# Chapter 8 Biological Resources – Terrestrial

## Introduction

This chapter describes the terrestrial biological resources in the study area and potential changes that could occur as a result of implementing the alternatives to augment flows in the lower Klamath River evaluated in this Environmental Impact Statement (EIS). Implementation of the alternatives could affect terrestrial resources by altering the ecological attributes of plant communities and habitat of terrestrial wildlife.

## Regulatory Environment and Compliance Requirements

Federal regulations relevant to implementation of the alternatives evaluated in this EIS for terrestrial resources include:

- **Endangered Species Act –** The Federal Endangered Species Act (ESA) applies to proposed Federal, state, and local projects that may result in the "take" of a fish or wildlife species that is federally listed as threatened or endangered and to actions that are proposed to be authorized, funded, or undertaken by a Federal agency and that may jeopardize the continued existence of any federally listed fish, wildlife, or plant species or which may adversely modify or destroy designated critical habitat for such species.

## Affected Environment

This section describes terrestrial biological resources that could potentially be directly or indirectly affected by implementing the action alternatives considered in this EIS. These changes may occur in the Lower Klamath and Trinity River Region defined as the Trinity River below Lewiston Dam, the Klamath River below its confluence with the Trinity River, and Trinity Lake and Lewiston Reservoir, and the Sacramento Valley and Bay-Delta Region defined as the Sacramento Valley north of the confluence of the San Joaquin and Sacramento Rivers and the Sacramento-San Joaquin River Delta (Delta). Terrestrial biological resources occur throughout these regions. However, the terrestrial biological resources that could be affected are located within or related to specific areas: 1) along the shorelines and riparian zone of Trinity Lake and Lewiston Reservoir and other reservoirs that store Central Valley Project (CVP) and State Water Project (SWP) water supplies, 2) along the shoreline and riparian zone of Trinity River downstream from Lewiston Dam and the Klamath River from its confluence with Trinity River to the ocean and along other rivers and waterways (including Yolo Bypass and other flood bypasses) downstream from CVP or SWP reservoirs, 3) wildlife refuges that receive CVP water supplies, 4) wetlands and riparian corridors within the Delta and Suisun Marsh, and 5) within agricultural acreage that is irrigated with CVP and SWP water supplies.

The following description of the affected environment is limited to the above described areas. An analysis of storage and water level changes in New Melones, Millerton and San Luis reservoirs and the San Joaquin and Stanislaus Rivers (per CalSim II; please see *Impact Analysis* below in this chapter, and Chapter 4, "Surface Water Supply and Management") indicates no difference in water surface elevation on these reservoirs would occur in any month under either action alternative compared to the No Action Alternative. Also, no change in flow in these rivers would occur in any month under either action alternative compared to the No Action Alternative. Therefore, descriptions of affected environment for these reservoirs and for the Stanislaus and San Joaquin Rivers, and analysis of potential changes to terrestrial biological resources for these facilities, are not further examined in this EIS.

## Overview of Species with Special Status

Species with special status are defined as species that are legally protected or otherwise considered sensitive by Federal, State, or local resource agencies, including:

- Species listed by the Federal government as threatened or endangered,
- Species listed by the State of California as threatened, endangered, or rare (rare status is for plants only),
- Species that are formally proposed for Federal listing or are candidates for Federal listing as threatened or endangered,
- Species that are candidates for State listing as threatened or endangered,
- Species that meet the definitions of rare, threatened, or endangered under California Environmental Quality Act,
- Species identified by the U.S. Fish and Wildlife Service (USFWS) as Birds of Conservation Concern,
- Species considered sensitive by the U.S. Bureau of Land Management (BLM) or U.S. Forest Service (USFS),
- Species identified by California Department of Fish and Wildlife (CDFW) as species of special concern, species designated by California statute as fully protected (e.g., California Fish and Game Code, sections 3511 [birds], 4700 [mammals], and 5050 [reptiles and amphibians] and 5515 [fish]) or bird species on the CDFW Watch List, and
- Species, subspecies, and varieties of plants considered by CDFW and California Native Plant Society (CNPS) to be rare, threatened, or endangered in California. The CNPS Inventory of Rare and Endangered Plants of California assigns California Rare Plant Ranks (CRPR) categories for plant species of concern. Only plant species in CRPR categories 1 and 2 are considered special status plant species in this document:

- CRPR 1A—Plants presumed to be extinct in California.
- CRPR 1B—Plants that are rare, threatened, or endangered in California and elsewhere.
- CRPR 2—Plants that are rare, threatened, or endangered in California but more common elsewhere.

A listing of wildlife and plant species with special status that occur or may occur in portions of the study area and may be affected by implementation of the alternatives is provided in Biological Resources – Terrestrial Technical Appendix. Relevant documents used to assemble these resource lists include the list of Federal endangered and threatened species that occur in or may be affected by projects in the counties within the study area generated on-line from the USFWS Sacramento Office.

To supplement the USFWS lists, the California Natural Diversity Database (CNDDB) was queried (DFG 2012) for regions where recent documentation was lacking. This included the Trinity River Region, including Trinity Lake, Lewiston Reservoir, Whiskeytown Lake, and Clear Creek between Carr Powerhouse and the Sacramento River confluence.

#### *Critical Habitat*

Critical habitat refers to areas designated by the USFWS for the conservation of species listed as threatened or endangered under ESA. When a species is proposed for listing under the ESA, the USFWS considers whether there are certain areas essential to the conservation of the species. Critical habitat is defined in Section 3, Provision 5 of the ESA as follows.

> *(5)(A) The term "critical habitat" for a threatened or endangered species means -*
>
> > *(i) the specific areas within the geographical area occupied by a species at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species, and (II) which may require special management considerations or protection; and*
> >
> > *(ii) specific areas outside the geographical area occupied by a species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species.*

Any Federal action (permit, license, or funding) in critical habitat requires that Federal agency to consult with the USFWS where the action has potential to adversely modify the habitat for terrestrial species.

The federally listed wildlife and plant species considered in this EIS that have designated critical habitat areas that could be affected by implementation of the alternatives considered in this EIS are presented in Table 8-1 below. There are occurrences of critical habitat of other species not included in Table 8-1 or other locations of critical habitat of the species listed in Table 8-1 which are not included below because those occurrences are not located within the areas that could be affected by implementation of the alternatives, such as lands located at high elevations within national forests where CVP and SWP water is not delivered.

Table 8-1. Terrestrial Species with Designated Critical Habitat in Portions of the Study Area that Could Be Affected by the Action Alternatives

| Species | Regions | Counties |
|---|---|---|
| Valley Elderberry Longhorn Beetle | Sacramento Valley and Delta | Sacramento |
| Yellow-billed cuckoo | Sacramento Valley and Delta | Butte, Colusa, Glenn, Sutter |
| Soft Bird's-Beak | Sacramento Valley and Delta | Solano |
| Suisun Thistle | Sacramento Valley and Delta | Solano |
| Antioch Dunes evening-primrose | Sacramento Valley and Delta | Sacramento |

*Source: USFWS 2016*

## Lower Klamath and Trinity River Region

For the Lower Klamath and Trinity River Region, the scope of analysis within this chapter is limited to the Trinity River from Lewiston Dam to its confluence with the Klamath River, the Klamath River from Trinity River to the Pacific Ocean, and Trinity Lake and Lewiston Reservoir.

### *Trinity River and Klamath River*

This chapter's scope of analysis within the Lower Klamath and Trinity River Region includes the shorelines, riparian zone and wetted perimeter of the Trinity River from Trinity Lake to the confluence with the Klamath River; and the shorelines, riparian zone and wetted perimeter of the lower Klamath River from the confluence with the Trinity River to the Pacific Ocean. The scope of analysis also includes Trinity Lake and Lewiston Reservoir and their shorelines and riparian zones.

The Trinity River system downstream from Lewiston Reservoir includes the mainstem, North Fork Trinity River, South Fork Trinity River, New River, and numerous smaller streams (NCRWQCB et al. 2009; USFWS et al. 2000). Trinity Lake and Lewiston Reservoir are located upstream from the confluences of the Trinity River with the North Fork, South Fork, and New River. However, these tributaries are not affected by implementing the alternatives considered in this EIS. The Trinity River flows approximately 112 miles from Lewiston Reservoir to the Klamath River through Trinity and Humboldt counties and the Hoopa Valley Indian Reservation within Trinity and Humboldt counties. The Trinity River is the largest tributary to the Klamath River (DOI and DFG 2012).

The lower Klamath River flows 43.5 miles from the confluence with the Trinity River to the Pacific Ocean (USFWS et al. 2000). Downstream from the Trinity River confluence, the Klamath River flows through Humboldt and Del Norte counties and through the Hoopa Valley Indian Reservation, Yurok Indian Reservation, and Resighini Indian Reservation within Humboldt and Del Norte counties (DOI and DFG 2012). There are no dams located in the Klamath River watershed downstream from the confluence with the Trinity River. The Klamath River estuary extends approximately 5 miles upstream from the Pacific Ocean. This area is generally under tidal effects and salt water can occur up to 4 miles from the coastline during high tides in summer and fall when Klamath River flows are low.

#### ***Trinity Lake and Lewiston Reservoir***

The dominant vegetation community in the Trinity River watershed upstream from Lewiston Reservoir includes mixed conifer, with Ponderosa Pine (*Pinus ponderosa*), Sugar Pine (*Pinus lambertiana*), and Douglas Fir (*Pseudotsuga menziesii*) as the dominant species. Some south-facing slopes are dominated by oak (*Quercus* spp.) and brush. Mixed hardwood communities occur at lower elevations, and include species such as Pacific Madrone (*Arbutus menziesii*), Big-Leaf Maple (*Acer macrophyllum*), and a variety of oaks. The shrub community at lower elevations includes a number of chaparral plants such as manzanitas (*Arctostaphylos* spp.), Bitterbrush (*Purshia tridentata*), and Deerbrush (*Ceanothus integerrimus*). South-facing slopes around Trinity Lake contain shrub fields that provide winter range for the Weaverville deer (*Odocoileus* spp.) herd (USFS 2005; STNF 2014)

Along some margins of Trinity Lake and Lewiston Reservoir, vegetation is consistent with species associated with a reservoir environment and standing water, including floating species, rooted aquatic species, and emergent wetland species. Emergent wetland and riparian vegetation is largely constrained by fluctuating water levels and steep banks, particularly on Trinity Lake (NCRWQCB et al. 2009; USFWS et al. 2000).

The reservoirs attract resting and foraging waterfowl and other species that favor standing or slow moving water. Impounded water in the reservoirs also provides foraging habitat for Bald Eagle (*Haliaeetus leucocephalus*) and other raptors that prey on fish (e.g., Osprey [*Pandion haliaetus*]) and waterfowl.

Recently, ten pairs of mating bald eagles were observed at Trinity Lake and three pairs at Lewiston Lake (USFS 2012).

#### ***Trinity River from Lewiston Reservoir to Klamath River***

Terrestrial habitat along the Trinity River below Trinity and Lewiston dams has changed since construction of the dams. The ongoing Trinity River Restoration Program (TRRP) is restoring portions of the habitat below Lewiston Dam. The following description reflects recent habitat changes along the mainstem of the Trinity River between Lewiston Reservoir and the confluence of the Klamath River.

**Trinity River Restoration Program** The hydrologic and geomorphic changes following construction of the Trinity and Lewiston dams changed the character of the river channel substantially and allowed riparian vegetation to encroach on areas that had previously been scoured by flood flows (USFWS et al. 2000). This resulted in the formation of a riparian berm that armored and anchored the river banks and prevented meandering of the river channel. The berm encouraged encroachment and maturation of woody vegetation along narrow bands bordering the stabilized channel essentially locking it in place. In addition, the extent of wetlands probably declined following dam construction due, in part, to reduced flows and elimination of river meanders.

The ongoing TRRP includes specific minimum instream flows, as described in Chapter 4, "Surface Water Supply and Management"; mechanical channel rehabilitation; fine and coarse sediment management; watershed restoration; infrastructure improvement; and adaptive management components (NCRWQCB et al. 2009; USFWS and Hoopa Valley Tribe 1999). The mechanical channel rehabilitation includes removal of fossilized riparian berms that had been anchored by extensive woody vegetation root systems and consolidated sand deposits that confined the river. Following removal of the berms and floodplain restoration, some areas have been re-vegetated to support native vegetation, re-establish alternate point bars, and re-establish complex fish habitat similar to conditions prior to construction of the dams. Sediment management activities include introduction of coarse sediment at locations to support spawning and other aquatic life stages. In areas closer to Lewiston Dam with limited gravel supply, gravel/cobble point bars are being rebuilt to increase gravel storage and improve channel dynamics. Riparian vegetation planted on the restored floodplains and flows will be managed to encourage natural riparian growth on the floodplain and limit encroachment on the newly formed gravel bars. Improvement projects have been completed and others are under construction or in the planning phases. The mechanical restoration actions are occurring between Lewiston Dam and the North Fork.

**Terrestrial Habitat** Despite the removal of certain riparian vegetation areas resulting from TRRP channel widening projects, the riparian corridor of the Trinity River from Lewiston Dam to the North Fork has remained nearly constant in size between 2003, when TRRP channel rehabilitation projects were initiated, and 2014 (TRRP 2015). In 2003, before TRRP channel widening projects were undertaken, riparian vegetation covered 979.3 acres. Riparian vegetation in 2014 was mapped at 970.1 acres. Between the North Fork and the South Fork, the Trinity River channel is restricted by steep canyon walls that limit riparian vegetation to a narrow band (NCRWQCB et al. 2009; USFWS et al. 2000). Between the South Fork and the confluence with the Klamath River, there are confined reaches with little riparian vegetation, alternating with vegetation similar to the pre-dam conditions in the upper reach below Lewiston dam.

Many wildlife species present prior to dam construction still inhabit the riverine and riparian habitats of the lower Trinity River. Species that prefer early-successional stages or require greater riverine structural diversity are likely to be less abundant under current conditions (NCRWQCB et al. 2009; USFWS et al. 2000). For example, Western Pond Turtle (*Emys marmorata*) declined since completion of the dams in response to diminishing instream habitat. In contrast, species such as Northern Goshawk (*Accipiter gentilis*) and Black Salamander (*Aneides flavipunctatus*) that favor mature, late-successional riparian habitats increased with more upland habitat along the narrow riparian corridor.

Current habitats along the Trinity River between Lewiston Dam and the Klamath River include annual grassland, fresh emergent wetland, montane riparian, valley-foothill riparian, and riverine habitats (NCRWQCB et al. 2009, 2013). The annual grassland species include grasses (e.g., Wild Oat species (*Avena* spp.), Soft Brome (*Bromus hordeaceus*), Ripgut Brome (*Bromus diandrus*), Cheatgrass (*Bromus tectorum*), and Barley [*Hordeum vulgare*]); forbs (e.g., Broadleaf Filaree (*Erodium botrys*), California Poppy (*Eschschia californica*), and Bur Clover [*Medicago polymorpha*]); and native perennial species (e.g., Creeping Wildrye [*Leymus triticoides*]). The annual grassland habitat supports Mourning Dove (*Zenaida macroura*), Savannah Sparrow (*Passerculus sandwichensis*), White-Crowned Sparrow (*Zonotrichia leucophrys*), American Kestrel (*Falco sparverius*), Red-Tailed Hawk (*Buteo jamaicensis*), Coyote (*Canis latrans*), California Ground Squirrel (*Otospermophilus beecheyi*), Botta's Pocket Gopher (*Thomomys bottae*), California Kangaroo Rat (*Dipodomys californicus*), Gopher Snake (*Pituophis catenifer*), Northwestern Fence Lizard (*Sceloporus occidentalis* ssp. *occidentalis*), Western Skink

(*Plestiodon skiltonianus*), Northern Pacific Rattlesnake (*Crotalus oreganus oreganus*), and Western Yellow-Bellied Racer (*Coluber constrictor* ssp. *mormon*). The fresh emergent wetland species occur along the backwater areas, depressions, and along the river edges, including Common Tule (*Schoenoplectus acutus* var. *occidentalis*), Narrow-Leaved Cattail (*Typha angustifolia*), Dense Sedge (*Carex densa*), Rye Grass (*Festuca perennis*), Himalayan Blackberry (*Rubus armeniacus*), and Narrow-Leaved Willow (*Salix exigua*). Wildlife species along the fresh emergent wetland include Western Toad (*Anaxyrus boreas*), Pacific Treefrog (*Pseudacris regilla*), American Bullfrog (*Lithobates catesbeianus*), Green Heron (*Butorides virescens*), Mallard (*Anas platyrhynchos*), and Red-Winged Blackbird (*Agelaius phoeniceus*). The montane riparian habitat adjacent to the river include trees, such as Big Leaf Maple, White Alder (*Alnus rhombifolia*), Oregon Ash (*Fraxinus latifolia*), Black Cottonwood (*Populus trichocarpa*), and Goodding's Black Willow (*Salix gooddingii*); and understory species, including Mugwort (*Artemisia* spp.), Western Virgin's Bower (*Clematis ligusticifolia*), American Dogwood (*Cornus sericea*), Oregon Golden-Aster (*Heterotheca oregona*), Dalmatian Toadflax (*Linaria dalmatica* ssp. *dalmatica*), White Sweet Clover (*Meliloyus albus*), Musk Monkeyflower (*Mimulus moschatus*), Straggly Gooseberry (*Ribes divariatum* var. *pubiflorum*), California Wild Grape (*Vitis californica*), and California Blackberry *(Rubus ursinus)*. The valley-foothill riparian habitat occur along alluvial fans, slightly dissected terraces, and floodplains; and include cottonwood species (*Populus* spp.), Western Sycamore (*Platanus racemosa*), Valley Oak (*Quercus lobata*), White Alder, Box Elder (*Acer negundo*), Oregon Ash (*Fraxinus latifolia*), California Wild Grape, California Wild Rose (*Rosa californica*), California Blackberry, Blue Elderberry (*Sambucus nigra*), Western Poison Oak (*Toxicodendron diversilobum*), button bush (*Cephalanthus* spp.), willow species (*Salix* spp.), sedges (*Carex* spp.), rushes (*Juncus* spp.), Miner's Lettuce (*Claytonia perfoliata*), and various grasses. Riparian woodlands along the montane riparian habitat support breeding, foraging, and roosting habitat for Tree Swallow (*Tachycineta bicolor*), Bushtit (*Psaltriparus minimus*), White-Breasted Nuthatch (*Sitta carolinensis*), Nuttall's Woodpecker (*Picoides nuttallii*), Downy Woodpecker (*Picoides pubescens*), Spotted Towhee (*Pipilo maculatus*), and Song Sparrow (*Melospiza melodia*); cover for amphibians, including Western Toad and Pacific Treefrog; and habitat for Deer Mouse, Raccoon (*Procyon lotor*), and Virginia Opossum (*Didelphis virginiana*). The riverine habitat supports amphibians and reptiles, including Western Toad, Pacific Treefrog, and American Bullfrog; birds, including Mallard, Great Blue Heron (*Ardea herodias*), Osprey, and Belted Kingfisher (*Megaceryle alcyon*); and mammals, including Northern River Otter (*Lontra canadensis*), American Beaver (*Castor canadensis*), Big Brown Bat (*Eptesicus fuscus*), and Yuma Myotis (*Myotis yumanensis*).

The lands upslope of the Trinity River are characterized by mixed chaparral, montane hardwood-conifer, blue oak-foothill pine, foothill pine, and Klamath mixed conifer (NCRWQCB et al. 2009, 2013). The trees include Pacific Madrone, Big Leaf Maple, Canyon Live Oak (*Quercus chrysolepis*), California Black Oak (*Quercus kelloggii*), Blue Oak (*Quercus douglasii*), Ponderosa Pine, Douglas Fir, and Incense Cedar (*Calocedrus decurrens*). Shrubs include Greenleaf Manzanita (*Arctostaphylos patula*), Buckbrush (*Ceanothus cuneatus*), Cascara (*Frangula purshiana*), Snowberry (*Symphoricarpos albus*), and Western Poison Oak. Underlying herbaceous vegetation includes Ripgut Brome, Blue Wild Rye (*Elymus glaucus*), Silver Bush Lupine (*Lupinus albifrons*), Purple Sanicle (*Sanicula bipinnatifida*), and California Hedge-Parsley (*Yabea microcarpa*). The habitats support numerous birds, including Northern Flicker (*Colaptes auratus*), Steller's Jay (*Cyanocitta stelleri*), Hairy Woodpecker (*Picoides villosus*), Acorn Woodpecker (*Melanerpes formicivorous*), Wrentit (*Chamaea fasciata*), Bewick's Wren (*Thryomanes bewickii*), California Quail (*Callipepla california*), Mountain Quail (*Oreortyx pictus*), Blue Grouse (*Dendragapus obscurus*), Sharp-Shinned Hawk (*Accipiter striatus*), Red-Tailed Hawk, and Great Horned Owl (*Bubo virginianus*); mammals including Black-Tailed Deer (*Odocoileus hemionus* ssp. *columbianus*), Gray Fox (*Urocyon cinereoargenteus*), Coyote, Black-Tailed Jackrabbit (*Lepus californicus*), Raccoon, Virginia Opossum, Western Spotted Skunk (*Spilogale gracilis*), Western Gray Squirrel (*Sciurus griseus*), Allen's Chipmunk (*Tamias senex*), Deer Mouse, and Pallid Bat (*Antrozous pallidus*); and reptiles and amphibians, including California Kingsnake (*Lampropeltis californiae*), Northern Pacific Rattlesnake, Sharp-Tailed Snake (*Contia* sp.), Northwestern Fence Lizard, Southern Alligator Lizard (*Elgaria multicarinata*), and Ensatina (*Ensatina eschscholtzii*).

Trinity Lake, Lewiston Reservoir, and Whiskeytown Lake inundated approximately 20,500 acres of habitat for an estimated 8,500 Black-Tailed Deer (USFWS 1975). The CDFW established a deer herd management plan for the Critical Winter Range for the Weaverville deer herd. A portion of the winter range is located along the Trinity River (NCRWQCB et al. 2009).

#### *Lower Klamath River Watershed from Trinity River to the Pacific Ocean*

The Klamath River from the confluence with the Trinity River to the Pacific Ocean is characterized by a forested river canyon with riparian vegetation occurring along the channel. There is a greater diversity of riparian vegetation along the lower Klamath River below the mouth of the Trinity River, partly as a result of a more natural hydrograph on the Klamath River than exists on the Trinity River. Plant species composition changes as the Klamath River nears the Pacific Ocean; the river slows and the tides affect salinity.

Grazing, timber harvest, and roads have degraded riparian conditions along the lower Klamath River (Yurok Tribe 2000). Riparian areas are dominated by deciduous trees including Red Alder (*Alnus rubra*). Red Alder is a typical hardwood in riparian zones, Tanoak (*Notholithocarpus densiflorus*) is a typical hardwood on mid to upper slopes, and Pacific Madrone occurs in small stands on drier sites (Green Diamond Resource Company 2006).

The broad lower Klamath River meanders within the floodplain and supports wetland habitats similar to those that existed pre-dam along the Trinity River. Wetland habitats along the lower Klamath River are dominated by cattails (*Typha* spp.), tules (*Schoenoplectus* spp.), and a variety of rushes and sedges. As the river nears the ocean, salt-tolerant plants such as cord grass (*Spartina* spp.) and pickleweed (*Salicornia* spp.) increase in abundance as the salinity increases (USFWS et al. 2000). Wildlife species in the lower Klamath River watershed are similar to those found in the Trinity River watershed.

### Sacramento Valley and Bay-Delta Region

For the Sacramento Valley and Bay-Delta Region, the scope of analysis within this chapter is limited to the Sacramento Valley below Shasta Dam and includes the Delta, Suisun Marsh, and the Yolo Bypass, and the rivers which feed into the Sacramento River below CVP/SWP dams. The scope of analysis also includes Shasta Lake, Whiskeytown Lake, Lewiston Reservoir, and other CVP and SWP reservoirs on river systems within the Sacramento Valley, and agricultural lands and wildlife refuges served by CVP and SWP water supplies within the Sacramento Valley and the Delta. The areas where terrestrial biological resources could potentially be affected include the fluctuation zones, associated riparian zones, and open water areas of the reservoirs; the shorelines, riparian zone and open water areas of the rivers and the shorelines, riparian zone and surface water of waterways within the Bay-Delta.

The Sacramento Valley and Bay-Delta Region is predominantly made up of lowlands and plains surrounded by foothills and tall mountains of the Coast Ranges to the west, the Cascade Range to the north, the Sierra Nevada Mountains to the east, and the San Joaquin Valley to the south. Communities of various sizes and an extensive network of roadways are located throughout the valley.

Land use within the Sacramento Valley is dominated by agriculture and urban development. Grassland and oak woodland habitats occur in the foothills, particularly in the mid-elevation eastern margin of the Sacramento Valley. Coniferous forests, mixed hardwood/coniferous forests, and oak woodlands generally represent the dominant vegetation surrounding CVP and SWP reservoirs. Riparian vegetation is generally constrained to narrow ribbons immediately adjacent to creeks and rivers. Many of the wetlands and riparian areas that once occurred in the Central Valley have been eliminated as a consequence of land use conversion to agriculture and urbanization.

#### *Overview of Terrestrial Communities*

This section describes the terrestrial communities in the Sacramento Valley and Bay-Delta Region that could be affected directly or indirectly by implementation of the alternatives considered in this EIS. These communities are broadly described for lakes/reservoirs (including open water and drawdown areas); rivers (including open water and riparian and floodplain areas); wetlands; wildlife refuges and agricultural lands.

**Lake/Reservoir Communities** Reservoirs potentially affected by implementation of the alternatives considered in this EIS provide habitat used by some terrestrial species, either within the open water area of the reservoirs or along the margins and in the drawdown areas.

*Open Water Areas* As described in Chapter 4, “Surface Water Supply and Management,” water surface elevations in reservoirs that store CVP and SWP water supplies change seasonally and annually due to hydrologic and operational variables. The open water areas of these reservoirs are used as foraging and resting sites by waterfowl and other birds, and by semi-aquatic mammals such as Northern River Otter and American Beaver. Bald Eagle and Osprey nest in forests at the margins of these reservoirs, and frequently use the reservoirs to forage for fish.

*Margin and Drawdown Areas* The CVP and SWP reservoirs in the Sacramento Valley and Bay-Delta Region are generally located in canyons where the surrounding slopes are dominated by upland vegetation such as woodland, forest, and chaparral. The water surface elevations in these reservoirs fluctuate within the inundation area, as described in Chapter 4, “Surface Water Supply and Management,” between maximum allowed storage elevations and minimum elevations defined by the lowest elevation on the intake structure. Along the water surface edge of the inundation area, the soils are usually shallow. Soil is frequently lost to wave action and periodic inundation, followed by severe desiccation when the water elevation declines, which generally results in a barren drawdown zone around the perimeter of the reservoirs. Natural regeneration of vegetation within the drawdown zone is generally prevented by the timing of seed release when reservoir levels are high in the spring, lack of sediment replenishment necessary for seedling establishment in the spring, and high temperatures combined with low soil moisture levels of exposed soils in the summer.

Lack of vegetative cover within the drawdown zone can limit wildlife use of this area. Rapidly rising reservoir levels can potentially result in direct mortality of some sedentary wildlife species or life stages within the drawdown zone of reservoirs. As reservoir levels drop, energy expenditures may slightly increase for piscivorous (fish-eating) birds foraging in the reservoirs as these species may have to travel greater distances to forage (DWR 2004a).

**Riverine Communities** The primary components of the rivers and streams that support plants and wildlife potentially influenced by implementation of the alternatives under this EIS, including open water areas and adjacent riparian and floodplain communities, are described below.

*Open Water Areas* The riverine environment downstream from reservoirs is managed generally for water supply and flood control purposes. As such, the extent of open water in the rivers varies somewhat predictably, although not substantially, within and among years. In the wetter years when bypasses and floodplains are inundated, vast areas of open water become available during the flood season, generally in the late winter and early spring. Open water portions of riverine systems provide foraging habitat for fish eating birds and waterfowl. Various gulls and terns, Osprey, and Bald Eagle forage over open water. Near shore and shoreline areas provide foraging habitat for birds such as waterfowl, heron, egret, shorebirds, and Belted Kingfisher. Many species of insectivorous birds such as swallows, swifts, and flycatchers forage over open water areas of lakes and streams. Mammals known to associate with open water and shoreline habitats include Northern River Otter, American Mink (*Neovison vison*), Common Muskrat (*Ondatra zibethicus*), and American Beaver.

*Riparian and Floodplain Areas* The riparian and floodplain communities that could be affected by implementation of the alternatives considered in this EIS refers primarily to the vegetation and associated wildlife community supported and influenced by proximity to the waterway, including areas frequently flooded by rising water levels in the rivers (floodplains). The extent of riparian vegetation within the Sacramento Valley has been reduced over time due to a variety of actions, including local, State, and Federal construction and operation of flood control facilities; agricultural and land use development that occurred following development of flood control projects; regulation of flows from dams that has reduced the magnitude and frequency of larger flow events, increased recession rates, and increased summertime flows; and construction and maintenance of active ship channels by the U.S. Army Corps of Engineers (USACE) (DWR 2012).

Characteristic riparian tree species in the Sacramento Valley include willows, cottonwoods, California Sycamore, and Valley Oak. Typical understory plants include elderberry species, California and Himalayan Blackberry, and Western Poison Oak. On the valley floor in the deep alluvial soils, the structure and species composition of the plant communities change with distance from the river, with the denser stands of willow and cottonwood at the water's edge transitioning into stands of Valley Oak on the less frequently inundated terraces. In other areas, the riparian zone does not support a canopy of large trees and instead is dominated by shrub species (sometimes referred to as riparian scrub).

Riparian and floodplain vegetation supports wildlife habitats because of its high floristic and structural diversity, high biomass and high food abundance, and proximity to water. In addition to providing breeding, foraging, and roosting habitat for an array of animals, riparian and floodplain vegetation also provides movement corridors for some species, connecting a variety of habitats throughout the region. The Sacramento Valley lacks substantial areas of natural habitat that support native biodiversity or corridors between the areas of natural habitat; therefore, riparian and floodplain corridors play a critical role in connecting wildlife among the few remaining natural areas (CalTrans and DFG 2010).

Typical wildlife species associated with the riparian and floodplain communities include mammals such as Striped Skunk (*Mephitis mephitis*), Raccoon, and Gray Fox. Riparian bird species include Red-Shouldered Hawk (*Buteo lineatus*), Wood Duck (*Aix sponsa*), Great Blue Heron, Black-Crowned Night Heron (*Nycticorax nycticorax*), and many neotropical migratory birds, including Yellow Warbler (*Setophaga petechia*). Amphibians and reptiles include Pacific Treefrog, Pacific Gopher Snake, and Common Gartersnake (*Thamnophis sirtalis*). Special status species that associate with riparian and floodplain habitats include Bank Swallow (*Riparia riparia*), Western Yellow-Billed Cuckoo (*Coccyzus americanus*), and the Valley Elderberry Longhorn Beetle (*Desmocerus californicus* ssp. *dimorphus*).

River flows and associated hydrologic and geomorphic processes are important for maintaining riparian and floodplain ecosystems. Most aspects of a flow regime (e.g., the magnitude, frequency, timing, duration, and sediment load) affect a variety of riparian and floodplain habitat processes. Two processes that create riparian and floodplain ecosystems are disturbance and plant recruitment. The interaction of these processes across the landscape is primarily responsible for the pattern and distribution of riparian and floodplain habitat structure and condition, and for the composition and abundance of riparian-associated species.

High flow events and associated scour, deposition, and prolonged inundation can create exposed substrate for plant establishment or openings in existing riparian and floodplain communities. Early successional species, like cottonwoods and willows that recruit into these openings, become more abundant in the landscape as vegetation grows within disturbed areas. As a result, structural and species diversity within riparian and floodplain vegetation could increase, as could overall wildlife habitat values. Without disturbance, larger trees and species less tolerant of frequent disturbance begin to dominate riparian woodlands.

The recruitment of cottonwoods and willows especially depends on geomorphic processes that create bare mineral soil through erosion and deposition of sediment along river channels and on floodplains, and on flow events that result in floodplain inundation. Receding flood flows that expose moist mineral soil create ideal conditions for germination of cottonwood and willow seedlings. After germination occurs, the water surface must decline gradually to enable seedling establishment. Riparian and floodplain communities also undergo natural disturbance cycles when flood flows remove streamside vegetation and redistribute sediments and seeds, thereby maintaining habitat diversity for terrestrial species that associate with riparian and floodplain corridors.

Both prolonged drought and prolonged inundation, however, can lead to plant death and loss of riparian plants (Kozlowski and Pallardy 2002). Riparian plants have high moisture requirements during the active growing season (spring through fall), and dry soil conditions can reduce growth and injure or kill plants. On the other hand, prolonged inundation creates anaerobic conditions that, during the active growing season, also can reduce growth, injure, or kill plants.

Riparian and floodplain communities are anticipated to change along levees within the federally authorized levee systems that have maintenance agreements with the USACE including Delta levees along the Sacramento River and other levees that are eligible for the Federal Rehabilitation and Inspection Program (Public Law 84-99). The vegetation management policies of the USACE were changed in 2009 and 2010. Historically, the USACE allowed brush and small trees to be located on the waterside of Federal flood management project levees if the vegetation would preserve, protect, or enhance natural resources, or protect rights of Native Americans, while maintaining the safety, structural integrity, and functionality of the levee (DWR 2011). After Hurricane Katrina in 2005, the USACE issued a policy and draft policy guidance to remove substantial vegetation from these levees throughout the nation (USACE 2009). In 2010, the USACE issued a draft policy guidance letter, *Draft Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls—75 Federal Register 6364-68* (USACE 2010) that included procedures for State and local agencies to request variances on a site-specific basis. The California Department of Water Resources (DWR) has been in negotiations with USACE to remove vegetation on the upper third of the waterside slope, top, and landside of the levees, and continue to allow vegetation on the lower two-thirds of the waterside slope of the levee and along benches above the water surface (DSC 2011). The effects of these changes have not become widespread at this time. Future conditions under these requirements are further described in the *Impacts Analysis* section of this chapter under the heading *Changes in Floodplains and Associated Wetlands of Sacramento River and Tributaries and the Delta*.

**Wetlands, Marshes, and Wet Meadows** Wetlands in the Sacramento Valley can be characterized as perennial or seasonal with perennial wetlands further classified as tidal or non-tidal. Natural, non-tidal perennial wetlands are scattered along the Sacramento River, typically in areas with slow moving backwaters. Management of wetlands, marshes, and wet meadows can include irrigation of open areas to support native herbaceous plants or cultivated species; periodic or continuous flooding to provide feeding and roosting sites for many wetland-associated birds; and either limited or no tilling or disturbance of the managed areas.

Managed seasonal wetlands on the west side of the Sacramento River generally occur between Willows and Dunnigan along the Colusa Basin Drain. Substantial portions of these managed wetland habitats occur at the flood bypasses, including the Yolo Bypass Wildlife Area and Fremont Weir, as a part of the Sacramento National Wildlife Refuge (NWR) Complex, and around the Thermalito Afterbay (Reclamation 2010). Both tidal and nontidal, perennial wetlands are found in the Delta and Suisun Marsh.

*Perennial Non-tidal (Freshwater) Wetlands and Marshes* In the Sacramento Valley and foothills, perennial non-tidal wetland habitats include freshwater emergent wetlands and wet meadows. Freshwater emergent wetlands, or marshes, are dominated by large, perennial herbaceous plants, particularly tules and cattails, which are generally restricted to shallow water.

In marshes, vegetation structure and the number of species are strongly influenced by disturbance, changes in water levels, and the range of elevations present at a site. Wet meadows are similar to perennial freshwater wetlands in many regards; however, they are dominated by a greater variety of perennial plants such as rushes, sedges, and grasses than are found in freshwater wetlands. Perennial freshwater wetlands also provide ecological functions related to water quality and hydrology. These areas generally qualify as jurisdictional wetlands subject to USACE jurisdiction under Sections 401 and 404 of the Federal Clean Water Act.

Perennial freshwater wetlands are among the most productive wildlife habitats in California (DFG 1988). In the Sacramento Valley and foothills, these wetlands support several sensitive amphibians, reptiles, birds, and mammals. Perennial freshwater wetlands also provide food, cover, and water for numerous species of wildlife. Wetlands in the Sacramento Valley and foothills are especially important to migratory birds and wintering waterfowl.

*Seasonal Wetlands* Natural seasonal wetlands occur in topographic depressions and swales that are seasonally saturated and exhibit hydric soils that support hydrophytic plant species. Natural seasonal wetlands are generally dominated by hydrophytic plants during the winter and spring months. Characteristic plant species in seasonal wetlands consist of both native and nonnative species. Native species include Coyote Thistle (*Eryngium vaseyi*), Toad Rush (*Juncus bufonius*), Hyssop Loosestrife (*Lythrum hyssopifolia*), and Foothill Meadowfoam (*Limnanthes douglasii* ssp. *rosea*). Natural seasonal wetlands provide food, cover, and water for numerous common and special status species of wildlife that rely on wetlands for all or part of their life cycle. Like perennial wetlands, seasonal wetlands have been substantially reduced from their historical extent.

Numerous managed seasonal wetlands occur within the Sacramento, Colusa, Sutter, Tisdale, and Yolo Bypasses and around the Thermalito Afterbay (Reclamation 2010).

Managed marsh areas are intentionally flooded and managed during specific seasonal periods to enhance habitat values for specific wildlife species (CALFED 2000). Managed marsh areas are distributed largely in the northern, central, and western portions of the Delta, as well as in Suisun Marsh and the Yolo Bypass, Stone Lakes NWR, and Suisun Marsh.

*Perennial Tidal Wetlands and Open Water* In the Sacramento Valley, tidal wetlands and open water are primarily found in the Delta and Suisun Marsh. Tidal wetlands are influenced by tidal movement of salt water from San Francisco Bay and inflow of freshwater from the Delta and smaller local watersheds. Tidal open water in the Delta is mainly freshwater habitat, with brackish and saline conditions occurring in the western Delta at times of high tides and low flows into the western Delta. It is freshwater in the Yolo Bypass and mainly brackish and saline in Suisun Marsh. Tidal mudflats occur as mostly unvegetated sediment deposits in the intertidal zone between the tidal wetland communities at its upper edge and the tidal perennial aquatic community at its lower edge. Tidal brackish wetlands exist from near Collinsville westward to the Carquinez Strait. Suisun Marsh is the largest contiguous brackish water marsh remaining on the North America west coast (Reclamation et al. 2011). Tidal freshwater marshes occur at the shallow, slow-moving or stagnant edges of freshwater waterways in the intertidal zone and are subject to frequent long duration flooding.

Salinity levels vary throughout the year and are influenced largely by inflow from the Delta (Reclamation et al. 2011). Tidal water in the Delta is mainly freshwater, with brackish and saline conditions occurring in the western Delta at times of high tides and low flows into the western Delta. Tidal marshes associated with the lower Yolo Bypass are freshwater, whereas they are mainly brackish and saline in Suisun Marsh where tidal brackish marshes exist from near Collinsville westward to the Carquinez Strait.

**Agricultural Lands** Agricultural land uses and farming practices in the Sacramento Valley provide habitats and resources for a variety of terrestrial species, including several Federal and State special status species. Agricultural lands are primarily found within the Sacramento Valley on the rich alluvial soils of the riverine floodplains. The distribution of seasonal crops varies annually and seasonally, depending on market forces and crop-rotation patterns. Some of the principal crop types and their value to wildlife are described below.

Crops in the Sacramento Valley include grain and seed crops (e.g., rice, corn and wheat), forage crops (e.g., hay and alfalfa), row crops (e.g., tomatoes), orchards (e.g., almonds, walnuts, peaches, plums, olives, pears, apricots), and vineyards. There are also areas of irrigated pastureland throughout the Sacramento Valley.

Most of the value for wildlife of grain and seed crops occurs during the early growing period because the later dense growth makes it difficult for wildlife to move through these fields. Following harvesting, waste grain is available to waterfowl and other birds, such as Sandhill Crane (*Grus Canadensis*). Row crop and silage fields generally provide lesser value to wildlife than native cover types, but can support abundant populations of small mammals, such as California Vole (*Microtus californicus*) and Western Harvest Mouse (*Reithrodontomys megalotis*). These species attract predators such as snakes and raptors. Other reptile and bird species prey on the abundant insect populations found in row crop and silage fields.

Species generally associated with field and row crops include the Red-Winged Blackbird, Western Meadowlark (*Sturnella neglecta*), California Vole, Black-Tailed Jackrabbit, Western Harvest Mouse, Botta's Pocket Gopher, Raccoon, Striped Skunk, and Virginia Opossum. Croplands also provide foraging habitat for many raptors including Swainson's Hawk (*Buteo swainsoni*), Northern Harrier (*Circus cyaneus*), Red-Tailed Hawk, and White-Tailed Kite (*Elanus leucurus*).

Alfalfa is irrigated and intensively mowed such that vegetation structure varies with the growing, harvesting, and fallowing cycle. As a result, alfalfa supports some of the highest biodiversity amongst crops in California, second only to rice in agricultural habitat biodiversity (Hartman and Kyle 2010), with many species using alfalfa to forage, nest, rest, and hide. A wide range of species, including songbirds, and swallows, bats, and many types of waterfowl and other migratory birds feed on insects in alfalfa fields. Mammals such as gophers, mice, and rabbits feed directly on alfalfa. Larger herbivorous mammals, such as Mule Deer (*Odocoileus hemionus*) and Black-tailed Deer, Pronghorn Antelope (*Antilocapra americana*), and Tule Elk (*Cervus canadensis nannodes*), frequent alfalfa fields, especially during dry or cold seasons. Raptors, migratory birds, Coyote, and Mountain Lion (*Puma concolor*) feed on the birds and rodents that feed on the alfalfa. Scavengers such as Coyote and Turkey Vulture (*Cathartes aura*) also feed on carrion (Putnam et al. 2001).

Rice fields provide surrogate wetland habitats and many wetland wildlife species use rice fields, especially waterfowl and shorebirds, and wading birds that forage on aquatic invertebrates and vertebrates. Other wildlife species that use flooded rice fields include Giant Gartersnake (*Thamnophis gigas*) and American Bullfrog. Ring-Necked Pheasant (*Phasianus colchicus*) and Sandhill Crane among others forage on post-harvest waste grain. The practice of flooding rice fields in winter to allow for decomposition of rice stubble, as opposed to burning, enhances the wildlife value of rice fields. Winter flooding provides loafing and foraging opportunities for a variety of birds, including waterfowl and wading birds.

Orchards and vineyards, typically dominated by a single tree species, are grown in fertile areas that once supported diverse and productive habitats for wildlife. Orchards and vineyards generally provide relatively low wildlife value; however, some species of birds and mammals have adapted to orchard and vineyard habitats. Many have become "agricultural pests" which result in crop losses. Deer and rabbits browse on the trees while other wildlife such as squirrels and numerous birds feed on fruit or nuts. Cover crops grown under the trees provide a food source for wildlife that feed on seeds or herbaceous vegetation. Wildlife species reported to feed on nuts (almonds and walnuts) include Northern Flicker, Western Scrub-Jay (*Aphelocoma californica*), American Crow (*Corvus brachyrhynchos*), Plain Titmouse (*Baeolophus*), Brewer's Blackbird (*Euphagus cyanocephalus*), House Finch (*Haemorhous mexicanus*), Western Gray Squirrel and California Ground Squirrel (DFG 1999a, 1999b, 1999c). Other fruit crops such as peaches, apricots, plums, olives, pears and prunes are also eaten by these same species and others such as Band-Tailed Pigeon (*Patagioenas fasciata*), Yellow-Billed Magpie (*Pica nuttalli*), Western Bluebird (*Sialia mexicana*), American Robin (*Turdus migratorius*), Varied Thrush (*Ixoreus naevius*), Northern Mockingbird (*Mimus polyglottos*), Cedar Waxwing (*Bombycilla cedrorum*), Yellow-Rumped Warbler (*Setophaga coronata*), Black-Headed Grosbeak (*Pheucticus melanocephalus*), Bullock's Oriole (*Icterus bullockii*), Cottontail (*Sylvilagus* spp.), Gray Squirrel, Coyote, Black Bear (*Ursus americanus*), Raccoon, and Mule Deer. Olive orchards do not provide the food for wildlife that many of the deciduous fruit and nut trees provide. Mourning Dove and California Quail use orchard habitats for cover and nesting sites.

Irrigated pastures are managed grasslands with a low structure of native herbaceous plants, cultivated species, or a mixture of both. Pastures are not typically tilled or disturbed frequently and provide breeding opportunities for ground-nesting birds, including waterfowl, Ring-Necked Pheasant, and Greater Sandhill Crane if adequate residual vegetation is present. Flood irrigation of pastures provides feeding and roosting sites for many wetland-associated birds, including shorebirds, wading birds, gulls, waterfowl, and raptors. Large mammals such as Mule Deer and Tule Elk graze in pastures when there is adequate escape cover adjacent to the open pasture. Burrowing species using irrigated pastures include California Ground Squirrel, pocket gopher, and Burrowing Owl (*Athene cunicularia*). Pastures provide foraging habitat for grassland-foraging wildlife, such as Coyote and Red Fox (*Vulpes vulpes*), and raptors like the Northern Harrier, American Kestrel, and Red-Tailed Hawk.

In addition to the crop lands, the network of irrigation canals, drains, and reservoirs that convey water in the agricultural areas provide habitat for many species of wildlife, including species with special status. These conveyance features, particularly those that contain water throughout the growing season, typically support some of the plants and animals characteristic of riverine systems and riparian areas. While water flows through many of these facilities intermittently, these features can provide habitat for species, such as Giant Garter Snake, which is frequently associated with the water conveyance systems that support rice cultivation.

**Invasive Species** Invasive plants and wildlife are species that are not native to the region, persist without human assistance, and have serious impacts on the environment. They are termed "invasive" because they displace native species and alter habitat functions and values. Many invasive plant species are considered "noxious weeds" by governmental agencies such as the U.S. Department of Agriculture and California Department of Food and Agriculture. Numerous invasive plants have been introduced into the study area, and many have become established. The California Invasive Plant Council maintains a list of species that have been designated as invasive in California (Cal-IPC 2006).

According to the CDFW's aquatic invasive species management plan (DFG 2008), invasive species threaten the diversity or abundance of native species through competition for resources, predation, parasitism, hybridization with native populations, introduction of pathogens, or physical or chemical alteration of the invaded habitat. Unlike the native riparian flora, many invasive riparian species do not provide the food, shelter, and other habitat components on which many native fish and wildlife species depend. In addition to the ability to degrade wildlife habitat, many of these invasive trees and shrubs have the potential to harm human health and the economy by adversely affecting the ecosystem, flood protection systems, water delivery, recreation, and agriculture.

Implementation of the alternatives considered in this EIS could affect the shorelines and riparian zone of reservoirs that store CVP and SWP water supplies within the Klamath and Sacramento and Bay-Delta Regions as defined above in this chapter, and shorelines and riparian zone of rivers downstream from the CVP and SWP reservoirs. Therefore, only those invasive plant species that are associated with the shorelines and riparian zone at these reservoirs and waterways would be likely to cause adverse effects on terrestrial biological resources. Examples of these invasive species include Tree-of-Heaven (*Ailanthus altissima*), Giant Reed (*Arundo donax*), Purple Loosestrife (*Lythrum salicaria*), Perennial Pepperweed (*Lepidium latifolium*), Tamarisk (*Tamarix*), and Red Sesbania (*Sesbania herbacea*).

