaluate eligibility for listing on the NRHP are further discussed in the next subsection.

The Section 106 process that is typically associated with NEPA compliance requires consultation of the federal lead agency with other federal, state, and local agencies, the Advisory Council on Historic Preservation, the State Historic Preservation Officer (SHPO), Indian tribes, and interested members of the public, such as historical societies. Throughout the Section 106 process, the federal lead agency and consulting parties work together to identify adverse impacts on sites of cultural significance or historic properties, and seek ways to avoid, minimize, or mitigate the adverse effects. A Memorandum of Agreement or Programmatic Agreement is issued by the participating parties that includes the measures agreed upon to avoid or reduce (i.e., mitigate) adverse effects. For large or complex undertakings, a Programmatic Agreement may also be negotiated to develop a phased approach to historic properties management or alternative Section 106 processes through consultations. Thus, impacts to cultural resources that are identified in a NEPA document are addressed through Section 106.

Section 110 of the NHPA sets out the broad responsibilities of Federal agencies for identifying and protecting historic properties under their jurisdiction, and for avoiding unnecessary damage to them. It is intended to ensure that an historic preservation program is fully integrated into the ongoing program of each Federal agency. Section 110 allows the costs of preservation activities as eligible project costs in all undertakings conducted or assisted by a Federal agency. Federal agencies are directed to withhold grants, licenses, approvals, or other assistance to applicants who intentionally damage or adversely affect historic properties in an effort to avoid the Section 106 process.

23.5.12 American Indian Religious Freedom Act

The American Indian Religious Freedom Act of 1978 protects the rights of Native Americans to freedom of expression of traditional religions (24 U.S. Code section 1996). This act established "the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions…including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites."

23.5.13 Indian Sacred Sites on Federal Land

Executive Order 13007 provides that in managing Federal lands, each Federal agency with statutory or administrative responsibility for management of Federal lands shall, to the extent practicable and as permitted by law, accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, and avoid adversely affecting the physical integrity of such sacred sites.

23.6 Consultation with Tribal Governments

Consistent with President Clinton's April 29, 1994 Memorandum and President Obama's November 5, 2009 Memorandum, Reclamation contacted federally-recognized tribal governments to participate in preparation of this EIS. Reclamation met with the California Valley Miwok Tribe in 2012 and the Miwok Maidu United Auburn Indian Community of the Auburn Rancheria in 2013.

Reclamation will continue to consult with each tribe on a government-to-government basis before taking any action that could affect a tribal government. Under the Federal Trust responsibility, Reclamation will provide full disclosure of the beneficial and adverse impacts of a project to the tribal government in a manner that provides adequate time for review and response. Reclamation will review comments received and consult with the tribal government prior to decisions related to a project.

Tribes and Indian Trust Assets were considered during preparation of this EIS, in accordance with environmental justice considerations identified in Executive Order 12898 (February 11, 1994), as summarized in Chapter 20, Indian Trust Assets, and Chapter 21, Environmental Justice.

23.7 References

SWC (State Water Contractors). 2015. "State Water Contractors – About Us." Site accessed June 23, 2015. http://www.swc.org/about-us

Chapter 24

Environmental Impact Statement Distribution List

This chapter provides locations where the Draft and Final Environmental Impact Statement (EIS) are available for review and a list of governmental entities, organizations, and interested parties that received copies of this EIS.

24.1 Document Availability

The public distribution of this Draft and Final EIS emphasizes the use of electronic media to ensure cost-effective, broad availability to the public and interested parties. The Draft and Final EIS are available on the Internet at Reclamation's website.

Printed copies of the Draft and Final EIS are available for review at the following locations.

U.S. Department of the Interior, Bureau of Reclamation Library
2800 Cottage Way
Sacramento, CA 95825

U.S. Department of the Interior, Bureau of Reclamation, Bay-Delta Office
801 I Street, Suite 140
Sacramento, CA 95814

Electronic copies of the Draft and Final EIS are available on compact disc for viewing at the following libraries.

