Chapter 10

Terrestrial Biological Resources

10.1 Introduction

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

10.2 Regulatory Environment and Compliance Requirements

Potential actions that could be implemented under the alternatives evaluated in this EIS could affect terrestrial biological resources in areas: along the shorelines and in the waters of reservoirs that store CVP and SWP water supplies, along rivers and waterways (including bypasses) impacted by changes in the operations of CVP or SWP reservoirs, within agricultural areas served by CVP and SWP water supplies, and modified to provide wetland habitat. Actions located on public agency lands; or implemented, funded, or approved by Federal and state agencies would need to be compliant with appropriate Federal and state agency policies and regulations, as summarized in Chapter 4, Approach to Environmental Analyses.

10.3 Affected Environment

This section describes terrestrial biological resources that could potentially be affected by implementing the alternatives considered in this EIS. Changes in terrestrial biological resources due to changes in CVP and SWP operations may occur in the Trinity River, Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions.

Terrestrial biological resources occur throughout the Study Area. However, the analysis in this EIS is focused on terrestrial biological resources that could be directly or indirectly affected by the implementation of the alternatives analyzed in this EIS. The areas that could be affected are related to specific areas: 1) along the shorelines of reservoirs that store CVP and SWP water supplies, 2) along rivers downstream of CVP or SWP reservoirs, 3) areas with wetland habitat restoration in the Yolo Bypass and Suisun Marsh, 4) wildlife refuges that receive CVP water supplies, 5) riparian corridors within the Delta, and 6) within agricultural acreage that is irrigated with CVP and SWP water supplies.

Therefore, the following description of the affected environment is limited to these areas.

10.3.1 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 are affected by the long-term coordinated operation of the CVP and SWP is provided in Appendix 10A. 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 Fish and Wildlife Office.

To supplement the U.S. Fish and Wildlife lists, the California Natural Diversity Database (CNDDB) was queried (DFG 2012) for regions where recent documentation was lacking. This included the Stanislaus River corridor between New Melones Dam and the San Joaquin River confluence, and the Trinity River Region, including Trinity Lake, Lewiston Reservoir, Whiskeytown Lake, and Clear Creek between Carr Powerhouse and the Sacramento River confluence.

10.3.1.1 Critical Habitat

Critical habitat refers to areas designated by the USFWS for the conservation of species listed as threatened or endangered under the Endangered Species Act of 1973, as amended through the 108th Congress (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 modification of CVP and SWP operations are presented in Table 10.1 below. There are occurrences of critical habitat of other species not included in Table 10.1 or other locations of critical habitat of the species listed in Table 10.1 which are not included below because those occurrences are not located within the CVP or SWP service areas or in areas that could be affected by modification of CVP and SWP operations, such as lands located at high elevations within national forests where CVP and SWP water is not delivered.

Table 10.1 Terrestrial Species with Designated Critical Habitat in Portions of the Study Area that Could Be Affected by Changes in CVP and SWP Operations

Species	Regions[a]	Counties
Least Bell's Vireo	Central Coast and Southern California	Riverside, San Bernardino, San Diego, Santa Barbara, Ventura
Buena Vista Lake Shrew	Central Valley	Kern
Fresno Kangaroo Rat	Central Valley	Fresno
California Tiger Salamander	Central Valley	Alameda, Kern, Kings, Madera, Merced, San Benito, San Joaquin, Santa Barbara, Solano, Stanislaus, Tulare, Yolo
California Red-legged Frog	Central Valley, San Francisco Bay Area, Central Coast, Southern California	Alameda, Butte, Contra Costa, El Dorado, Kern, Kings, Los Angeles, Merced, Nevada, Placer, San Benito, San Joaquin, Santa Barbara, Santa Clara, Solano, Stanislaus, Ventura, Yuba
Alameda Whipsnake	Central Valley and San Francisco Bay Area	Alameda, San Joaquin, Santa Clara
Valley Elderberry Longhorn Beetle	Central Valley	Sacramento
Conservancy Fairy Shrimp	Central Valley	Butte, Merced, Solano, Stanislaus, Tehama, Ventura
Longhorn Fairy Shrimp	Central Valley	Alameda, Contra Costa, Merced
Vernal Pool Fairy Shrimp	Central Valley and San Francisco Bay Area	Alameda, Butte, Contra Costa, Fresno, Glenn, Madera, Merced, Placer, Sacramento, San Benito, San Joaquin, Santa Barbara, Shasta, Solano, Stanislaus, Tehama, Tulare, Ventura, Yuba
Vernal Pool Tadpole Shrimp	Central Valley	Alameda, Colusa, Kings, Madera, Merced, Sacramento, Shasta, Solano, Stanislaus, Tehama, Tulare, Yolo, Yuba
Butte County Meadowfoam	Central Valley	Butte, Tehama
Colusa Grass	Central Valley	Merced, Stanislaus, Yolo
Hairy Orcutt Grass	Central Valley	Butte, Fresno, Madera, Merced, Stanislaus, Tehama
San Joaquin Hairy Orcutt Grass	Central Valley	Fresno, Madera, Merced, Tulare
Slender Orcutt Grass	Central Valley	Plumas, Sacramento, Shasta, Tehama