#### *Sacramento Valley*

The Sacramento Valley portion of the Sacramento Valley and Bay-Delta Region considered in this chapter includes Shasta Lake, Keswick Reservoir, and the Sacramento River from Keswick Reservoir to the Delta. This portion also includes the lower Yuba River and the middle and lower portions of the Feather River and American River watersheds that may be influenced by alteration of CVP and SWP operations pursuant to the alternatives considered by this EIS.

Historically, the Sacramento Valley contained a mosaic of riverine, wetland, and riparian communities with terrestrial habitats consisting of perennial grassland and oak woodlands. With development of the Sacramento Valley, native habitats were converted to cultivated fields, pastures, residences, water impoundments, and flood-control structures. As a result, native habitats generally are restricted in their distribution and size and are highly fragmented.

**Shasta Lake and Keswick Reservoir** The Shasta Lake area is characterized by a variety of vegetation and wildlife habitats typical of transitional mixed woodland and low-elevation forest habitats (Reclamation 2013). The majority of vegetation communities and wildlife habitats around Shasta Lake are tree-dominated, and include upland forests with associated mixed chaparral, riparian forests, and woodlands. Other wildlife habitats around the lake include annual grasslands and barren areas. Montane riparian, the dominant riparian vegetation type at and near Shasta Lake's shoreline, also occurs as thin stringers and patches along most stream corridors tributary to Shasta Lake.

Wildlife species around Shasta Lake are those typically associated with tree-dominated habitats and chaparral (Reclamation 2013). Mammals in these habitats include deer, rabbits, chipmunks, and squirrels. Mature trees provide nesting habitat for raptors such as the Bald Eagle and Osprey. Hollow trees and logs provide denning sites for mammals such as Coyote and skunk species, and cavities in mature trees are used by cavity-dwelling species such as the Acorn Woodpecker and Californian Myotis (*Myotis californicus*). Many amphibians and reptiles, including Ensatina, Western Skink, and Northwestern Fence Lizard, inhabit the detrital layer of moist areas. Snakes, including the Northern Pacific Rattlesnake and Sharp-Tailed Snake, also are found in these habitats.

Recently, 38 pairs of mating Bald Eagles were observed at Shasta Lake (USFS 2012).

Terrestrial resources around Keswick Reservoir are similar to those found at lower elevations around Shasta Lake. Northern River Otter, Gray Fox, Coyote, Bobcat (*Lynx rufus*), and Osprey occur along the Keswick Reservoir reach of the Sacramento River (BLM 2006). Historically, vegetation in this area of the watershed was harvested to provide fuel for mining smelters. Chaparral habitat, dominated by manzanita with intermittent oaks, Gray Pine (*Pinus sabiniana*), Ponderosa Pine, and Douglas-fir trees occur on the foothills above the reservoir. As described in Chapter 4, "Surface Water Supply and Management," water elevations in Keswick Reservoir are relatively stable throughout the year.

**Whiskeytown Lake and Clear Creek** Riparian communities within the Whiskeytown Unit of the Whiskeytown-Shasta-Trinity National Recreation Area, which includes Whiskeytown Reservoir, include the following species: Grey Pine, willow species, White Alder (*Alnus rhombifolia*), dogwoods (*Cornus* spp.), Oregon Ash (*Fraxinus latifolia*), Big Leaf Maple, and Fremont (*Populus fremontii*) and Black Cottonwood (*Populus trichocarpa*). Wild Grape is also very common; other riparian shrubs include Snowberry, California Blackberry, Toyon (*Heteromeles arbutifolia*), California Buckeye (*Aesculus californica*) and California Button Willow (*Cephalanthus occidentalis*). Flowering herbaceous plants, cattails, sedges, rushes, and ferns make up the riparian understory. The riparian habitats are generally vigorous and well-vegetated, especially in the most favorable locations, such as canyons and stream bottoms (NPS 1999).

Riparian vegetation is limited to a narrow band along the channel margins in the confined canyon reaches of Clear Creek between Whiskeytown Dam and Clear Creek Bridge, where the alluvial section of the creek begins. Downstream from Clear Creek Bridge, where the valley widens, the channel becomes predominately alluvial, and floodplains and terraces allow riparian vegetation to be more extensive (CBDA 2004).

Fresh emergent wetlands occur throughout the entire reach of lower Clear Creek from Whiskeytown Dam to the Sacramento River. These wetlands are more prominent in the reach below Clear Creek Road Bridge where soils are deeper and the valley becomes wider and is subject to periodic flooding. Valley-foothill riparian is found primarily in the lower reaches of lower Clear Creek from Clear Creek Road Bridge to the Sacramento River. In addition, smaller linear patches occur scattered throughout the system up to Whiskeytown Dam (BLM and NPS 2008).

Due to the diversity of habitats present within the watershed, the areas adjacent to Whiskeytown Lake and lower Clear Creek support a diverse assemblage of wildlife species. More than 200 vertebrate species are known to occur within the Whiskeytown Unit of the Whiskeytown-Shasta-Trinity National Recreation Area, including at least 35 mammal species, 150 bird species, and 25 reptile and amphibian species (NPS 2014).

**Sacramento River: Keswick Reservoir to the Delta** Controlled flow releases from Shasta Dam changed the pre-dam flow patterns from high flows in the mid-spring during snow melt to high flows in the summer months, as described in Chapter 4, "Surface Water Supply and Management." Consequently, in most years, the current flow regime precludes or substantially reduces opportunities for establishment of cottonwoods and willows; and the structure and composition of riparian vegetation has undergone change (Roberts et al. 2002). The extent of early-successional riparian communities (e.g., cottonwood forest) has been decreasing, while the extent of mid-successional communities (e.g., mixed riparian forest) has been increasing. Generally, these effects diminish with distance downstream because of the influence of inflows from tributaries, diversions, and flood bypasses (Reclamation 2013).

Much of the Sacramento River from Shasta Dam to Redding is deeply entrenched in bedrock, which precludes development of extensive areas of riparian vegetation (Reclamation 2013). The upper banks along these steep-sided, bedrock-constrained segments of the upper Sacramento River are characterized primarily by upland communities, including woodlands and chaparral. Outside the river corridor, other vegetation communities along the upper Sacramento River include riparian scrub, annual grassland, and agricultural lands.

The river corridor between Redding and Red Bluff once supported extensive areas of riparian vegetation (Reclamation 2013). Agricultural and residential development has permanently removed much of the native and natural habitat. Riparian vegetation now occupies only a small portion of floodplains. Willow and blackberry scrub and cottonwood- and willow-dominated riparian communities are still present along active channels and on the lower flood terraces, whereas Valley Oak–dominated communities occur on higher flood terraces. Although riparian woodlands along the upper Sacramento River typically occur in narrow or discontinuous patches, they are valuable for wildlife and support both common and special status species of birds, mammals, reptiles, amphibians, and invertebrates.

Portions of the adjacent land along the Sacramento River from Red Bluff to Hamilton City include substantial remnants of the pre-European Sacramento Valley historical riparian forest (Reclamation 2013). Along the Sacramento River below Red Bluff, riparian vegetation is characterized by narrow linear stands of trees and shrubs, in single- to multiple-story canopies.

These patches of riparian vegetation may be on or at the toe of levees. Riparian communities in this region include woodlands and riparian scrub.

From Red Bluff to Colusa, the Sacramento River contains point bars, islands, high and low terraces, instream woody cover, and early-successional riparian plant growth, reflecting river meander and erosional processes (Reclamation 2013). Major physiographic features include floodplains, basins, terraces, active and remnant channels, and oxbow sloughs. These features sustain a diverse riparian community and support a wide range of wildlife species including raptors, waterfowl, and migratory and resident avian species, plus a variety of mammals, amphibians, and reptiles that inhabit both aquatic and upland habitats.

Downstream from Colusa, the Sacramento River channel changes from a dynamic and active meandering one to an artificially confined, narrow channel (Reclamation 2013). Surrounding agricultural lands encroach directly adjacent to the levees, which have cut the river off from most of its riparian corridor, especially on the eastern side of the river. Most of the levees in this reach are lined with riprap, allowing the river no erodible substrate and limiting the extent of riparian vegetation and riparian wildlife habitat.

**Feather River** Lake Oroville and Thermalito Forebay and Afterbay; and the lower Feather River are features of the Feather River watershed that could be affected by implementation of the alternatives considered in this EIS.

*Lake Oroville and Thermalito Complex* Lake Oroville is situated in the foothills on the western slope of the Sierra Nevada Mountains, about a mile downstream from the confluence of its major tributaries. Below the dam, a portion of the river flow is diverted at the Thermalito Diversion Dam and routed to the Thermalito Forebay, which is an offstream reservoir with a surface area up to 630 acres (DWR 2007a, 2007b). Downstream from the forebay, water is stored in Thermalito Afterbay (up to 4,300 surface acres), which among other purposes serves as a warming basin for agricultural water.

The majority of vegetation around Lake Oroville consists of a variety of native vegetation associations, including mixed oak woodlands, foothill pine/mixed oak woodlands, and oak/pine woodlands with a mosaic of chaparral (DWR 2004a, 2007a). Open areas within the woodlands consist of annual grassland species. Native riparian habitats are restricted to narrow strips along tributaries, consisting mostly of alder, willow, and occasional cottonwood and Western Sycamore (*Platanus racemosa*). There is minimum wetland vegetation around Lake Oroville, and most is associated with seeps and springs that are a natural part of the landscape above the high water line. Emergent wetlands are generally absent within the drawdown zone of Lake Oroville.

Lack of vegetative cover within the drawdown zone severely limits wildlife use of this area. Thirty-six wildlife species were detected using habitats within the drawdown zone on at least one occasion during field surveys (DWR 2004a). Several of these species may use habitats within the drawdown zone for reproduction including Belted Kingfisher, Canada Goose (*Branta canadensis*), Canyon Wren (*Catherpes mexicanus*), American Dipper (*Cinclus mexicanus*), Killdeer (*Charadrius vociferus*), Mallard, Common Merganser (*Mergus merganser*), and Northern Rough-winged Swallow (*Stelgidopteryx serripennis*).

Riparian vegetation occurs around the north shore of Thermalito Forebay as a thin strip of mixed riparian species (mostly willows), with an understory of emergent wetland vegetation. Cottonwoods and willows occur in scattered areas around the high water surface elevation of Thermalito Afterbay shoreline (FERC 2007). Emergent wetlands ranging from thin strips to more extensive areas are found around Thermalito Forebay and Thermalito Afterbay. Waterfowl brood ponds constructed in inlets of Thermalito Afterbay support emergent vegetation along much of their shores.

Species observed within the wetland margin of Thermalito Afterbay include Barn Swallow (*Hirundo rustica*), Black Phoebe (*Sayornis nigricans*), White-tailed Kite, Black-tailed Jackrabbit, Brown-headed Cowbird (*Molothrus ater*), American Bullfrog, Common Garternake, Common Yellowthroat (*Geothlypis trichas*), Gopher Snake, Northern Harrier, Pacific Treefrog, Raccoon, Red-winged Blackbird, Ring-necked Pheasant, Short-eared Owl (*Asio flammeus*), Striped Skunk, Tree Swallow (*Tachycineta bicolor*), Virginia Opossum, and Violet-green Swallow (*Tachycineta thalassina*) (DWR 2004a).

In contrast to the drawdown area around the margin of Lake Oroville, the drawdown zone of Thermalito Afterbay supports a richer wildlife community and greater habitat diversity. Survey data collected as part of the relicensing process indicate that exposed mudflats seasonally provide habitat for a variety of migratory waterbirds including Black-necked Stilt (*Himantopus mexicanus*), Black Tern (*Chlidonias niger*), California Gull (*Larus californicus*), Caspian Tern (*Hydroprogne caspia*), Forster’s Tern (*Sterna forsteri*), Greater Yellowlegs (*Tringa melanoleuca*), Least Sandpiper (*Calidris minutilla*), Long-billed Dowitcher (*Limnodromus scolopaceus*), Ring-billed Gull (*Larus delawarensis*), Semipalmated Sandpiper (*Calidris pusilla*), Spotted Sandpiper (*Actitus macularius*), and White-faced Ibis (*Plegadis chihi*). Wading birds and other waterfowl have been observed on the mudflats as well as shallow flooded areas (DWR 2004a). Potentially suitable Giant Garter Snake habitat is present along portions of the afterbay and forebay margins. The existing waterfowl brood ponds provide a refuge for Giant Garter Snake during periods of afterbay drawdown.

Several invasive plant species are found around Lake Oroville and downstream in and around the Thermalito Complex. Invasive species associated with riparian and wetland areas include Purple Loosestrife, Giant Reed, Tree-of-Heaven, and Red Sesbania. About 85 of the roughly 900 acres of wetlands and riparian areas along the margin of Thermalito Afterbay contain varying densities of Purple Loosestrife (DWR 2007a). Purple Loosestrife adversely affects native vegetation.

*Feather River from Oroville Complex to the Sacramento River* The Feather River from Oroville Dam to the confluence with the Sacramento River supports stands of riparian vegetation, which have been restricted over time by flood control levees and land clearing for agriculture and urbanization. As a consequence, the vegetation generally occurs in a narrow zone along much of the river in this reach. However, remnant riparian forest exists in areas where wide meander bends persist, such as at Abbott Lake and O’Connor Lake near the Lake of the Woods State Recreation Area (DWR 2004b). This area contains mixed riparian forests, including Fremont Cottonwood, willow species, Boxelder, White Alder, and Oregon Ash. The riparian strip along the river is bordered mostly by agricultural fields. Downstream from Yuba City near the confluence with the Sacramento River, Valley Oak and Fremont Cottonwood riparian stands become more common.

As described above for the Sacramento River, riparian areas of the Feather River system provide value for wildlife and support a wide range of species of birds, mammals, reptiles, amphibians, and invertebrates.

**American River** The American River watershed encompasses approximately 2,100 square miles (Reclamation et al. 2006). The North, Middle, and South forks of the American River converge upstream from Folsom Lake. Lake Natoma is located downstream from Folsom Lake. Water continues to flow between Nimbus Dam and the confluence with the Sacramento River, as described in Chapter 4, "Surface Water Supply and Management."

*Folsom Lake and Lake Natoma* Folsom Lake, formed by Folsom Dam, has a surface area of about 11,500 acres, and 75 miles of shoreline (Reclamation 2005). Lake Natoma, which serves as an afterbay downstream from Folsom Dam, has about 540 acres of surface area.

Vegetation communities associated with Folsom Lake include oak woodland and annual grassland. The oak woodland habitat is located on the upland banks and slopes of the reservoir, and is dominated by Live Oak, Blue Oak, and Foothill Pine with several species of understory shrubs and forbs. Annual grasslands occur around the reservoir, primarily at the southern end.

The oak woodlands and annual grasslands around the reservoir support a variety of birds. A number of raptors, including Red-Tailed Hawk, Cooper's Hawk (*Accipiter cooperii*), Great Horned Owl, and Long-eared Owl (*Asio otus*) use oak woodlands for nesting, foraging, and roosting. Mammal species likely to occur in woodland habitats include deer, Coyote, Bobcat, Red Fox, Virginia Opossum, Raccoon, rabbits, squirrels, and a variety of other rodents. Amphibians and reptiles that may be found in oak woodlands include California Newt (*Taricha torosa*), Pacific Treefrog, Northwestern Fence Lizard, Gopher Snake, Caliornia Kingsnake, and Northern Pacific Rattlesnake. The adjacent grasslands are used by various bird species for foraging, including White-Crowned Sparrow, Lesser Goldfinch (*Spinus psaltria*), Western Meadowlark, and several raptor species. Migratory waterfowl also are known to feed and rest in the grasslands associated with the north fork of Folsom Reservoir.

Seasonal wetland communities occur both inside and outside of the area influenced by the reservoir. These communities are exposed to wetland hydrology for a limited period of time and may not meet all criteria for wetlands. Within the reservoir drawdown zone, this seasonal vegetation is frequently inundated and may receive overland flow from upland areas. Outside of the drawdown zone, seasonally wet areas receive water from seeps, drainages, and precipitation (Reclamation et al. 2006). Small areas of permanent freshwater marsh are found at the toe of the Mormon Island Auxiliary Dam. Water birds and other wildlife depend on the freshwater marshes in these areas for foraging and rearing habitat. These species include Pacific Treefrog, Western Toad, Common Garter Snake, American Beaver, Raccoon, and Common Muskrat (*Ondatra zibethicus*).

Folsom Lake is surrounded by a relatively barren drawdown zone due to annual fluctuations in water elevations. The majority of this zone is devoid of vegetation, although scattered stands of woody vegetation occur in some areas of the drawdown zone (Reclamation et al. 2006). The only contiguous riparian vegetation occurs along Sweetwater Creek at the southern end of the reservoir.

Between Folsom Dam and Lake Natoma, the river channel is narrower and flanked by steep, rocky cliffs (Reclamation 2005). The land along the river includes wooded canyon areas, sheer bluffs, and dredge tailings from the gold mining era. Within Lake Natoma, the open water is bordered by narrow bands of riparian woodland. Patches of permanent freshwater marsh exist in shallow coves that are inundated when water rises in Lake Natoma (Reclamation 2005).

*Lower American River between Lake Natoma and Confluence with the Sacramento River*

Downstream from Lake Natoma, the lower American River flows to the confluence with the Sacramento River. In the upper reaches of the lower American River, the river channel is controlled by natural bluffs and terraces. Levees have been constructed along the northern and southern banks for approximately 13 miles upstream from the confluence with the Sacramento River (Reclamation et al. 2006).

Most of the lower American River is encompassed by the American River Parkway, which preserves what remains of the historic riparian zone (Reclamation et al. 2006). Vegetation communities along the lower American River downstream from Nimbus Dam include freshwater emergent wetland, riparian forest and scrub. Oak woodland and annual grassland are present in the upper, drier areas farther away from the river. The current distribution and structure of riparian communities along the river reflects the human-induced changes caused by activities such as gravel extraction, dam construction and operations, and levee construction and maintenance, as well as by both historical and ongoing streamflow and sediment regimes, and channel dynamics.

In general, willow and alder tend to occupy areas within the active channel of the river that are repeatedly disturbed by river flows, with cottonwood-willow thickets occupying the narrow belts along the active river channel (Reclamation et al. 2006). Typical species in these thickets include Fremont Cottonwood, willow species, Western Poison Oak, Wild Grape, Himalayan Blackberry, Northern California Black Walnut (*Juglans californica*), and White Alder.

Cottonwood forest is found on the steep, moist banks along much of the river corridor (Reclamation et al. 2006). Valley Oak woodlands occur on upper terraces where fine sediment and adequate soil moisture provide a long growing season. Interior Live Oak woodland occurs on the more arid and gravelly terraces that are isolated from the fluvial dynamics and moisture of the river. Annual grassland occurs in areas that have been disturbed by human activity and can be found in many areas within the river corridor.

The cottonwood-dominated riparian forest and areas associated with backwater and off-river ponds are highest in wildlife diversity and species richness relative to other river corridor habitats (Reclamation et al. 2006). More than 220 species of birds have been recorded along the lower American River and more than 60 species are known to nest in the riparian habitats. Typical species that can be found along the river include Great Blue Heron, Mallard, Red-tailed Hawk, American Kestrel, California Quail, Killdeer, Belted Kingfisher, Western Scrub Jay, Swallows, and American Robin. Additionally, more than 30 species of mammals reside along the river, including Striped Skunk, Raccoon, Western Gray Squirrel, vole, Common Muskrat, deer, Red Fox, and Coyote. Reptiles and amphibians that occupy riparian habitats along the river include Western Toad, Pacific Treefrog, American Bullfrog, Northwestern Fence Lizard, Common Garter Snake, and Gopher Snake (Reclamation 2005).

Backwater areas and off-river ponds are located throughout the length of the river, but occur predominantly at the Sacramento Bar, Arden Bar, Rossmoor Bar, and between Watt Avenue and Howe Avenue (Reclamation 2005; Reclamation et al. 2006). Plant species that dominate these backwater areas include various species of willow, sedges, cattail, Bulrush, and Rushes. Riparian vegetation around these ponded areas is composed of mixed-age willow, alder, and cottonwoods. These backwater ponds may be connected to the river by surface water during high winter flood flows and by groundwater during other times of the year. Wildlife species typical of these areas include: Pied-billed Grebe (*Podilymbus podiceps*), American Bittern (*Botaurus lentiginosus*), Green Heron, Common Merganser, White-tailed Kite, Wood Duck (*Aix sponsa*), Yellow Warbler, Warbling Vireo (*Vireo gilvus*), Dusky-footed Woodrat (*Neotoma fuscipes*), Western Gray Squirrel, Pacific Treefrog, and Western Toad.

Several non-native weed populations are rapidly expanding in the riparian vegetation of the lower American River (County of Sacramento 2008). In particular, Red Sesbania is expanding along shorelines of streams and ponds, along with other invasive species such as Chinese Tallowtree (*Triadica sebifera*), Giant Reed (*Arundo donax*), Pampas Grass (*Cortaderia selloana*), Spanish Broom (*Spartium junceum*), Himalayan Blackberry, and Tamarisk (*Tamarix* spp.), which can rapidly colonize exposed bar surfaces and stream banks.

**Agricultural Lands in the Sacramento Valley** The study area in the Sacramento Valley includes Shasta, Plumas, Tehama, Glenn, Colusa, Butte, Sutter, Yuba, Nevada, Placer, El Dorado, Sacramento, Yolo, and Solano counties. As described in Chapter 11, “Agricultural Resources,” field and forage crops dominate the irrigated acreage in Sacramento Valley with over 1.4 million acres irrigated. Rice, irrigated pasture, and hay are the largest acreages. Second to field and forage crops are orchard and vine crops, making up roughly 21 percent of the total acreage. Almonds and walnuts are the largest acreages in this category. In total, the Sacramento Valley contains nearly two million agricultural acres. Typical terrestrial resources of these crops are similar to those described in subsection titled *Agricultural Lands in the Delta, Suisun Marsh and Yolo Bypass* below in this chapter.

**Wildlife Refuges in the Sacramento Valley** The Sacramento Valley supported three major landscape types: wetlands, grassland-prairies, and riparian woodlands (Reclamation et al 2001). These habitats were hydrologically and biologically linked to the river systems. Prior to their containment by the construction of dams and levees, the major rivers meandered, forming oxbows and riparian habitat. Winter floods would inundate and scour areas along these rivers, creating marshes and early-succession riparian scrub. Expanses of seasonal wetlands were also created by winter flooding. These seasonal wetlands formed habitat for overwintering and migrating waterfowl. Habitat areas such as wetlands are now intensively managed to support a wide range of birds and other wildlife within small and fragmented areas. Remnant wetlands and agricultural lands in the Central Valley support approximately 60 percent of the waterfowl wintering in the Pacific Flyway region (includes Alaska, Arizona, California, Idaho, Nevada, Oregon, Utah, Washington, and portions of Colorado, Montana, New Mexico, and Wyoming west of the Continental Divide [Pacific Flyway Council 2014]). In addition, another 20 percent of the Pacific Flyway population passes through the Central Valley, using the wetlands for foraging and resting on their migratory passage through the region. The Sacramento Valley provides winter habitat for 44 percent of the Pacific Flyway waterfowl. The wetland and associated habitat are also important to several Federally listed and proposed species, and other special status species such as the Peregrine Falcon (*Falco peregrinus*), Bald Eagle, Canada Goose, and California Tiger Salamander (*Ambystoma californiense*).

The Sacramento NWR Complex is composed of five national wildlife refuges (Sacramento, Delevan, Colusa, Sutter and Sacramento River NWRs) and three State wildlife management areas (Willow Creek-Lurline, Butte Sink and North Central Valley Wildlife Management Areas) (USFWS 2013). The refuges of the Sacramento NWR Complex contain permanent ponds, seasonal wetlands, irrigated moist soil impoundments, and uplands (Reclamation et al 2001). Gray Lodge Wildlife Area is located adjacent to the Butte Sink, an overflow area of Butte Creek and the Sacramento River. It consists of seasonal wetlands and upland areas with permanent wetland and riparian habitats (DFG 2011). The Gray Lodge Wildlife Area supports permanent and seasonal wetlands, crops, and pasture (Reclamation et al. 2001).

Seasonally flooded marsh is the most prevalent and diverse of the wetland habitat types (Reclamation et al 2001). Wetland units managed as seasonally flooded marsh are typically flooded from early September through mid-April. Their diversity is the product of a variety of water depths that result in an array of vegetative species that, in combination, provide habitat for the greatest number of wildlife species throughout the course of a year. Through the fall and winter, seasonally flooded marshes are used by a wide range of waterfowl and smaller numbers of wading birds, and shorebirds. In addition, raptors take advantage of the water bird prey base. Water is removed in the spring; therefore, shorebirds use the shallow depth and exposed mudflats on their northern migration.

Moist soil impoundments, or seasonally flooded impoundments, are similar to seasonally flooded marshes (Reclamation et al 2001). Moist soil impoundments are typically irrigated during the summer to bolster plant growth and to enhance seed production. Irrigation is usually performed in mid-summer to increase plant biomass and seed production of Watergrass (*Echinochloa* spp.), Sprangletop (*Leptochloa fusca*), and Smartweed (*Persicaria* spp.). During these irrigation periods, these units are often used by locally nesting colonial wading birds (e.g., egrets, herons).

Permanent ponds and summer water provide wetland habitat for year-round and summer resident species (Reclamation et al 2001). Permanent ponds remain flooded throughout the year, while units managed for summer water are flooded through June or July. Characterized by both emergent and submergent aquatic plants, permanent ponds and summer water units provide brood and molting areas for waterfowl, secure roosting and nesting sites for wading birds and other over-water nesters, and feeding areas for species like Double-crested Cormorant (*Phalacrocorax auritus*.) and American White Pelican (*Pelecanus erythrorhynchos*). Permanent wetland habitats are also important to a number of special status species, such as the Giant Garter Snake, White-faced Ibis, and Tricolored Blackbird (*Agelaius tricolor*).

Valley-foothill riparian habitats are found along low- to mid-elevation streams and waterways (Reclamation et al. 2001). Riparian habitats provide nesting, roosting, and feeding areas for passerines, raptors, wading birds, waterfowl, and small mammals. These areas also provide corridors for resident and migratory wildlife. Riparian woodland habitats are characterized by even-aged, broad-leafed, deciduous trees with open canopies that reflect flood-mediated episodic events. Cottonwood, willow, alder, and oak are typical trees found in riparian woodlands.

Riparian scrub habitats are described as streamside thickets dominated by one or more willow species, as well as other fast-growing shrubs and vines.

### *Delta, Suisun Marsh, and Yolo Bypass*

Historically, the natural Delta system was formed by water inflows from upstream tributaries in the Delta watershed and outflow to Suisun Bay and San Francisco Bay (SFEI 2012). Upstream from the Delta, during high Sacramento River flows, water spilled into the geologic formation known as the Yolo Basin which extends from Knights Landing Ridge upstream from the confluence between the Sacramento and Feather Rivers to the confluence of Cache Slough and the Sacramento River in the Delta upstream from Rio Vista and Suisun Marsh. The Delta and Suisun Marsh have a complex web of channels and islands and are located at the confluence of the Sacramento and San Joaquin Rivers. As further described below, Yolo Bypass is a 59,280-acre floodway through the Yolo Basin that was constructed as part of the Sacramento River Flood Control Project to protect the cities of Sacramento and West Sacramento and the north Delta from extreme flood events.

The Delta (as legally defined in the Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992 [California Water Code section 12220]) covers 737,358 acres, including 4,278 acres of the Suisun Marsh and 16,762 acres of the Yolo Bypass. Individually, the overall Delta, Suisun Marsh, and Yolo Bypass extend over 737,358 acres, 106,511 acres, and 59,280 acres, respectively. In total, the Delta, Suisun Marsh, and Yolo Bypass constitute a natural floodplain that covers approximately 882,200 acres and drains approximately 40 percent of the State (DWR 2009).

**Delta and Suisun Marsh** The Delta overlies the western portions of the Sacramento River and San Joaquin River watersheds. The Delta is a network of islands, channels, and marshland at the confluence of the Sacramento and San Joaquin Rivers. Major rivers entering the Delta are the Sacramento River flowing from the north, the San Joaquin River flowing from the south, and eastside tributaries (Cosumnes, Mokelumne, and Calaveras Rivers). Suisun Marsh is a tidally influenced brackish marsh located about 35 miles northeast of San Francisco in southern Solano County It is a critical part of the San Francisco Bay and Delta estuary ecosystem. The Delta, together with Suisun Marsh and greater San Francisco Bay, make up the largest estuary on the west coast of North and South America (DWR 2009).

The Delta was once composed of extensive freshwater and brackish marshes, with tules and cattails, broad riparian thickets of scrub willows, California Button Willow, and native brambles. In addition, there were extensive riparian forests of Fremont Cottonwood, Valley Oak, Oregon Ash, Boxelder, White Alder, and Goodding's Black Willow. Upland, non-riparian stands of Valley Oak and Coast Live Oak (*Quercus agrifolia*) occurred in a mosaic with seasonally flooded herbaceous vegetation, including vernal pools and alkali wetlands (SFEI 2012).

Substantial areas of the Delta and Suisun Marsh have been modified by agricultural, urban and suburban, and recreational land uses (Reclamation et al. 2011; SFEI 2012). Over the past 150 years, levees were constructed in the Delta and Suisun Marsh to provide lands for agricultural, municipal, industrial, and recreational land uses. The remaining natural vegetation is fragmented, and largely restricted to the edges of waterways, flooded islands, and small protected areas such as parks, wildlife areas, and nature reserves (Hickson and Keeler-Wolf 2007). A substantial portion of the emergent wetlands exists as thin strips along the margins of constructed levees (SFEI 2012). Current habitat along the Delta waterways includes seasonal wetlands, tidal wetlands, managed wetlands, riparian forests, and riparian scrub.

Seasonal wetlands historically had occurred along the riparian corridor at elevations that were inundated during high flow events. Many of the levees were constructed along the riparian corridor edges; and therefore, historic seasonal wetlands were substantially modified (SFEI 2012). Adjacent areas of perennial wetlands on the water-side of the riparian corridor were modified as levees were constructed and channels enlarged. In many of these areas the perennial wetlands were replaced by seasonal wetlands. The vegetation of seasonal wetlands is typically composed of wetland generalist species that occur in frequently disturbed sites such as Hyssop Loosestrife, Cocklebur (*Xanthium strumarium*), Dallis Grass (*Paspalum dilatatum*), Bermuda Grass (*Cynodon dactylon*), Barnyard Grass (*Echinochloa* spp.), and Rye Grass.

Alkali-related habitats occur near salt-influenced seasonal and perennial wetlands. Alkali seasonal wetlands occur on fine-textured soils that contain relatively high concentrations of dissolved salts. These types of soils are typically found at the historical locations of seasonal ponds in the Yolo Basin in and around the CDFW Tule Ranch Preserve, and upland in seasonal drainages that receive salts in runoff from upslope salt-bearing bedrock such as areas near Suisun Marsh and the Clifton Court Forebay. Alkali wetlands include Salt Grass (*Distichlis spicata*), Alkali Weed (*Cressa truxillensis*), Saltbush (*Atriplex* spp.), Alkali Heath (*Frankenia salina*), and Iodine Bush (*Allenrolfea occidentalis*). Small stands of alkali sink scrub (also known as valley sink scrub) are characterized by Iodine Bush.

Tidal wetlands consist of tidal brackish wetlands that occur either as relatively substantial tracts of complex tidal wetlands, or in narrow bands of fringing tidal wetlands (Siegel et al. 2010a). Fringing tidal marsh exists along the outboard side exterior levees and generally has formed since diking for managed wetlands began. Fringing tidal wetlands vary in size and vegetation composition, exhibit less geomorphic complexity, and have a low area-to-edge ratio. Fringing marshes lack connection with the upland transition, are often found in small, discontinuous segments, and can limit movement of terrestrial marsh species.

Plant zones in complex tidal wetlands are influenced by inundation regime and salinity. Tidal wetlands can be divided into three zones: low marsh, middle marsh, and high marsh (Reclamation et al. 2011). The low tidal wetland zone is tidally inundated once or twice per day. At the lowest elevations, vegetation is inhibited by frequent, prolonged, often deep inundation and by disturbance by waves or currents. The dominant plant species are bulrushes. Other species occurring in the low tidal wetland zone are Pickleweed, Lowclub Rush (*Isolepis cernua*), common reed (*Phragmites australis*), and cattails. The low tidal wetland zone provides foraging habitat for waterfowl and shorebirds, including California Ridgway's Rail (*Rallus longirostris obsoletus*), California Black Rail (*Laterallus jamaicensis coturniculus*), and other wading birds.

The middle tidal wetland zone is tidally inundated at least once per day; there is relatively little cover and no refuge from higher tides, which completely flood the vegetation of the middle marsh. The dominant plant species are Pickleweed, Salt Grass (*Distichlis spicata*), and bulrush. Other species occurring in the middle tidal marsh are Fleshy Jaumea (*Jaumea carnosa*), Sea Milkwort (*Lysimachia maritima*), rushes, Salt Marsh Dodder (*Cuscuta salina*), Alkali Heath, cattails, Sneezeweed (*Helenium* spp.), and Marsh Gumplant (*Grindelia stricta* var. *angustifolia*) (Siegel et al. 2010b). The middle tidal wetland zone provides foraging habitat for Salt-Marsh Harvest Mouse (*Reithrodontomys raviventris*) and Suisun Shrew (*Sorex ornatus sinuosus*), as well as common and special status bird species, including waterfowl and shorebirds, California Ridgway's Rail, California Black Rail, and other wading birds. This zone also provides nesting and foraging habitat for Suisun Song Sparrow (*Melospiza melodia* ssp. *maxillaris*) and Salt Marsh Common Yellowthroat (*Geothlypis trichas* ssp. *sinuosa*) (Reclamation et al. 2011).

The high tidal wetland zone receives intermittent inundation during the monthly tidal cycle, with the higher elevations being inundated during only the highest tides. Historically, the high marsh was an expansive transitional zone between the tidal wetlands and adjacent uplands. The high marsh and associated upland transition zone have been significantly affected by land use changes (e.g., managed wetlands, agriculture). The dominant plants are native species, such as Salt Grass, Pickleweed, and Baltic Rush (*Juncus balticus*), and nonnative species, including Perennial Pepperweed, Poison Hemlock (*Conium maculatum*), and Fennel (*Foeniculum vulgare*). Other species occurring in the high tidal marsh are Salt Marsh Dodder, Fleshy Jaumea, Seaside Arrow-Grass (*Triglochin concinna*), Alkali Heath, Brass-Button (*Cotula coronopifolia*), and rabbitsfoot grass (*Polypogon* spp.).

The high tidal marsh provides habitat for special status plants, including Suisun Marsh Aster (*Symphyotrichum lentum*), Soft Bird's Beak (*Chloropyron molle* ssp. *molle*), and Suisun Thistle (*Cirsium hydrophilum* var. *hydrophilum*) (Siegel et al. 2010b). The high marsh zone provides foraging and nesting habitat for waterfowl, shorebirds, California Ridgway's Rail, California Black Rail, and other birds. It also provides foraging and nesting habitat for special status species such as Salt Marsh Harvest Mouse and Suisun Shrew and provides escape cover for Salt Marsh Harvest Mouse, and Suisun Shrew during periods when the middle and lower portions of the high tidal wetland zone are inundated (Reclamation et al. 2011).

Managed wetlands are primarily located within the Suisun Marsh, Cache Slough, and near the confluence of the Mokelumne and Sacramento Rivers within the historical limits of the high tidal marsh and adjacent uplands that were diked and leveled for agricultural purposes and later managed to enhance habitat values for specific wildlife species (CALFED 2000). Diked managed wetlands and uplands are the most typical land cover type in the Suisun Marsh area. Managed wetlands are considered seasonal wetlands because they may be flooded and drained several times throughout the year. Watergrass and Smartweed are typically the dominant species in managed wetlands that use fresher water. Bulrush, cattail, and tule are the dominant species in managed wetlands that employ late drawdown management. Pickleweed, Fat-hen (*Atriplex prostrata*), and Brass-buttons are typical in the higher elevations of the managed wetlands. In marshes with higher soil salinity, pickleweed, Salt Grass, and other salt-tolerant species are dominant. Managed wetlands are managed specifically as habitat for wintering waterfowl species, including Northern Pintail (*Anas acuta*), Mallard, American Wigeon (*Anas americana*), Green-Winged Teal (*Anas crecca*), Northern Shoveler (*Anas clypeata*), Gadwall (*Anas strepera*), Cinnamon Teal (*Anas cyanoptera*), Ruddy Duck (*Oxyura jamaicensis*), and Canvasback (*Aythya valisineria*) ducks; Greater White-Fronted Goose (*Anser albifrons*), and Canada Goose. Some wetlands are also managed for breeding waterfowl, especially Mallard.

Riparian forest areas (excluding willow-dominated riparian habitats) are still present in some portions of the Delta along many of the major and minor waterways, oxbows, and levees (CALFED 2000). Riparian forest and woodland communities dominated by tree species are mostly limited to narrow bands along sloughs, channels, rivers, and other freshwater features throughout the Delta. Isolated patches of riparian vegetation are also found on the interior of reclaimed Delta islands, along drainage channels, along pond margins, and in abandoned, low-lying fields. Cottonwoods and willows, Oregon Ash, Boxelder, and California Sycamore, are the most typical riparian trees here. Valley Oak and Northern California Black Walnut are typical in riparian areas in the Delta. Riparian trees are used for nesting, foraging, and protective cover by many bird species and riparian canopies provide nesting and foraging habitat for a variety of mammals. Understory shrubs provide cover for ground-nesting birds that forage among the vegetation and leaf litter.

Riparian scrub in the Delta and Suisun Marsh consists of woody riparian shrubs in dense thickets (SFEI 2012). Riparian scrub thickets are usually associated with higher, sloping, better drained edges of marshes or topographic high areas, such as levee remnants and elevated flood deposits; and along shorelines of ponds or banks of channels in tidal or non-tidal freshwater habitats. Plant species may include willow, Himalayan Blackberry, button bush, Mule Fat, and other shrub species. Willow-dominated habitat types appear to be increasing in extent in recent years; and willows line many miles of artificial levees where waterways historically had flowed into freshwater emergent wetland. Nonnative Himalayan Blackberry thickets are a typical element of riparian scrub communities along levees and throughout pastures in the levees. Willow thickets provide habitat for a wide range of wildlife species, including the Song Sparrow, Lazuli Bunting (*Passerina amoena*), and Valley Elderberry Longhorn Beetle.

**Yolo Bypass** The Yolo Bypass is a 59,280-acre floodway through the natural-overflow of the Yolo Basin on the west side of the Sacramento River (DWR 2012). As described in Chapter 4, "Surface Water Supply and Management," the Yolo Bypass generally extends north to south from Fremont Weir along the Sacramento River (near Verona) to upstream from Rio Vista along the Sacramento River in the Delta. The bypass, part of the Sacramento River Flood Control Project, conveys floodwaters around the Sacramento River near the cities of Sacramento and West Sacramento. The bypass is utilized as a flood bypass approximately once every 3 years, generally during the period from November to April. Land use in the Yolo Bypass is generally restricted to specific agriculture, managed wetlands, and vegetation communities to ensure that floodway function is maintained (CALFED et al. 2001; USFWS 2002). Agricultural crops include corn, tomatoes, melons, safflower, and rice within the northern bypass; and corn, milo, safflower, beans, tomatoes, and sudan grass in the southern bypass. Waterfowl hunting areas are generally located in the southern bypass, and include rice fields, permanent open water, or a mixture of water and upland habitat.

The Yolo Bypass supports several major terrestrial vegetation types, including riparian woodland, Valley Oak woodland, open water, and wetland. Historically, riparian woodland and freshwater wetland were the dominant habitat types in the Yolo Basin (CALFED et al. 2001; USFWS 2002). Currently, riparian woodland and associated riparian scrub habitats are primarily found adjacent to Green's Lake, Putah Creek, and along the East Toe Drain within the Yolo Bypass Wildlife Area. Riparian woodland is a tree-dominated community found adjacent to riparian scrub on older river terraces where flooding frequency and duration is less. Riparian woodlands include Fremont Cottonwood, Valley Oak, Sycamore, willow species, Eucalyptus (*Eucalyptus*), Giant Reed, and Black Oak. The understory is typically sparse in this community with limited areas of California Grape, Himalayan Blackberry, Western Poison Oak, Mugwort, grasses, and forbs. The woodland canopy provides habitat for hawks, owls, American Crow (*Corvus brachyrhynchos*), Great Egret, Great Blue Heron, White-tailed Kite, Yellow-rumped Warbler (*Setophaga coronata*), Black Phoebe, woodpeckers, Wood Duck, bats, and Raccoon.

Riparian scrub is a shrub-dominated community typically found along stream margins and in the streambed, on gravel bars and similar formations (CALFED et al. 2001; USFWS 2002). This community is typically dominated by phreatophytes (i.e., deep-rooted plants that obtain their water from the water table or the layer of soil just above it), such as willows, and other plants representative of early- to mid-successional stage vegetation communities within riparian areas in the Sacramento Valley. The species include Alders, Elderberry, Fremont Cottonwood, California Wild Rose, Himalayan Blackberry, and Boxelder. This habitat supports Black-Crowned Night Heron, Snowy Egret (*Egretta thula*), Belted Kingfisher, Black Phoebe and Swallow species. Riparian scrub habitat frequently occurs adjacent to non-woody riparian habitat, including Giant Reed (*Arundo donax*), Cocklebur, weedy annual grasses, sedges, rushes, mustards (*Brassica* spp.), Sweet Clover (*Melilotus* spp.), thistles (*Cirsium* spp.), and other weedy species. The non-woody riparian habitat supports Savannah Sparrow, House Finch (*Haemorhous mexicanus*), American Goldfinch (*Spinus tristis*), California Ground Squirrel, and Gopher Snake.

Remnants of Valley Oak woodlands and savanna occur on floodplain terraces in fragmented areas, including downstream from Fremont Weir and along the southern portion of the Toe Drain (CALFED et al. 2001). The habitat also includes Sycamore, Black Walnut, Wild Grape, Western Poison Oak, Elderberry, Himalayan Blackberry, grasses, and sedges.

Depending on the duration of inundation, local soil factors, site history, and other characteristics, seasonal wetlands typically are dominated by species characteristic of one of three natural wetland communities: freshwater marshes, alkali marshes, or freshwater seasonal (often disturbed) wetlands (CALFED et al. 2001). Freshwater marsh communities are typically found in areas subjected to prolonged flooding during the winter months, and frequently do not dry out until early summer. Permanent open water is found throughout the Yolo Bypass, including Gray's Bend near Fremont Weir, Green's Lake near Interstate 80, ponds in the Yolo Bypass Wildlife Area, along Cache and Prospect sloughs, and within canals and drainage ditches. The wetlands support duck breeding habitat; and habitat for many lifestages of wading birds, rails, and raptors, and Muskrat, Raccoon, Virginia Opossum, Beaver, Ring-necked Pheasant, Pacific Treefrog, and American Bullfrog.

Managed wetlands in the Yolo Bypass occur near Fremont Weir, in the 16,770-acre Yolo Bypass Wildlife Area, and within and near Cache Slough. The managed wetlands are generally flooded in the fall, with standing water maintained continuously throughout the winter until drawdown occurs in the following spring (CALFED et al. 2001; DFG and Yolo Basin Foundation 2008). A primary objective of seasonal wetland management is to provide an abundance and diversity of seeds, aquatic invertebrates, and other foods for wintering waterfowl and other wildlife. The wetlands also are managed to control the extent of tules and cattails; and more recently, Common Water Hyacinth (*Eichhornia crassipes*). A portion of the managed wetlands occur within rice fields which are flooded in the winter to provide waterfowl habitat for feeding and resting habitats. A variety of annual plants germinate on the exposed mudflats of seasonal wetlands during the spring draw down, including Swamp Timothy (*Crypsis schoenoides*), Watergrass, Smartweed, and Cocklebur. These plants are then managed through the timing, duration or absence of summer irrigation. The mudflats support many species of shorebirds.

Managed semi-permanent wetlands, commonly referred to as "brood ponds," are flooded during the spring and summer, but may experience a 2 to 6 month dry period each year. These semi-permanent wetlands provide breeding ducks, ducklings, and other wetland wildlife with protection from predators and abundant invertebrate food supplies (DFG and Yolo Basin Foundation 2008). Permanent wetlands remain flooded throughout the year. Due to year-round flooding, permanent wetlands support a diverse, but usually not abundant, population of invertebrates. Permanent managed wetlands provide deep water habitat for diving ducks, such as Ruddy Duck, scaup (*Aythya* spp.), and goldeneye (*Bucephala* spp.); and other water birds, including Pied-Billed Grebe. They often have dense emergent cover on their edges that is the preferred breeding habitat for Marsh Wren and Red-Winged Blackbird; and roosting habitat for Black-crowned Night Heron, White-faced Ibis, and Great and Snowy egrets.

The managed wetlands are operated by private hunting clubs; private conservation entities, including conservation banks; and the Federal and State governments (CALFED et al. 2001). Some of the hunting clubs have implemented wetland management agreements with CDFW under the State Presley Program or Wetland Easement Program to coordinate the timing and patterns of flooding, drawdowns, irrigation, soil disturbance, and maintenance of brood habitat. The patterns may be adjusted annually to respond to specific wildlife and hydrologic needs. A similar program focused on providing spring habitat for breeding is provided by the Federal Waterbank Program.

Habitat in the Yolo Bypass is affected by periodic flooding (CALFED et al. 2001). Following a flood, roads, canals, and ditches may need to be excavated; debris needs to be removed from habitat, and water delivery facilities may need to be repaired. Flooding also disrupts nesting and resting activities of birds. During floods, hunting activities are diminished or ceased.

**Agricultural Lands in the Delta, Suisun Marsh, and Yolo Bypass** Major crops and cover types in agricultural production in the Delta and Suisun Marsh include small grains (wheat and barley), field crops (corn, sorghum, and safflower), truck crops (tomato and sugar beet), forage crops (hay and alfalfa), pastures, orchards, and vineyards. The distribution of seasonal crops varies annually, depending on crop rotation patterns and market forces. In many areas, cropping practices result in monotypic stands of vegetation for the growing season and bare ground in fall and winter. Some farmland is more intensively managed to provide wildlife habitat in addition to crops. Regular maintenance of fallow fields, roads, ditches, and levee slopes can reduce the establishment of ruderal vegetation or native plant communities.

Agriculture has been present in the Yolo Bypass since the seasonal wetlands and perennial marsh and riparian areas were first converted to farms in the mid-1800s. For many years, grazing was the primary use of agricultural lands in the Yolo Bypass. In the latter part of the 20th century, irrigation systems were developed and fields were engineered for the production of row crops (DFG and Yolo Basin Foundation 2008). Periodic flooding of the bypass limits the types of crops that can be grown. The Yolo Bypass Wildlife Area utilizes agriculture to manage habitats while providing income for the management and operation of the property. Working with local farmers, the Yolo Bypass Wildlife Area provides fields of milo, corn, and Sudan Grass specifically for wildlife forage. Rice is grown to provide food for thousands of waterfowl. Corn fields are harvested to provide forage for geese and cranes. Crops such as safflower are cultivated and mowed to provide seed for upland species such as Ring-Necked Pheasant and Mourning Dove. Row and truck crops are grown across the northern half of the Yolo Bypass Wildlife Area. The primary crops grown include rice, corn, millet, milo, safflower, sunflower, and tomatoes. These crops are cultivated during the summer months. From fall to spring, some farmed areas are fallowed and flooded to provide forage for wildlife as well as seasonal wetland habitat. An extensive area at the southern end of the wildlife area is used for grazing cattle. Cattle are brought onto the Yolo Bypass Wildlife Area in mid-spring or early summer after the threat of flooding has passed and are removed by January. Forage is provided in irrigated pasture, uplands within the bypass and the annual grassland-vernal pool complex. Alfalfa is only grown in the western portion of the bypass south of Interstate 80, along with a variety of row crops that are grown in this region (Yolo County 2013).