Alameda County Library
1247 Marin Avenue
Albany CA 94706

Alameda County Library
200 Civic Plaza
Dublin CA 94568

Alameda County Library
6300 Civic Terrace Avenue
Newark CA 94560

Butte County Library
1108 Sherman Avenue
Chico CA 95926

Colusa County Free Library
738 Market Street
Colusa CA 95932

Contra Costa County Library
501 W. 18th Street
Antioch CA 94509

Contra Costa County Library
104 Oak Street
Brentwood CA 94513

Contra Costa County Library
1050 Neroly Road
Oakley CA 94561

Contra Costa County Library
80 Power Avenue
Pittsburg CA 94565

Contra Costa County Library
1750 Oak Park Boulevard
Pleasant Hill CA 94523

El Dorado County Library
345 Fair Lane
Placerville CA 95667

Fresno County Library
2420 Mariposa Street
Fresno CA 93721

Glenn County Library
201 North Lassen Street
Willows CA 95988

Kern County Library
701 Truxton Avenue
Bakersfield CA 93301

Kings County - Hanford Branch Library
401 N Douty Street
Hanford CA 93230

Los Angeles County Central Library
630 West 5th Street
Los Angeles CA 90071

Madera County Library
121 North G Street
Madera CA 95637

Merced County Library
2100 O Street
Merced CA 95340

Napa County Library
580 Coombs Street
Napa CA 94559

Orange County Library
11200 Stanford Avenue
Garden Grove CA 92840

Placer County Library
350 Nevada Street
Auburn CA 95603

Plumas County Library
445 Jackson Street
Quincy CA 95970

Riverside County Library
5840 Mission Boulevard
Riverside CA 92509

Sacramento County Library
170 Primasing Avenue
Courtland CA 95615

Sacramento County Library
8900 Elk Grove Boulevard
Elk Grove CA 95624

Sacramento County Library
412 Union Street
Isleton CA 95641

Sacramento Central Library
828 I Street
Sacramento CA 95814

Santa Barbara County Library
40 E Anapamu Street
Santa Barbara CA 93101

San Benito County Library
470 5th Street
Hollister CA 95023

San Bernardino County Library - Norman Feldheym Central Library
555 W 6th Street
San Bernardino CA 92410

San Diego County Public Library
330 Park Boulevard
San Diego CA 92101

San Joaquin County - Escalon Branch Library
1540 2nd Street
Escalon CA 95320

San Joaquin County - Lathrop Branch Library
450 Spartan Way
Lathrop CA 95330

San Joaquin County - Manteca Public Library
320 W Center Street
Manteca CA 95336

San Joaquin County - Margaret K Troke Branch Library
502 W Benjamin Holt Drive
Stockton CA 95207

San Joaquin County - Cesar Chavez Central Library
605 N El Dorado Street
Stockton CA 95202

San Joaquin County - Tracy Branch Library
20 E Eaton Avenue
Tracy CA 95376

San Luis Obispo County Library
995 Palm Street
San Luis Obispo CA 93403

Santa Clara County - Cupertino Library
10800 Torre Avenue
Cupertino CA 95014

Santa Clara County - Milpitas Library
160 N Main Street
Milpitas CA 95035

Shasta County - Redding Public Library
1100 Parkview Avenue
Redding CA 96001

Solano County - Fairfield Civic Center Library
1150 Kentucky Street
Fairfield CA 94533

Solano County Fairfield Cordelia Library
5050 Business Center Drive
Fairfield CA 94534

Solano County - John F Kennedy Library
505 Santa Clara Street
Vallejo CA 94590

Solano County - Springstowne Library
1003 Oakwood Avenue
Vallejo CA 94591

Solano County - Vacaville Public Library
1 Town Square Place
Vacaville CA 95688

Solano County - Vacaville Public Library
1020 Ulatis Drive
Vacaville CA 95687

Solano County - Rio Vista Library
44 S 2nd Street
Rio Vista CA 94571

Solano County - Suisun City Library
601 Pintail Drive
Suisun City CA 94585

Stanislaus County Library
1500 I Street
Modesto CA 95354

Sutter County Library
750 Forbes Avenue
Yuba City CA 95991

Tehama County Library
645 Madison Street
Red Bluff CA 96080

Trinity County Library
351 N Main Street
Weaverville CA 96093

Tulare County Library
200 W Oak Avenue
Visalia CA 93291

Ventura County - Ojai Library
111 E Ojai Avenue
Ojai CA 93023

Ventura County - E P Foster Library
651 E Main Street
Ventura CA 93001

Ventura County - Oak Park Library
899 Kanan Road
Oak Park CA 91377

Yolo County - Clarksburg Branch Library
52915 Netherlands Road
Clarksburg CA 95612