Species	Regions[a]	Counties
Sacramento Orcutt Grass	Central Valley	Sacramento
Solano Grass	Central Valley	Yolo
Contra Costa Goldfields	Central Valley	Solano
Contra Costa Wallflower	Central Valley and San Francisco Bay Area	Contra Costa, Sacramento
Fleshy Owl's-Clover	Central Valley	Madera, Merced, Sacramento, San Joaquin, Stanislaus
Greene's Tuctoria	Central Valley	Madera, Merced, Shasta, Stanislaus, Tehama
Hoover's Spurge	Central Valley	Butte, Merced, Tehama, Tulare
Keck's Checker-Mallow	Central Valley	Fresno
Soft Bird's-Beak	Central Valley and San Francisco Bay Area	Contra Costa, Solano
Suisun Thistle	Central Valley	Solano

Source: USFWS 2014a - 2014aj

Note:
a. Only includes critical habitat within lands served by CVP or SWP water or in areas that could be affected by modification of CVP and SWP operations. Therefore, does not include lands where CVP and SWP water is not delivered or not affected by CVP and SWP operations.

10.3.2 Trinity River Region

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

The Trinity River includes the mainstem, North Fork Trinity River, South Fork Trinity River, New River, and numerous smaller streams (NCRWQCB et al. 2009; USFWS et al. 1999). The mainstem of the Trinity River flows 170 miles to the west from the headwaters to the confluence with the Klamath River. As described in Chapter 5, Surface Water Resources and Water Supplies, the CVP Trinity Lake and Lewiston Reservoir are located upstream of the confluences of the Trinity River and the North Fork, South Fork, and New River. Flows on the North Fork, South Fork, and New River are not affected by CVP facilities. The Trinity River flows approximately 112 miles from Lewiston Reservoir to the Klamath River through Trinity and Humboldt counties and the Hoopa 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. 1999). Downstream of the Trinity River confluence, the Klamath River flows through Humboldt and Del Norte counties and through the Hoopa 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 of the confluence with the Trinity River. The Klamath River estuary extends from approximately 5 miles upstream of 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.

As described in subsection 10.3.2, Overview of Species with Special Status, a listing of wildlife and plant species with special status that occur or may occur in portions of the Study Area affected by the long-term coordinated operation of the CVP and SWP is provided in Appendix 10A.

10.3.2.1 Trinity Lake and Lewiston Reservoir

The dominant vegetation community in the Trinity River watershed upstream of Trinity Lake and Lewiston Reservoir includes mixed conifer, with ponderosa pine, sugar pine, and Douglas-fir as the dominant species. Some south-facing slopes are dominated by oak and brush. Mixed hardwood communities occur at lower elevations, and include species such as madrone, big-leaf maple, and a variety of oaks. The shrub community at lower elevations includes a number of chaparral species such as manzanita, bitterbrush, and deerbrush. South-facing slopes around Trinity Lake contain shrub fields that provide winter range for the Weaverville deer herd (USFS 2005; STNF 2014)

Along the 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 constrained by fluctuating water levels and steep banks (NCRWQCB et al. 2009; USFWS et al. 1999).

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 eagles and other raptors that prey on fish (e.g., ospreys) and waterfowl.

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

10.3.2.2 Trinity River from Lewiston Reservoir to Klamath River

Current terrestrial habitat along the Trinity River is different than habitat prior to construction of Trinity and Lewiston dams. The ongoing Trinity River Restoration Program is restoring portions of the habitat. The following description reflects recent habitat changes along the mainstem of the Trinity River between Lewiston Reservoir and the confluence of the Klamath River.

10.3.2.2.1 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. 1999). 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 reduced the potential for encroachment and maturation of woody vegetation along the stabilized channel. In addition, the extent of wetlands probably declined following dam construction due, in part, to reduced flows and elimination of river meanders.

The ongoing Trinity River Restoration Program includes specific minimum instream flows, as described in Chapter 5, Surface Water Resources and Water Supplies; mechanical channel rehabilitation; fine and coarse sediment management; watershed restoration; infrastructure improvement; and adaptive management components (NCRWQCB et al. 2009; USFWS et al. 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, and thereby, had confined the river. Following removal of the berms, the areas had 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; and relocation of sand outside of the floodway. 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 restoration actions are occurring between Lewiston Dam and the North Fork.