**Wildlife Refuges in the Delta, Suisun Marsh, and Yolo Bypass** A number of wildlife areas that could be affected by implementation of the alternatives considered in this EIS are located in the Delta, Suisun Marsh, and Yolo Bypass. Conditions in the Yolo Bypass, including the Yolo Bypass Wildlife Area, are described above and not repeated in this subsection.

*Stone Lakes National Wildlife Refuge* The Stone Lakes NWR is located in the Beach-Stone Lakes Basin about 10 miles south of the city of Sacramento. It was established in 1994 and the refuge area is approximately 18,000 acres, of which about 9,000 acres is in a core refuge area owned by the USFWS surrounded by an approximately 9,000-acre “Cooperative Wildlife Management Area” where the USFWS seeks to enter into cooperative agreements or purchase conservation easements from willing landowners. The USFWS actively manages around 6,000 acres on the refuge (USFWS 2007).

The refuge vegetative communities include agricultural lands, open water, perennial freshwater wetlands, cottonwood-willow riparian, irrigated pasture and wet meadow, managed permanent and seasonal wetland, orchards, riparian scrub, upland forest, Valley Oak riparian woodland, vernal pool, and grasslands that facilitate wildlife movement and help compensate for habitat fragmentation and buffers the effects of urbanization on agricultural lands in the Delta region (USFWS 2007).

The diverse vegetation provides habitat for a wide range of mammals, birds, reptiles, and amphibians similar to those described for other sections of the Sacramento Valley (USFWS 2007). The grasslands, pastures, and woodlands support White-Faced Ibis, Geese, Black-bellied Plover (*Pluvialis squatarola*), Great Blue Heron, Great Egret, Greater Sand Hill Crane, Northern Harrier, White-tailed Kite, Red-shouldered Hawk, Swainson’s Hawk, Great Horned Owl, Barn Owl (*Tyto alba*), Bald Eagle, Golden Eagle, American Kestrel, Prairie Falcon (*Falco mexicanus*), Tree Swallow, Barn Swallow, Cliff Swallow (*Petrochelidon pyrrhonota*), songbirds, and birds that use the grasslands, including Killdeer, Ring-necked Pheasant, Burrowing Owl, Mourning Dove, Brewer’s Blackbird, and Turkey Vulture. The waterfowl species include Tundra Swan (*Cygnus columbianus*), Greater White-fronted Goose, Snow Goose (*Chen caerulescens*), Canada Goose, Mallard, Northern Pintail, Northern Shoveler, Cinnamon Teal, Green-winged

Teal, Wood, and Ruddy ducks. The wetland areas also support Common Yellowthroat, Red-winged Blackbird, Marsh Wren, American Coot, cormorant (*Phalacrocorax* spp.), and American White Pelican (*Pelecanus erythrorhynchos*). Other wildlife species on this refuge include Coyote, Deer Mouse, pocket gopher, Black-tailed Jackrabbit, California Vole, California Ground Squirrel, Pacific Treefrog, American Bullfrog, Red-eared Slider (*Trachemys scripta*), Northwestern Fence Lizard, Northwestern Garter Snake, Gopher Snake, Common Garter Snake, California King Snake, and Western Toad.

The riparian cottonwood forests include Fremont Cottonwood, Goodding's Black Willow, California Grape, California Boxelder, California Blackberry, button bush, and Blue Elderberry. The mixed riparian forest includes Valley Oak with vegetation similar to the riparian cottonwood forest but at lower densities. The Valley Oak riparian forest is dominated by Valley Oak, Oregon Ash, California Sycamore, and California Black Walnut with an understory of grasses, vines, and shrubs, including California Blackberry and California Wild Rose. The perennial wetlands include cattails, tules, cottonwood, willows, sedges, and rushes with areas of Watergrass, Smartweed, and Swamp Timothy that also occur in seasonal wetlands. The riparian vegetation provides vast amounts of insects, perches, and cover to support the wide range of bird species, the Valley Oak woodlands provide acorns, insects, and perch and nesting sites. The wetland sites provide foraging opportunities for waterbirds and upland species.

*Miner Slough Wildlife Area* The Miner Slough Wildlife Area within the Delta is about 10 miles north of Rio Vista at the junction of Miner and Cache sloughs and is accessed by boat (CDFW 2014a). The 37-acre Wildlife Area includes approximately 10 acres of tidal wetlands which become a narrow peninsula extending from Prospect Island at low tide. The riparian vegetation of willow, cottonwood, tules, and blackberry support a wide range of wildlife species including American Beaver, Black-Crowned Night Heron, and waterfowl.

*Decker Island Wildlife Area* Decker Island is a 648-acre island located about 20 feet above sea level surrounded by the Sacramento River and Horseshoe Bend in the Delta just south of Rio Vista (DWR 2003; Philipp 2005). The island was created between 1917 and 1937 as part of the actions to implement the Sacramento Deep Water Ship Channel, as described in Chapter 4, "Surface Water Supply and Management." CDFW owns the northernmost 33 acres of Decker Island and has been working with the DWR to reestablish and enhance wetland and upland habitats. The vegetation includes shallow water channels lined with thick stands of tules, sedges, willow, and alder. Many mammal species have been observed, including Northern River Otter, American Mink (*Neovison vison*), American Beaver, Coyote, mice and voles. Various species of raptors, waterfowl, songbirds, and shorebirds have also been observed. Amphibians and reptiles such as Pacific Treefrog, Northwestern Fence Lizard, and Gopher Snake have been seen. Invasive plants such as Perennial Pepperweed, Yellow Star Thistle (*Centaurea solstitialis*), Water Hyacinth, and Brazilian Waterweed (*Egeria densa*) continue to pose a threat to restoration efforts.

*Lower Sherman Island Wildlife Area* The Lower Sherman Island Wildlife Area occupies roughly 3,100 acres, primarily marsh and open water, at the confluence of the Sacramento and San Joaquin Rivers in the western Delta (DFG 2007). Riparian vegetation is characterized by narrow linear strips of trees and shrubs, in single-to multiple story canopies. Riparian vegetation primarily occurs along the historic levees above elevations that support tidal marsh. Native woody plant species occurring in the riparian strip include Fremont Cottonwood, willow species, Red Alder, and California Wild Rose. Himalayan Blackberry infests many of these areas. Marsh vegetation includes both emergent marsh and areas of floating aquatic vegetation. Most emergent marsh is dominated by bulrush, cattail, and common reed. In the northwestern portion of Lower Sherman Island, there is also upper elevation marsh dominated by Pickleweed and Salt Grass. Grasslands are dominated by annual grasses, but also include many perennial species that are also typical in seasonal wetlands. Pampas Grass and Perennial Pepperweed, two invasive nonnative species are also found in the grassland areas.

At the Lower Sherman Island Wildlife Area, habitat exists for a wide variety of wildlife species, including numerous bird species, mammals, reptiles, and amphibians (DFG 2007). Many of the bird species that occur in the wildlife area are migratory and are there only, or primarily, during the fall and winter months. Wintering birds include waterfowl, shorebirds, wading birds, and raptors. Other groups that utilize the wildlife area seasonally include upland game species, cavity-nesting birds, and neotropical migratory birds. Typical mammal species found in the upland grassland and disturbed areas of the wildlife area include Striped Skunk, Raccoon, Western Gray Squirrel, vole species, pocket gopher, Feral Cat (*Felis silvestris* ssp.), Red Fox, and Coyote. Muskrat and American Beaver may be found in the marsh vegetation. Typical reptiles and amphibians include Northwestern Fence Lizard, snakes, frogs, and toads.

*Rhode Island Wildlife Area* Rhode Island Wildlife Area is a 67-acre island, located in Contra Costa County that is managed by CDFW (CDFW 2014b). The vegetation along the perimeter of the island includes alder, willow, blackberry, and tule. The interior open water areas include marsh vegetation of tule and cattail. The island provides habitat for river otters, beaver, muskrat, and many species of birds including Great Blue Heron; Black-crowned Night Heron; Great and Snowy Egret; and Mallard, Cinnamon Teal, and Wood ducks.

*Hill Slough Wildlife Area* Hill Slough Wildlife Area, located in the northern part of Suisun Marsh, is operated by CDFW and contains 1,723 acres of saltwater tidal marsh, managed marshes, slough, and upland grassland (CDFW 2014c). The area supports a wide variety of waterfowl, including Northern Pintail, Mallard, Northern Shoveler, and Green-winged Teal ducks; and American Wigeon. Ferruginous Hawks (*Buteo regalis*) and Rough-legged Hawks (*Buteo lagopus*) winter in the area while year-round residents such as Golden Eagle, Northern Harrier, and Red-tailed Hawk forage over the ponds and upland areas. Mammals including Raccoon, Black-tailed Jackrabbit, and vole are found here and are preyed upon by Coyote.

*Grizzly Island Wildlife Area* Grizzly Island Wildlife Area is administered by CDFW and consists of approximately 15,300 acres of tidal wetlands and managed marshes within Suisun Marsh (CDFW 2014d, 2014e). The CDFW manages waterways to create more than 8,500 acres of seasonal ponds containing Alkali Bulrush and Fat-Hen. Grizzly Island Wildlife Area includes habitats that support Northern Pintail Duck, Green-winged Teal Duck, American Wigeon, Greater White-fronted Goose, Great Blue Heron, Snowy Egret, Black-crowned Night Heron, Yellowthroat, Marsh Wren, Suisun Song Sparrow, American White Pelican, Ferruginous Hawk, Sharp-shinned Hawk (*Accipiter striatus*), White-tailed Kite, Red-tailed Hawk, Prairie Falcon, Peregrine Falcon, Northern Harrier, and Short-eared Owl. The Grizzly Island Wildlife Area also supports mammals, including Northern River Otter and Tule Elk.

*Fremont Weir Wildlife Area* The Fremont Weir Wildlife Area is located within the Yolo Bypass from the Sacramento River to downstream from the Fremont Weir. During high flows, water from the Sacramento River flows into the Yolo Bypass over the Fremont Weir as part of the Sacramento River Flood Control Project, as described in Chapter 4, "Surface Water Supply and Management." The 1,461-acre refuge includes Valley Oak, willow, cottonwood, brush, and weedy vegetation (CDFW 2014f). The area supports Ring-Neck Pheasant, California Quail, Mourning Dove, a range of waterfowl species similar to those described for the Yolo Bypass, Brush Rabbit (*Sylvilagus bachmani*), and Black-tailed Jackrabbit.

*Sacramento Bypass Wildlife Area* The Sacramento Bypass Wildlife Area is located along a channel that connects the Sacramento River to the Yolo Bypass. During high flows, water from the Sacramento River flows into the Yolo Bypass through the Sacramento Bypass as part of the Sacramento River Flood Control Project, as described in Chapter 4, "Surface Water Supply and Management." The 360-acre refuge includes Valley Oak, willow species, Fremont Cottonwood, and weedy vegetation (CDFW 2014g). The area supports raptors, songbirds, Ring-Neck Pheasant, Mourning Dove, and a range of mammal species similar to those described for the Yolo Bypass.

*Calhoun Cut Ecological Reserve* The Calhoun Cut Ecological Reserve is located within the Cache Slough area approximately 15 miles south of Dixon and is only accessed by boat through Lindsay Slough (CDFW 2014h). Vegetation in Calhoun Cut includes grasslands, marshes, and riparian vegetation (Witham and Karacfelas 1994). The grasslands include native Purple Needle Grass (*Stipa pulchra*).

# Impact Analysis

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

## Potential Mechanisms for Change and Analytical Methods

As described in Chapter 3, "Considerations for Describing Affected Environment and Environmental Consequences," this impact analysis considers changes in terrestrial resources conditions related to or caused by augmentation of Trinity River flows from Trinity Lake and Lewiston Reservoir under Alternatives 1 and 2 as compared to the No Action Alternative.

Implementation of the action alternatives, as compared to the No Action Alternative, could affect these resources by altering the ecological attributes of plant communities or other habitat characteristics upon which terrestrial wildlife depend. Potential mechanisms of change to terrestrial resources fall into the following general causative categories associated with the alternatives:

1. Changes in habitat and species composition resulting from changes in flow releases downstream from CVP/SWP facilities.

2. Changes in habitat and species composition resulting from changes in storage levels in CVP/SWP reservoirs.

Mechanisms for change are analyzed in the following discussion. For reasons explained, some of these mechanisms are eliminated from further analysis of effects on terrestrial resources resulting from implementation of the action alternatives compared to the No Action Alternative, while other mechanisms of change are introduced for the purpose of further analysis in the following section, *Evaluation of Alternatives*.

#### *Changes in Habitat and Species Composition Resulting from Changes in Flow Releases Downstream from CVP/SWP Facilities*

**Changes in Rivers Downstream from CVP and SWP Reservoirs** Implementation of action alternatives would influence river flow regimes that renew and support adjacent riparian and wetland plant and wildlife communities. For example, certain riparian plants such as willow species require a specific sequence and timing of flow events to prepare the seedbed and to support germination and seedling growth in March through May. Changes in flow that support or interfere with these processes could influence riparian vegetation and its value as wildlife habitat. Conversely, increased discharge from Trinity Lake into the Trinity and Klamath Rivers in late August, September and October could cause flows in Clear Creek and Sacramento River to be reduced, since Trinity Lake supplies may not be available for diversion via Whiskeytown Lake or the Spring Creek diversion during those months (under Alternative 1). This could result in effects on terrestrial resources in Clear Creek and Sacramento River due to lower flows in these months, either due to decreased habitat values of riparian vegetation or due to changes in species composition from decreased food availability or reproductive success.

CalSim II modeling results (Chapter 4, “Surface Water Supply and Management”) provide information on flows below CVP and SWP reservoirs which aid in the analysis. The CalSim II modeling results can be used to provide a qualitative analysis on downstream terrestrial resources but does not include specific information on wetted stream area and therefore site specific evaluation of all terrestrial resource effects within and adjacent to these rivers and their riparian corridors is not possible. This analysis focuses on qualitative changes to these terrestrial resources and their habitats.

The analysis is focused on the Klamath, Trinity, Sacramento, Feather, and American Rivers and Clear Creek below Whiskeytown Dam because the flow regimes of these rivers may be altered by implementation of the action alternatives. Rivers downstream from other reservoirs in the CVP and SWP system are not included in this scope of analysis, either because their flows are conveyed by canal systems or pipelines with no or negligible terrestrial resource values, or because they are located south of the Delta such that changes in river flows under the action alternatives compared to the No Action Alternative are projected to be less than 1 percent in all months of all Sacramento water year types, or both.

As discussed above in *Affected Environment* of this chapter, the TRRP has established a comprehensive program to manage and restore riparian resources adjacent to the Trinity River between Lewiston Dam and the North Fork. TRRP has undertaken channel reconstruction projects to selectively remove much of the riparian encroachment that has developed since creation of Trinity Lake and Lewiston Reservoir. Riparian vegetation planted on the restored floodplains will be managed to encourage natural riparian growth on the floodplain and limit encroachment on the newly formed gravel bars. Monitoring efforts are underway to document the success of the altered riparian corridor. Augmentation of Klamath River flows using flows from Trinity Lake storage under the action alternatives as compared to the No Action Alternative could alter the success of riparian restoration efforts and result in effects on terrestrial wildlife that inhabit and depend on the Trinity River riparian corridor. Also, alteration of *Trinity River Mainstem Fishery Restoration Final EIS/Environmental Impact Report Record of Decision* (ROD) flows in spring to provide the storage needed for fall releases, as proposed in Alternative 2, could alter the effectiveness of Trinity River riparian restoration efforts and in turn wildlife which depend on the floodplain riparian corridor. Augmentation of flows along the lower Klamath could also affect wildlife which rely on the lower Klamath River and its riparian corridor.

Foothill Yellow-legged Frog and Western Pond Turtle are both identified by CDFW as Species of Special Concern. Foothill Yellow-legged Frogs breed on the Trinity River below Lewiston Dam from early April to mid-June (Wheeler et al. 2014) while Western Pond Turtles breed in May, June and July (USFWS and Hoopa Valley Tribe 1999). Foothill Yellow-legged Frog deposit their eggs in shallow, low-velocity areas along rocky, sparsely vegetated river bars (Lind et al. 1996). Tadpoles remain in low velocity areas until they metamorphose. Western Pond Turtles dig burrows to lay their eggs above the wetted perimeter in May, June and July (USFWS and Hoopa Valley Tribe 1999). The hatchlings migrate to slow, protected backwater pools and utilize the abundant zooplankton typical of these warmer backwater habitats.

Alterations in flow regimes and river temperatures below Lewiston Dam pursuant to Alternative 2 during these species' breeding periods (April through June) might affect their breeding success. Additionally, alterations in Trinity and Klamath River temperatures in August and September under either action alternative may affect these species by reducing aquatic life-stage growth and development rates.

**Changes in Floodplains and Associated Wetlands of Sacramento River and Tributaries and the Delta** Augmentation of Klamath River flows using flows from Trinity Lake storage under the action alternatives as compared to the No Action Alternative could alter the movement of flood flows from the Sacramento River or from its tributaries downstream from CVP/SWP facilities into adjacent floodplains and wetlands. These higher flows can provide habitat for wildlife within floodplains and associated wetlands and typically occur during late fall, winter and early spring, during the months of December through May.

Under all alternatives, development along major river corridors in the Sacramento Valley would continue to be limited by State regulations implemented by the Central Valley Flood Protection Board and the USACE. Within the Delta, the floodways are further regulated by the Delta Protection Commission and Delta Stewardship Council to preserve and protect the natural resources of the Delta; and prevent encroachment into Delta floodways. These regulations, as implemented in all alternatives, would prevent development within the floodplains and floodways of the Delta and adjacent to the Sacramento, Feather and American Rivers and Clear Creek upstream from the Delta.

Analysis of CalSim II modeling results (Chapter 4, "Surface Water Supply and Management") indicates that action alternatives would result in up to 1 percent difference in flows compared to the No Action Alternative during any month of any Sacramento River water year type, during the months of December through May, for Sacramento River below Keswick Dam, Clear Creek below Whiskeytown Dam, American River below Nimbus Dam, Feather River below Oroville Dam, Sacramento River at Freeport, and Delta Outflow. During the months of July, several rivers may have reductions in flows under the action alternatives compared to the No Action Alternative of up to 5 percent, however, such a reduction would not change any floodplains or reduce wetland hydrology fed from floodplains. These results indicate that the action alternatives would have no effects on terrestrial resources resulting from changes in river and Delta floodplains and associated wetlands compared to the No Action Alternative, and this potential effect is not further examined in this EIS.

**Changes in Flows into the Yolo Bypass** The Yolo Bypass receives flow from the Sacramento River through the Fremont Weir during significant winter and spring flood flow events. Analysis of CalSim II modeling results (Chapter 4, "Surface Water Supply and Management") indicates that action alternatives would result in less than 1 percent difference compared to the No Action Alternative during any month of any Sacramento River water year type, except during January of "Dry" water year type, which shows a -1 percent change in flow into the Yolo Bypass for both Alternatives 1 and 2 compared to the No Action Alternative. These results indicate that the action alternatives would have no effects on terrestrial resources within the Yolo Bypass compared to the No Action Alternative, and this potential effect is not further examined in this EIS.

**Changes in Wildlife Refuges** Wildlife Refuges in the Sacramento Valley receive water from the CVP under the Refuge Water Supply and Conveyance Program, managed jointly by the USFWS and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) (USFWS 2012). The Program provides that Level 2 supplies (422 thousand acre-feet (TAF) in the aggregate for all refuges in the CVP system) be provided to all refuges for basic water supply needs for wildlife. Although portions of the Incremental Level 4 supplies (an additional 133 TAF over all refuges) have at times been available to some of the refuges, they are not considered part of the No Action Alternative as they are subject to annual determination based on availability and willing water rights sellers. The water is used to flood refuge lands to provide for annual vegetative recovery and open water habitat for waterfowl. Analysis of CalSim II modeling results (Chapter 4, "Surface Water Supply and Management") indicates that action alternatives would result in 0 percent difference in Level 2 supplies compared to the No Action Alternative during any Sacramento Water Year Type, except during "Critical" years, which shows a 1 percent reduction in Level 2 Refuge water supplies for both Alternatives 1 and 2 compared to the No Action Alternative. These results indicate that the action alternatives would have no effects on terrestrial resources within Sacramento Valley wildlife refuges compared to the No Action Alternative, and this potential effect is not further examined in this EIS.

**Changes in Salinity in and Adjacent to Waterways of the Delta** Augmentation of Klamath River flows using flows from Trinity Lake storage under the alternatives as compared to the No Action Alternative could change the Delta salinity which could affect survival of riparian vegetation and wildlife which depend on it. The analysis evaluates changes in salinity by comparing the end of month X2 position. The X2 position is the extrapolated distance upstream from the Golden Gate Bridge where the salinity isohaline at 1 meter above bottom is 2 parts per thousand. Chapter 5, “Surface Water Quality,” indicates that in all months of all water year types, the X2 position of the action alternatives is a 0 percent change from the No Action Alternative, and in only 5 months of all water year types, it is calculated at 0.1 kilometer less (closer to the Bay) than the No Action Alternative. These results indicate that the action alternatives would have no or negligible effects on terrestrial resources resulting from changes in Delta salinity compared to the No Action Alternative, and this potential effect is not further examined in this EIS.

**Changes in Agricultural Acreage Irrigated with CVP and SWP Water** Augmentation of Klamath River flows using Trinity Lake storage under the action alternatives as compared to the No Action Alternative could change the extent of irrigated acreage and associated habitats by changing water deliveries to agriculture. It should be noted that certain agricultural crops contribute substantially to wildlife habitat values, whereas other crops have substantially less or negligible value to wildlife, hence a given reduction in water deliveries to agriculture may have a less than pro rata effect on wildlife which rely on agricultural acreage as habitat. For example, as explained above in *Affected Environment* of this chapter, rice and alfalfa fields provide much higher habitat values to wildlife, particularly waterfowl, than orchard or row crops. However, rice and alfalfa and other crops with higher value as wildlife habitat account for approximately one-third of total agricultural water use in California’s Central Valley, while row crops and orchards use approximately two-thirds of agricultural water (DWR 2014).

#### *Changes in Habitat and Species Composition from Changes in Storage Levels in CVP/SWP Reservoirs*

**Changes in CVP and SWP Reservoir Elevations** Changes in surface water elevations at the CVP and SWP reservoirs would influence the extent of the drawdown zone (the area of shoreline between the full inundation elevation and the water level), which can influence the availability and quality of nesting habitat for some ground-nesting birds (e.g., waterfowl) and possibly the prey base for nesting fish-eating raptors (e.g., Bald Eagle and Osprey) in March through June. The creation or enlargement of barren zones through reservoir drawdown can also affect the ability of wildlife species to gain access to water and food sources, and could cause them to be more vulnerable to predation, particularly as reservoirs are drawn down to minimum levels in the Fall.

As described in Chapter 4, “Surface Water Supply and Management,” CalSim II modeling results provide information on expected elevation changes of Trinity, Whiskeytown, Shasta, and Folsom Lakes and Lake Oroville, for each month of the year of the relevant water year type.

### Evaluation of Alternatives

As described in Chapter 3, “Considerations for Describing Affected Environment and Environmental Consequences,” action alternatives have been compared to the No Action Alternative.

#### *No Action Alternative*

For the analysis of effects on terrestrial biological resources, the No Action Alternative is comparable to the conditions described in the *Affected Environment* portion of this chapter. The effects of climate change and sea level rise are assumed to be included in the No Action

Alternative. The effects of climate change would be the same under the action alternatives as under the No Action Alternative. Sea level rise may affect the salinity level of the Delta, but would not change the analysis of effects due to salinity of the action alternatives as compared to the No Action Alternative.

#### ***Proposed Action (Alternative 1)***

#### **Lower Klamath and Trinity River Region**

*Changes in Rivers Downstream from CVP and SWP Reservoirs*

*Trinity River* CalSim II modeling results provide information on river flows of the Trinity River below Lewiston Dam under Alternative 1 compared to the No Action Alternative. Results indicate that for the months of the year when augmentation is not underway (all months of the year except August – September) average flows in most months of most Trinity water years would be within the range of 2 percent more than or less than the flows under the No Action Alternative, with the exception of 3 months in which flows under Alternative 1 are reduced by 6-8 percent. Changes in flow of this magnitude are expected to result in no or negligible positive or negative effects on terrestrial resources, as they are well within the range of seasonal and year to year anomalies in flow that wildlife species are typically equipped to adapt to. The 8 percent flow reduction in February of below normal Trinity water year type is earlier than the breeding season for most waterfowl and birds in the Trinity River region (USFWS et al. 2000). Thus this reduction would not adversely affect nesting birds.

CalSim II modeling results further show that, under Alternative 1 compared to the No Action Alternative, flows in August and September, months in which Trinity River ROD flows would be augmented under this alternative, will increase by 5 percent to 117 percent depending on the water year type. However, augmentation flows under Alternative 1 would be less than twice the No Action flow in approximately 55 percent of years in which any augmentation is needed. Augmentation years with higher releases occur most often in dry and critically dry years. In general, increased water flows in late summer and early fall would have a positive effect on riparian resources and terrestrial wildlife. As vegetation struggles to survive low water periods, particularly in dry and critically dry water years, the additional inundation could have a minor positive effect on riparian vegetation. However, as reviewed above and in the *Affected Environment* section of this chapter, goals of the TRRP include the sustained removal of vegetation which has in the past invaded the low flow channel, trapped sediments and narrowed the channel. The duration of increased flows would be no more than 2 months, which may be too short a period to result in substantial vegetation recruitment. Additionally, under Alternative 1 and the No Action Alternative, TRRP will continue to provide scouring flows in late April, May and June which can be expected to continue to prevent germination of new vegetation in the active channel by inundation and scouring of the channel. Also, Adaptive Management and Monitoring efforts by TRRP for sustaining the corrected low flow channel and revegetating upper river terraces above the low flow channel will continue under all alternatives. For these reasons, changes of flow of this magnitude are expected to have negligible effects on riparian resources and wildlife which rely on the Lower Trinity River riparian corridor.

Temperature decreases in the Trinity River downstream from Lewiston Dam and in the lower Klamath River in late summer associated with implementation of the action alternatives could affect both Foothill Yellow-legged Frog and Western Pond Turtle due to these species' reliance on water temperatures that optimize growth and food availability, particularly for young of the year and juveniles (Ashton et al. 2015, Wheeler et al. 2014). This analysis is based on the one-dimensional daily averaged water-temperature outputs from the RBM 10 water temperature models for the Trinity and Klamath Rivers, the analytic procedures for which are described in Chapter 5 "Surface Water Quality." Under Alternative 1, when fall flows are augmented in August and September, water temperatures in the Trinity River below Lewiston Dam in critical Trinity water years will be up to -2.8 ºF and -6.6 ºF degree F less, respectively than the No Action Alternative. Although this amount of temperature reduction in August and September represents up to 9 percent change from the No Action Alternative, it may result in a temporary, minor effect on these species because of their ability to behaviorally, thermo-regulate at this life-stage.

*Klamath River* Flows in the lower Klamath River below its confluence with Trinity River will increase in August and September under Alternative 1 compared to the No Action Alternative. At this time of year, flows in the Klamath River above the confluence can be expected to be low, particularly in dry and critical Trinity water year types. Riparian vegetation below the confluence will be more likely to survive through the dry late summer and fall as a result, and terrestrial species will undergo less stress from restricted access to water or adequate access to water adjacent to cover. The addition of flows from Trinity River in these months under Alternative 1 would have a temporary positive effect on riparian vegetation and terrestrial resources compared to the No Action Alternative.

*Changes in CVP and SWP Reservoir Elevations* CalSim II modeling results provide information on expected elevation changes of Trinity Lake, for each month of the Trinity water year type for Alternative 1 compared to the No Action Alternative. Results indicate that in all months of all Trinity water year types, elevation changes would be less than 1 percent. Changes in surface elevation would be 2 feet or less on average for all months of all water years except August, September, October and November of Critical water years, when reservoir elevations would vary between 3 feet and 6 feet less than under the No Action Alternative. During these events, reservoir levels may force some species to travel further across barren shorelines to access the water, which may leave them more exposed to predation. It may also make it more difficult for some species to reach food sources.

**Sacramento Valley and Bay-Delta Region**

*Changes in Rivers Downstream from CVP and SWP Reservoirs* CalSim II modeling results provide information on monthly average river flows of the Sacramento, Feather and American Rivers and Clear Creek, below CVP and SWP dams. They indicate that in all months of the year under all Sacramento water year types, changes in flow for Alternative 1 compared to the No Action Alternative will result in flow changes of plus or minus 2 percent, except as follows: for the Sacramento River in critical water years, September flows will be 4 percent less; for Feather River in critical water years June flows will be 7 percent higher; and for American River in critical water years, July flows will be 5 percent lower and September flows will be 6 percent higher. These results indicate that changes in rivers below CVP and SWP reservoirs under Alternative 1 compared to the No Action Alternative will have similar effects on wildlife in all months of most water year types, and will have minor positive effects on wildlife on the Feather River in June of critical water years and on the American River in September of critical water years.

*Changes in Agricultural Acreage Irrigated with CVP and SWP Water* CalSim II modeling results provide information on deliveries to Sacramento Valley agriculture. In wet, above normal, below normal and dry Sacramento water year types, annual average agricultural water deliveries north of the Delta would range from 0 percent to 4 percent less under Alternative 1 than under the No Action Alternative. In Sacramento critical water years, annual average agricultural water deliveries north of the Delta would be 11 percent less under Alternative 1 than the No Action Alternative. A reduction of 4 percent or less in water deliveries to agriculture might slightly reduce the number of acres under irrigation which are valuable to wildlife. A reduction of 11 percent in water deliveries to agriculture in Sacramento critical water years would likely reduce agricultural acreage. As noted above in *Potential Mechanisms of Change and Analytical Methods* of this chapter, rice and alfalfa fields provide much higher habitat values to wildlife, particularly waterfowl, than orchard or row crops, but account for approximately one-third of total agricultural water use in California's Central Valley. Row crops and orchards use approximately two-thirds of agricultural water, and in many cases have very minor value as habitat for wildlife. Thus, the 11 percent reduction in annual average water deliveries in critical Sacramento water years will not have a pro rata negative effect on wildlife. Reduction of water supplies to Sacramento Valley agriculture in critical water years under Alternative 1 will have a minor adverse effect on Sacramento Valley wildlife which utilize agriculture.

*Changes in CVP and SWP Reservoir Elevations* CalSim II modeling results provide information on expected elevation changes of Whiskeytown, Shasta, and Folsom Lakes and Lake Oroville, for each month of the Sacramento water year type for Alternative 1 compared to the No Action Alternative. Monthly average water surface elevations in all these reservoirs under Alternative 1 are similar to under the No Action Alternative with changes of 0 percent in almost all months of all water year types, and -1 percent in only several months. The changes are in all cases less than or equal to 1 foot in elevation. Changes in reservoir elevations of this magnitude would not be expected to alter success of wildlife in obtaining access to food sources, successfully breeding, or evading predators, thus changes in CVP and SWP reservoir elevations under Alternative 1 would have no or negligible effects on terrestrial wildlife resources at these reservoirs.

### *Trinity River ROD Flow Rescheduling Alternative (Alternative 2)*

#### Lower Klamath and Trinity River Region

*Changes in Rivers Downstream from CVP and SWP Reservoirs*

*Trinity River* CalSim II modeling results provide information on monthly average river flows of the Trinity River below Lewiston Dam under Alternative 2 compared to the No Action Alternative. Results indicate that for the months of the year when augmentation is not underway (all months of the year except August – September) average flows in most months of most Trinity water years would be in the range between 5 percent more or 5 percent less than flows under the No Action Alternative. Changes in flow of this magnitude are expected to result in no or negligible positive or negative effects on terrestrial resources, as they are well within the range of seasonal and year to year anomalies in flow that wildlife species are typically equipped to adapt to. Flows in May and June of dry water years would be reduced by 7 percent and 8 percent respectively compared to the No Action Alternative, and flows in May and June of critical water years would be reduced by 14 percent and 29 percent respectively compared to No Action Alternative. These data reveal the key feature of Alternative 2, which is designed to provide additional storage in Trinity Lake for potential flow augmentation in those years when the need is anticipated, by adjusting the timing of delivery of scouring and pulse flows as provided by the Trinity River ROD. Analysis of Trinity River ROD flow curve adjustments to accommodate the reserved storage under Alternative 2 shows that compared to the No Action Alternative the reduction of 7 to 8 percent in May and June of Trinity dry water years would occur over a time span of several days (Reclamation 2016). Based on this, the reduction in flows in May and June of Trinity dry water years would be a negligible adverse effect on terrestrial resources as it might slightly limit efforts to control riparian encroachment into the channel by the TRRP at the expense of preferred riparian growth on the upper terrace.

In dry and critically dry water years, scheduled Trinity River ROD flows in May and June are not high enough to provide a significant degree of scour to the low flow channel. However, the Trinity River ROD flows in theses months in dry and critical years serve to discourage germination of riparian plants on lower bar surfaces and minimally recharge groundwater. As the spring Trinity River ROD flow is reduced, the rate of flow reduction is intended to result in a reduction in river stage of less than or equal to 0.1 feet per day.

Under Alternative 2, the flow recession rates in all water year types would be similar to the No Action Alternative. The stage reduction will be less than 0.1 feet per day, thus there would be no effect on riparian resources due to the rate of flow reduction. However, the reduced duration of peak Trinity River ROD flows in critically dry years would reduce the period in which the terrace and floodplain above the low flow channel would be inundated, and thus may have a minor adverse effect on recruitment of riparian vegetation above the low flow channel.

CalSim II modeling results show that under Alternative 2 compared to the No Action Alternative, average flows in August and September will increase by 5 percent to 129 percent depending on the water year type. However, augmentation flows under Alternative 2 would be less than twice the No Action flow in approximately 55 percent of years in which any augmentation is needed. Years in which augmentation to prevent disease outbreak in the lower Klamath River is necessary occur most often in dry and critically dry years. In general, increased water flows in late summer and early fall would have a positive effect on riparian resources and terrestrial wildlife. As vegetation struggles to survive low water periods, particularly in Trinity dry and critical water years, the additional inundation could have a minor positive effect on riparian vegetation. However, as reviewed above and in the *Affected Environment* section of this chapter, goals of the TRRP include the sustained removal of vegetation which has in the past invaded the low flow channel, trapped sediments and narrowed the channel. The duration of increased flows would be no more than 2 months, which occurs outside of the germination window and may be too short a period to result in substantial vegetation recruitment. Additionally, under Alternative 2 compared to the No Action Alternative, TRRP will continue to provide pulse flows in late April, May and June which can be expected to continue to prevent germination of new vegetation in the active channel by inundation and scouring of the channel. Also, Adaptive Management and Monitoring efforts by TRRP for sustaining the corrected low flow channel and revegetating upper river terraces above the low flow channel will continue under all alternatives. For these reasons, changes of flow of this magnitude are expected to have negligible effects on riparian resources and wildlife which rely on the Trinity River riparian corridor below Lewiston Dam.

In critically dry Trinity water years under Alternative 2, Trinity River ROD flows in late May and early June will be reduced to the summer minimum of 450 cubic feet per second (cfs) (at Lewiston Dam) approximately 2 weeks sooner than the No Action Alternative or Alternative 1. As noted above, the rate of flow reduction of the spring Trinity River ROD flow (the "descending curve") under Alternative 2 is designed to result in a river stage reduction of less than 0.1 feet per day, consistent with Trinity River Flow Evaluation Report (USFWS and Hoopa Valley Tribe 1999). This rate of reduction has been determined in part to minimize adverse effects on Foothill Yellow-legged Frog which are depositing eggs in floodplain and river bar pools along the river margin during April, May and June. Although the Trinity River ROD flow under Alternative 2 in critically dry water years will be reduced to the 450 cfs base flow approximately two weeks earlier than under the No Action Alternative, effects on Foothill Yellow-legged Frogs are expected to be similar to the No Action Alternative because river stage reduction rates will not be changed.

Under Alternative 2, primarily in critically dry years, warmer temperatures in the Trinity River mainstem resulting from earlier cessation of spring Trinity River ROD flows may improve Foothill Yellow-legged Frog breeding success, tadpole development, and may advance the breeding season for this species (Wheeler et al. 2014). An earlier reduction in spring Trinity River ROD flows pursuant to Alternative 2, combined with a corresponding greater influence in temperature elevation from tributaries, might have a slight positive effect on Foothill Yellow-legged Frog breeding success and tadpole development.

Western Pond Turtles deposit eggs in burrows above the river's wetted perimeter, typically in May, June and July. Under Alternative 2 in critically dry water years, an earlier reduction of the Trinity River ROD flows (approximately two weeks) would not have an effect on their breeding success. An earlier reduction in spring Trinity River ROD flows in critically dry water years, under Alternative 2, combined with a corresponding greater influence in temperature from the warmer tributaries, might have a slight positive effect on Western Pond Turtle young-of-the-year and juveniles, which may be seeking out warmer refugia and food supplies during this period (Ashton et al. 2015).

*Klamath River* Flows in the lower Klamath River below its confluence with Trinity River will increase in August and September under Alternative 2 compared to the No Action Alternative. At this time of year, flows in the Klamath River will be low, particularly in Trinity dry and critical water year types. Riparian vegetation will be more likely to survive through late summer and fall when riverside conditions are dry as a result, and terrestrial species will undergo less stress and predation from restricted access to water or cover. The addition of flows from Trinity River in these months under Alternative 2 would have a temporary positive effect on riparian vegetation and terrestrial resources compared to the No Action Alternative. Depending on water year type under Alternative 2, Trinity River ROD flows in late May and early June will be reduced to the summer minimum of 450 cfs (at Lewiston Dam) approximately one day to 14 days sooner than they would under the No Action Alternative that could negatively affect riparian habitat in the lower Klamath River. However, on the lower Klamath River during these periods, the reduction in flow would have a diminished effect due to combined flows from the Klamath River and Trinity basin tributaries.

*Changes in CVP and SWP Reservoir Elevations* CalSim II modeling results provide information on expected elevation changes of Trinity Lake, for each month of the Trinity water year type for Alternative 2 compared to the No Action Alternative. Results indicate that in all months of all Trinity water year type, elevation changes would be less than 1 percent. Changes in average surface elevation would be 2 feet or less for all months of all water years except June, July and September of critical water years, when reservoir elevations would be from 3 feet to 4 feet less than the No Action Alternative. During these events, reservoir levels would not adversely affect most species' breeding success, but may force some species to travel further across barren shorelines to access the water, which may leave them more exposed to predation. It may also make it more difficult for some species to reach food sources. This represents a very minor impact to terrestrial wildlife species under Alternative 2.

**Sacramento Valley and Bay-Delta Region**

*Changes in Rivers Downstream from CVP and SWP Reservoirs* CalSim II modeling results provide information on river flows of the Sacramento, Feather and American Rivers and Clear Creek, below CVP/SWP dams. They indicate that in all months of the year under all Sacramento water year types, changes in average flow for Alternative 2 compared to the No Action Alternative will be plus or minus 2 percent, except as follows: for the Sacramento River in critical water years, average September flows will be 3 percent less; for Feather River in critical water years average June flows will be 7 percent higher; and for American River in critical water years, average September flows will be 5 percent higher. These results indicate that changes in rivers below CVP and SWP reservoirs will have no or negligible positive or negative effects on wildlife in all months of nearly all water year types, and will have minor positive effects on wildlife on the Feather River in June of critical water years.

*Changes in Agricultural Acreage Irrigated with CVP and SWP Water* CalSim II modeling results provide information on deliveries to Sacramento Valley and Delta agriculture. In wet, above normal, below normal and dry Sacramento water year types, average annual agricultural water deliveries in and north of the Delta would be less than 1 percent less under Alternative 2 than under the No Action Alternative. In Sacramento critical water years, average annual agricultural water deliveries in and north of the Delta would be 1 percent less under Alternative 2 than the No Action Alternative. Thus, in all Sacramento water year types, agricultural water deliveries in the Sacramento Valley under Alternative 2 will be reduced by 1 percent or less compared to the No Action Alternative, and changes in Sacramento Valley irrigated agricultural acreage under Alternative 2 will have no effects on terrestrial wildlife.

*Changes in CVP and SWP Reservoir Elevations* CalSim II modeling results provide information on expected elevation changes of Whiskeytown, Shasta, and Folsom Lakes and Lake Oroville, for each month of the Sacramento water year type for Alternative 2 compared to the No Action Alternative. Average water surface elevations in all these reservoirs under Alternative 2 are similar to under the No Action Alternative with changes of less than 1 percent in all months of all water year types. The changes are in all cases less than or equal to 1 foot in elevation. Changes in reservoir elevation of this magnitude would not be expected to alter success of wildlife in obtaining access to food sources,  or to evade predators, thus changes in CVP and SWP reservoir elevations under Alternative 2 would have no or negligible effects on terrestrial wildlife resources at these reservoirs.

### *Summary of Environmental Consequences*

The results of the environmental consequences of implementation of action alternatives as compared to the No Action Alternative are presented in Table 8-2.

Table 8-2. Comparison of Action Alternatives to No Action Alternative

| **Alternative** | **Potential Change** | **Consideration for Mitigation Measures** |
|---|---|---|
| Alternative 1 | Terrestrial resources at Trinity Lake and on the Trinity River would be similar to the No Action Alternative for most months and year types, except for:<br>• Minor adverse effects on terrestrial wildlife species at Trinity Lake in September of critically dry water years due to decreased storage elevation.<br>• Minor effects to Yellow-legged Frog and Western Pond Turtle from changes in flow and water temperature in Trinity River in late summer.<br>• Temporary minor positive effects on riparian terrestrial habitat and terrestrial wildlife on the Trinity River in August and September due to increased flows.<br>Terrestrial resources on the lower Klamath River would be similar to the No Action Alternative for most months and year types except for minor positive effects on riparian terrestrial habitat and terrestrial wildlife in August and September due to increased flows.<br>Minor positive effects on terrestrial resources on the Feather River in June of critical water years and on the American River in September of critical water years.<br>Alternative 1 would reduce habitat for Sacramento Valley wildlife which utilize agricultural lands due to reduced water supplies in critical water years. | None Needed |
| Alternative 2 | Terrestrial resources at Trinity Lake and on the Trinity River would be similar to the No Action Alternative for most months and year types, except for:<br>• Minor positive effects on terrestrial wildlife species at Trinity Lake during June through August of critical water years due to increased storage elevation and minor adverse effects in September in these years due to decreased storage elevation.<br>• Minor adverse effect on terrestrial resources on Trinity River in May and June of critically dry water years due to flow reductions which may hinder TRRP efforts to control riparian vegetation.<br>• Minor positive effect on Foothill Yellow-legged Frog breeding success and tadpole development, and Western Pond Turtles young-of-the-year and juveniles resulting from increased water temperatures in critically dry years.<br>• Minor effects to Yellow-legged Frog and Western Pond Turtle from changes in flow and water temperature in Trinity River in August and September.<br>Terrestrial resources on the lower Klamath River would be similar to the No Action Alternative for most months and year types, except for:<br>• Minor adverse effect on terrestrial resources in late May and early June of critically dry water years due to reduction of Trinity River ROD flows.<br>• Temporary positive effects on riparian terrestrial habitat and terrestrial wildlife in the August and September due to increased flows.<br>Minor positive effects on terrestrial resources on the Feather River in June of critical water years and on the American River in September of critical water years. | None needed |

## Potential Mitigation Measures

Mitigation measures are included in EIS to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse environmental effects of alternatives as compared to the No Action Alternative. Implementation of Alternatives 1 or 2 as compared to the No Action Alternative would result in very minor to minor adverse changes in terrestrial resources along the Trinity and Klamath Rivers and at Trinity Lake at certain times of the year and under certain water year types. Implementation of Alternative 1 as compared to the No Action Alternative would have minor adverse effects on Sacramento Valley wildlife which utilize agriculture due to reduced water supplies in critical water years. Because these adverse effects are very minor or minor in degree, no mitigation measures have been identified.

### *Cumulative Effects Analysis*

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 terrestrial resources is summarized in Table 8-3. The methodology for this cumulative effects analysis is described in the Cumulative Effects Technical Appendix.

Table 8-3. Summary of Cumulative Effects on Terrestrial Resources of Action Alternatives as Compared to the No Action Alternative

| Scenarios | Cumulative Effects of Actions |
|---|---|
| No Action Alternative with Associated Cumulative Effects Actions in Year 2030 | *Conditions and actions included in Quantitative Analyses*<br>*(Conditions and actions incorporated into No Action modeling)*<br>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 shoreline, riparian, and floodplain habitat.<br>Other actions, including restoration projects, FERC relicensing projects, and some future projects to improve water quality or habitat are anticipated to improve shoreline, riparian, and floodplain habitat.<br>*Additional Identified Actions*<br>*(Additional projects identified in Cumulative Effects Technical Appendix)*<br>Some of the future reasonably foreseeable actions, including Hoopa Valley Tribe watershed restoration projects and FERC relicensing projects, would improve shoreline, riparian, and floodplain habitat. Additional reasonably foreseeable actions under this cumulative effects analysis are not anticipated to change CVP water deliveries or associated habitat for Central Valley wildlife which utilize irrigated agricultural lands. |
| Alternative 1 with Associated Cumulative Effects Actions in Year 2030 | *Alternative 1 with Conditions and actions included in Quantitative Analyses*<br>Implementation of Alternative 1 would result in similar terrestrial resources conditions (shoreline, riparian, and floodplain habitat) as under the No Action Alternative.<br>*Alternative 1 with Additional Identified Actions*<br>The additional reasonably foreseeable actions would result in beneficial effects to terrestrial habitats in the Trinity River Subbasin, and therefore cumulative effects to terrestrial resources conditions are not anticipated. |
| Alternative 2 with Associated Cumulative Effects Actions in Year 2030 | *Alternative 2 with Conditions and actions included in Quantitative Analyses*<br>Implementation of Alternative 2 would result in similar terrestrial resources conditions (shoreline, riparian, and floodplain habitat) as under the No Action Alternative.<br>*Alternative 2 with Additional Identified Actions*<br>The additional reasonably foreseeable actions would result in beneficial effects to terrestrial habitats in the Trinity River Subbasin, and therefore cumulative effects to terrestrial resources conditions are not anticipated. |

Key:
CVP = Central Valley Project
FERC = Federal Energy Regulatory Commission

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# Chapter 9 Hydropower Generation

## Introduction

This chapter describes hydropower generation 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 hydropower generation resources through operational changes of the Central Valley Project (CVP) and State Water Project (SWP).

## Affected Environment

This section describes CVP and SWP energy resources that could potentially be affected by the implementation of the alternatives considered in this EIS. These resources include CVP and SWP hydroelectric generation facilities at the CVP and SWP reservoirs; transmission of the generated electricity; and the CVP and SWP pumping facilities needed to convey water supplies to CVP and SWP water contractors.