Yolo County - Mary L Stephens Davis Branch Library
315 E 14th Street
Davis CA 95616

Yolo County - Winters Branch Library
708 Railroad Avenue
Winters CA 95694

Yolo County Library
250 1st Street
Woodland CA 95695

Yolo County Branch Library
37750 Sacramento Street
Yolo CA 95697

24.2 Agencies and Organizations Receiving Copies of the Draft Environmental Impact Statement

All persons, agencies, and organizations listed in this chapter have been informed of the availability of and locations to obtain the Draft and Final EIS. Parties listed below have received an electronic copy on a compact disc of the Draft and Final EIS.

24.2.1 Federal Agencies

- Bureau of Indian Affairs
- National Marine Fisheries Service
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- Western Area Power Administration

24.2.2 Tribal Interests

- California Valley Miwok Tribe
- United Auburn Indian Community

24.2.3 State Agencies

- California Department of Fish & Wildlife
- California Department of Water Resources
- Delta Stewardship Council

24.2.4 Regional and Local Entities

- Alameda County Zone 7

- Anderson-Cottonwood Irrigation District
- Central Delta Water Agency
- Contra Costa Water District
- East Bay Municipal Utility District
- El Dorado County Water Agency
- El Dorado Irrigation District
- El Dorado Water and Power Authority
- Folsom, City of
- Friant Water Authority
- Glenn-Colusa Irrigation District
- Hesperia, City of
- Lower Tule River Irrigation District
- Oakdale Irrigation District
- Placer County Water Agency
- Reclamation District 108
- Roseville, City of
- Sacramento, City of
- San Diego County Water Authority
- San Juan Water District
- San Luis & Delta Mendota Water Authority
- Santa Clara Valley Water District
- South Delta Water Agency
- South San Joaquin Irrigation District
- Stanislaus, County of
- Stockton East Water District
- Sutter Mutual Water Company
- Tehama-Colusa Canal Authority
- Westlands Water District

24.2.5 Other Interested Parties

- AquAlliance
- The Bay Institute
- California Farm Bureau Federation
- Coalition for a Sustainable Delta
- California Water Impact Network
- California Sportfishing Protection Alliance
- The Center for Environmental Science Accuracy and Reliability
- Environmental Water Caucus
- Friends of the River
- Golden Gate Salmon Association
- Kern County Water Agency
- Northern California Water Agency
- Natural Resources Defense Council
- North Coast Rivers Alliance

- Pacific Coast Federation of Fisherman's Associations
- Restore the Delta
- South Valley Water Association
- State and Federal Contractors Water Authority
- State Water Contractors
- Water 4 Fish

Chapter 25

List of Preparers

The following individuals contributed to the preparation of this Environmental Impact Statement.

Bureau of Reclamation

Name	Title	Years of Experience
Theresa Olson	Chief, Conservation and Conveyance Division	23
Amy Aufdemberge	Assistant Regional Solicitor	More than 20
Andrew Shultz	Fish Biologist	20
Ann Stine	Natural Resources Specialist	32
Ben Nelson	Natural Resources Specialist	5
Bonnie Van Pelt	Natural Resources Specialist	9
Carolyn Bragg	Natural Resources Specialist	8
David O'Connor	Water Resource Modeler	9
David van Rijn	Chief, Science Division	22
Donna Garcia	Project Manager	–
Erwin Van Nieuwenhuyse	Supervisory Fish Biologist	15
Greg Krzys	Natural Resources Specialist	20
Janice Piñero	Endangered Species Act Compliance Specialist	15
Jason Hassrick	Fish Biologist	17
Joel Sturm	Geologist	40
John Dealy	Project Manager	More than 30
John Hannon	Fisheries Biologist	25
Josh Israel	Fish Biologist	11
Kaylee Allen	Assistant Regional Solicitor	16
Kirk Nelson	Civil Engineer (Hydraulic)	11
Kristin White	Hydraulic Engineer	11
Laureen Perry	Regional Archaeologist	25
Michael Mosley	Physical Scientist	7
Michael Tansey	Climate Change Coordinator	40
Michele Palmer	Fisheries Biologist	20
Michelle Banonis	BDCP Program Manager	16