10.3.2.2.2 Terrestrial Habitat

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. 1999). 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 that inhabited river and riparian habitats prior to dam construction still occur along the 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. 1999). For example, western pond turtle declined since completion of the dams in response to diminishing instream habitat. In contrast, species such as northern

goshawk and black salamander that favor mature, late-successional riparian habitats increased with more upland habitat along the riparian corridor.

Current habitats along the Trinity 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, soft brome, ripgut brome, cheatgrass, and barley); forbs (e.g., broadleaf filaree, California poppy, true clover, and bur clover); and native perennial species (e.g., Creeping Wildrye). The annual grassland habitat supports Mourning Dove, Savannah Sparrow, White-Crowned Sparrow, American Kestrel, Red-Tailed Hawk, coyote, California Ground Squirrel, Botta's Pocket Gopher, California Kangaroo Rat, Deer Mouse, Gopher Snake, Western Fence Lizard, Western Skink, Western Rattlesnake, and Yellow-Bellied Racer. The fresh emergent wetland species occur along the backwater areas, depressions, and along the river edges, including American Tule, Narrow-Leaved Cattail, Dense Sedge, Perennial Ryegrass, Himalayan Blackberry, and Narrow-Leaved Willow. Wildlife species along the fresh emergent wetland include Western Toad, Pacific Chorus Frog, Bullfrog, Green Heron, Mallard, and Red-Winged Blackbird. The montane riparian habitat adjacent to the river include trees, including bigleaf maple, white alder, oregon ash, black cottonwood, and Goodding's black willow; and understory species, including mugwort, virgin's bower, American dogwood, oregon golden-aster, dalmation toadflax, white sweet clover, musk monkeyflower, straggly gooseberry, California grape, and California blackberry. The valley-foothill riparian habitat occur along alluvial fans, slightly dissected terraces, and floodplains; and include cottonwood, California sycamore, valley oak, white alder, boxelder, Oregon ash, wild grape, wild rose, California blackberry, blue elderberry, poison oak, buttonbush, willow, sedge, rushes, grasses, and miner's lettuce. Riparian woodlands along the montane riparian habitat support breeding, foraging, and roosting habitat for tree swallow, bushtit, White-Breasted Nuthatch, Nuttall's Woodpecker, Downy Woodpecker, Spotted Towhee, and Song Sparrow; cover for amphibians, including Western Toad and Pacific Chorus Frog; and habitat for deer mouse, raccoon, and Virginia Opossum. The riverine habitat supports amphibians and reptiles, including Western Toad, Pacific Chorus Frog, bullfrog, and Western Pond Turtle; birds, including mallard, Great Blue Heron, Osprey, and Belted Kingfisher; and mammals, including river otter, beaver, Big Brown Bat, and Yuma Myotis (bat).

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, bigleaf maple, canyon live oak, black oak, blue oak, ponderosa pine, Douglas fir, and incense cedar. Shrubs include greenleaf manzanita, buckbrush, cascara, snowberry, and poison oak. Underlying herbaceous vegetation includes ripgut brome, blue wild rye, silver bush lupine, purple sanicle, false hedge-parsley, The habitats support numerous birds, including Northern Flicker, Stellar's Jay, Hairy Woodpecker, Acorn Woodpecker, Wrentit, Bewick's Wren, California Quail, Mountain Quail, Blue Grouse, Sharp-Shinned Hawk, Red-Tailed Hawk, and Great Horned Owl; mammals including Black-Tailed Deer, Gray Fox,

coyote, Black-Tailed Jackrabbit, Raccoon, Virginia Opossum, Spotted Skunk, Gray Squirrel, Allen's Chipmunk, Deer Mouse, and Pallid Bat; and reptiles and amphibians, including California Kingsnake, Western Rattlesnake, Sharp-Tailed Snake, Western Fence Lizard, Southern Alligator Lizard, and Ensatina.

Inundation of lands by 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).

10.3.2.3 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; because the river slows, temperatures increase, 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. Red alder is a typical hardwood in riparian zones, tanoak 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, tules, and a variety of rushes and sedges. As the river nears the ocean, salt-tolerant plants such as cord grass and pickleweed increase in abundance as the salinity increases (USFWS et al. 1999). Wildlife species in the lower Klamath River watershed are similar to those found in the Trinity River watershed.

10.3.3 Central Valley Region

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

The Central Valley Region includes portions of the Sacramento Valley and San Joaquin Valley; including the Delta, Suisun Marsh, and the Yolo Bypass. The areas where terrestrial biological resources could potentially be affected include the fluctuation zones associated with reservoirs; river margins influenced by the magnitude, duration, and frequency of flows; and agricultural lands and refuges served by CVP and SWP water supplies.