### Central Valley Project and State Water Project Electric Generation

Hydroelectric generation facilities (e.g., powerplants) are located at most of the CVP dams (see Figure 9-1). As water is released from the CVP reservoirs, the generation facilities produce power that is used by the CVP pumping plants. The SWP also generates hydroelectricity at the Oroville facilities and along the California Aqueduct at energy-recovery plants (DWR 2013a, 2013b).

Hydropower is an important source of renewable energy, and supplies between 11 and 28 percent of California’s electricity, depending upon the water-year type (HWG 2014). Between 1982 and 2012, approximately 33,927 gigawatt-hours (GWh) were generated annually, on average, in California by hydropower, including approximately 4,810 GWh on average generated by the CVP (HWG 2014). Power generated by the CVP is transmitted by Western Area Power Administration (Western) to CVP facilities. Power that exceeds CVP needs is marketed by Western to electric utilities, government and public installations, and commercial “preference” customers who have 20-year contracts (Reclamation 2013). Power generated by the SWP is transmitted by Pacific Gas and Electric Company, Southern California Edison, and California Independent System Operator through other facilities (DWR 2013a, 2013b). The SWP also markets energy in excess of the SWP demands to utility companies and members of the Western Systems Power Pool.


Figure 9-1. Central Valley Project and State Water Project Powerplants

### *CVP Hydroelectric Generation Facilities*

The CVP power facilities include 11 hydroelectric powerplants, and have a total maximum-generating capacity of 2,053 megawatts (MW), as presented in Table 9-1. Hydrology can vary significantly from year to year, which then affects the hydropower production. Typically, in an average water year, approximately 4,500 GWh of energy is produced by CVP power facilities (Reclamation 2013). Major factors that influence powerplant operations include required downstream water releases, electric system needs, and project-use demand. The power generated from CVP powerplants is dedicated to first meeting the requirements of the CVP facilities. The remaining energy is marketed by Western to preferred customers in northern California.

Table 9-1. Central Valley Project Hydroelectric Powerplants

| CVP Facility | Capacity (Megawatts) |
|---|---|
| Trinity Powerplant | 140 |
| Lewiston Powerplant | 0.3 |
| Judge Francis Powerplant | 154.4 |
| Shasta Powerplant | 714 |
| Spring Creek Powerplant | 180 |
| Keswick Powerplant | 117 |
| Folsom Powerplant | 207 |
| Nimbus Powerplant | 13.5 |
| New Melones Powerplant | 300 |
| O'Neill Pump-Generating Plant | 25.2 |
| San Luis Powerplant (CVP portion of the William R. Gianelli/San Luis Pump-Generating Plant) | 202 |

*Sources: CEC 2016, Reclamation 2016k*
Key:
CVP = Central Valley Project

**Trinity River Division Powerplants** The Trinity Powerplant is located along the Trinity River (Reclamation 2016a). Primary releases from Trinity Dam are made through the powerplant, and Trinity County has first preference to the power from this plant.

The Lewiston Powerplant is located at the Lewiston Dam along the Trinity River (Reclamation 2016b). It is operated in conjunction with spillway gates to maintain the minimum flow in the Trinity River downstream. The turbines are usually set at maximum output with the spillway gates adjusted to regulate river flow. The turbine capacity is less than the Trinity River minimum flow criteria, as described in Chapter 4, "Surface Water Supply and Management." The Lewiston Powerplant provides power to the adjacent fish hatchery.

The Judge Francis Carr Powerplant is a peaking powerplant located on the Clear Creek Tunnel (Reclamation 2016c). It generates power from water exported from the Trinity River Basin. Similar to the Trinity Powerplant, Trinity County has first preference to the power benefit from this facility.

Under the Trinity River Division Central Valley Project Act of 1955 (Public Law 84-386), 25 percent of the energy resulting from power generated by the Trinity River Division (TRD) must first be offered to preference power customers in Trinity County.

**Sacramento River Powerplants** The Shasta Powerplant is a peaking powerplant located downstream from Shasta Dam along the Sacramento River (Reclamation 2013, 2016d). Until the early 1990s, concerns with downstream temperatures resulted in the bypasses of outflows around the powerplant, and lost hydropower generation. Installation of the Shasta Temperature Control Device enabled operators to decide the depth of the reservoir from which the water feeding into the penstocks originates. The system has shown significant success in controlling the water temperature of powerplant releases through Shasta Dam. The Shasta Powerplant also provides water supply for the Livingston Stone National Fish Hatchery.

The Spring Creek Powerplant is a peaking plant located along Spring Creek, at the foot of Spring Creek Debris Dam (Reclamation 2016e). Water discharged via the Judge Francis Carr Powerplant flows into Whiskeytown Reservoir, and then provides the source of water for the Spring Creek Powerplant generation. Trinity County has first preference to the power benefits from Spring Creek Powerplant. Water from Spring Creek Powerplant is discharged into Keswick Reservoir. Releases from Spring Creek Powerplant also are operated to maintain water quality in the Spring Creek arm of Keswick Reservoir.

The Keswick Powerplant, located at Keswick Dam along the Sacramento River downstream from Shasta Dam, regulates the flows into the Sacramento River from both Shasta Lake and Spring Creek, and can be considered a run-of-the-river powerplant (Reclamation 2016f).

**American River Powerplants** The Folsom Powerplant is a peaking powerplant located at Folsom Dam along the American River (Reclamation 2016g). The Folsom Powerplant is operated in an integrated manner with flood control operations at Folsom Lake. One of the integrated operations is related to coordinating early flood control releases with power generation. It also provides power for the pumping plant that supplies the local domestic water supply. Folsom Powerplant provides voltage support for the Sacramento region during summer heavy-load times.

The Nimbus Powerplant is located at Nimbus Dam along the American River, downstream from Folsom Dam (Reclamation 2016h). The Nimbus Powerplant regulates releases from Folsom Dam into the American River and can be considered as a run-of-the river powerplant.

**Stanislaus River Powerplant** The New Melones Powerplant is a peaking powerplant located along the Stanislaus River (Reclamation 2016i). Primary reservoir releases are made through the powerplant. This plant provides significant voltage support to the Pacific Gas and Electric Company system during summer heavy-load periods.

**San Luis Reservoir Powerplants** The O'Neill Pump-Generating Plant is located on a channel that conveys water between the Delta-Mendota Canal and the O'Neill Forebay (Reclamation 2016j). This pump-generating plant only generates power when water is released from the O'Neill Reservoir to the Delta-Mendota Canal. When water is conveyed from the Delta-Mendota Canal to O'Neill Forebay, the units serve as pumps, not hydroelectric generators. The generated power is used to support CVP pumping and irrigation actions.

The William R. Gianelli (San Luis) Pump-Generating Plant is located along the along the western boundary of the O'Neill Forebay at the San Luis Dam (Reclamation 2016k). This pump-generating plant is owned by the Federal government but is operated as a joint Federal-State facility that is shared by the CVP and SWP. Energy is generated when water is needed to be conveyed from San Luis Reservoir back into O'Neill Forebay for continued conveyance to the Delta-Mendota Canal. The plant is operated in pumping mode when water is moved from O'Neill Forebay to San Luis Reservoir for storage, until heavier water demands develop. The generated power is used to offset CVP and SWP pumping loads. The powerplant can generate up to 424 MW, with CVP's share of the total capacity being 202 MW. This facility is operated and maintained by the State of California under an operation and maintenance agreement with U.S. Department of the Interior, Bureau of Reclamation (Reclamation).

### *SWP Electric Generation Facilities*

The SWP power facilities are operated primarily to provide power for SWP facilities (DWR 2015b). The SWP power facilities and capacities are summarized in Table 9-2. The SWP has power contracts with electric utilities and the California Independent System Operator that act as exchange agreements with utility companies for transmission and power sales/purchases. In all years, the SWP must purchase additional power to meet pumping requirements.

Table 9-2. State Water Project Hydroelectric Powerplants

| SWP Facility | Capacity (Megawatts) |
|---|---|
| Hyatt Pumping-Generating Plant | 645 |
| Thermalito Diversion Dam Powerplant | 3 |
| Thermalito Pumping-Generating Plant | 114 |
| William R. Gianelli (San Luis) Pumping-Generating Plant (SWP share) | 222 |
| Alamo Powerplant | 17 |
| Mojave Siphon Powerplant | 30 |
| Devil Canyon Powerplant | 276 |
| Warne Powerplant | 74 |

*Source: DWR 2015b*
Key:
SWP = State Water Project

**Feather River Powerplants** The Hyatt Pumping-Generating Plant is located on the channel between Lake Oroville and the Thermalito Diversion Pool (DWR 2007). Water in the Thermalito Diversion Pool can be pumped back to Lake Oroville to be released through the Hyatt Pumping-Generating Plant and generate more electricity; released through the Thermalito Diversion Dam Powerplant for delivery to the low-flow channel upstream from Thermalito Forebay; or conveyed to Thermalito Forebay for subsequent release through the Thermalito Pumping-Generating Plant. The combined Hyatt Pumping-Generating Plant and Thermalito Pumping-Generating Plant generate approximately 2,200 GWh of energy in a median-water year, while the 3 MW generated by Thermalito Diversion Dam Powerplant adds another 24 GWh per year (DWR 2015b).

**San Luis Reservoir Powerplant** As described above, the William R. Gianelli (San Luis) Pump-Generating Plant is owned by the Federal government and is operated as a joint Federal-State facility that is shared by the CVP and SWP. The SWP water flows from the California Aqueduct into O'Neill Forebay downstream from CVP's O'Neill Pump-Generating Plant. The pump-generating plant is located along the western boundary of the O'Neill Forebay at the San

Luis Dam (DWR 2013a, 2013b, Reclamation 2016k). Electricity is generated when water is transferred from San Luis Reservoir back to O'Neill Forebay for continued conveyance in the California Aqueduct. The facility acts as a pumping plant when water is transferred from O'Neill Forebay to San Luis Reservoir. The generated power is used to offset CVP and SWP pumping loads. The powerplant can generate up to 424 MW, with SWP's share of the total capacity being 222 MW. This facility is operated and maintained by the State of California under an operation and maintenance agreement with Reclamation.

**East Branch and West Branch Powerplants** Downstream from the Antelope Valley, the California Aqueduct divides into the East Branch and West Branch. The Alamo Powerplant, Mojave Powerplant, and Devil Canyon Powerplant are located along the East Branch which conveys water into San Bernardino County (DWR 2013a, 2013b). The Warne Powerplant is located along the West Branch, which conveys water into Los Angeles County for distribution to parts of coastal southern California. The generation rates vary at these powerplants depending upon the amount of water conveyed.

**Other Energy Resources for the State Water Project** Other energy supplies have been obtained by California Department of Water Resources (DWR) from other utilities and energy marketers under agreements that allow DWR to buy, sell, or exchange energy on a short-term hourly basis or a long-term multi-year basis (DWR 2013a, 2013b).

For example, DWR jointly developed the 1,254-megawatt Castaic Powerplant on the West Branch with the Los Angeles Department of Water and Power (DWR 2015b). The power is available to DWR at the Sylmar Substation.

DWR has a long-term purchase agreement with the Kings River Conservation District for approximately 400 million kilowatt-hours of energy from the 165-megawatt hydroelectric Pine Flat Powerplant (DWR 2015b). DWR also purchases energy from five hydroelectric plants with 30 MW of installed capacity that are owned and operated by Metropolitan Water District of Southern California (DWR 2015b).

DWR also purchases energy under short-term purchase agreements from utilities and energy marketers of the Western Systems Power Pool (DWR 2015b). In addition, the 1988 Coordination Agreement between DWR and Metropolitan Water District of Southern Californian enables DWR to purchase and exchange energy with that entity (DWR 2015b).

## CVP and SWP System Energy Demands

Power generation at CVP and SWP hydropower facilities fluctuates in response to reservoir releases and conveyance flows. Reservoir releases are significantly affected by hydrologic conditions, minimum stream-flow requirements, flow fluctuation restrictions, water quality requirements, and non-CVP and non-SWP water rights, which must be met prior to releases for CVP water service contractors and SWP contractors.

### *CVP Power Generation and Energy Use*

The CVP power generation facilities were developed to meet CVP energy use loads.

The majority of the energy used by the CVP is needed for pumping plants located in the Sacramento-San Joaquin River Delta (Delta), at San Luis Reservoir, and along the Delta-

Mendota Canal and San Luis Canal portion of the California Aqueduct. Table 9-3 presents historical average-annual CVP hydropower generation and use. Monthly power generation patterns follow seasonal reservoir releases, with peaks during the irrigation season.

The hydropower generation between January and June decreases after 2007, because the potential to convey CVP water across the Delta during this period was reduced. This was due to 2007 decreases in reverse flows in Old and Middle River, in accordance with legal decisions and subsequently through implementation of the Biological Opinions (BOs) issued by the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) in 2008 and 2009, respectively, for the operation of the CVP and SWP.

Table 9-3. Hydropower Generation and Energy Use by the CVP

| Calendar Year | Water Year Type[1] | Net CVP Hydropower Generation (Gigawatt-hours) | Energy Used CVP Facilities (Gigawatt-hours) |
|---|---|---|---|
| 2000 | AN | 5,667 | -- |
| 2001 | D | 4,107 | 957 |
| 2002 | D | 4,322 | 1,090 |
| 2003 | AN | 5,483 | 1,170 |
| 2004 | BN | 5,186 | 1,172 |
| 2005 | AN | 4,599 | 1,150 |
| 2006 | W | 7,284 | 1,037 |
| 2007 | D | 4,276 | 1,064 |
| 2008 | C | 3,659 | 923 |
| 2009 | D | 3,560 | 803 |
| 2010 | BN | 3,624 | 1,001 |
| 2011 | W | 5,469 | 1,276 |
| 2012 | BN | 4,849 | 990 |

*Source: Reclamation 2015*
Note:
[1] Water Year Type based on Sacramento Valley 40-30-30 Index, as described in Chapter 4, "Surface Water Supply and Management"
Key:
AN = Above Normal
BN = Below Normal
C = Critically Dry
CVP = Central Valley Project
D = Dry
W = Wet

Recently, the California Public Utilities Commission (CPUC) evaluated the "energy intensity" of several types of water supplies (CPUC 2010). The energy intensity is defined as the average amount of energy required to convey or treat water on a unit basis, such as per 1 acre-foot. Substantial quantities of energy are required by the CVP pumping plants to convey large amounts of water over long distances, with significant changes in elevation. The study indicated that the energy intensity of CVP water delivered to users downstream from San Luis Reservoir ranged from 0.292 megawatt-hours (MWh)/acre-foot for users along the Delta-Mendota Canal; to 0.428 MWh/acre-foot for users along the San Luis Canal/California Aqueduct; to 0.870 MWh/acre-foot in San Benito and Santa Clara Counties.

### *SWP Power Generation and Energy Use*

The SWP power generation facilities also were developed to meet SWP energy use loads. The majority of the energy used by the SWP is needed for pumping plants located in the Delta, at the San Luis Reservoir, and along the California Aqueduct. Table 9-4 presents historical average-annual SWP hydropower generation and use. Monthly power generation patterns follow seasonal reservoir releases, with peaks during the irrigation season. The energy generation and purchases, and energy use, decreases after 2007 because the potential to convey SWP water across the Delta was reduced in accordance with legal decisions, and subsequently through implementation of the BOs for the CVP and SWP by USFWS and NMFS in 2008 and 2009, respectively.

Table 9-4. Hydropower Generation and Energy Use by the SWP

| Calendar Year | Water Year Type[1] | SWP Hydropower Generation (Gigawatt-hour) | Energy Acquired through Long-term Agreements and Purchases (Gigawatt-hour) | Energy Used by SWP Facilities (Gigwatt-hour) |
|---|---|---|---|---|
| 2000 | AN | 6,372 | 5,741 | 9,190 |
| 2001 | D | 4,295 | 4,660 | 6,656 |
| 2002 | D | 4,953 | 4,610 | 8,394 |
| 2003 | AN | 5,511 | 4,668 | 9,175 |
| 2004 | BN | 6,056 | 4,429 | 9,868 |
| 2005 | AN | 5,151 | 5,367 | 8,308 |
| 2006 | W | 7,056 | 5,811 | 9,158 |
| 2007 | D | 5,577 | 6,642 | 9,773 |
| 2008 | C | 3,541 | 4,603 | 5,745 |
| 2009 | D | 3,650 | 3,970 | 6,089 |
| 2010 | BN | 3,920 | 5,081 | 7,187 |
| 2011 | W | 4,846 | 4,895 | 8,549 |
| 2012 | BN | 4,198 | 3,741 | 7,407 |
| 2013 | D | 3,069 | 3,604 | 5,736 |

*Sources: DWR 2002, 2004a, 2004b, 2005, 2006, 2007, 2008, 2012a, 2012b, 2013a, 2013b, 2014, 2015a, 2015b*

Note:

[1] Water Year Type based on Sacramento Valley 40-30-30 Index, as described in Chapter 4, "Surface Water Supply and Management"

Key:
AN = Above Normal
BN = Below Normal
C = Critically Dry
CVP = Central Valley Project
D = Dry
W = Wet

### *Energy Demands for Groundwater Pumping*

Groundwater provided approximately 37 percent, on average, of the State's agricultural, municipal, and industrial water supply between 1998 and 2010—or approximately 16 million acre-feet (MAF) per year of groundwater (DWR 2013c). The use of groundwater varies throughout the State, providing anywhere from less than 10 percent for some regions, to more than 90 percent for others (DWR 2013c).

The amount of energy used statewide to pump groundwater is not well quantified (CPUC 2010). The CPUC estimated groundwater energy use by hydrologic region and by type of use, to evaluate the water and energy relationships. Groundwater pumping estimates were calculated in each DWR Planning Area for agricultural and municipal water demands. Groundwater energy use was estimated based upon assumptions of well depths and pump efficiencies. Some wells use natural gas for individual engines instead of electricity; however, the amount of natural gas pumping versus electric pumping is generally unknown. In 2010, average groundwater use in the State was approximately 14.7 MAF, or 36 percent of total agricultural, municipal, and industrial water supplies (DWR 2013c). The CPUC estimated that in 2010, statewide groundwater pumping accounted for more electricity use between May and August than the total electricity use by the CVP and SWP during that time period (CPUC 2010). Over the entire year, it was estimated that groundwater pumping used approximately 10 percent more electricity than the SWP, and approximately 5 percent less than the CVP and SWP combined.

# Impact Analysis

## Potential Mechanisms for Change in Hydropower Generation and Analytical Methods

The environmental consequences assessment considers changes in energy resources conditions related to changes in CVP and SWP operations under the alternatives, as compared to the No Action Alternative.

### *Changes in Energy Resources Related to CVP and SWP Water Users*

Energy generation is limited on a monthly basis by the average power capacity of each generation facility, based upon reservoir elevations and water release patterns. The majority of the CVP and SWP energy use is for the conveyance facilities located in, and south of, the Delta. Energy use would change with changes in CVP and SWP deliveries.

Output for reservoir elevations and flow patterns through pumping facilities from the CalSim II model (see Chapter 4, "Surface Water Supply and Management") are used with LTGen and SWP Power Tools—as described in the Analytical Tools Technical Appendix—to estimate changes in energy generation and use. These tools estimate average annual peaking power capacity, energy use, energy generation, and net generation at CVP and SWP facilities. When net generation values are negative, the CVP or SWP would purchase power from other generation facilities. When net generation values are positive, power would be available for use by non-CVP and non-SWP electricity users.

When CVP and SWP water deliveries change, it is anticipated that water users would change their use of groundwater, recycled water, and desalinated water, as described in Chapter 4, "Surface Water Supply and Management," Chapter 6, "Groundwater Resources/Groundwater Quality," Chapter 11, "Agricultural Resources," and Chapter 12, "Socioeconomics." Specific responses by water users to changes in CVP and SWP water deliveries are not known; therefore, energy use for the alternate water supplies cannot be quantified in this analysis. It is not known whether the net change in energy use for the CVP or SWP would, or would not be, similar to the net change in energy use for alternate water supplies (e.g., groundwater pumping, water treatment, water conveyance).

## Evaluation of Alternatives

The impact analysis in this EIS is based upon the comparison of the alternatives to the No Action Alternative projected for the year 2030.

### *No Action Alternative*

**Changes in Energy Resources Related to CVP and SWP Water Uses** Under the No Action Alternative, energy resources would be comparable to the conditions described in the *Affected Environment* section of this chapter. Conditions in 2030 would be different than existing conditions primarily due to climate change and sea level rise, general plan development throughout California, and implementation of reasonable and foreseeable water resource 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. By 2030, the reservoirs would be full more frequently by the end of April or May, compared to 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 potential hydropower generation in the summer. These conditions would occur for all reservoirs in the California foothills and mountains, including non-CVP and non-SWP reservoirs. Climate change would result in a decline of the long-term average CVP and SWP water supply deliveries, reducing energy requirements for conveyance of water supplies to CVP and SWP contractors.

### *Proposed Action (Alternative 1)*

**Changes in Energy Resources Related to CVP and SWP Water Use** Changes in reservoir operations under Alternative 1 as compared to the No Action Alternative would result in small changes to CVP and SWP reservoir storages, as described in Chapter 4, "Surface Water Supply and Management." These changes would result in similar CVP and SWP energy generation (less than 1 percent change) as summarized in Table 9-5. Changes in reservoir operations under Alternative 1 as compared to the No Action Alternative would result in changes to CVP and SWP deliveries; the resulting annual CVP and SWP energy use would be similar to the No Action (less than 1 percent change), as summarized in Table 9-6. CVP and SWP net generation over the long-term conditions would be similar under Alternative 1 as compared to the No Action Alternative (less than 1 percent change), as summarized in Table 9-7.

Table 9-5. Long-Term Average Energy Generation Under Alternative 1 Compared to the No Action Alternative

| Year Type | Alternative 1 (GWh) | No Action (GWh) | Alternative 1 Compared to No Action (GWh) | Alternative 1 Compared to No Action (%) |
|---|---|---|---|---|
| **CVP Facilities** | | | | |
| Wet | 6108.6 | 6126.3 | -17.7 | -0.3% |
| Above Normal | 4985.0 | 4989.4 | -4.3 | -0.1% |
| Below Normal | 4211.6 | 4214.4 | -2.8 | -0.1% |
| Dry | 3641.8 | 3660.4 | -18.5 | -0.5% |
| Critical | 2707.7 | 2734.5 | -26.8 | -1.0% |
| All Years | 4576.7 | 4591.8 | -15.1 | -0.3% |
| **SWP Facilities** | | | | |
| Wet | 6039.0 | 6036.4 | 2.7 | 0.0% |
| Above Normal | 4605.3 | 4605.4 | -0.1 | 0.0% |
| Below Normal | 3997.2 | 3994.7 | 2.5 | 0.1% |
| Dry | 3165.9 | 3164.5 | 1.4 | 0.0% |
| Critical | 2005.4 | 1996.8 | 8.6 | 0.4% |
| All Years | 4246.8 | 4244.0 | 2.8 | 0.1% |

Key:
% = percent
CVP = Central Valley Project
GWh = gigawatt-hour
SWP = State Water Project

Table 9-6. Long-Term Average Energy Use Under Alternative 1 Compared to the No Action Alternative

| Year Type | Alternative 1 (GWh) | No Action (GWh) | Alternative 1 Compared to No Action (GWh) | Alternative 1 Compared to No Action (%) |
|---|---|---|---|---|
| **CVP Facilities** | | | | |
| Wet | 1385.3 | 1386.7 | -1.5 | -0.1% |
| Above Normal | 1147.9 | 1149.0 | -1.1 | -0.1% |
| Below Normal | 1126.3 | 1133.8 | -7.4 | -0.7% |
| Dry | 982.3 | 991.6 | -9.2 | -0.9% |
| Critical | 685.5 | 692.7 | -7.1 | -1.0% |
| All Years | 1112.2 | 1117.2 | -4.9 | -0.4% |
| **SWP Facilities** | | | | |
| Wet | 10122.5 | 10114.9 | 7.6 | 0.1% |
| Above Normal | 8588.2 | 8586.4 | 1.8 | 0.0% |
| Below Normal | 8202.9 | 8204.1 | -1.2 | 0.0% |
| Dry | 6595.3 | 6592.4 | 2.9 | 0.0% |
| Critical | 4077.9 | 4058.7 | 19.2 | 0.5% |
| All Years | 7876.9 | 7870.8 | 6.0 | 0.1% |

Key:
% = percent
CVP = Central Valley Project
GWh = gigawatt-hour
SWP = State Water Project

Table 9-7. Long-Term Average Net Generation Under Alternative 1 Compared to the No Action Alternative

| Year Type | Alternative 1 (GWh) | No Action (GWh) | Alternative 1 Compared to No Action (GWh) | Alternative 1 Compared to No Action (%) |
|---|---|---|---|---|
| **CVP Facilities** | | | | |
| Wet | 4723.4 | 4739.6 | -16.2 | -0.3% |
| Above Normal | 3837.1 | 3840.3 | -3.2 | -0.1% |
| Below Normal | 3085.3 | 3080.6 | 4.7 | 0.2% |
| Dry | 2659.5 | 2668.8 | -9.3 | -0.3% |
| Critical | 2022.2 | 2041.8 | -19.6 | -1.0% |
| All Years | 3464.4 | 3474.6 | -10.2 | -0.3% |
| **SWP Facilities** | | | | |
| Wet | -4083.5 | -4078.6 | -4.9 | -0.1% |
| Above Normal | -3982.9 | -3981.1 | -1.8 | 0.0% |
| Below Normal | -4205.7 | -4209.4 | 3.7 | 0.1% |
| Dry | -3429.4 | -3427.9 | -1.4 | 0.0% |
| Critical | -2072.5 | -2061.9 | -10.6 | -0.5% |
| All Years | -3630.1 | -3626.8 | -3.3 | -0.1% |

Key:
% = percent
CVP = Central Valley Project
GWh = gigawatt-hour
SWP = State Water Project

Trinity County has first preference to TRD generated energy. TRD energy generation would be similar for Alternative 1 compared to the No Action Alternative, as summarized in Table 9-8, with most year types and the long-term average changing less than 2 percent, with the exception of a reduction of 2.5 percent in critical years.

Table 9-8. Long-Term Average Trinity River Division Energy Generation Under Alternative 1 Compared to the No Action Alternative

| Year Type | Alternative 1 (GWh) | No Action (GWh) | Alternative 1 Compared to No Action (GWh) | Alternative 1 Compared to No Action (%) |
|---|---|---|---|---|
| Wet | 811.0 | 820.2 | -9.2 | -1.1% |
| Above Normal | 677.2 | 680.7 | -3.5 | -0.5% |
| Below Normal | 720.9 | 719.3 | 1.6 | 0.2% |
| Dry | 598.4 | 608.0 | -9.6 | -1.6% |
| Critical | 384.4 | 394.37 | -9.8 | -2.5% |
| All Years | 663.4 | 670.5 | -7.0 | -1.0% |

Key:
% = percent
GWh = gigawatt-hour

### *Trinity River Record of Decision Flow Rescheduling Alternative (Alternative 2)*

**Changes in Energy Resources Related to CVP and SWP Water Uses** Changes in reservoir operations under Alternative 2 as compared to the No Action Alternative would result in small changes to CVP and SWP reservoir storages, as described in Chapter 4, “Surface Water Supply and Management.” These changes would result in similar (less than 1 percent change) CVP and

SWP energy generation as summarized in Table 9-9. Changes in reservoir operations under Alternative 2 as compared to the No Action Alternative would result in similar CVP and SWP deliveries; the resulting annual CVP and SWP energy use would be similar to the No Action Alternative (less than 1 percent change), as summarized in Table 9-10. CVP and SWP net generation over the long-term conditions would be similar under Alternative 2 as compared to the No Action Alternative (less than 1 percent change), as summarized in Table 9-11.

Table 9-9. Long-Term Average Energy Generation Under Alternative 2 Compared to the No Action Alternative

| Year Type | Alternative 2 (GWh) | No Action (GWh) | Alternative 2 Compared to No Action (GWh) | Alternative 2 Compared to No Action (%) |
|---|---|---|---|---|
| **CVP Facilities** | | | | |
| Wet | 6116.6 | 6126.3 | -9.7 | -0.2% |
| Above Normal | 4997.2 | 4989.4 | 7.8 | 0.2% |
| Below Normal | 4227.4 | 4214.4 | 13.0 | 0.3% |
| Dry | 3659.6 | 3660.4 | -0.8 | 0.0% |
| Critical | 2731.1 | 2734.5 | -3.3 | -0.1% |
| All Years | 4591.0 | 4591.8 | -0.8 | 0.0% |
| **SWP Facilities** | | | | |
| Wet | 6039.3 | 6036.4 | 3.0 | 0.0% |
| Above Normal | 4603.2 | 4605.4 | -2.1 | 0.0% |
| Below Normal | 3995.8 | 3994.7 | 1.1 | 0.0% |
| Dry | 3161.9 | 3164.5 | -2.6 | -0.1% |
| Critical | 1998.4 | 1996.8 | 1.6 | 0.1% |
| All Years | 4244.3 | 4244.0 | 0.3 | 0.0% |

Key:
% = percent
CVP = Central Valley Project
GWh = gigawatt-hour
SWP = State Water Project

Table 9-10. Long-Term Average Energy Use Under Alternative 2 Compared to the No Action Alternative

| Year Type | Alternative 2 (GWh) | No Action (GWh) | Alternative 2 Compared to No Action (GWh) | Alternative 2 Compared to No Action (%) |
|---|---|---|---|---|
| **CVP Facilities** | | | | |
| Wet | 1386.8 | 1386.7 | 0.1 | 0.0% |
| Above Normal | 1151.5 | 1149.0 | 2.4 | 0.2% |
| Below Normal | 1133.8 | 1133.8 | 0.0 | 0.0% |
| Dry | 994.0 | 991.6 | 2.4 | 0.2% |
| Critical | 691.7 | 692.7 | -1.0 | -0.1% |
| All Years | 1118.0 | 1117.2 | 0.8 | 0.1% |
| **SWP Facilities** | | | | |
| Wet | 10122.0 | 10114.9 | 7.1 | 0.1% |
| Above Normal | 8584.7 | 8586.4 | -1.7 | 0.0% |
| Below Normal | 8201.9 | 8204.1 | -2.2 | 0.0% |
| Dry | 6594.0 | 6592.4 | 1.6 | 0.0% |
| Critical | 4061.2 | 4058.7 | 2.4 | 0.1% |
| All Years | 7873.3 | 7870.8 | 2.4 | 0.0% |

Key:
% = percent
CVP = Central Valley Project
GWh = gigawatt-hour
SWP = State Water Project

Table 9-11. Long-Term Average Net Generation Under Alternative 2 Compared to the No Action Alternative

| Year Type | Alternative 2 (GWh) | No Action (GWh) | Alternative 2 Compared to No Action (GWh) | Alternative 2 Compared to No Action (%) |
|---|---|---|---|---|
| **CVP Facilities** | | | | |
| Wet | 4729.8 | 4739.6 | -9.8 | -0.2% |
| Above Normal | 3845.7 | 3840.3 | 5.4 | 0.1% |
| Below Normal | 3093.6 | 3080.6 | 13.0 | 0.4% |
| Dry | 2665.7 | 2668.8 | -3.1 | -0.1% |
| Critical | 2039.5 | 2041.8 | -2.4 | -0.1% |
| All Years | 3473.0 | 3474.6 | -1.6 | 0.0% |
| **SWP Facilities** | | | | |
| Wet | -4082.7 | -4078.6 | -4.1 | 0.1% |
| Above Normal | -3981.5 | -3981.1 | -0.4 | 0.0% |
| Below Normal | -4206.1 | -4209.4 | 3.3 | -0.1% |
| Dry | -3432.2 | -3427.9 | -4.2 | 0.1% |
| Critical | -2062.8 | -2061.9 | -0.9 | 0.0% |
| All Years | -3628.9 | -3626.8 | -2.1 | 0.1% |

Key:
% = percent
CVP = Central Valley Project
GWh = gigawatt-hour
SWP = State Water Project

Trinity County has first preference to TRD generated energy. TRD energy generation would be similar for Alternative 2 compared to the No Action Alternative, as summarized in Table 9-12.

Table 9-12. Long-Term Average Trinity River Division Energy Generation Under Alternative 2 Compared to the No Action Alternative

| Year Type | Alternative 2 (GWh) | No Action (GWh) | Alternative 2 Compared to No Action (GWh) | Alternative 2 Compared to No Action (%) |
|---|---|---|---|---|
| Wet | 815.0 | 820.2 | -5.2 | -0.6% |
| Above Normal | 685.2 | 680.7 | 4.5 | 0.7% |
| Below Normal | 729.1 | 719.3 | 9.8 | 1.4% |
| Dry | 606.1 | 608.0 | -1.9 | -0.3% |
| Critical | 396.7 | 394.3 | 2.5 | 0.6% |
| All Years | 670.8 | 670.5 | 0.3 | 0.0% |

Key:
% = percent
GWh = gigawatt-hour

### *Summary of Impact Analysis*

Table 9-13 presents the results of the environmental consequences analysis for implementing the action alternatives compared to the No Action Alternative.

Table 9-13. Comparison of Action Alternatives to No Action Alternative

| Alternative | Potential Change | Consideration for Mitigation Measures |
|---|---|---|
| Alternative 1 | CVP and SWP annual energy generation, energy use, and net energy generation would be similar (less than 1% change). Long-term average decrease of 13.5 GWh in net energy generation for the CVP and SWP. Long-term average decrease of TRD generation by 7 GWh (1% change), with a maximum decrease of 9.8 GWh (2.5% change) in critical years. | None needed |
| Alternative 2 | CVP and SWP annual energy generation, energy use, and net energy generation would be similar (less than 1% change). Long-term average decrease of 3.7 GWh in net energy generation for the CVP and SWP. No long-term average change in TRD generation (0% change), with a maximum decrease of 5.2 GWh (0.6% change) in wet years and a maximum increase of 9.8 GWh (1.4% change) in below normal years. | None needed |

Key:
% = percent
CVP = Central Valley Project
GWh = gigawatt-hour
SWP = State Water Project

### *Potential Mitigation Measures*

Mitigation measures are presented in this section to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse environmental effects of action alternatives as compared to the No Action Alternative.

Changes under action alternatives as compared to the No Action Alternative would result in similar energy generation, energy use, and net energy generation at CVP and SWP power facilities. Therefore, there would be no adverse impacts to energy resources as compared to the No Action Alternative, and no mitigation measures are needed.

### *Cumulative Effects Analysis*

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 energy resources is summarized in Table 9-14. The methodology for this cumulative effects analysis is described in the Cumulative Effects Technical Appendix.

Table 9-14. Summary of Cumulative Effects on Energy Resources of Alternatives 1 and 2 as Compared to the No Action Alternative

| Scenarios | Cumulative Effects of Actions |
|---|---|
| No Action Alternative with Associated Cumulative Effects Actions in Year 2030 | *Conditions and Actions included in Quantitative Analyses*<br>*(Conditions and actions incorporated into No Action modeling)*<br>Climate change and sea level rise, development under the general plans, FERC relicensing projects, and some future projects to improve water quality or habitat are anticipated to reduce carryover storage in reservoirs and change in stream flow patterns in a manner that would likely reduce hydropower generation at CVP and SWP reservoirs. Reduced CVP and SWP water deliveries would also reduce CVP and SWP energy use (e.g. pumping requirements).<br>*Additional Identified Actions*<br>*(Additional reasonably foreseeable projects or actions identified in Cumulative Effects Technical Appendix)*<br>Removal of the four PacifiCorp dams on the mainstem of the Klamath River would reduce hydropower generation year round. Other additional identified actions (e.g., FERC relicensing projects) are also anticipated to reduce hydropower generation. |
| Alternative 1 with Associated Cumulative Effects Actions in Year 2030 | *Alternative 1 with Conditions and Actions included in Quantitative Analyses*<br>Implementation of Alternative 1 would result in reduced net hydropower generation as compared to the No Action Alternative, potentially contributing to cumulative impacts to energy resources.<br>*Alternative 1 with Additional Identified Actions*<br>Alternative 1 with the additional reasonably foreseeable actions would result in reduced net hydropower generation, potentially contributing to cumulative impacts to energy resources. |
| Alternative 2 with Associated Cumulative Effects Actions in Year 2030 | *Alternative 2 with Conditions and Actions included in Quantitative Analyses*<br>Implementation of Alternative 2 would result in reduced net hydropower generation as compared to the No Action Alternative, potentially contributing to cumulative impacts to energy resources.<br>*Alternative 2 with Additional Identified Actions*<br>Alternative 2 with the additional reasonably foreseeable actions would result in reduced net hydropower generation, potentially contributing to cumulative impacts to energy resources. |

Key:
CVP = Central Valley Project
FERC = Federal Energy Regulatory Commission
SWP = State Water Project

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# Chapter 10
# Air Quality, Greenhouse Gas Emissions, and Global Climate Change

## Introduction

This chapter describes the potential for greenhouse gas (GHG) emissions that could occur as a result of implementing the alternatives evaluated in this Environmental Impact Statement (EIS). For reasons presented below, air quality-related impacts are dismissed from this EIS. Implementation of the alternatives could affect GHG emissions through operational changes of the Central Valley Project (CVP) and State Water Project (SWP) as a result of augmenting flows in the lower Klamath River.

Air quality impacts can typically be discussed as short-term construction related and long-term operational related. Emissions from construction-related activities typically occur from the use of heavy-duty equipment in the form of exhaust emissions and fugitive dust from earth movement and vehicle travel on unpaved roads. The alternatives do not include construction activities and; therefore, construction-related impacts—associated with criteria air pollutants and precursors, fugitive dust emissions, and exposure of sensitive receptors to air toxics—are not discussed further.

With regards to long-term operational emissions, changes in CVP and SWP operations under the alternatives could change the use of individual engines to operate groundwater wells, resulting in increased use of diesel pumps and associated increases in diesel particulate matter, and criteria air pollutants and precursors. In California, local air districts (e.g., air quality management and air pollution control districts) have been established to oversee the attainment of both the California Ambient Air Quality Standards (CAAQS) and the National Ambient Air Quality Standards (NAAQS) 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, such as diesel pump engines. Therefore, any proposal to construct, modify, or operate a facility that emits pollutants from stationary sources must obtain either an Authority to Construct permit or an Operating Permit, pursuant to the California and Federal Clean Air Acts. Further, stationary sources of air pollutant emissions that comply with applicable rules and regulations would not be considered to interfere with maintaining or attaining the CAAQS, NAAQS, or General Conformity requirements, as appropriate emissions offsets and emissions controls would be required through the permitting process. For these reasons, long-term increases in diesel-related emissions are not discussed further in this EIS.

# Terminology

Important climate change and GHG emission terminology used in this chapter are summarized below:

- **California Ambient Air Quality Standard –** 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 California Air Resource Board (ARB). CAAQS are the standards which must be met per the requirements of the California Clean Air Act (ARB 2010).

- **Council on Environmental Quality –** The Council on Environmental Quality (CEQ) was established within the Executive Office of the President by Congress as part of the National Environmental Policy Act (NEPA) of 1969. CEQ coordinates Federal environmental efforts and works closely with agencies and other White House offices in the development of environmental policies and initiatives.

- **Greenhouse Gases –** Atmospheric gases (e.g., carbon dioxide ($CO_2$), methane ($CH_4$), hydrofluorocarbons (HFC), nitrous oxide ($N_2O$), ozone ($O_3$), 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, $CO_2$, $CH_4$, $N_2O$, HFC, PFC, and $SF_6$, are the subject of reductions under Kyoto Protocol and California Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006.

- **National Ambient Air Quality Standard –** Standards established by the U.S. Environmental Protection Agency (USEPA) that apply for outdoor air throughout the U.S. (USEPA 2006).

# Regulatory Environment and Compliance Requirements

Potential actions implemented under the alternatives evaluated in this EIS could result in possible GHG emissions. Changes in GHG emissions are analyzed in this EIS relative to appropriate Federal and State agency policies and regulations, including:

- CEQ 2016 Guidance on the Consideration of GHG Emissions and the Effects of Climate Change in NEPA Reviews

- AB 32, California Global Warming Solutions Act of 2006

- California Renewables Portfolio Standard (RPS)

- ARB's California Climate Change Scoping Plan

- Local regulations and policies of California air districts

## Council on Environmental Quality 2016 Guidance on the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews

The CEQ has issued final NEPA guidance on the consideration of the effects of climate change and GHG emissions. Issued on August 1, 2016, this guidance advises Federal agencies that they should consider the GHG emissions caused by Federal actions, adapt their actions to consider climate change effects throughout the process, and address these issues in their agency procedures. Where applicable, the scope of the NEPA analysis should cover the GHG emissions effects of a proposed action and alternative actions, as well as the relationship of climate change effects on a proposed action or alternatives.

## California Assembly Bill 32, Global Warning Solutions Act of 2006

On September 20, 2006, California adopted the California Global Warming Solutions Act of 2006 (generally referred to as AB 32 and codified in the California Health and Safety Code Section 38500). This law requires ARB to design and implement emission limits, regulations, and other measures such that statewide GHG emissions are reduced in a technologically feasible and cost-effective manner to 1990 levels by 2020 (representing a 25 percent reduction). AB 32 does not directly amend other environmental laws, such as California Environmental Quality Act (CEQA). Instead, it creates a program to identify GHG sources, prioritizes sources for regulation based on significance of contributions to California GHG emissions, and regulates priority sources.

AB 32 establishes a mass emissions threshold of 25,000 metric tons (MT) of carbon dioxide equivalent ($CO_2e$) per year for mandatory emissions reporting and participation in the cap-and-trade regulatory program for covered entities in California.

## California Renewables Portfolio Standard

RPS was established in 2002, under Senate Bill (SB) 1078. The RPS has since been accelerated in 2006, under SB 107, and expanded in 2011, under SB 2. The California Public Utilities Commission (CPUC) and the California Energy Commission jointly implement the RPS program. The RPS program requires investor-owned utilities, electricity providers, and community-choice aggregators to increase procurement from eligible renewable energy resources to 33 percent of total procurement by 2020 (CPUC 2016).

A hydroelectric generation facility of over 30 megawatts (MW) would not be considered an eligible renewable energy resource under SB 1078. Nearly all CVP and SWP facilities discussed in this analysis produce over 30 MW per year and; thus, would not be considered renewable energy resources.

## California Climate Change Scoping Plan

On December 11, 2008, pursuant to AB 32, ARB adopted the Climate Change Scoping Plan. This plan outlines how emissions reductions would be achieved from significant sources of GHGs via regulations, market mechanisms, and other actions. Various key elements, outlined in the plan, are identified to achieve emissions reduction targets. Of these, achieving a statewide renewable energy mix of 33 percent through implementation of RPS was identified.

Further, this plan also recommended 39 measures that were developed to reduce GHG emissions from key sources and activities while improving public health, promoting a cleaner environment, preserving our natural resources, and ensuring that the impacts of the reductions are equitable and do not disproportionately impact low-income and minority communities. These measures also put the State on a path to meet the long-term 2050 goal of reducing California's GHG emissions to 80 percent below 1990 levels. ARB is currently working on an update to this plan.

### California Air Districts

There are 35 air districts in California that are responsible for promulgating rules and regulations for the purpose of meeting CAAQS and NAAQS. ARB is responsible for monitoring the regulatory activity of the air districts.

## Affected Environment

This section describes the area of analysis and GHG emissions in the study area.

### Existing Greenhouse Gases and Emissions Sources

This subsection presents an overview of the greenhouse effect and climate change, 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 and regional scales. GHG emissions contribute cumulatively to the overall heat-trapping capability of the atmosphere, and the effects of warming (such as climate change) are manifested in different ways across the planet.

#### *Greenhouse Gas Emissions Regulations and Analyses*

Global warming is the name given to the increase in the average temperature of Earth's near-surface air and oceans—since the mid-20th century—and its projected continuation. According to the California Department of Water Resources (DWR), warming of the climate system is now considered to be unequivocal (DWR 2010) with the global surface temperature increase of approximately 1.33 degrees Fahrenheit (°F) over the last one-hundred years. Continued warming is projected to increase global average temperature between 2 and 11°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 GHG 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 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 Earth and is reflected back into space. Some GHGs occur naturally, and are necessary for keeping Earth's surface inhabitable. However, increases in the concentrations of these gases in the atmosphere during the last one-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 $CO_2$, $CH_4$, and $N_2O$ 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 varies over time. For example, $CH_4$ is twenty-five times as potent as $CO_2$ (IPCC 2007).

The primary anthropogenic 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— none of which are applicable to the action alternatives (DWR 2010). Deforestation and land cover conversion have also been identified as contributing to global warming by reducing Earth's capacity to remove $CO_2$ from the air, altering Earth's albedo or surface reflectance, allowing more solar radiation to be absorbed.

#### *An Overview of the Greenhouse Effect*

The greenhouse effect is a natural phenomenon that is essential to keeping 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 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 Earth's surface and emitted back into space. The portion absorbed by 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 Earth's surface. Therefore, some of the lower-frequency infrared radiation emitted by Earth's surface is absorbed and reflected, causing a warming of the atmosphere and earth surfaces.

**Global Climate Trends and Associated Impacts** The rate of increase in global average surface temperature over the last one-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 changes that 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 others 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 within the scientific community that these changes are a direct result of increased global temperatures.

**Overview of Greenhouse Gas Emission Sources** Naturally occurring GHGs include water vapor, $CO_2$, $CH_4$, and $N_2O$. Water vapor is introduced to the atmosphere from oceans and the natural biosphere. According to the National Academy of Sciences (NAS), water vapor introduced directly to the atmosphere, primarily from ocean evaporation is not long lived, and thus does not contribute substantially to a warming effect (NAS 2005). Carbon and nitrogen contained in $CO_2$, $CH_4$, and $N_2O$ 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. In addition to these GHGs, several classes of halogenated substances that contain fluorine, chlorine, or bromine also contribute to the greenhouse effect. These compounds are, for the most part, the product of industrial activities.

In addition to these natural sources of GHG emissions, $CO_2$, a byproduct of burning fossil fuels and biomass, as well as land-use changes and other industrial processes is the primary source of anthropogenic GHG emissions (USEPA 2012). It is the principal anthropogenic GHG that contributes to 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).

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 2016b) uses a metric developed by 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 $CO_2e$. In this way, emissions of various GHGs can be summed, and total GHG emissions can be inventoried in common units of MT per year of $CO_2e$. Most international inventories, including the U. S. inventory, use GWP values from the IPCC Fourth Assessment Report, per international consensus (IPCC 2007).

### *California Climate Trends and Greenhouse Gas Emissions*

According to the IPCC, global average temperature is expected to increase relative to the 1986–2005 period by 0.3–4.8 degrees Celsius (°C) (0.5-8.6 °F) by the end of the 21st century (2081-2100), depending on future GHG emission scenarios (IPCC 2014). According to U.S. Department of the Interior, Bureau of Reclamation (Reclamation), climate change models indicate temperatures throughout the Klamath River Basin may increase by approximately 5 to 6°F (Reclamation 2016b). In the Central Valley, temperature is also projected to increase steadily during the century, with changes generally higher farther away from the coast, reflecting a continued ocean cooling influence.

Another outcome of global climate change is sea-level rise. The average global sea level rose approximately 6.7-7.9 inches during the last century. According to the National Research Council (NRC)'s recent comprehensive assessment of sea level change projections for Pacific Coast, sea level along the State's coastline could be and one foot higher than 2000 levels by 2050, and about three feet higher than 2000 levels the end of this century (Reclamation 2016b).