Name	Title	Years of Experience
Nancy Parker	Hydraulic Engineer (Water Resources Engineer)	25
Patti Idlof	Supervisory Natural Resources Specialist	30
Paul Zedonis	Supervisory Natural Resource Specialist	25
Rain Emerson	Supervisory Natural Resource Specialist	6
Rebecca Victorine	Natural Resource Specialist	18
Ronald Silva	Chief, Engineering and O&M Division	30
Russell Grimes	Chief, Environmental Compliance and Habitat Conservation Branch	24
Scott Springer	Outdoor Recreation Planner	21
Stanley Parrott	Geologist	29
Steve Pavich	Agricultural Economist	18
Traci Michel	Water Management Goal Supervisor	22

CH2M HILL

Name	Project Role	Education
Gwendolyn Buchholz, Professional Engineer (P.E.)	Project Manager	M.S., Civil Engineering, 1976 B.A., Physics, 1974
Derya Sumer, P.E.	Deputy Project Manager, Modeling Lead	Ph.D., Civil Engineering–Water Resources, 2007 M.S., Civil Engineering–Water Resources, 2002 B.S., Civil Engineering, 1999
Robert Antel	Graphics	B.A., Art, 1990
Nathan Brown, Professional Geologist (PG)	Groundwater	M.S., Hydrogeology, 1995 B.S., Geology, 1993
Earl Byron	Water Quality	Ph.D., Ecology and Limnology, 1979 B.A., Marine Biology, 1973
Chandra Chilmakuri, P.E.	Water Supply, Surface Water, Water Quality	Ph.D., Hydrodynamics and Environmental Modeling, 2005 M.S., Civil and Environmental Engineering, 2002 B.S., Civil Engineering, 2000

Name	Project Role	Education
Heidi Chou, P.E.	Water Supply, Surface Water	M.S., Civil Engineering, B.S., Civil Engineering, 2010
David Christophel	Biological Resources	M.S., Biological Sciences, 1989 B.S., Biological Sciences, 1979
Tapash Das	Water Supply, Surface Water, Groundwater	Ph.D., Hydrology, 2006 M.T., Water Resources Development and Management, 2002 B.S., Agricultural Engineering, 1999
Tyson Daus	Graphics	B.S., Graphic Design, 2008
Rosemarie Dimacali	Water Quality	M.S., Civil Engineering B.S. 2009
Fawn Elhadidi	GIS Mapping	Certificate in Business Management and Accounting, 1989
Al Farber	Cultural Resources	M.A., Anthropology, 1982 B.A., Anthropology, 1976
Tyler Hatch, P.E.	Groundwater	Ph.D., Civil and Environmental Engineering, 2013 M.S., Civil and Environmental Engineering, 2011 B.S., Civil Engineering, 2008
Steven Hatchett	Agriculture, Socioeconomics	Ph.D., Agricultural Economics, 1984 M.A., Administration, 1980 B.S., Forestry, 1977
David Julian	Water Supply, Surface Water, Water Quality	M.S. Civil Engineering, 2013 B.S., Civil Engineering, 2011
Kevin Kasberg	Agriculture, Socioeconomics	M.S., Agricultural and Resources Economics, 2012 B.A., Environmental Studies/Economics, 2009
Justin LaNier	Groundwater	M.S., Civil Engineering, 2006 B.S., Civil Engineering, 2002
Peter Lawson, P.G.	Groundwater	M.S., Hydrology, 1988 B.S., Geology, 1985
Robert Leaf, P.E.	Water Supply Surface Water, Water Quality	M.S., Civil Engineering, 1994 B.S., Civil Engineering, 1992 B.S., Forest and Resource Management, 1987
Chakri Malakpet, P.E.	Water Supply	M.S., Civil Engineering, 2007 B.S., Civil Engineering, 2005