The Central Valley 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 Tehachapi Mountains to the south. Communities of various sizes and an extensive network of roadways are located throughout the valley.

Land use within the Sacramento Valley and San Joaquin 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 and San Joaquin valleys. 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.

10.3.3.1 Overview of Terrestrial Communities

This section describes the terrestrial communities in the Central Valley Region that could be affected directly or indirectly by operations of the CVP and SWP. These communities are broadly described for lakes/reservoirs (including open water and drawdown areas); rivers (including open water and riparian and floodplain areas); wetlands; and agricultural lands that could be affected by changes in water deliveries and ecosystem restoration activities. Other communities are described for areas that could be affected by restoration activities related to the proposed action and alternatives.

10.3.3.1.1 Lake/Reservoir Communities

Reservoirs that store CVP and SWP water supplies 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 5, Surface Water Resources and Water Supplies, 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 river otter and beaver. Bald Eagles and Ospreys 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 Central Valley 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 5, Surface Water Resources and Water Supplies, 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 can increase for piscivorous (fish-eating) birds foraging in the reservoirs as these species must travel greater distances to forage (DWR 2004a).

10.3.3.1.2 Riverine Communities

The rivers and streams influenced by the long-term coordinated operation of the CVP and SWP support habitats for plants and wildlife. The primary components of the riverine environment that support plants and wildlife, including open water areas and adjacent riparian and floodplain communities (including bypasses that are inundated at high flows), are described below.

Open Water Areas

The riverine environment downstream of 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. Gull, Tern, 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 river otter, American mink, muskrat, and beaver.

Riparian and Floodplain Areas

The riparian and floodplain communities that could be affected by CVP and SWP operations 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 Central Valley has been reduced over time due to a variety of actions, including local, state, and Federal construction and operation of flood control facilities isolated historic floodplains; 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). Currently, levee and bank protection structures associated with the flood protection system are present along more than 2,600 miles of rivers in the Central Valley, including the Delta (DWR 2009a).

Characteristic riparian tree species in the Central Valley include willows, cottonwoods, California sycamore, and valley oaks. Typical understory plants include elderberry, blackberries, and 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 oaks 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 (sometime 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 and San Joaquin valleys lack 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, raccoon, and gray fox. Riparian bird species include Red-Shouldered Hawk, Wood Duck, Great Blue Heron, Black-Crowned Night Heron, and many neotropical migratory birds, including Yellow Warbler and Western Yellow-Billed Cuckoo. Amphibians and reptiles include Pacific Tree Frog, Pacific Gopher Snake, Garter Snake, and Western Pond Turtle. Special status species that associate with riparian and floodplain habitats include Bank Swallow (state listed), Western Yellow-Billed Cuckoo (Federally and state listed), and the Valley Elderberry Longhorn Beetle (Federally listed).

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.

10.3.3.1.3 Wetlands, Marshes, and Wet Meadows

Wetlands in the Central 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 and San Joaquin rivers, 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 Complex, and around the Thermalito Afterbay (Reclamation 2010a). Both tidal and nontidal, perennial wetlands are found in the Delta and Suisun Marsh.

Perennial Non-tidal (Freshwater) Wetlands and Marshes

In the Sacramento and San Joaquin valleys 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 U.S. Army Corps of Engineers jurisdiction under Sections 401 and 404 of the federal Clean Water Act.

Perennial freshwater wetlands are among the most productive wildlife habitat in California (CDFW 1988a). In the Sacramento and San Joaquin valleys 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 and San Joaquin valleys 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, toad rush, hyssop loosestrife, and foothill meadowfoam. 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 2010a).

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 National Wildlife Refuge, Cosumnes River Preserve, and Suisun Marsh.

Perennial Tidal Wetlands and Open Water

In the Central 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.

10.3.3.1.4 Agricultural Lands

Agricultural land uses and farming practices in the Central 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 and San Joaquin valleys 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 and San Joaquin valleys include grain and seed crops (e.g., barley and wheat), forage crops (e.g., hay and alfalfa), row crops (e.g., tomatoes, lettuce, sugar beets), cotton, orchards (e.g., almonds, walnuts, peaches, plums), and vineyards. There are also areas of irrigated pastureland throughout the Sacramento and San Joaquin valleys.

Grain and seed crops include wheat, barley, corn, and other annual grasses that are grown in dense stands. Most of the value for wildlife 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. 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 and western harvest mouse. 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, 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, Northern Harrier, Red-Tailed Hawk, and White-Tailed Kite.