**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.

Reclamation recently completed two reports on water resources in the West. These reports examine potential future impacts using projected 21st-century climate changes. Following are some of the potential effects of a warming climate in California, as described in the reports (Reclamation 2016a, 2016b):

- Loss of snowpack storage will cause increased winter runoff, which generally would not be captured and stored because of the need to reserve flood capacity in reservoirs during the winter. By the end of the century, higher-elevation portions of the watershed may see a decrease of 70 percent in annual snowpack.
- 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 Sacramento-San Joaquin River Delta (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 required existing laws and regulations could further reduce storage levels.
- Increased temperatures may 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 damaging wildfires.
- Greater variability in precipitation would result in a 20 percent higher flood potential under a warm-wet climate scenario, and a 364 percent greater potential for drought in a hot-dry climate scenario. The increased intensity of droughts and floods raises concerns about infrastructure safety, the resiliency of species and ecosystems to these changes, and the ability to maintain adequate levels of hydropower production.

**Current California Emission Sources** The most recent California GHG emission inventory was released on March 30, 2016, with data updated through 2014. The GHG emissions in California have been estimated each year from 2000 to 2014, and are reported for several large sectors of emission sources. The 2014 estimates are summarized in Table 10-1, reported by sector as millions of tons per year of $CO_2e$ (ARB 2016a, 2016b).

Table 10-1. California Greenhouse Gas Emissions by Sector in 2014

| Sector | Total Emissions[1] (million tons/year of $CO_2$e) | Percent of Statewide Total Gross Emissions[2] |
|---|---|---|
| Agriculture and Forestry | 36.1 | 7.9 |
| Commercial and Residential | 49.0 | 10.7 |
| Electric Power[3] | 88.4 | 19.3 |
| Industrial | 104.2 | 22.8 |
| Transportation | 163.0 | 35.6 |
| High Global Warming Potential substance and ozone-depleting substance use | 17.1 | 3.7 |
| **Total** | 457.85 | 100 |

*Source: ARB 2016a; 2016b.*
Notes:
[1] Inventory reporting methodology change initiated by ARB no longer accounts for carbon sequestration.
[2] Based on the 457.85 million tons/year of $CO_2$e Total Gross Emissions estimate.
[3] Includes in-state-generated and imported electricity production.
Key:
ARB = Air Resources Board
$CO_2$e = carbon dioxide equivalent

Total gross statewide GHG emissions in 2014 were estimated to be 457.85 million tons per year of $CO_2$e. The two largest sectors contributing to emissions in California are transportation and industrial. The agricultural sector—which includes manure management, enteric fermentation, agricultural residue burning, soils management, and forestry—represents only 7.9 percent of the total gross statewide emissions.

### *Central Valley Project and State Water Project Study Area*

The CVP is composed of 18 reservoirs with a combined storage capacity of more than 11 million acre-feet, 10 hydroelectric power plants, and more than 500 miles of major canals and aqueducts. The major CVP reservoirs are in the Sacramento and San Joaquin River basins, including Shasta Lake on the Sacramento River, Folsom Lake on the American River, New Melones Reservoir on the Stanislaus River, and Millerton Lake on the San Joaquin River. The CVP also diverts water from Trinity Lake (on the Trinity River) to the Sacramento River system via Clear Creek Tunnel. CVP pumping plants and canals include the Red Bluff Pumping Plant, which diverts water from the Sacramento River into the CVP Tehama-Colusa Canal; Folsom South Canal, which conveys water from Folsom Lake to southeastern Sacramento County; Contra Costa Canal Pumping Plant, which diverts water from Rock Slough in the Delta into the CVP Contra Costa Canal; and C.W. Jones Pumping Plant, which diverts water from the south Delta into the CVP Delta-Mendota Canal.

The SWP includes a reservoir on the Feather River near Oroville (Lake Oroville), a Delta cross channel, an electric power transmission system, an aqueduct to convey water from the Delta to Solano and Napa Counties (North Bay Aqueduct), an aqueduct to convey water from the Delta to the San Francisco Bay Area (South Bay Aqueduct), an aqueduct (California Aqueduct) with the San Luis Dam to convey water from the Delta to the San Joaquin Valley and southern California, and several reservoirs in southern California.

As discussed below in further detail, GHG emissions could result from increases in indirect electricity generation replacing net decreases in hydroelectric generation between the CVP and

SWP, as well as from potential increases in the use of alternative local water sources (i.e., groundwater pumping) as changes in the CVP and SWP affect water deliveries. As such, GHG emissions would occur indirectly through energy generation or directly at local diesel pumps used for ground water pumping. Specific locations of these facilities and sources are unknown and; therefore, it is assumed that GHG emissions could occur anywhere within California.

# Impact Analysis

This section describes the potential mechanisms and analytical methods for changes in GHG emissions, results of the impact analysis and cumulative effects.

## Potential Mechanisms for Change and Analytical Methods and Assumptions

The impact analysis considers changes in GHG emissions related to changes in CVP and SWP operations under the alternatives, as compared to the No Action Alternative.

As discussed in Chapter 2, "Description of Alternatives," with regards to climate change further exacerbating identified impacts, the No Action Alternative assumes future conditions such as climate change and sea-level rise. As such, impacts discussed throughout this EIS, from various resources, address the impacts associated with climate change.

### Changes in Greenhouse Gas Emissions Due to Changes in Energy Generation or Use

Changes in CVP and SWP operations under the alternatives could change energy generation and use, and 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 would likely increase their use of groundwater, recycled water, and 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. Water users are anticipated to reduce their 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. Local water supply could include groundwater pumping, recycled water, desalination, or surface water from local water purveyors. Energy intensity for water conveyance and supply varies depending on several factors such as water source type, fuel source used for pumping and conveyance facilities, as well as distance water is conveyed. Information is not available to determine what types of local water supplies would be utilized, how much local water is needed, and how much energy would be required for distributing water. As such, GHG emissions associated with potential increases in energy use from local alternative water supplies are not quantified or evaluated further, as such would be speculative.

Changes in the timing and magnitude of net CVP and SWP hydroelectric generation would result in changes in GHG emissions. Increased net CVP and SWP hydroelectric generation would reduce the need for electricity generated through fossil fuel combustion, and would avoid the GHG emissions that 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. As such, for purposes of this GHG analysis, it is assumed that net reduction in hydroelectric generation would result in GHG emissions at a one-to-one ratio.

Operational GHG emissions were estimated in accordance with industry-approved methods and assumptions. GHG emission estimates were based on the net change in hydroelectric generation between the CVP and SWP for each action alternative, in comparison to the No Action Alternative. Total net annual energy consumption/generation was simulated using the LTGen and SWP_Power based on CalSim II model outputs. Each action alternative includes multiple water-year types, based on hydrologic conditions. The Analytical Tools Technical Appendix provides additional information on the assumptions used in these analyses, including assumptions regarding climate change and sea level rise.

The 2016 Guidance on the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews, released by CEQ, recommends using a frame of reference when discussing the impacts of GHG emissions. While there is no threshold of significance determined by CEQ, it is recommended to use relevant policies for GHG emissions reductions (CEQ 2016).

One of the more commonly suggested mass emissions thresholds is 25,000 MT $CO_2e$ per year. This value is the threshold established for mandatory emissions reporting for most sources in California, under AB 32 and is used to provide further context regarding the magnitude of GHG emission estimates under the action alternatives.

In addition to consideration of available numeric thresholds, implementation of each of the action alternatives was evaluated in the context of California's RPS and Scoping Plan, adopted for the purpose of reducing GHG emissions statewide.

## Evaluation of Alternatives

The action alternatives have been compared to the No Action Alternative.

### *No Action Alternative*

**Changes in Greenhouse Gas Emissions Due to Changes in Energy Generation or Use** The No Action Alternative assumes continued implementation of existing projects, plans, ecosystem restoration projects (e.g., Trinity River Restoration Program (TRRP)), land or resource management plans, water supply management and wastewater facilities, flood management facilities, and recreational facilities. The No Action Alternative assumes future conditions such as climate change and sea-level rise, development of lands in accordance with general plans in areas served by CVP water supplies, and continued operation of the CVP to the year 2030.

For the Klamath River Basin, temperatures and precipitation are both anticipated to increase. Climate change may also cause changes in stream flows in the Klamath Basin. Projected warming is anticipated to change runoff timing, with more rainfall runoff during the winter and less runoff during the late spring and summer. It is anticipated these changes in river flows will change annual hydropower generation patterns, including reducing generation in the late-spring and summer.

For the Central Valley, 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. It is anticipated that changes in reservoir storage levels and release patterns will reduce CVP and SWP generation. Declines in CVP and SWP water supply deliveries would result in reduced energy requirements for conveyance of water supplies to CVP and SWP contractors.

It was assumed that a net reduction in hydroelectric generation between the CVP and SWP would result in GHG emissions associated with replaced energy derived from fossil fuels. Annual GHG emissions were estimated for the No Action Alternative for each water-year type. Table 10-2 provides a summary of net energy generation and associated GHG emissions for the No Action Alternative.

The No Action Alternative would result in GHG emissions associated with the potential replacement of hydroelectric generation by fossil fuel electricity sources when net hydroelectric generation is negative. However, emissions associated with electricity generation throughout the State have been accounted for in the State GHG inventory and subsequent GHG reduction goals outlined by the Scoping Plan and RPS. Further, hydroelectric power generated by CVP/SWP facilities is not counted towards RPS, so replacing it with fossil fuel generated electricity (which also would not count towards RPS) would not affect the ability of energy utilities, or the State, to meet RPS, and subsequently AB 32 and Scoping Plan goals.

Table 10-2. No Action Alternative Net Hydroelectric Generation and Associated GHG Emissions

| Water Year | Net CVP Hydroelectric Generation (GWh/year) | CVP GHG Emissions (MT $CO_2$e/year)[1] | Net SWP Hydroelectric Generation (GWh/year) | SWP GHG Emissions (MT $CO_2$e/year)[1] | Net GHG Emissions (MT $CO_2$e/year) |
|---|---|---|---|---|---|
| Wet | 4,740 | -2,369,793 | -4,079 | 2,039,282 | N/A[2] |
| Above Normal | 3,840 | -1,920,160 | -3,981 | 1,990,528 | 70,369 |
| Below Normal | 3,081 | -1,540,314 | -4,209 | 2,104,708 | 564,394 |
| Dry | 2,669 | -1,334,404 | -3,428 | 1,713,961 | 379,556 |
| Critical | 2,042 | -1,020,920 | -2,062 | 1,030,962 | 10,042 |
| Average All Years | 3,475 | -1,737,308 | -3,627 | 1,813,424 | 76,115 |

Notes:

[1] Net positive hydrogenation in either the CVP or the SWP is assumed to result in no additional GHG emissions and is therefore presented as negative emissions for comparison purposes among the CVP and the SWP annual hydroelectric generation.

[2] When reporting net GHG emissions, the net change or increase in GHG emissions between action alternative are considered for impact determinations and thus when net negative emissions occur, no GHG emissions are presented.

Key:
$CO_2$e = carbon dioxide equivalent
CVP = Central Valley Project
GHG = Greenhouse Gas
GWh = gigawatt-hour
MT = metric tons
N/A = not applicable
SWP = State Water Project

### *Proposed Action (Alternative 1)*

Alternative 1 is compared to the No Action Alternative.

**Changes in GHG Emissions Due to Changes in Energy Generation or Use** As described in Chapter 9, "Hydropower Generation," CVP and SWP operations under Alternative 1 would result in various changes to pumping and total hydroelectric generation. In general, net hydroelectric generation between the CVP and the SWP under Alternative 1 would decrease in comparison to the No Action Alternative. As a result, under the assumption that a net decrease in hydroelectric generation would result in additional indirect GHG emissions associated with replaced fossil fuel generated electricity, Alternative 1 would result in additional GHG emissions compared to the No Action Alternative.

As described above, it was assumed that a net reduction in hydroelectric generation would result in GHG emissions associated with replaced energy derived from fossil fuels. Annual GHG emissions were estimated for Alternative 1 for each water year. Table 10-3 provides a summary of net energy generation and associated GHG emissions for Alternative 1 compared to the No Action Alternative.

Table 10-3. Alternative 1 Hydroelectric Generation and Associated GHG Emissions Compared to the No Action Alternative

| | CVP | | | SWP | | | Net |
|---|---|---|---|---|---|---|---|
| **Water Year** | **Net Hydro-electric Generation (GWh/ year)** | **Change in Net Generation Compared to No Action (GWh/ year)** | **GHG Emissions (MT $CO_2$e/ year)[1]** | **Net Hydro-electric Generation (GWh/ year)** | **Change in Net Generation Compared to No Action (GWh/ year)** | **GHG Emissions (MT $CO_2$e/ year)[1]** | **GHG Emissions (MT $CO_2$e/ year)** |
| Wet | 4,723 | -16 | 8,117 | -4,083 | -5 | 2,465 | 10,581 |
| Above Normal | 3,837 | -3 | 1,621 | -3,983 | -2 | 924 | 2,545 |
| Below Normal | 3,085 | 5 | -2,327 | -4,206 | 4 | -1,871 | N/A[1] |
| Dry | 2,660 | -9 | 4,654 | -3,429 | -1 | 720 | 5,373 |
| Critical | 2,022 | -20 | 9,822 | -2,073 | -11 | 5,304 | 15,127 |
| Average All Years | 3,464 | -10 | 5,091 | -3,630 | -3 | 1,629 | 6,720 |

Notes:
[1] When reporting net GHG emissions, the net change or increase in GHG emissions between action alternative are considered for impact determinations and thus when net negative emissions occur, no GHG emissions are presented.
Key:
$CO_2$e = carbon dioxide equivalent
CVP = Central Valley Project
GHG = Greenhouse Gas
GWh = gigawatt-hour
MT = metric tons
N/A = not applicable
SWP = State Water Project

Based on the modeling conducted, increases in GHG emissions associated with implementation of Alternative 1, in comparison to the No Action Alternative, could be as high as 15,127 MT $CO_2$e per year. Considering available guidance with respect to GHG emissions – 25,000 MT $CO_2$e per year, as discussed above – this level of emissions would not be considered substantial. Further, although GHG emissions would increase as fossil fuel generation replaces hydroelectric generation, individual utilities within California would still be required to achieve RPS goals. As hydroelectric power generated by CVP/SWP facilities is not counted towards RPS, replacing it with fossil fuel generated electricity (which also would not count towards RPS) would not affect the ability of energy utilities, or the State, to meet RPS, and subsequently AB 32 and Scoping Plan goals.

#### *Trinity River Record of Decision Flow Rescheduling Alternative (Alternative 2)*

Alternative 2 is compared to the No Action Alternative.

**Changes in Greenhouse Gas Emissions Due to Changes in Energy Generation or Use** As described in Chapter 9, "Hydropower Generation," CVP and SWP operations under Alternative 2 would result in various changes to pumping and total hydroelectric generation. Under certain water conditions (i.e., wet and dry years), net hydroelectric generation between the CVP and the SWP under Alternative 2 would decrease in comparison to the No Action Alternative. As a result, under the assumption that a net decrease in hydroelectric generation would result in additional indirect GHG emissions associated with replaced fossil fuel generated electricity, Alternative 2 would result in additional GHG emissions compared to the No Action Alternative during wet and dry years.

As described above, it was assumed that a net reduction in hydroelectric generation would result in GHG emissions associated with replaced energy derived from fossil fuels. Annual GHG emissions were estimated for Alternative 2 for each water-year scenario. During years where a net positive hydroelectric generation is expected, no additional GHG emissions would occur. Table 10-4 provides a summary of net energy generation and associated GHG emissions for Alternative 2 compared to the No Action Alternative.

Table 10-4. Alternative 2 Hydroelectric Generation and Associated GHG Emissions Compared to the No Action Alternative

| | CVP | | | SWP | | | Net |
|---|---|---|---|---|---|---|---|
| **Water Year** | **Net Hydro-electric Generation (GWh/ year)** | **Change in Net Generation Compared to No Action (GWh/ year)** | **GHG Emissions ($MT\ CO_2e$/ year)[1]** | **Net Hydro-electric Generation (GWh/ year)** | **Change in Net Generation Compared to No Action (GWh/ year)** | **GHG Emissions ($MT\ CO_2e$/ year)** | **GHG Emissions ($MT\ CO_2e$/ year)** |
| Wet | 4,730 | -10 | 4,884 | -4,083 | -4 | 2,070 | 6,954 |
| Above Normal | 3,846 | 5 | -2,694 | -3,982 | 0 | 222 | N/A[2] |
| Below Normal | 3,094 | 13 | -6,506 | -4,206 | 3 | -1,641 | N/A[2] |
| Dry | 2,666 | -3 | 1,573 | -3,432 | -4 | 2,118 | 3,691 |
| Critical | 2,039 | -2 | 1,189 | -2,063 | -1 | 428 | 1,617 |
| Average All Years | 3,473 | -2 | 807 | -3,629 | -2 | 1,051 | 1,857 |

Notes:

[1] Net positive hydrogenation in either the CVP or the SWP is assumed to result in no additional GHG emissions and is therefore presented as negative emissions for comparison purposes among the CVP and the SWP annual hydroelectric generation.

[2] When reporting net GHG emissions, the net change or increase in GHG emissions between action alternative are considered for impact determinations and thus when net negative emissions occur, no GHG emissions are presented.

Key:
$CO_2e$ = carbon dioxide equivalent
CVP = Central Valley Project
GHG = Greenhouse Gas
GWh = gigawatt-hour
MT = metric tons
N/A = not applicable
SWP = State Water Project

Based on the modeling conducted, increases in GHG emissions associated with implementation of Alternative 2, in comparison to the No Action Alternative, could be as high as 6,954 MT $CO_2e$ per year in wet years. Considering available guidance with respect to GHG emissions – 25,000 MT $CO_2e$ per year, as discussed above – this level of emissions would not be considered substantial. Further, although GHG emissions would increase as fossil fuel generation replaces hydroelectric generation, individual utilities within the State would still be required to achieve RPS goals. As hydroelectric power currently is not counted towards RPS, replacing it with fossil fuel generated electricity (which also would not count towards RPS) would not affect the ability of energy utilities or the State to meet RPS, and subsequently AB 32 and Scoping Plan goals.

***Summary of Impact Analysis***

Table 10-5 compares the changes in GHG emissions of implementing the action alternatives compared to the No Action Alternative. Alternative 1 would result in an increase in GHG emissions under each water year type, except for below normal water years. In years with increased emissions, those increases ranged from 2,545 MT to 15,127 MT $CO_2$e per year. Alternative 2 would result in an increase in GHG emissions under each water year when compared to the No Action Alternative, except for above normal and below normal water years. In years with increased emissions, those increases ranged from 1,617 MT in critical years to 6,954 MT $CO_2$e per year in wet years. In each instance, for the reasons discussed under the *Evaluation of Alternatives*, the increase over the No Action Alternative would not be considered substantial. Table 10-6 compares the environmental consequences of implementing the action alternatives compared to the No Action Alternative.

Table 10-5. Comparison of Increase in GHG Emissions from Alternatives 1 and Alternative 2 Compared to the No Action Alternative

| Water Year | No Action Alternative (MT $CO_2$e/year) | Net Increase in GHG Emissions Under Alternative 1 (MT $CO_2$e/year)[1] | Net Increase in GHG Emissions Under Alternative 2 (MT $CO_2$e/year)[1] |
|---|---|---|---|
| Wet | N/A[2] | 10,581 | 6,954 |
| Above Normal | 70,369 | 2,545 | N/A[2] |
| Below Normal | 564,394 | N/A[2] | N/A[2] |
| Dry | 379,556 | 5,373 | 3,691 |
| Critical | 10,042 | 15,127 | 1,617 |
| Average All Years | 76,115 | 6,720 | 1,857 |

Notes:
[1] GHG emissions are presented as an increase in emissions compared to the No Action Alternative.
[2] No GHG emissions associated with positive net hydroelectric generation.
Key:
$CO_2$e = carbon dioxide equivalent
CVP = Central Valley Project
GHG = Greenhouse Gas
GWh = gigawatt-hour
MT = metric tons
N/A = not applicable
SWP = State Water Project

Table 10-6. Comparison of Action Alternatives to No Action Alternative

| Alternative | Potential Change | Consideration for Mitigation Measures |
|---|---|---|
| Alternative 1 | Average annual increase in GHG emissions of 6,720 MT $CO_2e$ in comparison to the No Action Alternative. | None needed |
| Alternative 2 | Average annual increase in GHG emissions of 1,857 MT $CO_2e$ in comparison to the No Action Alternative. | None needed |

Key:
$CO_2e$ = carbon dioxide equivalent
GHG = Greenhouse Gas
MT = metric tons

### *Potential Mitigation Measures*

As discussed under the Evaluation of Alternatives, implementation of Alternative 1 or Alternative 2 would not result in increases in GHG emissions as compared to the No Action Alternative that, when considering available guidance – 25,000 MT $CO_2e$ per year, as discussed above – would be substantial. Further, the action alternatives and No Action Alternative do not conflict with existing plans and policies such as the RPS and the Scoping Plan. No mitigation measures are proposed.

### *Cumulative Effects Analysis*

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 action alternatives for GHG emissions is summarized in Table 10-7. The methodology for this cumulative effects analysis is described in the Cumulative Effects Technical Appendix.

As described in the *Affected Environment*, GHG emissions are global pollutants and therefore contribute to a global—not local or regional—problem. Based on the global nature of GHG emissions, the global climate change analysis is inherently cumulative. Indirect emissions as a result of the alternatives would be cumulative contributions to a global issue. The regulatory framework in the State sets California GHG reduction targets (i.e., goals set by the Scoping Plan) that are to be met.

Table 10-7. Summary of Cumulative Effects on Greenhouse Gas Emissions of Action Alternatives as Compared to the No Action Alternative

| Scenarios | Cumulative Effects of Actions |
|---|---|
| No Action Alternative with Associated Cumulative Effects Actions in Year 2030 | *Conditions and Actions included in Quantitative Analyses*<br>*(Conditions and actions incorporated into No Action Alternative modeling)*<br><br>Climate change and sea-level rise, development under the general plans, FERC relicensing projects, and some future projects to improve water quality or habitat are anticipated to reduce carryover storage in reservoirs and change stream flow patterns as compared to past conditions. These factors could reduce hydroelectric generation, which could result in increased use of fossil fuels, indirectly increasing GHG emissions for fossil fuel generation, and increased use of diesel engines for additional groundwater use.<br><br>*Additional Identified Actions*<br>*(Additional reasonably foreseeable projects or actions identified in Cumulative Effects Technical Appendix)*<br><br>Removal of the four PacifiCorp dams on the mainstem of the Klamath River would reduce hydroelectric generation. Other additional identified actions (e.g., FERC relicensing projects) are also anticipated to reduce hydropower generation. These reductions in hydropower generation could result in increased use of fossil fuels and indirectly increase GHG emissions for fossil fuel generation. |
| Alternative 1 with Associated Cumulative Effects Actions in Year 2030 | *Alternative 1 with Conditions and Actions included in Quantitative Analyses*<br><br>Implementation of Alternative 1 could result in increased GHG emissions as compared to the No Action Alternative. Indirect GHG emissions as a result of Alternative 1 could be cumulative contributions to a global issue.<br><br>*Alternative 1 with Additional Identified Actions*<br><br>Alternative 1 with the additional reasonably foreseeable actions could result in increased GHG emissions. Indirect GHG emissions as a result of Alternative 1 and the additional reasonably foreseeable actions could be cumulative contributions to a global issue. |
| Alternative 2 with Associated Cumulative Effects Actions in Year 2030 | *Alternative 2 with Conditions and Actions included in Quantitative Analyses*<br><br>Implementation of Alternative 2 could result in increased GHG emissions as compared to the No Action Alternative. Indirect GHG emissions as a result of Alternative 2 could be cumulative contributions to a global issue.<br><br>*Alternative 2 with Additional Identified Actions*<br><br>Alternative 2 with the additional reasonably foreseeable actions could result in increased GHG emissions. Indirect GHG emissions as a result of Alternative 2 and the additional reasonably foreseeable actions could be cumulative contributions to a global issue. |

Key:
FERC = Federal Energy Regulatory Commission
GHG = greenhouse gas

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# Chapter 11
# Agricultural Resources

## Introduction

Agricultural resources in the study area could see potential changes occur as a result of implementing the alternatives evaluated in this Environmental Impact Statement (EIS). Implementation of the alternatives could affect these resources through operational changes of the Central Valley Project (CVP) and State Water Project (SWP).

## Affected Environment

This section describes agricultural resources that could be potentially affected by the implementation of the alternatives considered in this EIS. Changes in agricultural resources due to changes in CVP operations may occur in the Central Valley and Bay-Delta Region. Direct agricultural resource effects from implementation of the alternatives analyzed in this EIS are related to changes in agricultural land uses due to the availability and reliability of CVP water supplies. An overview of California agriculture follows, with agricultural resources information for each of the potentially affected regions.

### Overview of California Agriculture

California agriculture is an important resource that produces over 400 types of crops. California is the nation's leading producer of 82 commodities; and produces more than 99 percent of the nation's almonds, artichokes, dates, figs, raisins, kiwifruit, olives, clingstone peaches, pistachios, prunes, pomegranates, sweet rice, and walnuts (USDA-NASS 2015). In 2013, cultivation of 25.5 million acres of agricultural land contributed about $46.4 billion to California's economy and nearly 12 percent of total agricultural revenues in the United States (USDA-NASS 2015).

Recent trends in California agricultural production include reductions in field and forage crop acreage and increases in orchard and vine acreage (Reclamation 2015). The U.S. Department of Agriculture National Agricultural Statistics Service California Field Office publishes annual reports containing data from County Agricultural Commissioners and periodic statewide censuses of agricultural producers. County Agricultural Commissioners' data covers acres planted, total production, prices, yield per acre, and value of production across crop groups and counties.

### Central Valley and Bay-Delta Region

The Central Valley and Bay-Delta Region extends from above Shasta Lake to the Tehachapi Mountains, and includes the Sacramento Valley and San Joaquin Valley. In this chapter, the counties within the Sacramento-San Joaquin River Delta (Delta) area are included in the description of the Sacramento and San Joaquin Valleys. The Delta counties of Sacramento, Yolo, and Solano Counties are included within the Sacramento Valley discussion. San Joaquin County is included within the San Joaquin Valley discussion.

Central Valley agriculture is highly productive due to favorable climate, adequate supplies of good quality irrigation water, and deep, fertile soils. Most of the Central Valley receives rainfall in the late fall through the winter months. Very little of the annual rainfall occurs during the peak agricultural irrigation season, which extends from early spring through fall. The seasonality of rainfall in the Central Valley is important for agricultural resources, as the timing of precipitation does not reliably support dryland (non-irrigated) farming. Lower value over-winter, non-irrigated crops (e.g., winter wheat) can be grown economically in many years, but higher value row crops and permanent crops require substantial supplemental irrigation (DWR 2009). Irrigation water provided by the CVP and SWP, local surface water, and groundwater have transformed lands in the Central Valley into some of the most productive and diverse agricultural lands in the United States.

#### *Sacramento Valley*

The Sacramento Valley includes the counties of Shasta, Plumas, Tehama, Glenn, Colusa, Butte, Sutter, Yuba, Nevada, Placer, El Dorado, Sacramento, Yolo, and Solano Counties. Agriculture in other counties in the Sacramento Valley are not anticipated to be affected by changes in CVP operations, and are not discussed here, including: Alpine, Sierra, Lassen, and Amador Counties.

Field and forage crops dominate the irrigated acreage in Sacramento Valley, with over 1.4 million acres irrigated and about 38 percent of crop value produced, as summarized in Table 11-1. Rice, irrigated pasture, and hay are the largest acreages. Second to field and forage are orchard and vine crops, making up roughly 21 percent of total acreage, but providing more than 38 percent of the total crop value produced. Almonds and walnuts represent the largest acreages in this category. In total, the Sacramento Valley contains nearly two million agricultural acres generating over $4 billion per year in value of production.

Table 11-1. Recent Annual Agricultural Acreage and Value of Production in Sacramento Valley

| | Orchards, Vineyards, and Berries | Field and Forage | Livestock, Dairy, and Poultry | Nursery, Other | Vegetable | Total |
|---|---|---|---|---|---|---|
| Acreage[1,2] | 419,263 | 1,435,923 | N/A | 1,658 | 91,684 | 1,948,527 |
| Value[1,3] | $1,636 | $1,648 | $528 | $141 | $336 | $4,288 |

*Sources: USDA-NASS 2008, 2009, 2010, 2011, 2012, 2013*

Notes:

[1] Annual acreages and values are average annual between 2007 and 2012.

[2] Not all acreages and/or production values are reported for every crop in every county. Therefore, the implied value of production per acre may be misleading for some crop categories.

[3] Values in million dollars, 2016 basis.

Key:

N/A = Not Applicable

#### *San Joaquin Valley*

The San Joaquin Valley includes Stanislaus, Merced, Madera, San Joaquin, Fresno, Kings, Tulare, and Kern Counties. Other counties in the San Joaquin Valley are not anticipated to be affected by changes in CVP operations, and are not discussed here, including: Calaveras, Mariposa, and Tuolumne Counties.

Field and forage crops are also the largest category by acreage in this region, as summarized in Table 11-2. Hay, cotton, and silage have the largest acreage in this category. Second to field and forage is orchard and vine crops, with almost two million acres, but providing more than three times the value of production. Almonds and grapes are the two largest acreages of orchard and vine crops in the San Joaquin Valley. In total, the San Joaquin Valley contains over 5.5 million irrigated acres, generating over twenty-seven billion dollars in value of production.

Important differences exist in water supply mix and reliability within the San Joaquin Valley. The CVP water users that are located on the west side of the valley, and the SWP water users in Kings and Kern Counties, rely primarily on surface water conveyed through the Delta and groundwater. Agricultural producers within these CVP water service contractors and SWP contractors are especially susceptible to large variation in available surface water and imported supplies. The San Joaquin River Exchange Contractors receive CVP water supplies in exchange for their water rights on the San Joaquin River; and therefore, have much higher water supply reliability than CVP water service contractors or SWP contractors.

On the east side of the San Joaquin Valley, at the base of the Sierra Nevada, surface water is delivered under water rights on streams from the Sierra Nevada, or by the CVP from Millerton Lake at Friant Dam. The reliability of CVP water supplies from Friant Dam have generally been similar to, or higher, than that of CVP water supplies conveyed through the Delta. However, in 2014, the allocations were reduced to zero and available water from Friant Dam was provided to the San Joaquin River Exchange Contractors under terms of the exchange contract. A number of agricultural areas throughout the valley have no or very low priority surface water rights. Growers in these areas rely more heavily on groundwater for irrigation water.

Table 11-2. Recent Annual Agricultural Acreage and Value of Production in San Joaquin Valley

| | Orchards, Vineyards, and Berries | Field and Forage | Livestock, Dairy, and Poultry | Nursery, Other | Vegetable | Total |
|---|---|---|---|---|---|---|
| Acreage[1,2] | 1,943,549 | 3,078,803 | N/A | 3,838 | 510,370 | 5,536,560 |
| Value[1,3] | $11,380 | $3,179 | $9,831 | $489 | $2,908 | $27,786 |

*Sources: USDA-NASS2008, 2009, 2010, 2011, 2012, 2013*

Notes:

[1] Annual acreages and values are average annual between 2007 and 2012.

[2] Not all acreages and/or production values are reported for every crop in every county. Therefore, the implied value of production per acre may be misleading for some crop categories.

[3] Values in million dollars, 2016 basis.

Key:

N/A = Not Applicable

# Impact Analysis

## Potential Mechanisms for Change in Agricultural Resources and Analytical Methods

The environmental consequences assessment considers changes in agricultural resource conditions related to changes in CVP operations under the alternatives, as compared to the No Action Alternative.

### *Changes in Irrigated Agricultural Acreage and Total Production Value*

Changes in CVP operations under the alternatives could change the extent of irrigated acreage and total production value over the long-term average condition and in dry and critical dry years as compared to the No Action Alternative.

The results of the impact analysis represents comparison of long-term changes that would occur between alternatives in 2030. The impact analysis does not represent short-term responses, especially during one-to-five years, in response to emergency flood or drought conditions.

Agricultural impacts were evaluated using a regional agricultural production model developed for large-scale analysis of irrigation water supply and cost changes. The Statewide Agricultural Production (SWAP) model is a regional model of irrigated agricultural production and economics that simulates the decisions of producers (farmers) in 27 agricultural subregions 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 Analytical Tools Technical Appendix provides further information on the SWAP model.

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, quantities used, and other inputs. The model also fallows land when that appears to be the most cost-effective response to resource conditions. SWAP produces estimates of the change in value and costs of agricultural production.

SWAP was used to compare the long-run agricultural economic responses to potential changes in CVP and SWP irrigation water delivery and to changes in groundwater conditions associated with the alternatives. Results from the surface water analysis that used the CalSim II model, as described in Chapter 4, "Surface Water Supply and Management," were provided as inputs into SWAP through a standardized data linkage procedure. Groundwater elevations are not expected to significantly change with the alternatives, as described in Chapter 6, "Groundwater Resources/Groundwater Quality," and no changes in pumping lift between the No Action Alternative and the alternatives were made in SWAP.

In addition, the analysis does not restrict groundwater withdrawals based upon groundwater overdraft or groundwater quality conditions. As described in Chapter 6, "Groundwater Resources/Groundwater Quality," the Sustainable Groundwater Management Act requires preparation of Groundwater Sustainability Plans (GSP) by 2020 or 2022 for most of the groundwater basins in the Central Valley Region. 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 and it was assumed that Central Valley agriculture water users would not restrict groundwater withdrawals by 2030.

## Evaluation of Alternatives

The impact analysis in this EIS is based upon the comparison of the alternatives to the No Action Alternative in the year 2030.

### *No Action Alternative*

**Potential Changes in Irrigated Agricultural Production** Under the No Action Alternative, agricultural resources would be comparable to the conditions described in the *Affected Environment* section of this chapter. Conditions in 2030 would be different than existing conditions, primarily due to climate change and sea-level rise, general plan development throughout California, and implementation of reasonable and foreseeable water resource management projects to provide water supplies. Climate change and sea-level rise are anticipated to reduce long-term average CVP water supply deliveries by 2030, as compared to recent historical long-term average deliveries. These reduced deliveries could result in more crop idling or changes in cropping patterns. Development under general plans would disrupt agricultural resources.

### *Proposed Action (Alternative 1)*

**Central Valley and Bay-Delta Region**

*Potential Changes in Irrigated Agricultural Production in the Sacramento Valley* Results of the SWAP analysis indicated that agricultural cropping patterns in the Sacramento Valley would be similar (less than a 1 percent change) under Alternative 1 as compared to the No Action Alternative over long-term average conditions and in dry and critical dry years, as summarized in Tables 11-3 and 11-4.

Table 11-3. Changes in Sacramento Valley Irrigated Acreage over the Long-term Average Conditions Under Alternative 1 as Compared to the No Action Alternative

| Crops | Alternative 1 (1000s acres) | No Action Alternative (1000s acres) | Changes (1000s acres) |
|---|---|---|---|
| Grain Crops | 155 | 155 | 0 |
| Rice | 548 | 548 | 0 |
| Field Crops | 59 | 59 | 0 |
| Forage Crops | 199 | 199 | 0 |
| Vegetables and Truck Crops | 119 | 119 | 0 |
| Orchards and Vineyards | 456 | 456 | 0 |
| Total | 1,537 | 1,537 | 0 |

Notes:
Grain crops include corn, dry beans and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
Totals may not sum due to rounding.

Table 11-4. Changes in Sacramento Valley Irrigated Acreage in Dry and Critical Dry Years Under Alternative 1 as Compared to the No Action Alternative

| Crops | Alternative 1 (1000s acres) | No Action Alternative (1000s acres) | Changes (1000s acres) |
|---|---|---|---|
| Grain Crops | 155 | 155 | 0 |
| Rice | 543 | 544 | -1 |
| Field Crops | 59 | 59 | 0 |
| Forage Crops | 197 | 197 | 0 |
| Vegetables and Truck Crops | 119 | 119 | 0 |
| Orchards and Vineyards | 456 | 456 | 0 |
| Total | 1,528 | 1,529 | -1 |

Notes:
Grain crops include corn, dry beans, and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
Totals may not sum due to rounding.

Agricultural production in the Sacramento Valley would be similar (less than a 1 percent change) under Alternative 1 as compared to the No Action Alternative over long-term average conditions and in dry and critical dry years (less than 1 percent change), as summarized in Tables 11-5 and 11-6.

Table 11-5. Changes in Sacramento Valley Agricultural Production over the Long-term Average Conditions Under Alternative 1 as Compared to the No Action Alternative

| Crops | Alternative 1 ($ millions) | No Action Alternative ($ millions) | Changes ($ millions) |
|---|---|---|---|
| Grain Crops | 158 | 158 | 0.0 |
| Rice | 1,178 | 1,178 | 0.0 |
| Field Crops | 82 | 82 | 0.0 |
| Forage Crops | 260 | 260 | 0.0 |
| Vegetables and Truck Crops | 1,023 | 1,023 | 0.0 |
| Orchards and Vineyards | 3,375 | 3,375 | 0.0 |
| Total | 6,076 | 6,076 | 0.0 |

Notes:
Grain crops include corn, dry beans and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
All values of production are in 2016 dollar equivalent values.
Totals may not sum due to rounding.

Table 11-6. Changes in Sacramento Valley Agricultural Production in Dry and Critical Dry Years Under Alternative 1 as Compared to the No Action Alternative

| Crops | Alternative 1 ($ millions) | No Action Alternative ($ millions) | Changes ($ millions) |
|---|---|---|---|
| Grain Crops | 158 | 158 | 0.0 |
| Rice | 1,169 | 1,170 | -1.3 |
| Field Crops | 82 | 82 | 0.0 |
| Forage Crops | 257 | 257 | 0.0 |
| Vegetables and Truck Crops | 1,022 | 1,022 | 0.0 |
| Orchards and Vineyards | 3,375 | 3,375 | -0.1 |
| Total | 6,064 | 6,064 | -1.5 |

Notes:
Grain crops include corn, dry beans, and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
All values of production are in 2016 dollar equivalent values.
Totals may not sum due to rounding.

*Potential Changes in Irrigated Agricultural Production in the San Joaquin Valley* Results of the SWAP analysis indicated that irrigated acreage in the San Joaquin Valley, including the Tulare Lake area, would be similar (less than 1 percent change) under Alternative 1 as compared to the No Action Alternative over long-term average conditions and in dry and critical dry years, as summarized in Tables 11-7 and 11-8.

Table 11-7. Changes in San Joaquin Valley Irrigated Acreage over the Long-term Average Conditions Under Alternative 1 as Compared to the No Action Alternative

| Crops | Alternative 1 (1000s acres) | No Action Alternative (1000s acres) | Changes (1000s acres) |
|---|---|---|---|
| Grain Crops | 1,024 | 1,024 | 0 |
| Rice | 17 | 17 | 0 |
| Field Crops | 828 | 828 | 0 |
| Forage Crops | 735 | 735 | 0 |
| Vegetables and Truck Crops | 633 | 633 | 0 |
| Orchards and Vineyards | 2,156 | 2,156 | 0 |
| Total | 5,392 | 5,392 | 0 |

Notes:
Grain crops include corn, dry beans, and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
Totals may not sum due to rounding.

Table 11-8. Changes in San Joaquin Valley Irrigated Acreage in Dry and Critical Dry Years Under Alternative 1 as Compared to the No Action Alternative

| Crops | Alternative 1 (1000s acres) | No Action Alternative (1000s acres) | Changes (1000s acres) |
|---|---|---|---|
| Grain Crops | 1,010 | 1,010 | 0 |
| Rice | 17 | 17 | 0 |
| Field Crops | 827 | 827 | 0 |
| Forage Crops | 735 | 735 | 0 |
| Vegetables and Truck Crops | 633 | 633 | 0 |
| Orchards and Vineyards | 2,154 | 2,154 | 0 |
| Total | 5,376 | 5,376 | 0 |

Notes:
Grain crops include corn, dry beans and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
Totals may not sum due to rounding.

Agricultural production in the San Joaquin Valley would be similar (less than 1 percent change) under Alternative 1 as compared to the No Action Alternative over long-term average conditions and in dry and critical dry years (less than 1 percent change), as summarized in Tables 11-9 and 11-10.

Table 11-9. Changes in San Joaquin Valley Agricultural Production over the Long-term Average Conditions Under Alternative 1 as Compared to the No Action Alternative

| Crops | Alternative 1 ($ millions) | No Action Alternative ($ millions) | Changes ($ millions) |
|---|---|---|---|
| Grain Crops | 1,452 | 1,452 | 0.0 |
| Rice | 33 | 33 | 0.0 |
| Field Crops | 1,519 | 1,519 | 0.0 |
| Forage Crops | 1,508 | 1,508 | 0.0 |
| Vegetables and Truck Crops | 4,889 | 4,889 | 0.0 |
| Orchards and Vineyards | 17,499 | 17,499 | 0.0 |
| Total | 26,900 | 26,900 | 0.0 |

Notes:
Grain crops include corn, dry beans and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
All values of production are in 2016 dollar equivalent values.
Totals may not sum due to rounding.

Table 11-10. Changes in San Joaquin Valley Agricultural Production in Dry and Critical Dry Years Under Alternative 1 as Compared to the No Action Alternative

| Crops | Alternative 1 ($ millions) | No Action Alternative ($ millions) | Changes ($ millions) |
|---|---|---|---|
| Grain Crops | 1,437 | 1,437 | 0.0 |
| Rice | 33 | 33 | 0.0 |
| Field Crops | 1,518 | 1,518 | 0.0 |
| Forage Crops | 1,508 | 1,508 | 0.0 |
| Vegetables and Truck Crops | 4,888 | 4,888 | 0.0 |
| Orchards and Vineyards | 17,494 | 17,494 | 0.1 |
| Total | 26,879 | 26,879 | 0.1 |

Notes:
Grain crops include corn, dry beans and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
All values of production are in 2016 dollar equivalent values.
Totals may not sum due to rounding.

#### ***Trinity River Record of Decision Flow Rescheduling Alternative (Alternative 2)***

##### Central Valley and Bay-Delta Region

*Potential Changes in Irrigated Agricultural Production in the Sacramento Valley* Results of the SWAP analysis indicated that the agricultural cropping pattern in the Sacramento Valley would be similar (less than 1 percent change) under Alternative 2 as compared to the No Action Alternative over long-term average conditions and in dry and critical dry years, as summarized in Tables 11-11 and 11-12.

Table 11-11. Changes in Sacramento Valley Irrigated Acreage over the Long-term Average Conditions Under Alternative 2 as Compared to the No Action Alternative

| Crops | Alternative 2 (1000s acres) | No Action Alternative (1000s acres) | Changes (1000s acres) |
|---|---|---|---|
| Grain Crops | 155 | 155 | 0 |
| Rice | 548 | 548 | 0 |
| Field Crops | 59 | 59 | 0 |
| Forage Crops | 199 | 199 | 0 |
| Vegetables and Truck Crops | 119 | 119 | 0 |
| Orchards and Vineyards | 456 | 456 | 0 |
| Total | 1,537 | 1,537 | 0 |

Notes:
Grain crops include corn, dry beans and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
Totals may not sum due to rounding.

Table 11-12. Changes in Sacramento Valley Irrigated Acreage in Dry and Critical Dry Years Under Alternative 2 as Compared to the No Action Alternative

| Crops | Alternative 2 (1000s acres) | No Action Alternative (1000s acres) | Changes (1000s acres) |
|---|---|---|---|
| Grain Crops | 155 | 155 | 0 |
| Rice | 544 | 544 | 0 |
| Field Crops | 59 | 59 | 0 |
| Forage Crops | 197 | 197 | 0 |
| Vegetables and Truck Crops | 119 | 119 | 0 |
| Orchards and Vineyards | 456 | 456 | 0 |
| Total | 1,529 | 1,529 | 0 |

Notes:
Grain crops include corn, dry beans and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
Totals may not sum due to rounding.

Agricultural production in the Sacramento Valley would be similar (less than 1 percent change) under Alternative 2 as compared to the No Action Alternative over long-term average conditions and in dry and critical dry years, as summarized in Tables 11-13 and 11-14.

Table 11-13. Changes in Sacramento Valley Agricultural Production over the Long-term Average Conditions Under Alternative 2 as Compared to the No Action Alternative

| Crops | Alternative 2 ($ millions) | No Action Alternative ($ millions) | Changes ($ millions) |
|---|---|---|---|
| Grain Crops | 158 | 158 | 0.0 |
| Rice | 1,178 | 1,178 | 0.0 |
| Field Crops | 82 | 82 | 0.0 |
| Forage Crops | 260 | 260 | 0.0 |
| Vegetables and Truck Crops | 1,023 | 1,023 | 0.0 |
| Orchards and Vineyards | 3,375 | 3,375 | 0.0 |
| Total | 6,076 | 6,076 | 0.0 |

Notes:
Grain crops include corn, dry beans and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
All values of production are in 2016 dollar equivalent values.
Totals may not sum due to rounding.

Table 11-14. Changes in Sacramento Valley Agricultural Production in Dry and Critical Dry Years Under Alternative 2 as Compared to the No Action Alternative

| Crops | Alternative 2 ($ millions) | No Action Alternative ($ millions) | Changes ($ millions) |
|---|---|---|---|
| Grain Crops | 158 | 158 | 0.0 |
| Rice | 1,170 | 1,170 | 0.0 |
| Field Crops | 82 | 82 | 0.0 |
| Forage Crops | 257 | 257 | 0.0 |
| Vegetables and Truck Crops | 1,022 | 1,022 | 0.0 |
| Orchards and Vineyards | 3,375 | 3,375 | 0.0 |
| Total | 6,064 | 6,064 | 0.0 |

Notes:
Grain crops include corn, dry beans, and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
All values of production are in 2016 dollar equivalent values.
Totals may not sum due to rounding.

*Potential Changes in Irrigated Agricultural Production in the San Joaquin Valley* Results of the SWAP analysis indicated that irrigated acreage in the San Joaquin Valley would be similar (less than 1 percent change) under Alternative 2 as compared to the No Action Alternative over long-term average conditions and in dry and critical dry years, as summarized in Tables 11-15 and 11-16.

Table 11-15. Changes in San Joaquin Valley Irrigated Acreage over the Long-term Average Conditions Under Alternative 2 as Compared to the No Action Alternative

| Crops | Alternative 2 (1000s acres) | No Action Alternative (1000s acres) | Changes (1000s acres) |
|---|---|---|---|
| Grain Crops | 1,024 | 1,024 | 0 |
| Rice | 17 | 17 | 0 |
| Field Crops | 828 | 828 | 0 |
| Forage Crops | 735 | 735 | 0 |
| Vegetables and Truck Crops | 633 | 633 | 0 |
| Orchards and Vineyards | 2,156 | 2,156 | 0 |
| Total | 5,392 | 5,392 | 0 |

Notes:
Grain crops include corn, dry beans and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
Totals may not sum due to rounding.