Name	Project Role	Education
Armin Munévar, P.E.	Water Supply Surface Water, Water Quality	M.S., Civil Engineering, 1997 B.S., Civil Engineering, 1991
Neil Nikirk	Biological Resources	M.S., Fisheries Science, 1992 B.S., Fisheries Science, 1987
Harry Ohlendorf	Water Quality	Ph.D., Wildlife Science, 1971 M.S., Wildlife Science, 1969 B.S., Wildlife Management, 1962
Lisa Porta, P.E.	Groundwater, Water Quality	M.S., Environmental Science and Engineering, 2007 B.S., Biological Systems Engineering, 2004
Reed Thayer	Water Supply, Surface Water	M.S., Civil Engineering, 2015 B.S., Civil Engineering, 2013
Elisabeth Towers	GIS Mapping	B.A., Human Geography and Planning, 2013
Robert Tull, P.E.	Water Supply, Surface Water	M.S., Environmental Engineering, 10986 B.S., Environmental Planning, 1981
Jeff Tupen	Biological Resources	B.S., Environmental and Systematic Biology, 1989
Pamela Vanderbilt	Air Quality and Biological Resources	M.A., Biology, 1979 B.A., Biology, 1977
Brian Van Lienden, P.E.	Water Supply, Energy Resources	M.S., Civil Engineering, 2000 B.S., Civil Engineering, 1998
Kyle Winslow, P.E.	Water Quality	Ph.D., Environmental Fluid Mechanics, 2001 M.S., Environmental Water Resources, 1996 B.S., Civil Engineering, 1995
Fatuma Yusuf	Socioeconomics	Ph.D., Agricultural Economics, 2000 M.S., Statistics, 1999 M.A., Agricultural Economics, 1994 B.S., Range Management, 1990

Ag-Recon

Name	Project Role	Education
David Olson	Agricultural Resources	B.S., Agricultural Engineering, 1985

Cramer Fish Sciences

Name	Project Role	Education
Paul Bergman	Aquatic Resources	M.S., Fisheries, 2007 B.S., Fisheries and Biology, 1994
Brad Cavallo	Aquatic Resources	M.S., Aquatic Ecology, 1997 B.S. Wildlife and Fisheries Biology, 1994
Travis Hinkelman	Aquatic Resources	Ph.D., Biological Sciences, 2012 M.S., Aquaculture, Fisheries and Wildlife, 2004 B.S., Fisheries and Wildlife, 2001
Steven Zeug	Aquatic Resources	Ph.D., Wildlife and Fisheries Sciences, 2007 B.S., Fisheries Biology, 2001

ERA Economics

Name	Project Role	Education
Duncan MacEwan	Agricultural Resources	Ph.D., Economics, 2012 M.S., Economics, 2008 B.S., Economics, 2006

InCommunications

Name	Project Role	Education
Christine Kohn	Consultation and Coordination	M.S., Journalism and Public Affairs, 1993 B.A., Journalism, 1991

Kearns and West

Name	Project Role	Education
Michael Harty	Consultation and Coordination	J.D., Georgetown University Law Center, 1986 B.A., Political Philosophy, 1978

QEDA

Name	Project Role	Education
Noble Hendrix	Aquatic Resources	Ph.D., Aquatic and Fisheries Sciences, 2003 M.S., Aquatic and Fisheries Sciences, 2000

Resource Management Associates

Name	Project Role	Education
Stacie Grinbergs, P.E.	Surface Water Modeling	M.S., Civil Engineering, 1998
Donald Smith, P.E.	Water Temperature Modeling	B.S., Civil Engineering, 1968

RMann Economics

Name	Project Role	Education
Roger Mann	Socioeconomics	Ph.D., Agricultural Economics, 1978

Stillwater Associates

Name	Project Role	Education
Ethan Bell	Aquatic Resources	M.S., Biology, 2001
Joshua Strange	Aquatic Resources	Ph.D., Fisheries Biologist, 2001

Chapter 26

Index

D

E

F

G

H

I

J

K

L

M

N

O

P

R

S

T