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, swallows, bats, and many types of waterfowl and migratory birds feed on insects in alfalfa fields. Mammals such as gophers, mice, and rabbits feed directly on alfalfa. Larger herbivorous mammals, such as deer, antelope, and elk, frequent alfalfa fields, especially during dry or cold seasons. Hawks, eagles, migratory birds, coyotes, and mountain lions feed on the birds and rodents that feed on the alfalfa. Scavengers such as coyotes and vultures feed on carrion (Putnam et al. 2001).

Rice cultivation is also widespread in the Sacramento Valley. 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 such as crayfish and small fish. Foraging opportunities are provided by fish that become entrained in the irrigation canals that supply water to the rice fields and the crayfish that are found along canal banks and berms of the rice fields. Other wildlife species that use flooded rice fields include Giant Garter Snake and bullfrog. Ring-necked pheasant and Sandhill Cranes 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, cranes, herons, and egrets.

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, American Crow, Plain Titmouse, Brewer's Blackbird, House Finch, Gray Squirrel and California Ground Squirrel (DFG 1999a, 1999b, 1999c). Other fruit crops such as apples, cherries, figs, pears and prunes are also eaten by these same species and others such as Band-Tailed Pigeon, Yellow-Billed Magpie, Western Bluebird, American Robin, Varied Thrush, Northern Mockingbird, Cedar Waxwing, Yellow-Rumped Warbler, Black-Headed Grosbeak, Bullock's Oriole, Desert Cottontail, Gray Squirrel, coyote, black bear, raccoon, and Mule Deer. Evergreen orchards (citrus, olives, avocado) 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. Carnivores such as fox, bobcat, and coyote frequently use avocado orchards (Nogeire et al. 2013). 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 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 deer, and 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 Gophers, and Burrowing Owls. Pastures provide foraging habitat for grassland-foraging wildlife, such as coyote and fox, 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. Giant Garter Snake is frequently associated with the water conveyance systems that support rice cultivation.

10.3.3.1.5 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 (CalIPC 2006).

According to the California Department of Fish and Wildlife'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.

Changes in CVP and SWP operations would affect the wetted edges at CVP and SWP reservoirs, reservoirs that store CVP and SWP water supplies, and along the rivers downstream of the CVP and SWP reservoirs. Therefore, only those invasive plant species that are associated with the margins at these waterways would be likely to cause adverse effects on terrestrial biological resources. Examples of these species include tree-of-heaven, giant reed, purple loosestrife, perennial pepperweed, tamarisk, and red sesbania. In addition to the potential effects caused by changed water operations, invasive species have the potential to be introduced as part of construction of habitat restoration, or to colonize areas disturbed by restoration construction activities (e.g., yellow star thistle, perennial pepperweed, Spanish broom, Himalaya blackberry).

10.3.3.2 Sacramento Valley

The Sacramento Valley portion of the Central Valley Region considered in this EIS includes Shasta Lake, Keswick Reservoir, and the Sacramento River from Keswick Reservoir to the Delta. The Sacramento Valley also includes the lower Yuba River and the middle and lower portions of the Feather River and American River watersheds that are influenced by CVP and SWP operations, respectively.

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.

A listing of wildlife and plant species with special status that occur or may occur in portions of the Study Area affected by the long-term coordinated operation of the CVP and SWP is provided in Appendix 10A.

The USFWS has approved a habitat conservation plan for the Natomas Basin/Metropolitan Air Park near Sacramento. Six other habitat conservation plans are being prepared in the Sacramento Valley, including programs for Butte County, Yuba-Sutter counties, Placer County, Yolo County, South Sacramento County, and Solano County.

10.3.3.2.1 Shasta Lake and Keswick Reservoir

The area in which Shasta Lake is situated is characterized by a variety of vegetation and wildlife habitats typical of transitional mixed woodland and low-elevation forest habitats (Reclamation 2013a). 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, 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 2013a). 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 the coyote and skunks, and cavities in mature trees are used by cavity-dwelling species such as the Acorn Woodpecker and California Myotis. Many amphibians and reptiles, including Ensatina, Western Skink, and Western Fence Lizard, inhabit the detrital layer of moist areas. Snakes, including the Western 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. Otters, Gray Fox, coyote, bobcat, Osprey, and turtles 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 oak, pine, and fir trees occur on the foothills above the reservoir. As described in Chapter 5, Surface Water Resources and Water Supplies, water elevations in Keswick Reservoir are relatively stable throughout the year.

10.3.3.2.2 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, white alder, dogwoods, Oregon ash, bigleaf maple, and Fremont and black cottonwood. Wild grape is also very common; other riparian shrubs include snowberry, California blackberry, toyon, buckeye, and button willow. 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 of 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).

10.3.3.2.3 Sacramento River: Keswick Reservoir to the Delta

Release of flows 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 5, Surface Water Resources and Water Supplies. 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 2013a).