Table 11-16. Changes in San Joaquin Valley Irrigated Acreage in Dry and Critical Dry Years Under Alternative 2 as Compared to the No Action Alternative

| Crops | Alternative 2 (1000s acres) | No Action Alternative (1000s acres) | Changes (1000s acres) |
|---|---|---|---|
| Grain Crops | 1,010 | 1,010 | 0 |
| Rice | 17 | 17 | 0 |
| Field Crops | 827 | 827 | 0 |
| Forage Crops | 735 | 735 | 0 |
| Vegetables and Truck Crops | 633 | 633 | 0 |
| Orchards and Vineyards | 2,154 | 2,154 | 0 |
| Total | 5,376 | 5,376 | 0 |

Notes:
Grain crops include corn, dry beans, and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
Totals may not sum due to rounding.

Agricultural production in the San Joaquin Valley would be similar under Alternative 2 as compared to the No Action Alternative over long-term average conditions and in dry and critical dry years due to reduced use of groundwater, as summarized in Tables 11-17 and 11-18.

Table 11-17. Changes in San Joaquin Valley Agricultural Production over the Long-term Average Conditions Under Alternative 2 as Compared to the No Action Alternative

| Crops | Alternative 2 ($ millions) | No Action Alternative ($ millions) | Changes ($ millions) |
|---|---|---|---|
| Grain Crops | 1,452 | 1,452 | 0.0 |
| Rice | 33 | 33 | 0.0 |
| Field Crops | 1,519 | 1,519 | 0.0 |
| Forage Crops | 1,508 | 1,508 | 0.0 |
| Vegetables and Truck Crops | 4,889 | 4,889 | 0.0 |
| Orchards and Vineyards | 17,499 | 17,499 | 0.0 |
| Total | 26,900 | 26,900 | 0.0 |

Notes:
Grain crops include corn, dry beans and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
All values of production are in 2016 dollar equivalent values.
Totals may not sum due to rounding.

Table 11-18. Changes in San Joaquin Valley Agricultural Production in Dry and Critical Dry Years Under Alternative 2 as Compared to the No Action Alternative

| Crops | Alternative 2 ($ millions) | No Action Alternative ($ millions) | Changes ($ millions) |
|---|---|---|---|
| Grain Crops | 1,437 | 1,437 | 0.0 |
| Rice | 33 | 33 | 0.0 |
| Field Crops | 1,518 | 1,518 | 0.0 |
| Forage Crops | 1,508 | 1,508 | 0.0 |
| Vegetables and Truck Crops | 4,888 | 4,888 | 0.0 |
| Orchards and Vineyards | 17,494 | 17,494 | 0.0 |
| Total | 26,879 | 26,879 | 0.0 |

Notes:
Grain crops include corn, dry beans and grain.
Field crops include cotton, grass, hay, safflower, and sugar beets.
Forage crops include alfalfa and pasture.
All values of production are in 2016 dollar equivalent values.
Totals may not sum due to rounding.

***Summary of Environmental Consequences***

Table 11-19 presents the results of the environmental consequences analysis for implementing the action alternatives compared to the No Action Alternative. The results of the impact analysis represent comparison of long-term changes that would occur between alternatives in 2030. The impact analysis does not represent short-term responses, especially during one-to-five years, in response to emergency flood or drought conditions.

Table 11-19. Comparison of Action Alternatives to No Action Alternative

| Alternative | Potential Change | Consideration for Mitigation Measures |
|---|---|---|
| Alternative 1 | Agricultural resources would be similar to the No Action Alternative. Changes in irrigated acreage and agricultural production would be less than 1% for all year types in the Sacramento and San Joaquin Valleys. | None needed |
| Alternative 2 | Agricultural resources would be similar to the No Action Alternative. Changes in irrigated acreage and agricultural production would be less than 1% for all year types in the Sacramento and San Joaquin Valleys. | None needed |

Key:
% = percent

***Potential Mitigation Measures***

Mitigation measures are identified, as appropriate, to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse environmental effects of action alternatives, as compared to the No Action Alternative.

Changes in CVP operations under action alternatives as compared to the No Action Alternative, would not result in changes in agricultural resources. Therefore, there would be no adverse impacts to agricultural resources; and no mitigation measures are required.

### *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 Agricultural Resources is summarized in Table 11-20. The methodology for this cumulative effects analysis is described in the Cumulative Effects Technical Appendix.

Table 11-20. Summary of Cumulative Effects on Agricultural Resources of Action Alternatives as Compared to the No Action Alternative

| Scenarios | Cumulative Effects of Actions |
|---|---|
| No Action Alternative with Associated Cumulative Effects Actions in Year 2030 | *Conditions and Actions included in Quantitative Analyses*<br>*(Conditions and actions incorporated into No Action Alternative modeling)*<br><br>Climate change and sea-level rise, development under general plans, FERC relicensing projects, and some future projects to improve water quality or habitat are anticipated to reduce the availability of CVP water deliveries as compared to past conditions. Reductions in CVP water supply reliability may result in changes in agricultural production, including changes in irrigated acres and crop types.<br><br>*Additional Identified Actions*<br>*(Additional reasonably foreseeable projects or actions identified in Cumulative Effects Technical Appendix)*<br><br>Additional reasonably foreseeable actions under this cumulative effects analysis are not anticipated to change CVP water deliveries or associated agricultural production. |
| Alternative 1 with Associated Cumulative Effects Actions in Year 2030 | *Alternative 1 with Conditions and Actions included in Quantitative Analyses*<br><br>Implementation of Alternative 1 would result in similar irrigated acreage and agricultural production as compared to the No Action Alternative.<br><br>*Alternative 1 with Additional Identified Actions*<br><br>The additional reasonably foreseeable actions are not anticipated to affect irrigated acreage or agricultural production. |
| Alternative 2 with Associated Cumulative Effects Actions in Year 2030 | *Alternative 2 with Conditions and Actions included in Quantitative Analyses*<br><br>Implementation of Alternative 2 would result in similar irrigated acreage and agricultural production as compared to the No Action Alternative.<br><br>*Alternative 2 with Additional Identified Actions*<br><br>The additional reasonably foreseeable actions are not anticipated to affect irrigated acreage or agricultural production. |

Key:
CVP = Central Valley Project
FERC = Federal Energy Regulatory Commission

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# Chapter 12
# Socioeconomics

## Introduction

This chapter describes socioeconomics 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 these resources by augmenting flows in the lower Klamath River, through operational changes of the Trinity River Division. These resources include: effects to recreation due to changes in reservoir storage and river flows; effects to commercial, sport, and tribal fisheries due to changes in river flows, river temperatures, and fish health; and effects to irrigated agricultural production value and employment due to changes in Central Valley Project (CVP) water supplies.

## 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 employment, recreation, and agricultural output.

### Characterization of Socioeconomic Conditions

Characterization of the socioeconomic conditions within the study area is based on publicly available data sources. The data sources used include the U.S. Bureau of Economic Analysis (BEA) and California Employment and Development Department (EDD). The data was summarized and used to compare historical and current trends of the socioeconomic conditions in the study area. Characterization of potentially affected commercial, sport, and tribal fisheries is based on Pacific Fishery Management Council (PFMC) data. Characterization of recreation opportunities in the study area is based on U.S. Forest Service (USFS) and local recreation area data.

### Lower Klamath and Trinity River Region

The Lower Klamath and Trinity River Region includes the area in Trinity County along the Trinity River from Trinity Lake to the river's confluence with the Klamath River; and in Humboldt and Del Norte Counties along the lower Klamath River, from its confluence with the Trinity River to the Pacific Ocean. Tribal lands along the Trinity or lower Klamath Rivers, within the Lower Klamath and 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 Trinity County's local economy (EDD 2016a).

Humboldt County is the largest and most populous of the north coast counties and encompasses 2.3 million acres, including protected redwoods and recreation areas—80 percent of which is forestlands (Humboldt County 2016). Humboldt County is the leading timber producing county in the State (CDFA 2014). The portion of Humboldt County in the Lower Klamath and 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 Johnsons 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 area (EDD 2016b). The portion of Del Norte County in the Lower Klamath and 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).

### *Employment*

Total employment and the farm employment in 2005, 2010 and 2014 in the Lower Klamath and Trinity River Region counties are presented in Table 12-1. The Lower Klamath and Trinity River Region farm employment represents approximately 1 percent of farm employment in the State.

Table 12-1. Employment in Lower Klamath and Trinity River Region

| Area | 2005 | 2010 | 2014[1] |
|---|---|---|---|
| **Total Employment** | | | |
| Trinity County | 5,040 | 4,710 | 4,810 |
| Humboldt County | 71,597 | 68,807 | 70,296 |
| Del Norte County | 11,210 | 10,903 | 10,964 |
| **STATE OF CALIFORNIA** | **20,255,748** | **19,803,742** | **22,040,057** |
| **Farm Employment[1]** | | | |
| Trinity County | 140 | 203 | 236 |
| Humboldt County | 1,431 | 1,325 | 1,396 |
| Del Norte County | 366 | 290 | 305 |
| **STATE OF CALIFORNIA** | **244,144** | **232,545** | **243,247** |

*Source: BEA 2015a, 2015b*
Note:
[1] Most recent data available.
[2] Farm employment includes employment numbers in forestry, fishing, and related activities.

### *Commercial, Sport, and Tribal Salmon Fishing*

The alternatives may affect commercial, sport, and tribal fishing in the Lower Klamath and Trinity River Region. Participants in the ocean commercial fishery who could be potentially affected by the alternatives consist of small, independently owned and operated trollers. The fishery is a mixed stock fishery, that is, the commercial harvest includes salmon stocks from different rivers, including the Klamath River. The PFMC manages the salmon fishery on the basis of "weak stock management," whereby regulations are designed to protect weaker stocks, even if that means foregoing some harvest of the healthier stocks that comingle with the weaker ones in the ocean harvest. In the ocean, Klamath River fall Chinook Salmon range from approximately Point Sur, California to Cape Falcon, Oregon (PFMC 2016).

The abundance of Klamath River fall-run Chinook Salmon routinely constrain the troll fishery in the range described above. Table 12-2 summarizes landings (poundage) in the last three decades in Crescent City and Eureka, California. Landings and value decreased from the 1980s to the 1990s. Factors contributing to this decline include more conservative management policies to protect weak stocks, and a 1993 opinion by the Department of the Interior Solicitor reserving 50 percent of Klamath-Trinity River salmon for the Yurok Tribe and Hoopa Valley Tribe. Landing reductions began occurring in Crescent City and Eureka port areas in the mid-1980s—in relation to conservation concerns for Klamath River fall Chinook Salmon—and low landings remain persistent features in those areas (PFMC 2016).

Commercial sales in Klamath River's Yurok and Hoopa Valley Reservation tribal fall gillnet fisheries occurred in 1987-1989, 1996, 1999-2004, and 2007-2015 (PFMC 2016). Average commercial catch of fall Chinook Salmon over those years was approximately 22,200 fish, most of which were taken in the estuary. In 2015 approximately 17,100 commercial fall Chinook Salmon were harvested, 44 percent more than in 2014, but 67 percent below the 52,100 fish harvested in 2013. The 82,900 fall Chinook Salmon harvested in 2012 was more than double the previous highest total of 40,147, taken in 1996. No spring Chinook Salmon commercial harvest occurred in 2014 or 2015. By comparison, 971 spring Chinook Salmon were harvested in 2013, 856 in 2012, and 33 in 2011. In addition to the commercial tribal fisheries discussed above, fish are taken in tribal fisheries each year for ceremonial and subsistence purposes.

Table 12-2. Landings of Troll-Caught Chinook Salmon (1000s of pounds dressed weight), 1976-2015, by Crescent City and Eureka Port Areas

| Time period | Crescent City | Eureka |
|---|---|---|
| 1976-1980 Average | 393 | 1,403 |
| 1981-1985 Average | 350 | 428 |
| 1986-1990 Average | 155 | 405 |
| 1991-1995 Average | 2 | 25 |
| 1996-2000 Average | 2 | 35 |
| 2001 | 3 | 61 |
| 2002 | 54 | 108 |
| 2003 | 38 | 7 |
| 2004 | 308 | 65 |
| 2005 | 25 | 77 |
| 2006 | 0 | 0 |
| 2007 | 34 | 81 |
| 2008 | 0 | 0 |
| 2009 | 0 | 0 |
| 2010 | 0 | 4 |
| 2011 | 8 | 53 |
| 2012 | 5 | 78 |
| 2013 | 24 | 200 |
| 2014 | 27 | 110 |
| 2015 | 6 | 48 |

*Source: PFMC 2016*
Key:
PFMC = Pacific Fishery Management Council

In general, the recreational fishery has tended to have a somewhat more stable harvest level than the commercial fishery. The majority of the annual available ocean harvest is usually harvested by the commercial fishery. However, both commercial and recreational fisheries have suffered substantial declines relative to 1980s harvest levels (PFMC 2016). Recreational ocean-area salmon fishing takes place primarily in two modes: anglers fishing from privately-owned pleasure craft, and anglers employing the services of charter vessels. In general, success rates on charter vessels tend to be higher than success rates on private vessels. Small amounts of shore-based effort directed toward ocean-area salmon also occur from jetties and piers. The number of ocean recreational salmon trips in California in 2015 (81,800) continued a downward trend over the prior three years. The 2015 total was 32 percent below 2014 (120,300), 44 percent lower than in 2013 (147,300), and 45 percent lower than in 2012 (148,000). The number of salmon trips in 2015 was 85 percent lower than the prior year in Crescent City, and 49 percent lower in Eureka.

***Recreation***

Recreational visitation and related spending contribute to tourism-related sectors of the regional economy. Major recreational opportunities occur at Trinity Lake, Lewiston Reservoir, along the Trinity River between Lewiston Reservoir and its confluence with the Klamath River, and along the lower Klamath River.

Trinity Lake is a CVP facility on the Trinity River that is located approximately 50 miles northwest of Redding. Trinity Lake is part of the Whiskeytown-Shasta-Trinity National

Recreation Area and is part of the Shasta-Trinity National Forest. Recreational facilities and activities at Trinity Lake are administered by the USFS. When the water storage in the reservoir is at full capacity (water elevation at 2,370 feet mean sea level (msl)), Trinity Lake has a surface area of 17,222 acres with 147 miles of shoreline (USFS 2014). Table 12-3 presents Trinity Lake elevations that affect facility use, with useable boat ramp elevations that range 2,370 msl to 2,170 msl. Boating, windsurfing, and fishing primarily occur in the northern part of the lake near Trinity Center. Houseboats, motorboats, and water skiing primarily occur in the southern part of the lake.

Table 12-3. Trinity Lake Elevations that Affect Facility Use

| Facility | Elevation (msl) | Effect of Drop Below Elevation |
|---|---|---|
| Stuart Fork Boat Ramps | 2,320 | Cease operation |
| Fairview Boat Ramp | 2,310 | Cease operation |
| Major Marinas | 2,310 | Must move facilities |
| Trinity Center Boat Ramp | 2,295 | Cease operation |
| Campgrounds | 2,270 | Decrease in use |
| Minersville Ramp | 2,170 | Cease operation |

*Source: USFWS et al. 2000*
Key:
msl = mean sea level

Lewiston Reservoir is a CVP facility on the Trinity River that is located immediately downstream of the Trinity Dam. 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 with 15 miles of shoreline (USFS 2014). The water elevation is generally stable in Lewiston Reservoir because it is used as a regulating reservoir, with releases for downstream uses.

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. There are approximately 35 developed recreation sites and more than 200 access points along the Trinity River, and numerous river access sites between Lewiston Dam and Weitchpec (NCRWQCB et al. 2009; USFWS et al. 2000). Recreation occurs year-round in the Trinity River area. Water-related activities include boating, kayaking, canoeing, white-water rafting, inner tubing, fishing, swimming, wading, gold panning, camping, and picnicking (NCRWQCB et al. 2009). Trinity River recreation activity preferred flow ranges during the primary recreation season (Memorial Day to Labor Day) are presented in Table 12-4.

Table 12-4. Trinity River Recreation Activity Preferred Flow Ranges

| Activity | Preferred Flow Ranges[1] (cfs) |
|---|---|
| Canoeing | 200-1,500 |
| Drift-Boat and Drift-Raft Fishing | 200-1,500 |
| White-Water (i.e., Kayaking, Canoeing and Rafting) | 450-8,000 |
| Recreational Mining | 350-600 |
| Shore Fishing | 300-800 |
| Swimming/Inner-Tubing | 150-800 |
| Wading | 300-800 |
| **Campground Use Precluded** | **Flow** |
| Steel Bridge, Douglas City | 8,000 or greater |
| Steiner Flat, North Fork | 10,000 or greater |
| Poker Bar | 12,000 or greater |

*Source: USFWS et al. 2000*

Note:

[1] Trinity River flows in the primary recreation season (Memorial Day to Labor Day)

Key:

cfs = cubic feet per second

The Klamath River continues for 43.5 miles from its Trinity River confluence to the Pacific Ocean (NCRWQCB et al. 2009). Near the confluence with the Pacific Ocean, the Klamath River flows through Redwood National Park. These reaches are primarily within Humboldt and Del Norte Counties. Recreation along the Klamath River downstream of the Trinity River is limited (DOI and DFG 2012). Canoeing, kayaking, and white-water boating occur along this reach. White-water rafting generally requires a minimum flow of 1,800 cubic feet per second (cfs) in this portion of 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). The California Coastal Trail is also located along the Klamath River near the Pacific Ocean confluence (California Coastal Trail 2016).

## Central Valley and Bay-Delta Region

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

### *Sacramento Valley*

The Sacramento Valley includes Shasta, Plumas, Tehama, Glenn, Colusa, Butte, Sutter, Yuba, Nevada, Placer, El Dorado, Sacramento, Yolo, and Solano Counties. Other counties in Sacramento Valley are not anticipated to be affected by changes in CVP 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 11, “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 California.

**Employment** Total employment and farm employment in 2005, 2010, and 2014 in the Sacramento Valley counties are presented in Table 12-5. The farm employment numbers presented in Table 12-5 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 Bay-Delta Region; and supports many other businesses including farm inputs (e.g., fertilizer, seed, machinery, and fuel) and the processing of food and fiber grown on farms.

Table 12-5. Employment in Central Valley and Bay-Delta Region – Sacramento Valley

| Area | 2005 | 2010 | 2014[1] |
|---|---|---|---|
| **Total Employment** | | | |
| Shasta County | 93,546 | 85,727 | 90,076 |
| Plumas County | 11,335 | 9,706 | 9,440 |
| Tehama County | 24,692 | 22,497 | 23,814 |
| Glenn County | 11,699 | 11,923 | 12,555 |
| Colusa County | 10,589 | 11,506 | 11,787 |
| Butte County | 106,671 | 99,642 | 109,017 |
| Yuba County | 26,700 | 25,398 | 28,069 |
| Nevada County | 57,605 | 54,665 | 57,307 |
| Sutter County | 42,211 | 42,507 | 45,193 |
| Placer County | 187,268 | 180,749 | 202,549 |
| El Dorado County | 93,003 | 89,194 | 94,477 |
| Sacramento County | 793,925 | 761,002 | 830,627 |
| Yolo County | 118,799 | 115,917 | 124,228 |
| Solano County | 174,067 | 168,460 | 177,011 |
| **STATE OF CALIFORNIA** | **20,255,748** | **19,803,742** | **22,040,057** |
| **Farm Employment[2]** | | | |
| Shasta County | 1,726 | 1,751 | 1,935 |
| Plumas County | 171 | 130 | 126 |
| Tehama County | 2,278 | 2,414 | 2,475 |
| Glenn County | 1,787 | 2,143 | 2,295 |
| Colusa County | 1,998 | 1,931 | 2,104 |
| Butte County | 3,167 | 3,390 | 3,566 |
| Yuba County | 1,423 | 1,258 | 1,150 |
| Nevada County | 623 | 680 | 683 |
| Sutter County | 2,947 | 3,056 | 3,229 |
| Placer County | 1,578 | 1,476 | 1,424 |
| El Dorado County | 1,315 | 1,363 | 1,355 |
| Sacramento County | 2,890 | 2,704 | 2,810 |
| Yolo County | 2,385 | 2,914 | 2,967 |
| Solano County | 1,825 | 1,594 | 1,881 |
| **STATE OF CALIFORNIA** | **244,144** | **232,545** | **243,247** |

Source: BEA 2015a, 2015b

Note:
[1]Most recent data available.
[2]Farm employment includes employment numbers in forestry, fishing, and related activities.

**Recreation** CVP and State Water Project (SWP) facilities include multiple dams, reservoirs, and canals that provide substantial water-based recreational activities. Releases from dams, on major tributaries to the Sacramento River, provide numerous recreational opportunities, especially boating and fishing. Reservoirs such as Shasta Lake, Whiskeytown Lake, Folsom Lake and Lake Oroville provide boating, fishing, camping, and other recreational activities. Recreational visitation and spending contribute to tourism-related sectors of the regional economy.

***San Joaquin Valley***

The San Joaquin Valley includes Stanislaus, Merced, Madera, Fresno, Kings, Tulare, Kern, and San Joaquin Counties. Other counties in the San Joaquin Valley are not anticipated to be affected by changes in CVP operations, and are not discussed further.

**Employment** Total employment and farm employment in 2005, 2010 and 2014 in the San Joaquin Valley portion of the Central Valley and Bay-Delta Region are presented in Table 12-6. The contribution of farm employment to the total employment declined between 2005 and 2014 except in Madera and Kern Counties.

Table 12-6. Employment in Central Valley and Bay-Delta Region – San Joaquin Valley

| Area | 2005 | 2010 | 2014[1] |
|---|---|---|---|
| **Total Employment** | | | |
| Stanislaus County | 222,238 | 209,191 | 227,971 |
| Madera County | 58,244 | 57,226 | 63,296 |
| Merced County | 88,256 | 90,679 | 100,466 |
| Fresno County | 428,516 | 425,816 | 468,804 |
| Tulare County | 179,581 | 186,016 | 195,901 |
| Kings County | 55,661 | 54,991 | 58,482 |
| Kern County | 345,020 | 353,907 | 412,183 |
| San Joaquin County | 282,627 | 268,849 | 294,674 |
| **STATE OF CALIFORNIA** | **20,255,748** | **19,803,742** | **22,040,057** |
| **Farm Employment[2]** | | | |
| Stanislaus County | 10,188 | 9,656 | 10,403 |
| Madera County | 5,264 | 5,205 | 5,766 |
| Merced County | 8,260 | 8,319 | 9,326 |
| Fresno County | 22,066 | 20,031 | 20,202 |
| Tulare County | 17,143 | 16,230 | 15,062 |
| Kings County | 4,606 | 4,213 | 4,436 |
| Kern County | 16,593 | 16,688 | 18,463 |
| San Joaquin County | 10,478 | 9,696 | 10,418 |
| **STATE OF CALIFORNIA** | **244,144** | **232,545** | **243,247** |

*Source: BEA 2015a, 2015b*

Note:

[1] Most recent data available.

[2] Farm employment includes employment numbers in forestry, fishing, and related activities.

The farm employment numbers presented in Table 12-6 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 the 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 12-6.

Total farm-dependent employment is not reported in the BEA or by the U.S. Bureau of Labor Statistics (BLS); 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 region (UCAIC 2009).

**Recreation** CVP and SWP facilities include multiple dams, reservoirs, and canals that provide substantial water-based recreational activities. Releases from dams on major tributaries to the San Joaquin River provide numerous recreational opportunities. Reservoirs such as the San Luis and New Melones Reservoirs provide boating, fishing, camping, and other recreational activities. Recreational visitation and spending contribute to tourism-related sectors of the regional economy.

# Impact Analysis

## Potential Mechanisms for Change in Socioeconomics and Analytical Methods

The impact assessment considers changes in socioeconomic factors related to changes in CVP operations, under the alternatives as compared to the No Action Alternative. More detailed discussions of changes in agricultural production are presented in Chapter 11, "Agricultural Resources."

Flow augmentation actions, under the actions alternatives as compared to the No Action Alternative, could change conditions for salmon in the lower Klamath and Trinity Rivers that are relied upon by commercial, sport, and tribal fisherman; water supply availability for CVP and SWP water users; and, recreational opportunities at reservoirs that store CVP and SWP water and in rivers downstream of these facilities.

### *Changes in Commercial, Sport, and Tribal Salmon Fishing Opportunities*

Flow augmentation under the action alternatives could change the salmon population as compared to the No Action Alternative. The action alternatives include flow augmentation actions to reduce the likelihood, and potentially reduce the severity, of an *Ichthyophthirius multifiliis* (Ich) epizootic event in the lower Klamath and Trinity Rivers that could lead to an associated fish die-off in future years. Commercial, sport, and tribal fishing primarily rely 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.

### *Regional Changes in Irrigated Agricultural Production Value and Employment*

Changes in CVP operations could change the extent of total agricultural production value as compared to the No Action Alternative. This analysis uses model output from the Statewide Agricultural Production (SWAP) model and the IMpact Analysis for PLANning (IMPLAN) model as described in the Analytical Tools Technical Appendix of this EIS.

As described in Chapter 11, "Agricultural Resources," there was no change in agricultural production in the Central Valley under long-term conditions (over the 82-year model simulation period). Therefore, this analysis only addresses regional economic changes during dry and critical years. The impact to irrigated acreage and agricultural production is relatively small under the action alternatives. Small changes in CVP irrigation supplies would be offset by small 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 supply and have no access to groundwater could have their irrigated acreage affected by larger amounts. From the larger, regional perspective, total value of agricultural production under the alternatives, as compared to the No Action Alternative, is estimated to be similar.

The regional economic analysis was conducted using the results of the impact analysis on agricultural production. The incremental impact results, estimated by the SWAP economic model, were input into the regional IMPLAN models as the direct change caused by each alternative, as compared to the No Action Alternative. Changes in economic effects depend upon changes in agricultural production, 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 BEA, BLS, 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 and Bay-Delta 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.

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 the use of monthly assumptions—and other assumptions that are indicative of real-time operations but do not specifically 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 are 5 percent or less, the conditions under the specific alternative would be considered to be “similar” to conditions under the No Action Alternative.

#### *Regional Changes in Municipal and Industrial Water Supplies and Water Supply Costs*

Changes in CVP operations could change availability of water supplies for municipal and industrial (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. M&I water supplies under the alternatives would be similar to the No Action Alternative as described in Chapter 4, “Surface Water Supply and Management.” Therefore, changes in the costs of additional supplies or shortages under the alternatives, as compared to the No Action Alternative, are not anticipated and not evaluated in this EIS.

### *Changes in Recreational Economics*

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. Associated recreational visitation contributes to tourism-related sectors of local economies. By the end of September, reservoir 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 elevation declines, boat ramps may become unavailable and the water surface recedes along 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 years—as compared to the No Action Alternative.

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 is typically the end of the highest volume recreation-participation season, and reservoir elevations are generally low. To assess changes in recreational resources, changes in reservoir elevations and the distance-to-water surface elevation from full-capacity storage at the end of September were compared between action alternatives and the No Action Alternative. The recreation season (May through September) end of month reservoir elevations were compared to Trinity Lake elevations that affect facility use displayed in Table 12-3, above, as a measure of facility availability. The number of months in which Trinity Lake elevations affect facility use and a percentage of recreation facility availability was developed and compared to the No Action Alternative. Changes in CVP water supplies and operations, under alternatives as compared to the No Action Alternative, would result in similar reservoir elevations in the Central Valley and Bay-Delta Region in all water year types, as described in Chapter 4, "Surface Water Supply and Management." Therefore, this analysis only addresses regional reservoir recreational-opportunity changes in the Lower Klamath and Trinity River Region.

Changes in CVP operations under the alternatives could change the river flows in a manner that would affect recreational opportunities, including boating and swimming during the spring and summer months, especially in dry and critical years. Results of the CalSim II and Trinity River HEC-5Q Water Quality models were used to assess changes in daily flows that could affect recreational opportunities under the alternatives, as compared to the No Action Alternative. Changes in CVP water supplies and operations under alternatives as compared to the No Action Alternative in the Central Valley and Bay-Delta Region would result in a range of river flows within the historical operational range and recreational opportunities are not anticipated to change. Therefore, this analysis only addresses regional river recreational-opportunity changes in the Lower Klamath and Trinity River Region. Changes in daily flows were used to compare the percentage of flows in the primary recreation season with the preferred range of flows for Trinity River recreation activities (presented in Table 12-4, above)—between the alternatives and the No Action Alternative—to assess changes in recreational opportunities. This EIS does not quantitatively analyze potential changes in recreation user days or recreation spending. The qualitative analysis presented in this chapter is based upon changes in recreational opportunities related to changes under the alternatives as compared to the No Action Alternative.

## Evaluation of Alternatives

The impact analysis in this EIS is based upon the comparison of the alternatives to the No Action Alternative projected in the year 2030.

### *No Action Alternative*

Under the No Action Alternative, socioeconomic resources would be similar to the conditions described in the *Affected Environment* section of this chapter. Conditions in 2030 would be different than existing conditions primarily due to climate change and sea-level rise, general plan development throughout California, and implementation of reasonable and foreseeable water resource management projects to provide water supplies. Climate change and sea-level rise are anticipated to reduce long-term average CVP water supply deliveries by 2030, as compared to recent historical long-term average deliveries. These reduced deliveries could result in more crop idling or changes in cropping patterns, and changes in regional income and employment. The No Action Alternative assumes implementation of a number of conservation efforts and major water supply projects by 2030 that would provide additional water supply flexibility and availability.

Under the No Action Alternative, climate change and sea-level rise, and development under the general plans, are anticipated to reduce carryover storage in reservoirs. It would reduce CVP and SWP water supply availability and recreational opportunities at some reservoirs that store CVP and SWP water, and in the rivers where dams make releases.

Under the No Action Alternative, the flows in the lower Klamath River are anticipated to fall under 2,800 cfs during late August and September in most years. These conditions, combined with the potential of Ich presence in the river, lead to an increased risk for a fish die-off in the lower Klamath River under the No Action Alternative. Fish die-offs would negatively impact any fishery-related socioeconomic resources. This includes lost revenue from commercial salmon sales, loss of fishing guide and charter revenue (both on the river and in the ocean), decreased recreational fishing tourism, and the added cost to people who rely on salmon for food who would then need to purchase other food sources.

### *Proposed Action (Alternative 1)*

#### Lower Klamath and Trinity River Region

*Regional Changes to Commercial, Sport, and Tribal Salmon Fishing* Trinity River flows would be increased through supplemental flows to prevent a disease outbreak in the lower Klamath River in years when the flow in the lower Klamath River is projected to be low (less than 2,800 cfs, under Alternative 1 as compared to the No Action Alternative. Flow augmentation under Alternative 1 would increase cross-sectional channel area to expand habitat space, increase water velocities that can reduce efficacy of Ich parasites from finding and attaching to adult salmon hosts, potentially provide migration cues to further disperse adult salmon and reduce densities and reduce the frequency of water temperatures exceeding 73.4 degrees Fahrenheit (°F). These conditions would be expected to result in reduced risk of Ich infection, epizootic outbreaks and consequent fish die-offs. This could result in improved commercial salmon sales, fishing guide and charter revenue (both on the river and in the ocean), recreational fishing tourism, and the reduction in cost to the people who rely on the salmon for food.

*Regional Changes in Recreational Opportunities* As described in Chapter 4, “Surface Water Supply and Management,” Trinity Lake elevations under Alternative 1 are similar to the No

Action Alternative, with 1 percent or less change in all months of all water year types. The end of September distance-to-water surface elevation from full-capacity storage would be increased (less than 5 percent) for all water year types. Table 12-7 presents changes in Trinity Lake recreation facility availability. Trinity Lake recreation facility availability would change by less than 1 percent for all facilities. Changes to water surface and shoreline activity, and reservoir-recreational economic opportunities under Alternative 1 are not anticipated due to these small changes. Similarly, changes in Trinity Lake recreational visitation and spending in tourism-related sectors are not anticipated.

Table 12-7. Changes in Percentage of Trinity Lake Recreation Facility Availability Under Alternative 1 as Compared to the No Action Alternative

| Facility | Elevation (msl) | No Action (percent availability) | Alternative 1 (percent availability) | Percent Change[1] |
|---|---|---|---|---|
| Stuart Fork Boat Ramps | 2,320 | 44 | 43 | 0 |
| Fairview Boat Ramp | 2,310 | 51 | 50 | 0 |
| Major Marinas | 2,310 | 51 | 50 | 0 |
| Trinity Center Boat Ramp | 2,295 | 59 | 59 | 0 |
| Campgrounds | 2,270 | 75 | 74 | -1 |
| Minersville Ramp | 2,170 | 98 | 98 | 0 |

Note:
[1] Percent change may not sum due to rounding. Changes in Trinity Lake recreation facility availability are estimated for the recreation season.
Key:
msl = mean sea level

As described in Chapter 4, "Surface Water Supply and Management," flows in the Trinity River, released from Lewiston Dam, would increase in August and September of all year types, from 2 percent in August of extremely wet years, to 115 percent in September of critically dry years (under Alternative 1 as compared to the No Action Alternative). Table 12-8 presents changes in the percentage of flows in the preferred range for Trinity River recreation activities. Under Alternative 1, the percentage of flows released from Lewiston Dam in the primary recreation season in the preferred flow range for canoeing, drift-boating, and drift-raft fishing would decrease by less than 1 percent. The percentage of flows released from Lewiston Dam in the preferred range for white-water activities (i.e., kayaking and rafting) would be the same. The percentage of flows in the preferred range for recreational mining would decrease 6 percent. The percentage of flows in the preferred range for shore fishing, swimming, inner tubing, and wading would decrease by 4 percent. In addition, the percentage of flows that would preclude campground use (presented in Table 12-4 above) would not change during the primary recreation season at Poker Bar, Steiner Flat, North Fork, Steel Bridge, and Douglas City Campgrounds.

Table 12-8. Changes in Percentage of Trinity River Flows in Preferred Range for Recreation Activities Under Alternative 1 as Compared to the No Action Alternative

| Recreation Activity | Preferred Flow Ranges[1] (cfs) | No Action Alternative (percent) | Alternative 1 (percent) | Change (percent) |
|---|---|---|---|---|
| Canoeing | 200-1,500 | 71 | 70 | -1 |
| Drift-Boat and Drift-Raft Fishing | 200-1,500 | 71 | 70 | -1 |
| White Water (i.e., Kayaking and Rafting) | 450-8,000 | 97 | 97 | 0 |
| Recreational Mining | 350-600 | 58 | 52 | -6 |
| Shore Fishing | 300-800 | 61 | 57 | -4 |
| Swimming/Inner-Tubing | 150-800 | 61 | 57 | -4 |
| Wading | 300-800 | 61 | 57 | -4 |

Note:
[1] Trinity River flows in the primary recreation season (Memorial Day to Labor Day)

The percentage of flows released from Lewiston Dam in the preferred range for whitewater activities would not change. However, white-water participants who prefer flows above the minimum of the preferred range would experience improved conditions compared to the No Action Alternative. The small change in percentages of flows in the preferred range for canoeing, drift-boat and drift-raft fishing, recreational mining, shore fishing, swimming, inner tubing, and wading in the Trinity River are not anticipated to change recreational visitation and spending. Overall, under Alternative 1, recreational visitation and spending is anticipated to be similar during the primary recreation season.

In the lower Klamath River, from the Trinity River confluence to the Pacific Ocean, limited recreation opportunities exist. Recreational opportunities within the lower Klamath River are anticipated to be similar.

### Central Valley and Bay-Delta Region

*Regional Changes to Irrigated Agriculture* As described in Chapter 4, "Surface Water Supply and Management," CVP and SWP agricultural water deliveries under long-term average conditions would be similar under Alternative 1 as compared to the No Action. In dry and critical water year types CVP North-of-Delta (NOD) agricultural water contractor deliveries would be reduced by 1 percent and CVP South-of-Delta (SOD) agricultural contractor deliveries would be reduced by 1 percent. 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 11, "Agricultural Resources."

Agricultural production value under long-term average conditions would not change. Agricultural production value in Sacramento and San Joaquin Valleys under dry and critical dry conditions would be similar and decrease by less than 1 percent. The direct changes in agricultural production in dry and critical years would result in small changes to employment and regional economic output in the Sacramento and San Joaquin Valleys, as summarized in Tables 12-9 and 12-10, respectively. In the Sacramento Valley, the small decrease in agricultural production would lead to small decreases in related indirect and induced economic output and employment (less than 1 percent change). In the San Joaquin Valley, agricultural production value and employment would be similar (less than 1 percent change).

Table 12-9. Changes in Agricultural-Related Employment and Regional Economic Output for the Sacramento Valley Under Alternative 1 as Compared to the No Action Alternative in Dry and Critical Years

| Economic Sectors | Direct | Indirect | Induced | Total |
|---|---|---|---|---|
| **Employment (Jobs)** | | | | |
| Agriculture | -14 | -3 | 0 | -17 |
| Mining and Logging | 0 | 0 | 0 | 0 |
| Construction | 0 | 0 | 0 | 0 |
| Manufacturing | 0 | 0 | 0 | 0 |
| Transportation, Warehousing and Utilities | 0 | 0 | 0 | 0 |
| Wholesale Trade | 0 | 0 | 0 | 0 |
| Retail Trade | 0 | 0 | -1 | -1 |
| Information | 0 | 0 | 0 | 0 |
| Financial Activities | 0 | 0 | 0 | -1 |
| Services | 0 | -2 | -3 | -4 |
| Government | 0 | 0 | 0 | 0 |
| **Total** | **-14** | **-5** | **-4** | **-24** |
| **Economic Output ($ millions)** | | | | |
| Agriculture | -1.5 | -0.1 | 0.0 | -1.6 |
| Mining and Logging | 0.0 | 0.0 | 0.0 | 0.0 |
| Construction | 0.0 | 0.0 | 0.0 | 0.0 |
| Manufacturing | 0.0 | 0.0 | 0.0 | 0.0 |
| Transportation, Warehousing and Utilities | 0.0 | 0.0 | 0.0 | 0.0 |
| Wholesale Trade | 0.0 | 0.0 | -0.1 | -0.1 |
| Retail Trade | 0.0 | -0.1 | 0.0 | -0.1 |
| Information | 0.0 | 0.0 | 0.0 | 0.0 |
| Financial Activities | 0.0 | -0.1 | -0.1 | -0.1 |
| Services | 0.0 | -0.2 | -0.3 | -0.5 |
| Government | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | **-1.5** | **-0.6** | **-0.5** | **-2.6** |

Notes:

Employment and economic output changes estimated by the Impact Analysis for Planning model. Economic output is in 2016 dollars. Totals may not sum due to rounding.

Table 12-10. Changes in Agricultural-Related Employment and Regional Economic Output for the San Joaquin Valley Under Alternative 1 as Compared to the No Action Alternative in Dry and Critical Dry Years

| Economic Sectors | Direct | Indirect | Induced | Total |
|---|---|---|---|---|
| **Employment (Jobs)** | | | | |
| Agriculture | 1 | 0 | 0 | 1 |
| Mining and Logging | 0 | 0 | 0 | 0 |
| Construction | 0 | 0 | 0 | 0 |
| Manufacturing | 0 | 0 | 0 | 0 |
| Transportation, Warehousing and Utilities | 0 | 0 | 0 | 0 |
| Wholesale Trade | 0 | 0 | -1 | -1 |
| Retail Trade | 0 | 0 | 0 | 0 |
| Information | 0 | 0 | 0 | 0 |
| Financial Activities | 0 | 0 | 0 | 0 |
| Services | 0 | 0 | -2 | -2 |
| Government | 0 | 0 | 0 | 0 |
| **Total** | **1** | **1** | **-4** | **-2** |
| **Economic Output ($ millions)** | | | | |
| Agriculture | 0.1 | 0.0 | 0.0 | 0.1 |
| Mining and Logging | 0.0 | 0.0 | 0.0 | 0.0 |
| Construction | 0.0 | 0.0 | 0.0 | 0.0 |
| Manufacturing | 0.0 | 0.0 | 0.0 | 0.0 |
| Transportation, Warehousing and Utilities | 0.0 | 0.0 | 0.0 | 0.0 |
| Wholesale Trade | 0.0 | 0.0 | -0.1 | -0.1 |
| Retail Trade | 0.0 | 0.0 | 0.0 | 0.0 |
| Information | 0.0 | 0.0 | 0.0 | 0.0 |
| Financial Activities | 0.0 | 0.0 | 0.0 | 0.0 |
| Services | 0.0 | 0.0 | -0.3 | -0.3 |
| Government | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | **0.1** | **0.0** | **-0.4** | **-0.3** |

Notes:
Employment and economic output changes estimated by the Impact Analysis for Planning model. Economic output is in 2016 dollars. Totals may not sum due to rounding.

### *Trinity River Record of Decision Flow Rescheduling Alternative (Alternative 2)*

#### Lower Klamath and Trinity River Region

*Regional Changes to Commercial, Sport, and Tribal Salmon Fishing* Trinity River flows would be increased through supplemental flows, to prevent a disease outbreak in the lower Klamath River in years when the flow in the lower Klamath River are projected to be low (less than 2,800 cfs, under Alternative 2 as compared to the No Action Alternative. Flow augmentation under Alternative 2 would increase cross-sectional channel area to expand habitat space, increase water velocities that can reduce efficacy of Ich parasites from finding and attaching to adult salmon hosts, potentially provide migration cues to further disperse adult salmon and reduce densities and reduce the frequency of water temperatures exceeding 73.4°F. These conditions would be expected to result in reduced risk of Ich infection, epizootic outbreaks and consequent fish die-offs. This could result in improved commercial salmon sales, fishing guide and charter revenue (both on the river and in the ocean), recreational fishing tourism, and the reduction in cost to the people who rely on the salmon for food.

*Regional Changes to Irrigated Agriculture* There are no agricultural lands irrigated with CVP water supplies in the Lower Klamath and Trinity River Region. Therefore, there would be no changes in irrigated lands under Alternative 2 as compared to the No Action Alternative.

*Regional Changes in Recreational Opportunities* Trinity Lake elevations under Alternative 2 are similar to those under the No Action Alternative, with less than 1 percent change in all months of all water year type. The end of September distance-to-water surface elevation from full-capacity storage would be increased (less than 1 percent) in any water year type. Table 12-11 presents changes in Trinity Lake recreation facility availability. Trinity Lake recreation facility availability would change by less than 1 percent for all facilities. Changes to water surface and shoreline activity, and reservoir-recreational economic opportunities under Alternative 2 are not anticipated. Changes in recreational visitation and spending in tourism-related sectors are not anticipated.

Table 12-11. Changes in Trinity Lake Recreation Facility Availability Under Alternative 2 as Compared to the No Action Alternative

| Facility | Elevation (msl) | No Action (percent availability) | Alternative 2 (percent availability) | Percent Change[1] |
|---|---|---|---|---|
| Stuart Fork Boat Ramps | 2,320 | 44 | 43 | 0 |
| Fairview Boat Ramp | 2,310 | 51 | 51 | 0 |
| Major Marinas | 2,310 | 51 | 51 | 0 |
| Trinity Center Boat Ramp | 2,295 | 59 | 60 | 1 |
| Campgrounds | 2,270 | 75 | 75 | 1 |
| Minersville Ramp | 2,170 | 98 | 98 | 0 |

Note:
[1] Percent change may not sum due to rounding. Changes in Trinity Lake recreation facility availability are estimated for the recreation season.
Key:
msl = mean sea level

Flows in the Trinity River released from Lewiston Dam would increase in August and September of all water year type, from 2 percent in August of extremely wet years to 132 percent in September of critically dry years, under Alternative 2 as compared to the No Action Alternative. Decreases in flows in May and June of most water year type, from 1 percent in June of extremely wet years to 38 percent in June of critically dry years, would occur under Alternative 2 as compared to the No Action Alternative.

Table 12-12 presents changes in the percentage of flows in the preferred range for Trinity River recreation activities. Under Alternative 2, the percentage of flows released from Lewiston Dam—during the primary recreation season in the preferred-flow range for canoeing, drift-boating, and drift-raft fishing—would not change. The percentage of flows released from Lewiston Dam in the preferred range for white-water activities (i.e., kayaking and rafting) would increase 1 percent. The percentage of flows in the preferred range for recreational mining would decrease 3 percent. The percentage of flows in the preferred range for shore fishing, swimming, inner tubing, and wading would decrease by 1 percent or less. In addition, the percentage of flows that would preclude campground use (presented in Table 12-4 above) would not change during the primary recreation season at Poker Bar, Steiner Flat, North Fork, Steel Bridge, and Douglas City Campgrounds.

Table 12-12. Changes in Percentage of Trinity River Flows in Preferred Range for Recreation Activities Under Alternative 2 as Compared to the No Action Alternative

| Recreation Activity | Preferred Flow Ranges[1] (cfs) | No Action Alternative (percent) | Alternative 2 (percent) | Change (percent) |
|---|---|---|---|---|
| Canoeing | 200-1,500 | 71 | 70 | 0 |
| Drift-Boat and Drift-Raft Fishing | 200-1,500 | 71 | 70 | 0 |
| White Water (i.e., Kayaking and Rafting) | 450-8,000 | 97 | 98 | 1 |
| Recreational Mining | 350-600 | 58 | 54 | -3 |
| Shore Fishing | 300-800 | 61 | 60 | -1 |
| Swimming/Inner-Tubing | 150-800 | 61 | 60 | -1 |
| Wading | 300-800 | 61 | 60 | -1 |

Note:
[1] Trinity River flows in the primary recreation season (Memorial Day to Labor Day)

The small change in percentage of flows released from Lewiston Dam in the preferred range for white-water recreational visitation is not anticipated to increase white-water recreational visitation and spending. However, white-water participants who prefer flows above the minimum of the preferred range would experience improved conditions compared to the No Action Alternative. The small change in percentages of flows in the preferred range for recreational mining, shore fishing, swimming, inner tubing, and wading in the Trinity River are not anticipated to change recreational visitation and spending. Overall, under Alternative 2 Trinity River recreational visitation and spending are anticipated to be similar during the primary recreation.

In the lower Klamath River, from the Trinity River confluence to the Pacific Ocean, limited recreation opportunities exist. Recreational opportunities within the lower Klamath River are anticipated to be similar.

### Central Valley and Bay-Delta Region

*Regional Changes to Irrigated Agriculture* CVP and SWP water supplies would be similar under Alternative 1 as compared to the No Action Alternative under long-term average conditions. In dry and critical water year types CVP NOD agricultural water contractor deliveries would be reduced by less than 1 percent. In dry water year type conditions CVP SOD agricultural contractor deliveries would be increased by less than 1 percent and in critical water year type conditions would be reduced by less than 1 percent. 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 11, "Agricultural Resources."

Agricultural production value under long-term average, and dry and critical year conditions would not change. Employment and regional economic output in the Sacramento and San Joaquin Valleys would also not change, as summarized in Tables 12-13 and 12-14, respectively.

Table 12-13. Changes in Agricultural-Related Employment and Regional Economic Output for the Sacramento Valley Under Alternative 2 as Compared to the No Action Alternative in Dry and Critical Years

| **Economic Sectors** | **Direct** | **Indirect** | **Induced** | **Total** |
|---|---|---|---|---|
| **Employment (Jobs)** | | | | |
| Agriculture | 0 | 0 | 0 | 0 |
| Mining and Logging | 0 | 0 | 0 | 0 |
| Construction | 0 | 0 | 0 | 0 |
| Manufacturing | 0 | 0 | 0 | 0 |
| Transportation, Warehousing and Utilities | 0 | 0 | 0 | 0 |
| Wholesale Trade | 0 | 0 | 0 | 0 |
| Retail Trade | 0 | 0 | 0 | 0 |
| Information | 0 | 0 | 0 | 0 |
| Financial Activities | 0 | 0 | 0 | 0 |
| Services | 0 | 0 | 0 | 0 |
| Government | 0 | 0 | 0 | 0 |
| **Total** | **0** | **0** | **0** | **0** |
| **Economic Output ($ millions)** | | | | |
| Agriculture | 0.0 | 0.0 | 0.0 | 0.0 |
| Mining and Logging | 0.0 | 0.0 | 0.0 | 0.0 |
| Construction | 0.0 | 0.0 | 0.0 | 0.0 |
| Manufacturing | 0.0 | 0.0 | 0.0 | 0.0 |
| Transportation, Warehousing and Utilities | 0.0 | 0.0 | 0.0 | 0.0 |
| Wholesale Trade | 0.0 | 0.0 | 0.0 | 0.0 |
| Retail Trade | 0.0 | 0.0 | 0.0 | 0.0 |
| Information | 0.0 | 0.0 | 0.0 | 0.0 |
| Financial Activities | 0.0 | 0.0 | 0.0 | 0.0 |
| Services | 0.0 | 0.0 | 0.0 | 0.0 |
| Government | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | **0.0** | **0.0** | **0.0** | **0.0** |

Notes:

Employment and economic output changes estimated by the Impact Analysis for Planning model. Economic output is in 2016 dollars. Totals may not sum due to rounding.

Table 12-14. Changes in Agricultural-Related Employment and Regional Economic Output for the San Joaquin Valley Under Alternative 2 as Compared to the No Action Alternative in Dry and Critical Years

| Economic Sectors | Direct | Indirect | Induced | Total |
|---|---|---|---|---|
| **Employment (Jobs)** | | | | |
| Agriculture | 0 | 0 | 0 | 0 |
| Mining and Logging | 0 | 0 | 0 | 0 |
| Construction | 0 | 0 | 0 | 0 |
| Manufacturing | 0 | 0 | 0 | 0 |
| Transportation, Warehousing and Utilities | 0 | 0 | 0 | 0 |
| Wholesale Trade | 0 | 0 | 0 | 0 |
| Retail Trade | 0 | 0 | 0 | 0 |
| Information | 0 | 0 | 0 | 0 |
| Financial Activities | 0 | 0 | 0 | 0 |
| Services | 0 | 0 | 0 | 0 |
| Government | 0 | 0 | 0 | 0 |
| **Total** | **0** | **0** | **0** | **0** |
| **Economic Output ($ millions)** | | | | |
| Agriculture | 0.0 | 0.0 | 0.0 | 0.0 |
| Mining and Logging | 0.0 | 0.0 | 0.0 | 0.0 |
| Construction | 0.0 | 0.0 | 0.0 | 0.0 |
| Manufacturing | 0.0 | 0.0 | 0.0 | 0.0 |
| Transportation, Warehousing and Utilities | 0.0 | 0.0 | 0.0 | 0.0 |
| Wholesale Trade | 0.0 | 0.0 | 0.0 | 0.0 |
| Retail Trade | 0.0 | 0.0 | 0.0 | 0.0 |
| Information | 0.0 | 0.0 | 0.0 | 0.0 |
| Financial Activities | 0.0 | 0.0 | 0.0 | 0.0 |
| Services | 0.0 | 0.0 | 0.0 | 0.0 |
| Government | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total** | **0.0** | **0.0** | **0.0** | **0.0** |

Notes:
Employment and economic output changes estimated by the Impact Analysis for Planning model. Economic output is in 2016 dollars. Totals may not sum due to rounding.

### *Summary of Environmental Consequences*

Table 12-15 presents the results of the environmental consequences analysis for implementing the action alternatives compared to the No Action Alternative.

### *Potential Mitigation Measures*

Mitigation measures are identified, as appropriate, to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse environmental effects of action alternatives, as compared to the No Action Alternative.

By augmenting flows in the lower Klamath River, and associated changes in CVP and SWP operations, action alternatives—as compared to the No Action Alternative—would not result in adverse changes in socioeconomic factors related to regional salmon fishing, agricultural production, M&I water supply operating expenses, and recreational resources. Therefore, there would be no adverse impacts to socioeconomic resources; and no mitigation measures are required.

Table 12-15. Comparison of Action Alternatives to No Action Alternative

| Alternative | Potential Change | Consideration for Mitigation Measures |
|---|---|---|
| Alternative 1 | *Lower Klamath and Trinity Rivers*<br>Commercial, sport, and tribal fishing opportunities would be improved due to reduced likelihood of an Ich outbreak and associated fish-die off.<br>Recreational economic factors would be similar, related to the use of Trinity Lake.<br>Recreational economic factors would be similar, related to the use of rivers downstream of Lewiston Dam.<br>*Central Valley and Bay-Delta*<br>Agricultural production related employment would decrease by less than 1 percent and be similar.<br>Recreational economic factors would be similar related to the use of CVP reservoirs. | None needed |
| Alternative 2 | *Lower Klamath and Trinity Rivers*<br>Commercial, sport, and tribal fishing opportunities would be improved due to reduced likelihood of an Ich outbreak and associated fish-die off.<br>Recreational economic factors would be similar, related to the use of Trinity Lake.<br>Recreational economic factors would be similar, related to the use of rivers downstream of Lewiston Dam.<br>*Central Valley and Bay-Delta*<br>Agricultural production related employment would be similar.<br>Recreational economic factors would be similar related to the use of CVP reservoirs. | None needed |

Key:
CVP = Central Valley Project

### *Cumulative Effects Analysis*

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 agricultural resources is summarized in Table 12-16. The methodology for this cumulative effects analysis is described in the Cumulative Effects Technical Appendix.

Table 12-16. Summary of Cumulative Effects on Socioeconomics of Action Alternatives as Compared to the No Action Alternative

| Scenarios | Cumulative Effects of Actions |
|---|---|
| No Action Alternative with Associated Cumulative Effects Actions Projected for Year 2030 | *Conditions and Actions included in Quantitative Analyses*<br>*(Conditions and actions incorporated into No Action Alternative modeling)*<br><br>*Commercial, Sport and Tribal Fishing in the Klamath* Climate change is anticipated to shift winter precipitation from snow to rain, which will lead to larger runoff events in the winter and less snowmelt in the spring. River flows in turn will be reduced during summer months. Lower summer river flows, combined with increases in ambient air temperatures, are expected to cause further increases in water temperatures compared to recent historical conditions. Lower flow and increased temperature conditions during summer months would likely increase the potential for Ich epizootic events and related fish die-offs.<br><br>*Agricultural Water-Related Employment* Climate change and sea-level rise, development under general plans, FERC relicensing projects, and some future projects to improve water quality or habitat are anticipated to reduce the availability of CVP water supplies as compared to past conditions. Reductions in CVP water supply reliability may change agricultural water-related employment.<br><br>*Recreation* Climate change and sea level rise, and development under the general plans, are anticipated to reduce carryover storage in reservoirs and change instream flow patterns in a manner that would change recreational opportunities and associated recreation economic factors.<br><br>*Additional Identified Actions*<br>*(Additional reasonably foreseeable projects or actions identified in Cumulative Effects Technical Appendix)*<br><br>*Commercial, Sport and Tribal Fishing in the Klamath Basin* Additional reasonably foreseeable actions, including the Klamath River Main Stem Dam Removal and Hoopa Valley Tribe Watershed Restoration Projects, are anticipated to improve and increase fish habitat. Improved and increased fish habitat is anticipated to have beneficial effects to commercial, sport and tribal fishing.<br><br>*Agricultural Water-Related Employment* Additional reasonably foreseeable actions under this cumulative effects analysis are not anticipated to change CVP water deliveries or associated agricultural water-related employment.<br><br>*Recreation* Additional reasonably foreseeable actions considered under this cumulative effects analysis are not anticipated to affect recreation economic factors. |
| Alternative 1 with Associated Cumulative Effects Actions Projected for Year 2030 | *Alternative 1 with Conditions and Actions included in Quantitative Analyses*<br><br>*Commercial, Sport and Tribal Fishing in the Klamath River Basin* Implementation of Alternative 1 would result in improved commercial, sport and tribal fishing as compared to the No Action Alternative.<br><br>*Agricultural Water-Related Employment* Implementation of Alternative 1 would result in similar agricultural water-related employment as compared to the No Action Alternative.<br><br>*Recreation* Implementation of Alternative 1 would result in similar recreation economic factors as compared to the No Action Alternative.<br><br>*Alternative 1 with Additional Identified Actions*<br><br>*Commercial, Sport and Tribal Fishing in the Klamath River Basin* Alternative 1 with the additional reasonably foreseeable actions would result in beneficial effects to fish habitat in the Klamath Basin, and therefore cumulative effects to commercial, sport and tribal fishing are not anticipated.<br><br>*Agricultural Water-Related Employment* The additional reasonably foreseeable actions are not anticipated to affect agricultural water-related employment<br><br>*Recreation* The additional reasonably foreseeable actions are not anticipated to affect recreation economic factors. |

Table 12-16. Summary of Cumulative Effects on Socioeconomics of Action Alternatives as Compared to the No Action Alternative (contd.)

| Scenarios | Cumulative Effects of Actions |
|---|---|
| Alternative 2 with Associated Cumulative Effects Actions Projected for Year 2030 | *Alternative 2 with Conditions and Actions included in Quantitative Analyses*<br><br>*Commercial, Sport and Tribal Fishing in the Klamath River Basin* Implementation of Alternative 2 would result in improved commercial, sport and tribal fishing as compared to the No Action Alternative.<br><br>*Agricultural Water-Related Employment* Implementation of Alternative 2 would result in similar agricultural water-related employment as compared to the No Action Alternative.<br><br>*Recreation* Implementation of Alternative 2 would result in similar recreation economic factors as compared to the No Action Alternative.<br><br>*Alternative 2 with Additional Identified Actions*<br><br>*Commercial, Sport and Tribal Fishing in the Klamath River Basin* Alternative 2 with the additional reasonably foreseeable actions would result in beneficial effects to fish habitat in the Klamath Basin, and therefore cumulative effects to commercial, sport and tribal fishing are not anticipated.<br><br>*Agricultural Water-Related Employment* The additional reasonably foreseeable actions are not anticipated to affect agricultural water-related employment.<br><br>*Recreation* The additional reasonably foreseeable actions are not anticipated to affect recreation economic factors. |

Key:
CVP = Central Valley Project
FERC = Federal Energy Regulatory Commission

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# Chapter 13
# Indian Trust Assets

## Introduction

This chapter describes Indian Trust Assets (ITA) in the study area and potential impacts that could occur as a result of implementing the alternatives evaluated in this Environmental Impact Statement (EIS). Implementation of the alternatives could affect these resources through potential changes in operation of the Trinity River Division (TRD) of the Central Valley Project (CVP). Direct effects to ITAs caused by the implementation of the alternatives analyzed in this EIS—specifically tribal water rights, fishing rights, and rights to wildlife and vegetation resources—are related to flow changes in the Trinity River and lower Klamath River.

## Regulatory Environment and Compliance Requirements

Consistent with President William J. Clinton's 1994 memorandum, "Government-to-Government Relations with Native American Tribal Governments," the U.S. Department of the Interior, 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 tribal trust resources (Federal Register, Vol. 59, No. 85, May 4, 1994, pages 22951–22952). The Department of Interior (DOI) Departmental Manual Part 512.2 describes the responsibility for ensuring protection of tribal trust resources to the heads of bureaus and offices. DOI is required to carry out activities in a manner that protects tribal trust resources and avoids adverse effects whenever possible.

ITAs are legal interests in property held in trust by the U.S. Government 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 historical 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.

# Affected Environment

## Lower Klamath and Trinity River Region

Multiple court rulings have established the important "Indian purpose" for the Hoopa Valley Indian Reservation. In addition, the Yurok Indian Reservation is to reserve tribal rights to harvest fish from the Klamath and Trinity Rivers. The Hoopa Valley Indian Reservation is located on the Trinity River. The Yurok Indian Reservation is on the Klamath River at its confluence with the Trinity River. Numerous and varied trust assets exist in the vicinity of the action alternatives, including fish, riparian plants, and wildlife. While the Hoopa and Yurok Tribes are described here, there are also others within the region including, but not limited to, the Karuk and Klamath tribes, Resighini Rancheria, and Quartz Valley Indian Tribe, as shown in Figure 13-1.

### *History and Culture of Tribal Groups*

This section provides an overview of the individual histories and cultures of the Hoopa Valley and Yurok Tribes in the Lower Klamath and Trinity River Region. Each tribe has a unique history of long-term occupation and use of the land and establishment of its tribal government, reservations, rancherias, or other tribal lands. The tribes derived their cultures, commerce, and subsistence primarily from the river and its aquatic and terrestrial resources. This section is organized by tribe to highlight the tribes' individual histories.

The information presented in this section is primarily drawn from the 2012 DOI *Background Technical Report Informing the Secretarial Determination Overview Report: Current Effects of PacifiCorp Dams on Indian Trust Resources and Cultural Values*. This DOI report also provides additional information on tribal trust resources and cultural values for the tribes in the Klamath and Trinity River basins.

**Hoopa Valley Tribe** The Hoopa Valley Indian Reservation is in the northeastern corner of Humboldt County in northern California, approximately 44 miles upstream from the Klamath estuary. The Reservation encompasses roughly 20 percent of Hupa aboriginal territory. The Reservation, known as "The 12-mile Square," is laid out geometrically with sides approximately 12 miles in length for a total of a little less than 144 square miles. At close to 90,000 acres, and bisected by the Trinity River, the Reservation is the largest in California. A small length of the northern border of the Reservation includes about a quarter mile reach of the Klamath River called Saints Rest Bar, situated several miles upriver from Weitchpec, California. The 2010 census reported Tribal membership to be 2,631 individuals (U.S. Census 2013).

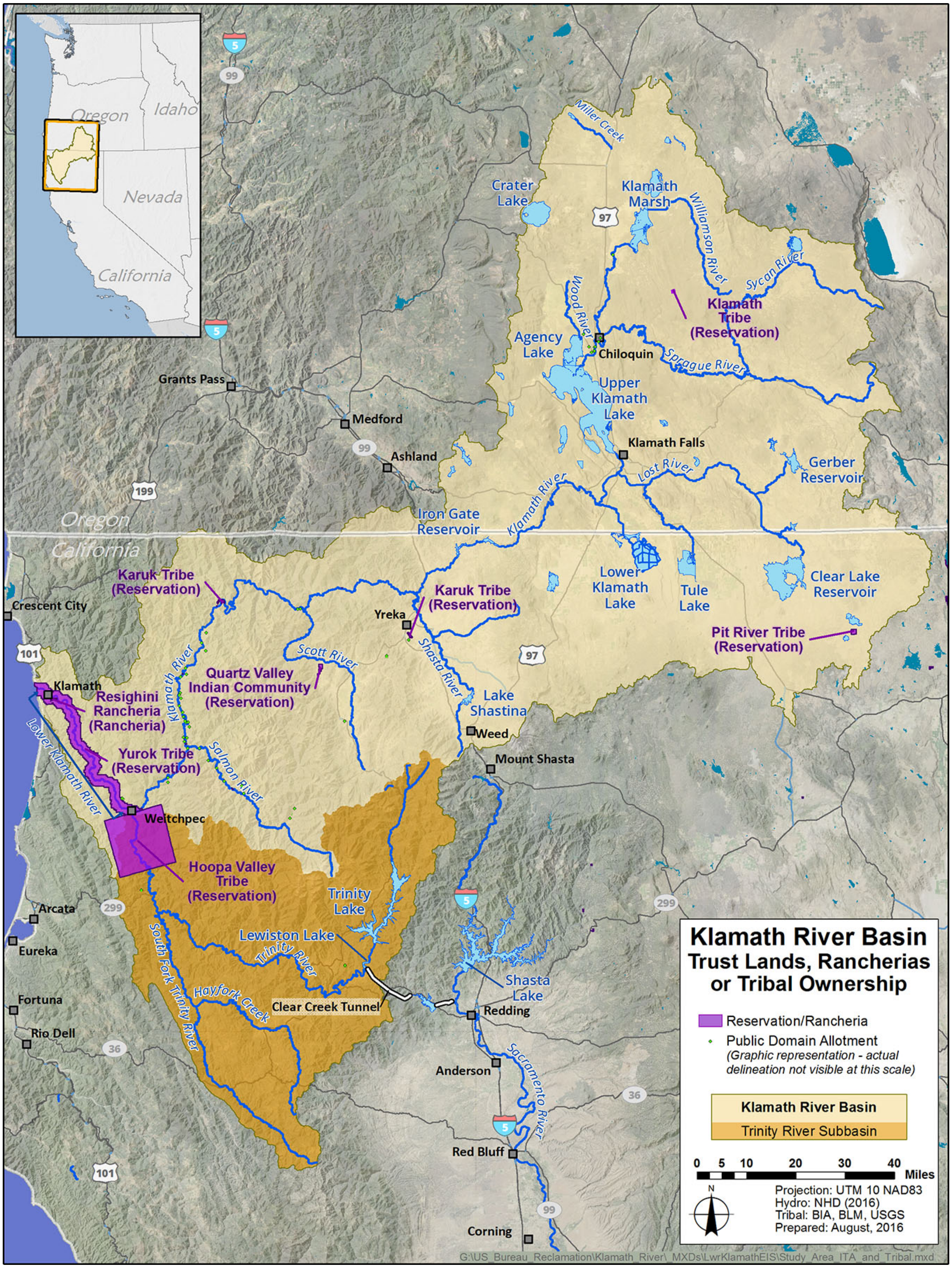


Figure 13-1. Klamath River Basin Trust Lands, Rancherias, and Tribal Ownership

*Hoopa Valley Indian Tribe History* The Hupa are culturally related to the Yurok and also the Karuk to the north, although the three tribes' traditional languages are entirely different from one another. The word Hupa is from the Yurok name for the Hoopa Valley. Hoopa is used when referring to the name of the Tribe, and Hupa is used when referring to the people, place, or culture. The Hupa called themselves *Natinook-wa*, meaning "People of the Place Where the Trails Return."

The boundaries of the Hoopa Valley Indian Reservation were established by executive order of President Grant on June 23, 1876, pursuant to a Congressional act of 1864. The Reservation was expanded by executive order in 1891 to connect the old Klamath River (Yurok) Reservation with the Hoopa Valley Indian Reservation. From 1891 through 1988 the Hoopa Valley Reservation was composed of the Hoopa Valley 12-mile Square, the extension of the Reservation along the Klamath River, and the original Klamath River Reservation. Confirmation of the sovereignty by the Hoopa Tribe of the Hoopa Valley Indian Reservation came on October 31, 1988, when President Reagan signed Public Law 100-580, the Hoopa-Yurok Settlement Act, again separating the Reservation and retaining the original square Reservation for the Hupa.

*Hoopa Valley Tribe Cultural Practices* The Trinity River is of prime importance to the Hoopa Valley Tribe because it is the river that runs through the Hoopa Valley Indian Reservation. It is a vital natural resource that is the foundation of their social and cultural way of life. At its most basic level, the river has always been a source for food and other necessities of daily Hupa life, with salmon and acorns providing the bulk of the native diet. Other important fish include steelhead, sturgeon, and lamprey. Fish destined for the Trinity River must pass through the lower Klamath River and are therefore affected by Klamath River conditions. The river also provides basket materials, fish net materials, and a means of transportation. Uses of the Trinity River by the Hupa people are highlighted by maintenance of fisheries and religious ceremonies (e.g., ceremonies that involve prayers offered by people trained to make medicine).

Religious beliefs and practices played an important role in everyday life for the Hupa people. The religion of the Hupa is based on individual effort through ritual cleanliness as well as ceremonies that bring the entire Tribe together. The tribes of the region, including the Hoopa, practice the annual World Renewal Ceremonies, which involve songs and dances that have been preserved for generations. The Hoopa Valley Indians continue to conduct many of their traditional religious ceremonies, and the cultural significance of the Trinity River is captured in many of these ceremonies. The White Deerskin and Jump Dances, the Flower Dance, and the Brush Dance all demonstrate the importance of the river flows to the Hupa people, and how vital the rivers are to Hupa familial and Tribal well-being and self-esteem. Ancient religious sites on the river were believed to be designated by spiritual deities—at a time beyond living memory—and are still used in current Tribal rituals. Prayers conducted at the dances are directed toward the well-being of everyone, and food, particularly fish, is shared with all who attend the ceremonies.

**Yurok Tribe of the Yurok Reservation** The Yurok Tribe is the largest tribe in California (U.S. Census 2013). As of September 2016, the Yurok Tribe membership was 6,155 individuals (pers comm R. McMahon 2016). The Tribe's ancestral territory covers approximately 350,000 acres and includes approximately 50 miles of Pacific Ocean coastline. Today, the Tribe's Reservation, located in Del Norte and Humboldt Counties, California, encompasses approximately 57,000 acres, and consists of a strip of land that begins at the Pacific Ocean and extends a mile along each side of the Klamath River (a distance of about 44 miles upriver) to just above the confluence of the Klamath and Trinity Rivers (Yurok 2016). This Reservation configuration came about through a complex series of Federal reports and legislative acts.

Today the Yurok Tribe—headquartered in Klamath, California, with an upriver office located in Weitchpec, California—employs almost 300 people, and has one of the most substantial fishery programs on the entire Klamath River, self-regulating its subsistence and commercial fishery. The Tribe actively participates in the in-river and upslope restoration of its ancestral lands, and has signed a collaborative management agreement with the DOI memorializing the prime role that the Yurok Tribe maintains in managing its resource base.

*Yurok Tribe History* In 1855, by executive order (pursuant to a Congressional act of March 3, 1853, 10 Stat. 226, 238), President Pierce established the Klamath River Reservation, defined as a strip of land beginning at the Pacific Ocean and extending one mile on each side of the Klamath River for a distance of about 20 miles, an area that was entirely contained within the Yurok's ancestral lands. The government's intention was to eventually move all of the region's Indians onto this Reservation, but only some Yurok and Tolowa were actually moved. Flooding in 1862 forced the closing of the area's Indian Bureau offices at Waukel Flat and Fort Terwer; without a fort, the military withdrew and these withdrawals contributed to the perception that the Reservation had been abandoned. However, the Yurok had continued to occupy the Reservation.

In 1864, the Hoopa Valley Indian Reservation was created on the Trinity River, and in 1876 President Grant issued an executive order that formally established its boundaries. A few years later, in 1885, a special agent for the DOI proposed that the Klamath River Reservation and the Hoopa Valley Reservation be joined. Based on the agent's recommendations, in 1891 President Harrison extended the Hoopa Valley Indian Reservation to the Pacific Ocean, subsuming the connecting strip and the Klamath Reserve and effectively requiring that two culturally-distinct tribes occupy the same reservation called the Hoopa Valley Indian Reservation. As a result of the Indian General Allotment Act of 1887, individual Indians received allotments of tribal land in the former Klamath Reserve and connecting strip portions of the Hoopa Valley Indian Reservation. Eighty-five percent of the remainder of the Yurok portion of the reserve was declared surplus and opened to homesteading by non-Indians.

The Hoopa-Yurok Settlement Act (Public Law 100-580, 102 Stat. 2924), enacted by the U.S. Congress on October 31, 1988, divided the Hoopa Valley Indian Reservation into separate Hoopa and Yurok Reservations and allowed the Yurok to govern themselves through the Yurok Tribal government.

*Yurok Cultural Practices* Fish are the Yurok Tribe's most valuable asset and a mainstay of their economy. Abundant fish allow Yurok to feed themselves and their families and to acquire products from outside their territory through trade. Fish were the baseline resource that facilitated the acquisition of wealth and upward social mobility in Yurok culture.

The lives of the Yurok people have always been intricately tied to the Klamath River. Historically, they depended on the river for sustenance, and much of their world was defined in terms of their physical relation to the river. Natural and cultural sites, daily and seasonal ceremonial practices, oral traditions, transportation routes, economic resources, social relationships, and the Yurok identity were all drawn from the river.

First Salmon Ceremonies were initiated around April when fish first breeched the sandbar at the mouth of the Klamath River. The ceremony was conducted to celebrate the harvesting of fish and to pray for continuing prosperity and access to subsistence resources. In early spring, the first salmon to enter the Klamath River was traditionally speared and ritually eaten by Yurok medicine men, which signified the beginning of the fishing season. Salmon are ritually managed to ensure that Yurok are provided with fish and that enough fish spawn to maintain the fishery. Yurok maintain a general reverence for salmon, and a strong belief prevails that without proper ceremony the salmon will not return in sufficient numbers. The river is central to most Yurok ceremonies. There are several rocks along the river etched with petroglyphs that provide instructions from the Creator to the Yurok people.

Many of the Yurok cultural sites on the Klamath and lower Trinity Rivers are traditional fishing spots owned by families. Over time, as the rivers' flows have changed, so have the locations of these cultural sites. To this day, the Yurok continue to live in some of the village sites that line the Klamath and lower Trinity Rivers, where they still practice many of their traditions in places where the Yurok have lived, fished, gathered, prayed, and buried their dead for centuries.

### *Indian Reserved Rights*

By first creating reservations "for Indian Purposes," the United States sought to provide the Hoopa Valley and Yurok Tribes with the opportunity to remain mostly self-sufficient, exercise their rights as sovereigns, and maintain their traditional ways of life (Pevar 1992). Implicit in this objective was an expectation that the Federal Government would protect the tribes and their resources (a protection that extended beyond reservation borders). Specifically relevant to the No Action Alternative and the action alternatives considered in this EIS are the fishing rights, tribal water rights, and rights to wildlife and vegetation resources in the Klamath and Trinity Rivers, as summarized below.

**Fishing Rights** Salmon, steelhead, sturgeon, and lamprey that spawn in the Trinity River pass through the Hoopa Valley and Yurok Reservations and are harvested in tribal fisheries. The fishing traditions of these tribes stem from practices that far pre-date the arrival of non-Indians. Accordingly, when the Federal government established what are today the Hoopa Valley and Yurok Indian Reservations on the Trinity and lower Klamath Rivers, it reserved for the benefit of the Indian tribes of those reservations a right to the fish resources in the rivers running through them. The United States has long recognized the rights of the tribes of the Lower Klamath and Trinity River Region to fish. The Federal government, as trustee, has an affirmative obligation to manage tribal rights and resources for the benefit of the tribes.

Tribal fishing rights are held in trust by the United States for the benefit of the Indians. These rights have been acknowledged and confirmed by the executive, legislative, and judiciary branches of the Federal government in a number of authorities including: (1) Secretarial Issue Document on Trinity River Fishery Mitigation, issued January 14, 1981; (2) Opinion of the Solicitor of the DOI re: Fishing Rights of the Yurok and Hoopa Valley Tribes (M-36979: October 4, 1993); (3) the Central Valley Project Improvement Act (CVPIA) (3406 (b) (23)); and (4) Parravano v. Babbitt, 837 F. Supp. 1034 (N.D. Calif. 1993), 861 F Supp. 914 (N.D. Calif.

1994), affirmed 70 F.3d 539 (9th Cir. 1995), cert. denied, 518 U.S. 1016 (1996). In most cases, tribal fishing rights cannot be supplanted by State or Federal regulation.

The above referenced 1993 solicitor's opinion: (1) reaffirms the historic and legal basis of the reserved fishing rights of the Hoopa Valley and Yurok Tribes; (2) acknowledges the Federal government's cognizance of the importance of fish to these Indians at the time it first established reservations on their behalf; (3) concludes that the tribes' reserved fishing rights entitle them to what is necessary to support a moderate standard of living, or 50 percent of the harvestable share of the Klamath-Trinity basin fishery, whichever is less; (4) recognizes that under the current depleted condition of the fishery, a 50 percent allocation does not adequately meet the tribes' needs; and (5) argues that it was the degree of the Hoopa Valley and Yurok Tribes' dependence on fisheries at the time their reservations were first created or expanded—and not the tribes' specific uses of the fish—that is relevant in quantifying their fishing rights.

Today, the reserved fishing right includes that right to harvest quantities of fish that the Indians require to maintain a moderate standard of living, unless limited by the 50 percent allocation. Specifically, the tribes have a right to harvest all species of Klamath and Trinity River fish for their subsistence, ceremonial, and commercial needs. Tribal harvest of these species is guided by conservation requirements outlined in carefully developed tribal harvest management plans.

**Water Rights** The tribes have reserved rights to water. The concept of reserved rights in general—and Indian reserved water rights specifically—originated at the start of the 20th century with Winters v. United States, 207 U.S. 564 (1908). The ruling in this case, commonly referred to as the Winters Doctrine, provides that the establishment of Indian or other Federal reservations also implicitly reserves the water rights necessary to achieve the purposes of those reservations. Generally, all original documents related to the establishment of reservations—treaty, executive order, or statute—indicate, at a minimum, that the purpose of the reservations is to provide a permanent home for the tribe(s) in question. In cases where reservations have been created with specific language stating or implying reserved fishing, hunting, gathering, or other rights, the Winters Doctrine has been interpreted to mean that adequate water supplies for these purposes have been reserved (even in addition to more general uses—see U.S. v. Adair, 723 F.2d 1410[9th Cir. 1983]).

The alternatives in this EIS have important implications for the Federal government's duty to protect those rights. Pursuant to statutory and fiduciary obligations, sufficient water must remain in the Trinity River to support the anadromous fishery and other trust resources.

**Rights to Wildlife and Vegetation Resource** While the focus of the legal history surrounding Indian rights to resources has mostly focused on water and fisheries, it is important to recognize that other resources (such as wildlife and vegetation) are extremely important to the tribes and no less reserved. In the case of the Hoopa Valley and Yurok Tribes, the decline in the health of the region's rivers has limited the availability of grasses and other plants that are important to traditional basketry, art, and medicine. Thus, while fish are the focus of the action alternatives, other trust assets such as vegetation also fall under the umbrella of the Federal government's trust responsibility and, accordingly, need to be considered in the decision-making process.

### *Potentially Impacted Indian Trust Assets*

Indian tribes of the Lower Klamath and Trinity River Region have firmly established Federally-protected rights to numerous natural resources. These general resources groupings represent culturally important ITAs. A partial list of trust assets—particularly those potentially affected by the action alternatives—is presented in Table 13-1. While each tribe has its own unique uses for the species and resources presented, Table 13-1 provides a general summary of the uses of each asset.

Table 13-1. Partial List of Tribal Trust Assets

| Asset | Primary Uses by Tribes |
|---|---|
| **Water** | Subsistence, ceremonial, commercial, medicine |
| **Fish**[1] | |
| Fall-run Chinook Salmon | Subsistence, ceremonial, commercial |
| Spring-run Chinook Salmon | Subsistence, ceremonial, commercial |
| Summer steelhead | Subsistence, ceremonial, commercial |
| Fall steelhead | Subsistence, ceremonial, commercial |
| Winter steelhead | Subsistence, ceremonial, commercial |
| Coho Salmon | Subsistence, ceremonial, commercial |
| Pacific Lamprey | Subsistence, ceremonial, commercial |
| White Sturgeon | Subsistence, ceremonial, commercial |
| Green Sturgeon | Subsistence, ceremonial, commercial |
| Eulachon | Subsistence, ceremonial, commercial |
| **Vegetation** | |
| Willow shoots | Basketry, ceremonial |
| Cottonwood | Basketry |
| Wild grape | Basketry |
| Bulrush | Basketry |
| Hazel sticks | Basketry and weaving, ceremonial |
| Tules | Medicine |
| Spearmint | Medicine, subsistence |
| Blackberries | Subsistence |
| **Wildlife** | |
| Bear | Subsistence |
| Bald eagle | Ceremonial |
| Blue heron | Ceremonial |
| Mallard | Ceremonial |

*Source: USFWS et al. 2000*

Note:

[1] While many of the fish listed are not currently commercially harvested by the tribes of the region, historically, all these trust species were used for commercial purposes, and the tribes continue to have the right for commercial harvest.

# Impact Analysis

This section describes the potential mechanisms and analytical methods for change in ITAs; results of the impact analysis; potential mitigation measures; and cumulative effects. Changes in TRD operations under the action alternatives, as compared to the No Action Alternative, could impact tribal trust resources related to water, fisheries, and terrestrial biological resources by changing flows and water quality in the Trinity River and lower Klamath River.

## Potential Mechanisms for Change in Indian Trust Assets

The impact analysis considers changes in ITAs related to changes in TRD operations under the action alternatives, as compared to the No Action Alternative.

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

### *Changes to Trust Resources Related to Fisheries*

Changes in fishery resources in the Trinity River and lower Klamath River could directly affect tribal trust fisheries. As described in Chapter 7, "Biological Resources – Fisheries," implementation of action alternatives, as compared to the No Action Alternative, could affect fishery resources in the Trinity River and the lower Klamath River.

### *Changes to Trust Resources Related to Water*

Changes in flow in the Trinity River and lower Klamath River could directly affect trust assets related to water. As described in Chapter 4, "Surface Water Supply and Management," implementation of action alternatives, as compared to the No Action Alternative, could affect flows in the Trinity River and the lower Klamath River.

### *Changes to Trust Resources Related to Terrestrial Biological Resources*

Changes in terrestrial biological resources in the Trinity River and lower Klamath River could directly affect tribal trust wildlife and vegetation. As described in Chapter 8, "Biological Resources – Terrestrial," implementation of action alternatives, as compared to the No Action Alternative, has the potential to affect terrestrial biological resources in the Trinity River and the lower Klamath River.

## Evaluation of Alternatives

The impact analysis in this EIS is based upon the comparison of the action alternatives to the No Action Alternative projected for year 2030. The evaluation of alternatives is focused on the Lower Klamath and Trinity River Region because, as discussed above, potential changes that could affect ITAs located along the Klamath and Trinity Rivers.

### *No Action Alternative*

Under the No Action Alternative, ITAs would be comparable to the conditions described in the *Affected Environment* section of this chapter. Conditions in 2030 would be different than existing conditions, primarily due to climate change and sea-level rise, general plan development throughout California, and implementation of reasonable and foreseeable water resource management projects to provide water supplies.

As described in Chapter 7, "Biological Resources – Fisheries," there is a continued risk of a fish die-off from an *Ichthyophthirius multifiliis* (Ich) epizootic in the lower Klamath River under the No Action Alternative. A fish die-off, regardless of apparent causes, would be devastating for the tribal trust fisheries in the Klamath and Trinity Rivers. The Hoopa Valley Tribe and the Yurok Tribe both depend on the salmon harvest for subsistence, ceremonial, and commercial needs to maintain a moderate standard of living. These Tribes have fished these rivers for thousands of years and tribal culture is deeply connected to the river and the salmon. Without the harvest, these Tribal communities would be greatly impacted. These conditions, combined with the potential of Ich presence in the river, lead to a continued risk for a fish die-off in the lower Klamath River under the No Action Alternative. Fish die-offs would adversely affect tribal trust fisheries.

As described in Chapter 4, “Surface Water Supply and Management,” for the Klamath River Basin, temperatures and precipitation are both anticipated to increase. Climate change may also cause changes in stream flows within the Klamath River Basin. Projected warming is anticipated to change runoff timing, with more rainfall runoff during the winter and less runoff during the late spring and summer.

As described in Chapter 8, “Biological Resources – Terrestrial,” the No Action Alternative is comparable to the conditions described in the *Affected Environment* section of that chapter. Effects to ITAs related to terrestrial biological resources are anticipated to be the same as those described in Chapter 8.

#### ***Proposed Action (Alternative 1)***

##### **Lower Klamath and Trinity River Region**

*Changes to Trust Resources Related to Fisheries* As described in Chapter 7, “Biological Resources – Fisheries,” the risk of a fish die-off is reduced with the implementation of Alternative 1. Therefore, as compared to the No Action, there are no substantial adverse effects to tribal trust fisheries from the implementation of Alternative 1. Chapter 7 provides additional information on the affects to the Trinity River and lower Klamath River fisheries.

*Changes to Trust Resources Related to Water* Table 13-2 summarizes average annual changes in Lewiston Dam releases to the Trinity River. As compared to the No Action Alternative, Alternative 1 would increase average annual releases from Lewiston Dam to the Trinity River under all water year types, except in extremely wet years when there is a one percent decrease in flows.

Chapter 4, “Surface Water Supply and Management,” provides more information about potential changes in flows within the Trinity River from Trinity Lake downstream to the confluence with the Klamath River, and within the lower Klamath River, from the Trinity River confluence to the Pacific Ocean.

Table 13-2. Changes in Average Annual Lewiston Dam Releases to Trinity River Under Alternative 1 as Compared to the No Action Alternative, by Trinity Water Year Type

| Alternative/Comparison | Extremely Wet | Wet | Normal | Dry | Critically Dry | Average All Years |
|---|---|---|---|---|---|---|
| **Lewiston Releases to Trinity River** | | | | | | |
| No Action (TAF) | 1,190 | 868 | 652 | 452 | 364 | 707 |
| Alternative 1 (TAF) | 1,183 | 874 | 665 | 476 | 405 | 721 |
| No Action Compared to Alternative 1 (TAF) | -7 | 6 | 13 | 24 | 41 | 14 |
| No Action Compared to Alternative 1 (%) | -1% | 1% | 2% | 5% | 11% | 2% |

Key:
% = percent
TAF = thousand acre-feet

*Changes to Trust Resources Related to Terrestrial Biological Resources* As described in Chapter 8, "Biological Resources – Terrestrial," there are no substantial adverse effects on terrestrial biological resources from the implementation of Alternative 1. Therefore, as compared to the No Action Alternative, there are no substantial adverse effects to tribal trust wildlife and vegetation from the implementation of Alternative 1. Chapter 8 provides additional information on the affects to the Trinity River and lower Klamath River terrestrial biological resources.

### *Trinity River Record of Decision Flow Rescheduling Alternative (Alternative 2)*

#### Lower Klamath and Trinity River Region

*Changes to Trust Resources Related to Fisheries* As described in Chapter 7, "Biological Resources – Fisheries," the risk of a fish die-off is reduced with the implementation of Alternative 2. Therefore, as compared to the No Action Alternative, there are no substantial adverse effects to tribal trust fisheries from the implementation of Alternative 2. Chapter 7 provides additional information on the affects to the Trinity River and lower Klamath River fisheries.

*Changes to Trust Resources Related to Water* Table 13-3 summarizes average annual changes in Lewiston Dam releases to the Trinity River. Releases from Lewiston Dam to the Trinity River are generally similar to the No Action Alternative, with increases of less than, or equal to, three percent under all water year types, except in extremely wet water year types when there is a one percent decrease in flows.

Chapter 4, "Surface Water Supply and Management," provides more information about potential changes in flows within the Trinity River from Trinity Lake downstream to the confluence with the Klamath River, and the lower Klamath River, from the Trinity River confluence to the Paciic Ocean.

Table 13-3. Changes in Average Annual Trinity River Releases Below Lewiston Dam Under Alternative 2 as Compared to the No Action Alternative, by Trinity Water Year Type

| Alternative/Comparison | Extremely Wet | Wet | Normal | Dry | Critically Dry | Average All Years |
|---|---|---|---|---|---|---|
| **Lewiston Releases to Trinity River** | | | | | | |
| No Action (TAF) | 1,190 | 868 | 652 | 452 | 364 | 707 |
| Alternative 2 (TAF) | 1,184 | 870 | 655 | 452 | 376 | 709 |
| No Action Compared to Alternative 2 (TAF) | -6 | 2 | 3 | 0 | 12 | 2 |
| No Action Compared to Alternative 2 (%) | -1% | 0% | 0% | 0% | 3% | 0% |

Key:
% = percent
TAF = thousand acre-feet

*Changes to Trust Resources Related to Terrestrial Biological Resources* As described in Chapter 8, "Biological Resources – Terrestrial," there are no substantial adverse effects on terrestrial biological resources from the implementation of Alternative 2. Therefore, as compared to the No Action, there are no substantial adverse effects to tribal trust wildlife and vegetation from the implementation of Alternative 2. Chapter 8 provides additional information on the affects to the Trinity River and lower Klamath River terrestrial biological resources.

#### *Summary of Impact Analysis*

The results of the impact analysis of implementation of action alternatives, as compared to the No Action Alternative, are presented in Table 13-4.

Table 13-4. Comparison of Action Alternatives to No Action Alternative

| Alternative | Potential Change | Consideration for Mitigation Measures |
|---|---|---|
| Alternative 1 | *Potential Changes to Indian Trust Assets*<br>There are no substantial adverse effects to Indian Trust Assets related to fisheries resources, water, and terrestrial biological resources. | None needed |
| Alternative 2 | *Potential Changes to Indian Trust Resources*<br>There are no substantial adverse effects to Indian Trust Assets related to fisheries resources, water, and terrestrial biological resources. | None needed |

#### *Potential Mitigation Measures*

Mitigation measures are presented in this section to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse effects to ITAs of the action alternatives, as compared to the No Action Alternative.

There would be no adverse impacts to ITAs, therefore no mitigation measures are needed.

#### *Cumulative Effects Analysis*

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 ITAs are summarized in Table 13-5. The methodology for this cumulative effects analysis is described in the Cumulative Effects Technical Appendix.

Table 13-5. Summary of Cumulative Effects on Indian Trust Assets with Implementation of Action Alternatives as Compared to the No Action Alternative

| Scenarios | Cumulative Effects of Actions |
|---|---|
| No Action Alternative with Associated Cumulative Effects Actions in Year 2030 | *Conditions and Actions included in Quantitative Analyses*<br>*(Conditions and actions incorporated into No Action Alternative modeling)*<br><br>Climate change is anticipated to shift winter precipitation from snow to rain, which will lead to larger runoff events in the winter and less snowmelt in the spring. River flows in turn will be reduced during summer months. Lower summer river flows, combined with increases in ambient air temperatures, are expected to cause further increases in water temperatures compared to recent historical conditions. Lower flow and increased temperature conditions during summer months would likely increase the potential for Ich epizootic events and related fish die-offs.<br><br>*Additional Identified Actions*<br>*(Additional reasonably foreseeable projects or actions identified in Cumulative Effects Technical Appendix)*<br><br>Additional reasonably foreseeable actions, including the Klamath River Mainstem Dam Removal and Hoopa Valley Tribe Watershed Restoration Projects, are anticipated to improve and increase fish habitat. Improved and increased fish habitat is anticipated to have beneficial effects for tribal trust fisheries resources. |
| Alternative 1 with Associated Cumulative Effects Actions in Year 2030 | *Alternative 1 with Conditions and Actions included in Quantitative Analyses*<br><br>Implementation of Alternative 1 would result in improved tribal trust fisheries resources as compared to the No Action Alternative. Implementation of Alternative 1 would result in similar tribal trust terrestrial and water resource conditions as compared to the No Action Alternative.<br><br>*Alternative 1 with Additional Identified Actions*<br><br>Alternative 1 with the additional reasonably foreseeable action would result in beneficial effects to fish habitat in the Klamath Basin, and therefore cumulative impacts to tribal trust fisheries resources are not anticipated. The additional reasonably foreseeable actions would result in beneficial effects to terrestrial habitats in the Trinity River Subbasin, and therefore cumulative effects to tribal terrestrial resources conditions are not anticipated. Additional reasonably foreseeable actions are not anticipated to affect tribal trust water resource conditions. |
| Alternative 2 with Associated Cumulative Effects Actions in Year 2030 | *Alternative 2 with Conditions and Actions Included in Quantitative Analyses*<br><br>Implementation of Alternative 2 would result in improved tribal trust fisheries resources as compared to the No Action Alternative. Implementation of Alternative 2 would result in similar tribal trust terrestrial and water resource conditions as compared to the No Action Alternative.<br><br>*Alternative 2 with Additional Identified Actions*<br><br>Alternative 2 with the additional reasonably foreseeable action would result in beneficial effects to fish habitat in the Klamath Basin, and therefore cumulative impacts to tribal trust fisheries resources are not anticipated. The additional reasonably foreseeable actions would result in beneficial effects to terrestrial habitats in the Trinity River Subbasin, and therefore cumulative effects to tribal terrestrial resources conditions are not anticipated. Additional reasonably foreseeable actions are not anticipated to affect tribal trust water resource conditions. |

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# Chapter 14
# Environmental Justice

## Introduction

This chapter provides the environmental justice analysis to identify and address any disproportionate and adverse impacts on minority or low-income populations that could occur as a result of implementing the alternatives evaluated in this Environmental Impact Statement (EIS). This chapter evaluates the potential for disproportionate and adverse impacts on minority or low-income populations, from changes to tribal fisheries and irrigated agricultural production.

## Regulatory Environment and Compliance Requirements

This chapter was prepared in compliance with Presidential Executive Order (EO) 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, as described below:

- **Executive Order 12898 –** EO 12898, issued by President Clinton in 1994, requires that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations…." In his memorandum transmitting EO 12898 to Federal agencies, President Clinton further specified that, "each Federal agency shall analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by the National Environmental Policy Act of 1969."

- **Title VI of the Civil Rights Act of 1964 –** Title VI of the Civil Rights Act of 1964 states that "No person in the United States shall, on the ground of race, color, or national origin be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." Title VI bars intentional discrimination, but also unjustified disparate impact discrimination resulting from policies and practices that are neutral on their face (i.e., there is no evidence of intentional discrimination) but have the effect of discrimination on protected groups.

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 or low-income populations.

# Affected Environment

The conditions described in this chapter are related to the distribution of minority populations and populations below poverty levels.

## Area of Analysis

Below, a summary of conditions are described for the following regions that could be affected by the implementation of alternatives analyzed:

- Lower Klamath and Trinity River Region
- Central Valley and the Bay-Delta Region

## Characterization of Conditions Considered in the Environmental Justice Analysis

Characterization of the conditions within the Lower Klamath and Trinity River Region and the Central Valley Region and Bay-Delta Region is based upon publicly-available data from government websites and other statistical sources. The data sources used include the 2010 U.S. Census Bureau data on minority populations and the 2010 American Community Survey (ACS) five-year population estimates on populations below the poverty level. The 2011-2015 ACS survey is not anticipated to be released until late 2016 or early 2017, therefore, that data is not represented in this chapter.

### *Determination of Minority Populations*

Minority populations are defined by the U.S. Census Bureau as racial and ethnic minorities. Racial minorities, as defined by the U.S. Census Bureau, 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 of the races listed above and White).

Ethnic minorities, as defined by the U.S. Census Bureau, include individuals who identified themselves as being of Hispanic or Latino origin by identifying with 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 may be of one or more races according to the U.S. Census Bureau.

#### *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.

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*.

#### *Social Services*

The need for, and delivery of, social services within each county is another indication of social conditions. These include Federal grants to State and local agencies for Medicaid, other health-related activities, nutrition and family welfare, Federal direct payments made to individuals under the CalFresh program (previously referred to as *Food Stamps*), and supplemental social security income.

### Lower Klamath and Trinity River Region

The Lower Klamath and Trinity River Region for this analysis includes the area in Trinity County along the Trinity River, from Trinity Lake to its 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 Rivers within the Trinity River Region include the Hoopa Valley Indian Reservation, Yurok Indian Reservation, and Resighini Rancheria.

#### *Minority Populations*

Table 14-1 provides a summary of the minority population distribution in the Lower Klamath and Trinity River Region as compared to the State of California. There are fewer minorities in the Lower Klamath and Trinity River Region than in the entire State; however, there are a distinctively higher percentage of American Indian and Native Alaskan populations in all three counties compared to the statewide percentage.

Table 14-1. Minority Population Distribution in Lower Klamath and 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% |
| 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 2016a*

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.