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 2013a). 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 2013a). 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 provide value 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 2013a). 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 2013a). 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 of Colusa, the Sacramento River channel changes from a dynamic and active meandering one to a confined, narrow channel (Reclamation 2013a). 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.

10.3.3.2.4 Feather River

Antelope Lake, Lake Davis, and Frenchman Lake located in the Upper Feather River; Lake Oroville and Thermalito Forebay and Afterbay; and the lower Feather River are located within areas in the Feather River watershed that could be affected by changes in CVP and/or SWP operations. Downstream of Lake Oroville, the basin extends south and includes the drainage of the Yuba and Bear Rivers.

Upper Feather River Lakes

The Upper Feather River Lakes, including Antelope Lake, Lake Davis, and Frenchman Lake, are SWP facilities on the upper Feather River upstream of Lake Oroville. These lakes are part of the Plumas National Forest and provide habitat for raptor nesting and wintering areas, waterfowl nesting area, and deer movement area (DWR 2013a; Plumas County 2012). Deer movement and fawning areas also occur around Lake Davis.

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 of 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 of 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 sycamore. 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, Canyon Wren, American Dipper, killdeer, mallard, Common Merganser, and Northern Rough-Winged Swallow.

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, Black Phoebe, White-Tailed Kite, Black-Tailed Jackrabbit, Brown-Headed Cowbird, bullfrog, Common Garter Snake, Common Yellowthroat, Gopher Snake, Northern Harrier, Pacific tree Frog, raccoon, red-Winged Blackbird, Ring-Necked Pheasant, Short-Eared Owl, Striped Skunk, Tree Swallow, Virginia Opossum, and Violet-Green Swallow (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, Black Tern, California Gull, Caspian Tern, Forster's Tern, Greater Yellowlegs, Least Sandpiper, Long-Billed Dowitcher, Ring-Billed Gull, Semipalmated Sandpiper, Spotted Sandpiper, and White-Faced Ibis. 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 Snakes 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 exist 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, boxelder, alder, and Oregon ash. The riparian strip along the river is bordered mostly by agricultural fields. Downstream of Yuba City near the confluence with the Sacramento River, valley oak and cottonwood riparian stands becomes more common.

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

10.3.3.2.5 Yuba River

Portions of the Yuba River watershed along the North Yuba River between New Bullards Bar Reservoir and Englebright Lake and along the Lower Yuba River between Englebright Lake and the Feather River could be affected by operation of the Lower Yuba River Water Accord (DWR et al. 2007b).

New Bullards Bar Dam and Reservoir are owned and operated by the Yuba County Water Agency to provide flood control, water storage, and hydroelectric generation. The Harry L. Englebright Dam and Reservoir were constructed by the California Debris Commission downstream of New Bullards Bar Reservoir to trap and store sediment from historical hydraulic mining sites in the upper watershed, and to provide recreation and hydroelectric generation opportunities (USACE 2013). Following decommissioning of the California Debris Commission in 1986, administration of Englebright Dam and Reservoir (Lake) was assumed by the USACE. Portions of the watershed along the Middle Yuba River between New Bullards Bar Reservoir and Englebright Reservoir are within the Plumas and Tahoe national forests.

Vegetation communities adjacent to New Bullards Bar Reservoir include oak woodlands, mixed conifer, and montane hardwood habitats which include live oak, blue oak, foothill pine, California wild rose, and lupine (DWR et al. 2007). The shoreline is generally barren. Bald Eagles have been observed near New Bullards Bar Reservoir; and California Red-legged Frogs have been reported in a tributary to the reservoir, Oregon Creek.

Vegetation communities at Englebright Reservoir are generally blue oak woodland and montane chaparral with small areas of mixed chaparral and live oak woodland (Yuba County 2011).

Vegetation along the lower Yuba River downstream of Englebright Dam is characterized by a number of vegetation types including grasslands, woodlands, and chaparral (USACE 2014). Within the Narrows, a steep gorge in the

Yuba River immediately below Englebright Dam, there is little vegetation; small, isolated clumps of willow, mulefat, and other riparian species are widely scattered along the mostly barren, rocky banks. Downstream of the Narrows, there are extensive piles of cobble and gravel left from past gold and gravel mining operations. Here there are narrow strips of riparian vegetation consisting of Fremont cottonwood, willow, boxelder, and elderberry shrub. As described above for the Sacramento River, these communities support a wide range of similar 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.

10.3.3.2.6 Bear River

The Bear River flows into the Feather River downstream of the confluence with the Yuba River. As described in Chapter 5, Surface Water Resources and Water Supplies, the Bear River includes Nevada Irrigation District's Rollins and Combie reservoirs along the upper and middle reaches of the Bear River, and South Sutter Water District's Camp Far West Reservoir along the lower reach of the Bear River (FERC 2013; NID 2005).

Vegetation communities near the reservoirs and along the Bear River from Rollins Reservoir to the confluence with the Feather River occur in bands based on elevations (FERC 2013; NID 2005). Gray pine, ponderosa pine, hardwoods, and chaparral shrubs occur at the higher elevations with black cottonwood, white alder, and valley oak in the riparian zones. Incense cedar, Douglas fir, white fir, madrone, sugar pine, Brewer's oak, whiteleaf manzanita, greenleaf manzanita, wedgeleaf ceanothus, deerbrush, and poison oak at mid-elevations with white alders, maple, and willow along the riparian areas.

10.3.3.2.7 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 of Folsom Lake. Lake Natoma is located downstream of Folsom Lake. Water continues to flow between Nimbus Dam and the confluence with the Sacramento River, as described in Chapter 5, Surface Water Resources and Water Supplies.

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 2005a). Lake Natoma, which serves as an afterbay downstream of 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, great horned owl, and long-eared owl use oak woodlands for nesting, foraging, and roosting. Mammal species likely to occur in woodland habitats include deer, coyote, bobcat, fox, Virginia Opossum, raccoon, rabbits, squirrels, and a variety of rodents. Amphibians and reptiles that may be found in oak woodlands include California Newt, Pacific Tree Frog, Western Fence Lizard, Gopher Snake, Common Kingsnake, and Western Rattlesnake. The adjacent grasslands are used by various bird species for foraging, including White-Crowned Sparrow, Lesser Goldfinch, 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/or rearing habitat. These species include Pacific Tree Frog, Western Toad, Common Garter Snake, beaver, raccoon, and muskrat.

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 2005a). 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 2005a).

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

Downstream of 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 of 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 of 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, poison oak, wild grape, blackberry, northern California black walnut, 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. 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 skunk, rabbit, raccoon, squirrel, vole, muskrat, deer, fox, and coyote. Reptiles and amphibians that occupy riparian habitats along the river include Western Toad, Pacific Tree Frog, bullfrog, Western Pond Turtle, Western Fence Lizard, Common Garter Snake, and Gopher Snake (Reclamation 2005a).

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 2005a; Reclamation et al. 2006). Plant species that dominate these backwater areas include various species of willow, sedge, cattail, bulrush, and rush. Riparian vegetation around these ponded areas is composed of mixed-age willow, alder, and cottonwood. 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, American Bittern, Green Heron, Common Merganser, White-Tailed Kite, Wood Duck, Yellow Warbler,

Warbling Vireo, Dusky-Footed Woodrat, Western Gray Squirrel, Pacific Tree Frog, 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, giant reed, pampasgrass, Spanish broom, Himalayan blackberry, and tamarisk, which can rapidly colonize exposed bar surfaces and stream banks.

10.3.3.2.8 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 12, 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 described in subsection 10.3.4.1.4, Agricultural Lands.

10.3.3.2.9 Wildlife Refuges in the Sacramento Valley

The Sacramento Valley supported three major landscape types: wetlands, grassland-prairies, and riparian woodlands (Reclamation et al 2001a). 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 [PFC 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 American Peregrine Falcon, Bald Eagle, Aleutian Canada Goose, Giant Garter Snake, and California Tiger Salamander.

The Sacramento National Wildlife Refuge (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 2013a). 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 2011a). 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 egret, heron, ibis, and grebe, to name a few. 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, sprangletop, and smartweed plants. During these irrigation periods, these units are often used by locally nesting colonial water birds (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 cormorants and pelicans. 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.

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, herons, egrets, 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.

10.3.3.3 San Joaquin Valley

The San Joaquin Valley portion of the Central Valley Region considered in this EIS includes the San Joaquin River from Millerton Lake to the Delta; lower Stanislaus River from New Melones Reservoir to the confluence with the San Joaquin River; San Luis Reservoir; and agricultural areas and wildlife refuges that use CVP and SWP water supplies.

Historically, the San Joaquin Valley was a large floodplain that supported vast expanses of permanent and seasonal marshes, lakes, and riparian areas. Almost 70 percent of the valley has been converted to irrigated agriculture (Reclamation 2005b). Relict stands of alkali desert scrub are widely scattered throughout the San Joaquin Valley, but are generally found in the Tulare Basin in the southern San Joaquin Valley. Annual and perennial grasslands occur throughout the San Joaquin Valley, mostly on level plains and the gently rolling foothills at elevations immediately higher than the patches of alkali desert scrub. Ruderal vegetation is typically associated with road and utility rights-of-way, borders of fields, ditches, and abandoned fields.

As described in subsection 10.3.2, Overview of Species with Special Status, A listing of wildlife and plant species with special status that occur or may occur in portions of the Study Area affected by the long-term coordinated operation of the CVP and SWP is provided in Appendix 10A.