Key:

% = percent

### *Poverty Levels*

Poverty levels presented in Table 14-2 are calculated on a subset of the total population of a county, as described above in the *Determination of Populations below the Poverty Level* section

Table 14-2. Population Below Poverty Level in Lower Klamath and 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% |
| State of California | 35,877,036 | 4,919,945 | 13.7% |

*Source: U.S. Census 2016b*

Note:

[a] Population numbers are only those for whom poverty status was determined and excludes institutionalized individuals.

Key:

% = percent

The U.S. Census Bureau defines geographical areas with more than 20 percent of the population below the poverty level as a poverty area. In the Lower Klamath and Trinity River Region, Del Norte County is defined as a poverty area.

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 2016). 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). Poverty rates from the 2010 census were not available for Native American tribes.

***Social Services***

Table 14-3 provides a summary of the Federal funds distributed for social programs in the Lower Klamath and Trinity River Region in 2010 as compared to the State of California.

Table 14-3. Federal Funds Distributed for Social Programs in the Lower Klamath and 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 |
| State of California | $41,931.1 | $11,743.7 | $12,469.4 |

*Source: Gaquin and Ryan 2013*

## Central Valley and Bay-Delta Region

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

***Sacramento Valley***

The Sacramento Valley includes Shasta, Plumas, Tehama, Glenn, Colusa, Butte, Sutter, Yuba, Nevada, Placer, El Dorado, Sacramento, Yolo, and Solano Counties. Other counties in Sacramento Valley are not anticipated to be affected by changes in CVP operations, and are not discussed here, including: Alpine, Sierra, Lassen, and Amador Counties.

**Minority Populations** Table 14-4 provides a summary of the minority population distribution in the Sacramento Valley as compared to the State of California. Colusa, Sacramento, Yolo and Solano Counties had over 50 percent of the county that identified themselves as a racial minority or of Hispanic or Latino origin, regardless of race, as presented in Table 14-4.

**Poverty Levels** Poverty levels presented in Table 14-5 are calculated on a subset of the total population of a county, as described above in the *Determination of Populations Below the Poverty Level* section.

The U.S. Census Bureau defines geographical areas with more than 20 percent of the population below the poverty level as a poverty area. Under these terms, Tehama and Yuba Counties are defined as poverty areas.

**Social Services** Table 14-6 provides a summary of the Federal funds distributed for social programs in the Sacramento Valley in 2010 as compared to the State of California.

Table 14-4. Minority Population Distribution in the 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 County | 1,418,788 | 57.5% | 10.4% | 1.0% | 14.3% | 1.0% | 9.3% | 21.6% | 21.6% | 51.6% |
| Yolo County | 200,849 | 63.2% | 2.6% | 1.1% | 13.0% | 0.5% | 13.9% | 30.3% | 30.3% | 50.1% |
| Solano County | 413,344 | 51.0% | 14.7% | 0.8% | 14.6% | 0.9% | 10.5% | 24.0% | 24.0% | 59.2% |
| 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 2016a*

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.

Key:

% = percent

Table 14-5. Population below Poverty Level in the 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 | 21,3501 | 39,290 | 18.4% |
| Yuba County | 68,848 | 13,750 | 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 County | 1,368,693 | 190,768 | 13.9% |
| Yolo County | 186,800 | 31,895 | 17.1% |
| Solano County | 397,576 | 41,158 | 10.4% |
| State of California | 35,877,036 | 4,919,945 | 13.7% |

*Source: U.S. Census 2016b*

Note:

[a] Population numbers are only those for whom poverty status was determined and excludes institutionalized individuals

Key:

% = percent

Table 14-6. Federal Funds Distributed for Social Programs in the Sacramento 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 |
| 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 | $236.4 | $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 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 |
| State of California | $41,931.1 | $11,743.7 | $12,469.4 |

*Source: Gaquin and Ryan 2013*

### *San Joaquin Valley*

The San Joaquin Valley includes Stanislaus, Merced, Madera, Fresno, Kings, Tulare, Kern, and San Joaquin Counties. Other counties in the San Joaquin Valley are not anticipated to be affected by changes in CVP operations, and are not discussed here.

**Minority Populations** Table 14-7 provides a summary of the minority population distribution in the Sacramento Valley as compared to the State of California. All of the San Joaquin Valley counties had over 50 percent of the county that identified themselves as a racial minority or of Hispanic or Latino origin, regardless of race, as presented in Table 14-7.

**Poverty Levels** Poverty levels presented in Table 14-8 are calculated on a subset of the total population of a county, as described above in the *Determination of Populations Below the Poverty Level* section.

The U.S. Census Bureau defines geographical areas with more than 20 percent of the population below the poverty level as poverty areas. Merced, Fresno, Tulare, and Kern Counties are defined as poverty areas and have the highest concentration of total minority populations. There are communities within these counties that have higher concentrations of minority populations or populations below the poverty level. These communities are mainly farming communities that may be impacted by loss in agricultural employment.

**Social Services** Table 14-9 provides a summary of the Federal funds distributed for social programs in the San Joaquin Valley in 2010 as compared to the State of California.

Table 14-7. Minority Population Distribution in the 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 | 514,453 | 65.6% | 2.9% | 1.1% | 5.1% | 0.7% | 19.3% | 5.4% | 41.9% | 53.3% |
| Madera | 150,865 | 62.6% | 3.7% | 2.7% | 1.9% | 0.1% | 24.8% | 4.2% | 53.7% | 62.0% |
| Merced | 255,793 | 58.0% | 3.9% | 1.4% | 7.4% | 0.2% | 24.5% | 4.7% | 54.9% | 68.1% |
| Fresno | 930,450 | 55.4% | 5.3% | 1.7% | 9.6% | 0.2% | 23.3% | 4.5% | 50.3% | 67.3% |
| Tulare | 442,179 | 60.1% | 1.6% | 1.6% | 3.4% | 0.1% | 29.0% | 4.2% | 60.6% | 67.4% |
| Kings | 152,982 | 54.3% | 7.2% | 1.7% | 3.7% | 0.2% | 28.1% | 4.9% | 50.9% | 64.8% |
| Kern | 839,631 | 59.5% | 5.8% | 1.5% | 4.2% | 0.1% | 24.3% | 4.5% | 49.2% | 61.4% |
| San Joaquin County | 685,306 | 51.0% | 7.6% | 1.1% | 14.4% | 0.5% | 19.1% | 38.9% | 38.9% | 64.1% |
| 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 2016a*
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.
Key:
% = percent

Table 14-8. Population Below Poverty Level in the San Joaquin Valley, 2006 – 2010

| Areas | Total Population[a] | Population Below Poverty Level | Percent of Population Below Poverty Level |
|---|---|---|---|
| Stanislaus | 502,108 | 82,480 | 16.4% |
| Madera | 138,151 | 26,656 | 19.3% |
| Merced | 246,260 | 53,738 | 21.8% |
| Fresno | 890,694 | 200,288 | 25.5% |
| Tulare | 423,902 | 97,012 | 22.9% |
| Kings | 133,206 | 25,713 | 19.3% |
| Kern | 777,622 | 159,967 | 20.6% |
| San Joaquin County | 657,594 | 105,502 | 16.0% |
| State of California | 35,877,036 | 4,919,945 | 13.7% |

*Source: U.S. Census 2016b*
Note:
[a] Population numbers are only those for whom poverty status was determined and excludes institutionalized individuals
Key:
% = percent

Table 14-9. Federal Funds Distributed for Social Programs in the 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 | $535.9 | $145.3 | $198.7 |
| Madera | $144.3 | $33.6 | $45.6 |
| Merced | $260.0 | $73.7 | $126.0 |
| Fresno | $992.0 | $274.8 | $468.5 |
| Tulare | $569.1 | $116.0 | $196.5 |
| Kings | $129.2 | $37.8 | $49.3 |
| Kern | $712.0 | $203.4 | $328.6 |
| San Joaquin County | $739.1 | $153.5 | $287.4 |
| State of California | $41,931.1 | $11,743.7 | $12,469.4 |

*Source: Gaquin and Ryan 2013*

# 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.

## Potential Mechanisms for Change and Analytical Methods

The impact analysis considers changes in factors that affect minority and low-income populations, specifically related to changes in CVP operations that would be brought about by implementing one of the alternatives.

The Council of Environmental Quality (CEQ) and U.S. Environmental Protection Agency established guidelines to assist Federal agencies in the analysis of environmental justice effects (CEQ 1997). The following guidelines are used to determine if minority populations are present in the 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. The CEQ guidelines state that low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the U.S. Census Bureau's Current Population Reports. Therefore, since the U.S. Census Bureau defines areas with more than 20 percent of the population below the poverty level as poverty areas, this same percentage is used to determine low-income populations for purposes of this analysis.

The alternatives considered in this EIS do not include project-specific construction activities. In most portions of the study area, the availability of CVP water supplies directly or indirectly affects most of the population within a county. Therefore, the entire population of each county within the study area is considered, to determine whether minority or low-income areas could be affected by implementation of the alternatives.

In the Lower Klamath and Trinity River Region and the Central Valley and Bay-Delta Region, low-income populations include Tehama, Yuba, Merced, Fresno, Tulare and Kern Counties.

In the Central Valley and Bay-Delta Region, the following counties have 50 percent or more of the total population as minority populations: Colusa, Sacramento, Yolo, Solano, Stanislaus, Madera, Merced, Fresno, Tulare, Kings, Kern, and San Joaquin Counties.

Although the majority of the populations in the Lower Klamath and Trinity River Region counties are not minority or low-income 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 because of the high percentage of Indian populations, consistent with CEQ guidance.

The CEQ guidance provides 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:

- Whether there is or will be an impact on the natural or physical environment that significantly (as employed by National Environmental Policy Act (NEPA)) and adversely affects a minority population, low-income population, or Indian tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated on the natural or physical environment; and

- Whether the environmental effects are significant (as employed by NEPA) and are or may be having an adverse impact on minority populations, low-income populations, or Indian tribes that appreciably exceeds, or is likely to appreciably exceed, those on the general population or other appropriate comparison group; and

- Whether the environmental effects occur, or would occur, in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.

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 to water supply and fish populations were considered within the counties that had a minority population of 50 percent or greater of the total population.

The changes were analyzed to determine if the impacts would be disproportionally high on the minority or low-income populations or Indian tribes, in comparison to the total population. Potential adverse impacts were evaluated with regard to changes in CVP operations under the alternatives that could result in disproportionally high effects on minority or low-income populations or Indian tribes, due to changes in irrigated agricultural production and fish populations.

#### *Potential changes in Irrigated Agricultural Production Affecting Minority or Low-Income Populations or Indian Tribes*

Changes in CVP operations under the alternatives could result in reduced water deliveries to the CVP. To evaluate the potential changes in irrigated agricultural production, value, and employment due to changes in CVP water supplies—that may affect minority or low-income populations or Indian tribes—results from Chapter 11, "Agricultural Resources," and Chapter 12, "Socioeconomics," were used.

#### *Changes in Fish Population Due to Fish Die-Off from Ich Disease Affecting Minority or Low-Income Populations or Indian Tribes*

To evaluate the potential effects on minority populations, low-income populations, and Indian tribes from changes in fish population (including fish die-off from *Ichthyophthirius multifiliis* (Ich) disease), results from Chapter 7, "Biological Resources – Fisheries," were used. In addition, to evaluate the changes to tribal fisheries due to changes in river flows, river temperatures, and fish health, results from Chapter 12, "Socioeconomics," were analyzed.

### Evaluation of Alternatives

Action alternatives have been compared to the No Action Alternative.

#### *No Action Alternative*

**Potential Changes in Irrigated Agricultural Production Affecting Minority or Low-Income Populations or Indian Tribes** Under the No Action Alternative, effects on minority or low-income populations or Indian tribes (due to changes in irrigated agricultural production conditions) would be similar to conditions described in the *Affected Environment* section of this chapter.

Conditions in 2030 would be different than existing conditions, primarily due to climate change and sea-level rise, general plan development throughout California, and implementation of reasonable and foreseeable water resource management projects to provide water supplies. Climate change and sea-level rise are anticipated to reduce long-term average CVP water supply deliveries by 2030, as compared to recent historical long-term average deliveries. These reduced deliveries could result in more crop idling or changes in cropping patterns, and changes in regional income and employment. The No Action Alternative assumes implementation of a number of conservation efforts and major water supply projects by 2030 that would provide additional water supply flexibility and availability.

**Changes in Fish Population Due to Fish Die-Off from Ich Disease Affecting Minority or Low-Income Populations or Indian Tribes** Under the No Action Alternative, the flows in the lower Klamath River are anticipated to fall under 2,800 cubic feet per second during late August and September in most years. These conditions, combined with the potential of Ich presence in the river, lead to an increased risk for a fish die-off in the lower Klamath River under the No Action Alternative. Fish die-offs would impact the people who rely on salmon for food, by increasing costs to purchase other food sources. This could disproportionally affect the Yurok and Karuk Indian Reservations whose poverty levels are above 50 percent.

#### *Proposed Action (Alternative 1)*

### Lower Klamath and Trinity River Region

*Potential Changes in Irrigated Agricultural Production Affecting Minority or Low-Income Populations or Indian Tribes* There are no agricultural lands irrigated with CVP water supplies in the Lower Klamath and Trinity River Region. Therefore, there would be no changes in irrigated lands under Alternative 1 as compared to the No Action Alternative.

*Changes in Fish Population Due to Fish Die-Off from Ich Disease Affecting Minority or Low-Income Populations or Indian Tribes* During August and September, Trinity River flows would be increased (through augmentation flows) to reduce the likelihood of a disease outbreak in the lower Klamath River in years when the flow in the lower Klamath River are low—less than 2,800 cubic feet per second (cfs)—under Alternative 1. Flow augmentation under Alternative 1 would increase cross-sectional channel area to expand habitat space, increase water velocities that can reduce efficacy of Ich parasites from finding and attaching to adult salmon hosts, potentially provide migration cues to further disperse adult salmon and reduce densities and reduce the frequency of water temperatures exceeding 73.4 degrees Fahrenheit (°F). These conditions would be expected to result in reduced risk of Ich infection, epizootic outbreaks and consequent fish die-offs. This could result in the benefit of reduced cost to the Indian tribes that rely on salmon for food (i.e., Yurok, Karuk, and Hoopa Valley Tribes).

### Central Valley and Bay-Delta Region

*Potential Changes in Irrigated Agricultural Production Affecting Minority or Low-Income Populations or Indian Tribes* As stated in Chapter 12, "Socioeconomics," the direct changes in agricultural production in dry and critical years would result in changes to employment and regional economic output in the Sacramento and San Joaquin Valleys. In the Sacramento Valley, the small decrease in agricultural production would lead to small decreases in related indirect and induced economic output and employment. In the San Joaquin Valley, small increases in agricultural production would lead to small increases in related indirect and induced economic output and employment.

The small decreases in related indirect and induced economic output and employment could affect populations in Tehama, Yuba, Sacramento, Yolo or Solano Counties. These counties have 50 percent or more of the total population as minority populations or are considered low-income populations. However, this change does not disproportionally affect these populations because all segments of the economy (related to agriculture) would be equally affected across the region.

The decreased net revenue to farmers in the San Joaquin Valley could affect populations in Fresno, Tulare, Merced, Kern and Kings Counties. These counties have 50 percent or more of the total population as minority populations or are considered to have low-income populations. However, this change does not disproportionally affect these populations because all segments of the economy related to agriculture would be equally affected across the region.

*Changes in Fish Population Due to Fish Die-Off from Ich Disease Affecting Minority or Low-Income Populations or Indian Tribes* There are no changes to fish populations due to Ich disease fish die-off in the Central Valley and Bay-Delta Region. Therefore, there would be no changes to fish populations under Alternative 1.

### *Trinity River Record of Decision Flow Rescheduling Alternative (Alternative 2)*

#### Lower Klamath and Trinity River Region

*Potential Changes in Irrigated Agricultural Production Affecting Minority or Low-Income Populations or Indian Tribes* There are no agricultural lands irrigated with CVP water supplies in the Lower Klamath and Trinity River Region. Therefore, there would be no changes in irrigated lands under Alternative 2.

*Changes in Fish Population Due to Fish Die-Off from Ich Disease Affecting Minority or Low-Income Populations or Indian Tribes* During August and September, Trinity River flows would be increased (through augmentation flows) to reduce the likelihood of a disease outbreak in the lower Klamath River in years when the flow in the lower Klamath River are low—less than 2,800 cfs—under Alternative 2. Flow augmentation under Alternative 2 would increase cross-sectional channel area to expand habitat space, increase water velocities that can reduce efficacy of Ich parasites from finding and attaching to adult salmon hosts, potentially provide migration cues to further disperse adult salmon and reduce densities and reduce the frequency of water temperatures exceeding 73.4°F. These conditions would be expected to result in reduced risk of Ich infection, epizootic outbreaks and consequent fish die-offs. This could result in the benefit of reduced cost to the Indian tribes that rely on salmon for food (i.e., Yurok, Karuk, and Hoopa Valley Tribes).

#### Central Valley Region and Bay-Delta Region

*Potential Changes in Irrigated Agricultural Production Affecting Minority or Low-Income Populations or Indian Tribes* As stated in Chapter 12, "Socioeconomics," agricultural production value under long-term average, and dry and critical year conditions, would not change under Alternative 2. In addition, employment and regional economic output in the Sacramento and San Joaquin Valleys—including those counties that have 50 percent or more of the total population as minority populations—would also not change.

*Changes in Fish Population Due to Fish Die-Off from Ich Disease Affecting Minority or Low-Income Populations or Indian Tribes* There are no changes to fish populations due to fish die-off from Ich disease in the Central Valley and Bay-Delta Region. Therefore, there would be no changes to fish populations under Alternative 2.

### *Summary of Environmental Consequences*

The results of the environmental consequences, of implementation of action alternatives as compared to the No Action Alternative, are presented in Table 14-10.

Table 14-10. Comparison of Action Alternatives to No Action Alternative

| Alternative | Potential Change | Consideration for Mitigation Measures |
|---|---|---|
| Alternative 1 | No disproportionately high and adverse effects on low-income or minority populations or Indian tribes. | None needed |
| Alternative 2 | No disproportionately high and adverse effects on low-income or minority populations or Indian tribes. | None needed |

### *Potential Mitigation Measures*

Mitigation measures are presented in this section to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse environmental effects of implementing one of the action alternatives.

Changes in CVP operations under action alternatives would not result in changes in irrigated agricultural production that would disproportionally affect minority or low-income populations or Indian tribes. Also, changes in fish population due to fish die-off from Ich disease would not disproportionally affect minority or low-income populations or Indian tribes. Therefore, there would be no disproportionately high or adverse environmental effects on minority or low-income populations or Indian tribes; and no mitigation measures are required.

### *Cumulative Effects Analysis*

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 action alternatives for environmental justice are summarized in Table 14-11. The methodology for this cumulative effects analysis is described in the Cumulative Effects Technical Appendix.

Table 14-11. Summary of Cumulative Effects on Environmental Justice of Alternatives 1 and 2 as Compared to the No Action Alternative

| **Scenarios** | **Cumulative Effects of Actions** |
|---|---|
| No Action Alternative with Associated Cumulative Effects Actions in Year 2030 | *Conditions and Actions included in Quantitative Analyses*<br>*(Conditions and actions incorporated into No Action Alternative modeling)*<br><br>*Irrigated Agricultural Production Affecting Minority or Low-Income Populations or Indian Tribes* Climate change and sea-level rise, development under general plans, Federal Energy Regulatory Commission relicensing projects, and some future projects to improve water quality or habitats are anticipated to reduce the availability of CVP water supplies as compared to past conditions. Reductions in CVP water supply reliability may result in changes in agricultural production, including changes in irrigated acres and crop types.<br><br>*Changes in Fish Population Due to Fish Die-Off from Ich Disease Affecting Minority or Low-Income Populations or Indian Tribes* Climate change is anticipated to shift winter precipitation from snow to rain, which will lead to larger runoff events in the winter and less snowmelt in the spring. River flows in turn will be reduced during summer months. Lower river flows, combined with increases in ambient air temperatures, are expected to cause further increases in water temperatures compared to recent historical conditions. Lower flow and increased temperature conditions during summer months would likely result in poorer habitat conditions, and increase the potential for Ich epizootic events and related fish die-offs.<br><br>*Additional Identified Actions*<br>*(Additional projects identified in Cumulative Effects Technical Appendix)*<br><br>*Irrigated Agricultural Production Affecting Minority or Low-Income Populations or Indian Tribes* Additional reasonably foreseeable actions under this cumulative effects analysis are not anticipated to change CVP water deliveries, agricultural production, or water-related employment.<br><br>*Changes in Fish Population Due to Fish Die-Off from Ich Disease Affecting Minority or Low-Income Populations or Indian Tribes* Additional foreseeable actions, including the Klamath River Main Stem Dam Removal and Hoopa Valley Tribe Watershed Restoration Projects, are anticipated to improve and increase fish habitat. Improved and increased fish habitat is anticipated to have beneficial effects to fish populations. |

Table 14-11. Summary of Cumulative Effects on Environmental Justice of Alternatives 1 and 2 as Compared to the No Action Alternative (contd.)

| Scenarios | Cumulative Effects of Actions |
|---|---|
| Alternative 1 with Associated Cumulative Effects Actions in Year 2030 | *Alternative 1 with Conditions and Actions included in Quantitative Analyses*<br><br>*Irrigated Agricultural Production Affecting Minority or Low-Income Populations or Indian Tribes* Implementation of Alternative 1 would result in similar agricultural production and related employment as under the No Action Alternative.<br><br>*Changes in Fish Population Due to Fish Die-Off from Ich Disease Affecting Minority or Low-Income Populations or Indian Tribes* Implementation of Alternative 1 would result in reduced likelihood of fish-die offs and increased likelihood of maintaining fish populations compared to the No Action Alternative.<br><br>*Alternative 1 with Additional Identified Actions*<br><br>*Irrigated Agricultural Production Affecting Minority or Low-Income Populations or Indian Tribes* The additional reasonably foreseeable actions are not anticipated to affect agricultural production and related employment.<br><br>*Changes in Fish Population Due to Fish Die-Off from Ich Disease Affecting Minority or Low-Income Populations or Indian Tribes* Alternative 1 with the additional reasonably foreseeable actions would result in reduced likelihood of fish die-offs and increased likelihood of maintaining fish populations, and therefore cumulative effects to fish populations are not anticipated. |
| Alternative 2 with Associated Cumulative Effects Actions in Year 2030 | *Alternative 2 with Conditions and Actions included in Quantitative Analyses*<br><br>*Irrigated Agricultural Production Affecting Minority or Low-Income Populations or Indian Tribes* Implementation of Alternative 2 would result in similar agricultural production and related employment as under the No Action Alternative.<br><br>*Changes in Fish Population Due to Fish Die-Off from Ich Disease Affecting Minority or Low-Income Populations or Indian Tribes* Implementation of Alternative 2 would result in reduced likelihood of fish-die offs and increased likelihood of maintaining fish populations compared to the No Action Alternative.<br><br>*Alternative 2 with Additional Identified Actions*<br><br>*Irrigated Agricultural Production Affecting Minority or Low-Income Populations or Indian Tribes* The additional reasonably foreseeable actions are not anticipated to affect agricultural production and related employment.<br><br>*Changes in Fish Population Due to Fish Die-Off from Ich Disease Affecting Minority or Low-Income Populations or Indian Tribes* Alternative 2 with the additional reasonably foreseeable actions would result in reduced likelihood of fish-die offs and increased likelihood of maintaining fish populations, and therefore cumulative effects to fish populations are not anticipated. |

Key:
CVP = Central Valley Project

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____. 2012c. Karuk Tribe Fishery Socioeconomics Technical Report, For the Secretarial Determination on Whether to Remove Four Dams on the Klamath River in California and Oregon. August 31. 9 pp.

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# Chapter 15 Consultation, Coordination and Compliance

## Introduction

Environmental Impact Statement (EIS) preparation involves public outreach and engagement with cooperating agencies, Native American Tribes and other interested parties. This chapter summarizes completed, ongoing, and anticipated efforts associated with the preparation of this EIS.

## Consultation with the Public and Interested Parties

Consultation and outreach activities in support of this EIS initiated in mid-2015, with the release of the Notice of Intent (NOI), followed by a series of scoping meetings consistent with requirements of the National Environmental Policy Act (NEPA). This activity built upon previous outreach to the public, tribes, stakeholders (including hydropower generators and water users), and Federal and State agencies (engaged in the development of Environmental Assessments in 2003, 2012, 2013, 2015, and 2016), to cover annual flow augmentation in support of salmon health in the lower Klamath River during late summer. In addition, as described in Chapter 1, "Introduction," a number of stakeholders were engaged in the development of the *Draft Long-Term Plan for Protecting Late Summer Adult Salmon in the Lower Klamath River* (Reclamation 2015a), including the California Department of Fish and Wildlife (CDFW), California Water Impact Network, Hoopa Valley Tribe, Klamath Water Users Association, National Marine Fisheries Service (NMFS), San Luis & Delta-Mendota Water Authority (SLDMWA), Westlands Water District, Stillwater Sciences, Yurok Tribe and Northern California Power Agency.

### Scoping Process

The scoping process was initiated on July 14, 2015, with publication of the NOI in the Federal Register, and continued through August 20, 2015.[1] During this period, U.S. Department of the Interior, Bureau of Reclamation (Reclamation) held scoping meetings, to inform the public and interested stakeholders about the project and to solicit comments and input on this EIS. These meetings were publicized via advertising, a news release, postcard notices, and the project website. Table 15-1 provides additional details on the public scoping meetings for this EIS.

[1] See *Scoping Report Long-Term Plan for Protecting Late Summer Adult Salmon in the Lower Klamath River*, Appendix A, for copy of NOI (Reclamation 2015b).

Table 15-1. EIS Scoping Meetings

| Time/Date | Location | Attendance |
|---|---|---|
| 5:30 to 7 p.m., August 5, 2015 | Red Roof Inn<br>4975 Valley West Boulevard<br>Arcata, California 95521 | 74 |
| 5:30 to 7 p.m., August 6, 2015 | Trinity County Library<br>351 Main Street<br>Weaverville, California 96093 | 13 |
| 5:30 to 7 p.m., August 11, 2015 | Shilo Inn<br>2500 Almond Street<br>Klamath Falls, Oregon 97601 | 28 |
| 5:30 to 7 p.m., August 12, 2015 | Bureau of Reclamation, Mid-Pacific Regional Office<br>Cafeteria Conference Rooms 1001 & 1002<br>2800 Cottage Way<br>Sacramento, California 95825 | 11 |

Reclamation issued a news release on July 14, 2015, to media serving Arcata, Weaverville, and Sacramento, California, and Klamath Falls, Oregon,[2] announcing scheduled scoping meetings. In addition, Reclamation placed advertisements twice in each of the following papers: the Eureka, California-based *Times Standard* (ad runs July 29, 2015 and August 2, 2015); the Weaverville, California-based *Trinity Journal* (ad runs July 29, 2015 and August 5, 2015); and the Klamath Falls, Oregon-based *Herald & News* (ad runs August 4, 2015 and August 9, 2015).[3] Postcard notices were mailed on July 27, 2015 to 2,805 individuals and organizations on the mailing list for this EIS.[4]

The format for scoping meetings included an informal open house with poster stations staffed by Reclamation personnel. The format was designed to provide attendees an opportunity to review information about this EIS, ask questions, and have informal one-on-one discussions with staff. Each attendee was invited to sign in, and they were provided an information packet containing the meeting agenda, comment sheet and fact sheet.[5] A short presentation was held at each meeting to orient attendees to the overall project, the format of the meeting, and the process to provide written comments by mail or e-mail. Posters provided for attendee review included NEPA EIS process, scoping purpose, flow augmentation timeline, biology of potentially-affected fish species, hydrology of the affected regions, and potential environmental impacts and concerns.

In addition to the four public scoping meetings, tribal information meetings were held with the Klamath Tribes, Quartz Valley Tribe, Hoopa Valley Tribe, Resighini Rancheria, Yurok Tribe and Karuk Tribe. The same information and materials provided during the scoping meetings were presented at the tribal information meetings. Table 15-2 provides additional details for these tribal information meetings.

[2] See *Scoping Report on the Long-Term Plan for Protecting Late Summer Adult Salmon in the Lower Klamath River*, Appendix B, November 2015 for copy of news release (Reclamation 2015b).
[3] See *Scoping Report on the Long-Term Plan for Protecting Late Summer Adult Salmon in the Lower Klamath River*, Appendix C, November 2015 for copy of display advertisements (Reclamation 2015b).
[4] See *Scoping Report on the Long-Term Plan for Protecting Late Summer Adult Salmon in the Lower Klamath River*, Appendix D, November 2015 for copy of postcard notices (Reclamation 2015b).
[5] See *Scoping Report on the Long-Term Plan for Protecting Late Summer Adult Salmon in the Lower Klamath River*, Appendix E, November 2015 for copy of handout materials (Reclamation 2015b).

Table 15-2. EIS Tribal Information Meetings

| Time/Date | Location | Attendance |
| --- | --- | --- |
| 1:30 p.m., October 5, 2015 | Klamath Tribes<br>Chiloquin, Oregon | 6 |
| 9 a.m., October 6, 2015 | Quartz Valley Tribe<br>Fort Jones, California | 3 |
| 1 p.m., October 7, 2015 | Hoopa Valley Tribe<br>Hoopa, California | 3 |
| 1 p.m., October 12, 2015 | Resighini Rancheria<br>Klamath, California | 8 |
| 10 a.m., October 13, 2015 | Yurok Tribe<br>Klamath, California | 21 |
| 1:30 p.m., October 29, 2015 | Karuk Tribe<br>Conference Call | 3 |

As summarized in the *Scoping Report on the Long-Term Plan for Protecting Late Summer Adult Salmon in the Lower Klamath River* (Reclamation 2015b), stakeholder input received during the scoping process was categorized into 13 areas:

- Purpose and Need
- Scope
- Alternatives Development
- Water Rights and Legal Authority
- Water Resources
- Biological Resources
- Tribal Trust Resources
- Environmental Justice
- Socioeconomic Resources
- Public Health
- Cumulative Impacts
- Global Climate
- Mitigation

A total of 112 comment documents, containing 338 comments, were received during the scoping period from agencies, organizations and individuals. Thirty-one comment documents were submitted at scoping meetings, 26 were mailed, 24 were e-mailed, and 21 were faxed. Three comment letters were received following tribal information meetings.

### Public Websites

The Reclamation NEPA website provides the public and stakeholders with access to the scoping report, information distributed during the scoping process, and the contents of this EIS. Reclamation's NEPA web portal is located at:

http://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=22021

The Klamath Basin Area Office (KBAO) website provides the public and stakeholders with access to copies of a preliminary version of the *Draft Long-Term Plan for Protecting Late Summer Adult Salmon in the Lower Klamath River* (December 2014), comments received on the December 2014 version, and the April 2015 *Draft Long-Term Plan for Protecting Late Summer Adult Salmon in the Lower Klamath River* (Reclamation 2015a). These documents are located on the KBAO website at:

http://www.usbr.gov/mp/kbao/programs/lt-plan.html

### Cooperating Agency Involvement during Preparation of this EIS

Following release of the *Scoping Report on the Long-Term Plan for Protecting Late Summer Adult Salmon in the Lower Klamath River* (Reclamation 2015b), Reclamation—as the Federal lead agency—solicited interest among stakeholders and agencies to participate in preparation of this EIS, as a cooperating agency consistent with NEPA. Under NEPA, a cooperating agency is any agency, other than the lead agency, that has jurisdiction by law, or special expertise, with respect to any environmental impact involved in an action requiring an EIS. This solicitation included the six Federally-recognized tribes engaged during the scoping process, Federal and State agencies with applicable technical or regulatory responsibilities, and affected Central Valley Project water contractors. Stakeholders and agencies that requested and received cooperating agency status pursuant to NEPA include:

- U.S. Fish and Wildlife Service (USFWS)
- CDFW
- NMFS
- Bureau of Indian Affairs
- Humboldt County
- Hoopa Valley Tribe
- Karuk Tribe
- Klamath Tribes
- Yurok Tribe
- SLDMWA

Engagement with cooperating agencies for development of this EIS consisted of four, in-person meetings/workshops and two webinars. Each were designed to present data and receive cooperating agency feedback and advice for development of this EIS. Each cooperating agency workshop was supported by a webinar to share information visually, and to support participation by agency representatives with travel restrictions. Cooperating agency engagement in development of this EIS is summarized in Table 15-3.

Table 15-3. EIS Cooperating Agency Engagement

| Meeting | Date | Location | Milestone/Focus |
|---|---|---|---|
| Cooperating Agency Workshop Number 1 | 3/24/2016 | Weaverville, California | • Convene cooperating agency members<br>• Review and comment on measures identified during project scoping for accuracy and completeness; identify additional measures |
| Cooperating Agency Meeting: Central Valley Project Water Contractors | 5/5/2016 | Sacramento, California | • Discuss San Luis & Delta-Mendota Water Authority project alternative concepts |
| Cooperating Agency Workshop Number 2 | 5/10/2016 | Redding, California | • Review and receive cooperating agency comments on proposed project actions<br>• Identify and append proposed actions to conform, where applicable, to cooperating agency missions and requirements<br>• Revisit and revise as necessary the schedule for cooperating agency workshops |
| Cooperating Agency Webinar: Developed Hydrology | 6/8/2016 | Sacramento, California | • Klamath River hydrology development and methodologies<br>• Frequency of action analysis: preventive pulse and emergency flows<br>• Integration of pulse flow frequency estimates into CalSim modeling |
| Cooperating Agency Workshop Number 3 | 7/25/2016 | Redding, California | • Provide update on EIS schedule<br>• Review alternatives development process and alternatives evaluated in EIS<br>• Review modeling assumptions and receive comments on preliminary modeling results |
| Cooperating Agency Webinar: Administrative Draft EIS Review | 9/6/2016 | Sacramento, California | • Provide overview of Administrative Draft EIS, following its release for cooperating agency review and comment<br>• Provide and discuss requested process for receipt of cooperating agency comments |

Key:
EIS = Environmental Impact Statement

## Next Steps in the Environmental Review Process

This Draft EIS will be released, for a 45-day period, to allow for public and agency review and comment. During this period, Reclamation will host an open house and public hearing pursuant to NEPA. The open house will occur during the first hour of the scheduled event. Following a brief presentation of the project and Draft EIS, attendees will be invited to visit and speak one-on-one, or in small groups, with project staff at poster stations set up in the meeting room.

Notification for the public hearing and availability of the Draft EIS will include release of the Notice of Availability (NOA) in the Federal Register, direct mail, and a news release, per NEPA requirements. The news release will be distributed to Reclamation's statewide VOCUS media database.

Following the close of the public comment period, Reclamation will review all agency and public comments in preparation for the Final EIS. When the Final EIS is complete, Reclamation will publish the document, and the NOA will be printed in the Federal Register, which will mark the start of a minimum 30-day waiting period before Reclamation issues its Record of Decision (ROD) on the project. In the ROD, which is the final step in the NEPA process, Reclamation will document its decision on which actions, if any, to take in order to address the purpose and need. It will also describe other risk-reduction plans it considered, identify any mitigation plans, and describe factors and comments taken into consideration when making its decision under NEPA.

# Consultation with U.S. Fish and Wildlife Service and National Marine Fisheries Service

## Endangered Species Act

The Federal Endangered Species Act (ESA), as amended, was enacted in 1973. The ESA applies to proposed Federal undertakings that are to be authorized, funded, or undertaken by a Federal agency and that may jeopardize the continued existence of any Federally-listed fish, wildlife, or plant species, or which may adversely modify or destroy designated critical habitat for such species. “Take” is defined under the ESA as, “To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct” (16 United States Code (U.S.C.) Section 1532(19)). Under Federal regulations, “harm” is defined as, “An act which actually kills or injures wildlife.” This includes significant habitat modification or degradation where it actually results, or is reasonably expected to result, in death or injury to wildlife by substantially impairing essential behavioral patterns, including breeding, feeding, sheltering, spawning, rearing, and migrating (50 CFR sections 17.3, 222.102). “Harass” is defined similarly broadly. If there is a potential that implementing a project would result in take of a Federally-listed species, either a habitat conservation plan and incidental take permit (under Section 10(a) of the ESA), or a Federal interagency consultation (under Section 7 of the ESA), is required. The ESA also applies to private, State and local activities that may take a listed-species fish or wildlife species, but does not prohibit the take of listed plant species by these entities.

Under the ESA, NMFS has jurisdiction over anadromous fish, marine fish and reptiles, and most marine mammals; and the USFWS has jurisdiction over all other species, including all terrestrial and plant species, freshwater fish species, and a few marine mammals (such as the California sea otter). Listed species within the project area are described in Chapter 7, “Biological Resources – Fisheries,” and the Biological Resources – Terrestrial Technical Appendix.

Besides listing species within their respective jurisdictions as threatened or endangered, the issuing of incidental take permits, and conducting interagency consultations; NMFS and USFWS also are charged with designating “critical habitat” for threatened and endangered species. ESA defines critical habitat as: (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to a species’ conservation, and those features may require special management considerations or protection, and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation of the species (16 U.S.C. Section 1532(5)(A)). USFWS and NMFS also prepare recovery plans for the listed species.

In carrying out its obligations, Reclamation must consult with the appropriate regulatory agency or agencies (e.g., USFWS and NMFS) if the Federal undertaking is likely to affect a listed species or critical habitat. 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.

### Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act (Public Law 104-297), requires that all Federal agencies consult with NMFS on activities or proposed activities authorized, funded, or undertaken by that agency that may adversely affect Essential Fish Habitat (EFH) for commercially managed marine and anadromous fish species. EFH includes specifically identified waters and substrate necessary for fish spawning, breeding, feeding, or growing to maturity. EFH also includes all habitats necessary to allow the production of commercially valuable aquatic species, to support a long-term sustainable fishery, and to contribute to a healthy ecosystem (16 U.S.C. Section 1802(10)).

### Marine Mammal Protection Act

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 non-fishing activities; for scientific research; and for public display at licensed institutions such as aquaria and science centers.

## Consultation with Tribal Governments

Consistent with President Clinton’s April 29, 1994 Memorandum, and President Obama’s November 5, 2009 Memorandum, Reclamation engaged six Federally-recognized tribal governments to participate in preparation of this EIS. Reclamation met with tribes in California and Oregon in 2015, to, in part, solicit their participation in this EIS as cooperating agencies. Tribes contacted were Klamath Tribes, Quartz Valley Tribe, Hoopa Valley Tribe, Resighini Rancheria, Yurok Tribe and Karuk Tribe. Tribes with specialized technical resources, consistent with NEPA criteria for cooperating agency status, were invited to join the project as cooperating agencies. Native American tribes that accepted the invitation as cooperating agencies include the Klamath Tribes, Hoopa Valley Tribe, Yurok Tribe and Karuk Tribe.

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 13, "Indian Trust Assets," and Chapter 14, "Environmental Justice."

# References

Reclamation (U.S. Department of the Interior, Bureau of Reclamation). 2015a. Draft Long-Term Plan for Protecting Late Summer Adult Salmon in the Lower Klamath River. April.

____. 2015b. Scoping Report on the Long-Term Plan for Protecting Late Summer Adult Salmon in the Lower Klamath River. Humboldt County, California. November.

# Chapter 16 Distribution of Draft EIS

## Introduction

This chapter provides locations where the Draft Environmental Impact Statement (EIS) is available for review and a list of the governmental entities, organizations, and interested parties that received copies of this Draft EIS.

## Document Availability

The public distribution of this Draft EIS emphasized the use of electronic media to ensure cost-effective, broad availability to the public and interested parties. This Draft EIS is available for viewing on the U.S. Department of the Interior, Bureau of Reclamation website at http://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=22021.

An electronic copy of the Draft EIS is available for review at the following locations:

U.S. Department of the Interior, Bureau of Reclamation Library
2800 Cottage Way
Sacramento, California 95825

Bureau of Reclamation, Northern California Area Office
16349 Shasta Dam Boulevard
Shasta Lake, California 96019

Chiloquin Branch Library
104 South 1st Avenue
Chiloquin, Oregon 97624

Humboldt County Library
1313 3rd Street
Eureka, California 95501

Klamath County Library
126 South 3rd Street
Klamath Falls, Oregon 97601

Los Banos Public Library
1312 South 7th Street
Los Banos, California 93635

Shasta County Public Library
Redding Library
1100 Parkview Avenue
Redding, California 96001

Trinity County Library
351 Main Street
Weaverville, California 96093

Trinity River Restoration Program
1313 Main Street
Weaverville, California 96093

# Distribution List

Over 2,800 individuals, agencies, and organizations were informed by e-mail or mail of the availability of, and locations to obtain, the Draft EIS.

Parties listed below received an electronic copy of this Draft EIS.

## Federal Agencies

- U.S. Department of Commerce, National Marine Fisheries Service
- U.S. Department of the Interior, Bureau of Indian Affairs
- U.S. Department of the Interior, Fish and Wildlife Service
- U.S. Environmental Protection Agency

## State Agencies

- California Department of Fish and Wildlife
- State Water Resources Control Board

## Regional and Local Entities

- Humboldt County
- San Luis & Delta-Mendota Water Authority

## Tribal Interests

- Hoopa Valley Tribe
- Karuk Tribe
- Klamath Tribes
- Yurok Tribe

# Chapter 17
# List of Preparers

Several agency and consultant staff were involved in the review of the Draft Environmental Impact Statement. Following is a list of persons who were primarily responsible for preparing sections of the Environmental Impact Statement (40 CFR 1502.17).

| Reclamation (NEPA Lead Agency) | | |
|---|---|---|
| **Name** | **Qualifications** | **Participation** |
| Julia Long | B.S., Natural Resources Management; 15 years of experience. | Project Manager; NEPA |
| Charlie Chamberlain | B.S., Agricultural Science; 19 years of experience. | Biological Resources |
| Russ Grimes | B.A., Environmental Studies; M.S., Environmental Management; 26 years of experience. | NEPA Sufficiency |
| Tom Kisanuki | B.S., Wildlife and Fisheries Biology; M.S., Natural Resources; 36 years of experience. | Biological Resources |
| Andrea Meier | B.S., Environmental Toxicology; Master of Public Policy and Administration; 14 years of experience. | NEPA Process |
| Nancy Parker | B.S., Systems Science Engineering; 26 years of experience. | Water Resources Modeling, Surface Water Supply and Management |
| Paul Zedonis | B.S., Biology; M.S., Fisheries Management; 25 years of experience. | Alternatives Development |
| **MWH** | | |
| **Name** | **Qualifications** | **Participation** |
| Mary Paasch, P.E., PMP | B.S., Agricultural Engineering; M.S., Agricultural Engineering; 21 years of experience. | Project Manager, Alternatives Development |
| Rina Binder-Macleod | B.Eng., Environmental Engineering; M.Eng., Civil Engineering; 4 years of experience. | Project Coordinator |
| Matt Bachman | B.S., Civil and Environmental Engineering; M.S., Water Science and Policy; 4 years of experience. | Water Resources Modeling, Hydropower Generation |
| Vincent Barbara | B.S., Agriculture Business; M.A., Economics; 8 years of experience. | Agricultural Resources, Socioeconomics |
| Ian Buck, P.E., PMP | B.S., Civil Engineering; 5 years of experience. | Water Resources Planning |
| Tom FitzHugh | B.A., Political Science; M.S., Geographic Information Systems; 20 years of experience. | Water Resources Modeling, Surface Water Quality |

| **MWH** | | |
|---|---|---|
| **Name** | **Qualifications** | **Participation** |
| Cindy Jones | B.S., Biology; M.S., Environmental Studies/Science and Biological Sciences; 23 years of experience. | Biological Resources |
| Hugh Klein, P.G. | B.A., Geology; M.S., Engineering; M.S., Geology; 30 years of experience. | Groundwater Resources/Groundwater Quality |
| Barbara McDonnell | B.A., Biology; M.A., Biology; 44 years of experience. | NEPA |
| Craig Moyle, PMP | B.A., Journalism; 24 years of experience. | Public and Stakeholder Outreach |
| Danelle Pecot, P.E., PMP | B.S., Civil Engineering; M.S., Civil Engineering; 8 years of experience. | Alternatives Development |
| Meredith Parkin, PMP | B.S, Human Nutrition and Food Science; J.D., Law; 21 years of experience. | NEPA, Environmental Justice |
| Jeff Payne, P.E. | B.S., Civil Engineering; M.S., Civil and Environmental Engineering; 17 years of experience. | Water Resources Planning |
| William Smith, P.E. | B.S., Forest Engineering; 40 years of experience. | Water Resources Modeling, Surface Water Supply and Management, Surface Water Quality, Hydropower Generation |
| Stephanie Theis | B.S., Fisheries Ecology; Graduate Studies, Applied Ecology and Conservation Biology; 26 years of experience. | Biological Resources – Fisheries, Tribal Trust Resources |
| **Ascent Environmental** (Under subcontract to MWH) | | |
| **Name** | **Qualifications** | **Participation** |
| Dimitri Antoniou | B.S., Environmental Management and Protection; M.S., City and Regional Planning; 6 years of experience. | Air Quality and Greenhouse Gas |
| Honey Walters | B.S., Environmental Science and Chemistry; M.S., Atmospheric Science; 16 years of experience. | Air Quality and Greenhouse Gas |
| **Cramer Fish Science** (Under subcontract to MWH) | | |
| **Name** | **Qualifications** | **Participation** |
| Brad Cavallo | B.S., Fisheries Biology; M.S., Aquatic Ecology; 22 years of experience. | Fisheries Lifecycle Modeling |
| **North State Resources** (Under subcontract to MWH) | | |
| **Name** | **Qualifications** | **Participation** |
| Len Lindstrand III | B.S., Wildlife Management; Minors in Fisheries Management and Forestry; 24 years of experience. | Biological Resources – Terrestrial |

| North State Resources (NSR)<br>(Under subcontract to MWH) | | |
|---|---|---|
| **Name** | **Qualifications** | **Participation** |
| Bruce Webb | B.A., Psychology; Certified Environmental Planner; 44 years of experience. | Biological Resources – Terrestrial |
| Keith Marine | B.S., Wildlife and Fisheries Biology; M.S., Ecology; 33 years of experience. | Biological Resources – Fisheries |
| **Watercourse Engineering**<br>(Under subcontract to MWH) | | |
| **Name** | **Qualifications** | **Participation** |
| Mike Deas, P.E. | B.S., Civil Engineering; M.S., Civil and Environmental Engineering; PhD, Civil and Environmental Engineering; 30 years of experience. | Surface Water Supply and Management, Surface Water Quality |
| Edwin Limanto | B.S., Civil Engineering; M.S., Civil and Environmental Engineering; 10 years of experience. | Surface Water Supply and Management, Surface Water Quality |
| I.E. Sogutlugil | B.S., Civil Engineering; M.S., Civil and Environmental Engineering; 14 years of experience. | Surface Water Supply and Management, Surface Water Quality |
| **Westwater Research**<br>(Under subcontract to MWH) | | |
| **Name** | **Qualifications** | **Participation** |
| Harry Seely | B.S., Economics; M.S., Natural Resources and Agricultural Economics; 23 years of experience | Agricultural Economics |

Key:
BA = Bachelor of Arts
B.Eng. = Bachelor of Engineering
B.S. = Bachelor of Science
M.A. = Master of Arts
M.Eng = Master of Engineering
M.S. = Master of Science
NEPA = National Environmental Policy Act
PE = Professional Engineer
P.G. = Professional Geologist
PMP = Project Management Professional
Reclamation = U.S. Department of the Interior, Bureau of Reclamation

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# Chapter 18
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