The USFWS has approved a habitat conservation plan for San Joaquin County Multi-species Habitat Conservation and Open Space Plan, Kern Water Bank, and the Metropolitan Bakersfield.

10.3.3.3.1 San Joaquin River

Potential changes in CVP and SWP operations could affect terrestrial resources associated with the San Joaquin River from Millerton Lake to the Delta.

Millerton Lake

Millerton Lake on the San Joaquin River is located in the western foothills of the Sierra Nevada Mountains in an area that ranges from grasslands and rolling hills near Friant Dam, to steep, craggy slopes in the upper reaches of the lake. Vegetation around Millerton Lake consists of a number of terrestrial communities, including annual grassland, oak woodland, foothill pine oak woodland, and chaparral (Reclamation 2011; Reclamation and State Parks 2010).

The most dominant vegetation community near the water edge is the nonnative grassland with blue oak woodland on the slopes above the lake and mixed riparian woodlands along drainages to the lake (Reclamation 2011; Reclamation and State Parks 2010). The dominant grassland species include broad-leaf filaree, fiddleneck, Heermann tarweed, vinegar weed, and ripgut brome, soft chess,

zorro grass. The blue oak woodland also includes gray pine, buck brush, bush lupine, holly-leaf redberry, and hoary coffeeberry. The mixed riparian woodland species include interior live oak and gray pine with red willow, Fremont cottonwood, California buckeye, edible fig, and Oregon ash with an understory of California grape, button bush, Himalayan blackberry, sedges, and nonnative spearmint. Aquatic plants occur along the drainages where the water is relatively stagnant including mosquito fern, common duckweed, dotted duckmeat, punctuate smartweed, tall flat sedge, and broad-leaf cattail. Much of the shoreline is barren or characterized by nonnative grasslands with weedy species, such as Bermuda grass and cocklebur, and sporadic Goodding's black willow.

Mule Deer, California Quail, wild turkey, and feral pig, all of which are game species, occur in the area around Millerton Lake (Reclamation 2011; Reclamation and State Parks 2010). The region provides winter range and migratory routes for the San Joaquin deer herd. A number of special status bat species have potential to occur in the area, and suitable roost sites may be found throughout the area. Other special status species that may occur in the area include the ringtail, American badger, and San Joaquin pocket mouse.

A relatively diverse community of reptile and amphibian species exists in and around Millerton Lake (Reclamation 2011; Reclamation and State Parks 2010). The presence of the nonnative bullfrog has changed, and continues to dramatically alter, the extant reptile and amphibian community through predation and because of its ability to out-compete native species. The Western Pond Turtle is known to occur around the lake. The California Tiger Salamander has also been reported. Limited areas of potential breeding habitat for California tiger salamander, primarily stock ponds dominated by nonnative species, have been identified in the San Joaquin River gorge upstream of the lake.

Bald eagles use roost trees near open water for foraging and are known to winter around Millerton Lake (Reclamation 2011; Reclamation and State Parks 2010). Several species associated with riparian habitats, including the least Bell's vireo and willow flycatcher, occurred historically around the lake, but have not been recently documented. A number of nonnative birds, including European Starling and Brown-Headed Cowbird, influence the native bird community through competition and nest parasitism.

A number of rare and listed plant species are known to occur around Millerton Lake and the upper San Joaquin River (Reclamation 2011; Reclamation and State Parks 2010). These include Ewan's larkspur, Michael's piperia, tree anemone, and Madera leptosiphon. Two plant species which serve as hosts for special status invertebrates, the elderberry and California pipevine, are also known to occur in the area. California pipevine is the obligate host plant for the pipevine swallowtail, a butterfly species and the elderberry shrub is the host plant of the Valley Elderberry Longhorn Beetle.

San Joaquin River from Friant Dam to the Confluence with the Merced River

A multilayered riparian forest dominated by cottonwoods occurs on the active low floodplain of the San Joaquin River along with older stands of cottonwood-

dominated riparian forest in areas that were formerly active floodplains prior to the completion of Friant Dam and associated diversion channels, and the resulting reduction in river flow (DWR and Reclamation 2002; Reclamation and DWR 2011). Other areas on the low floodplain are dominated by willow, with occasional scattered cottonwood, ash, or white alder. California buttonbush is often present and may even dominate the riverbank for stretches.

The intermediate terrace of the floodplain of the San Joaquin River is primarily a mixed-species riparian forest (DWR and Reclamation 2002; Reclamation and DWR 2011). Species dominance in this mixed riparian forest depends on site conditions, such as availability of groundwater and frequency of flooding. Typical dominant trees in the overstory and midstory include Fremont cottonwood, boxelder, Goodding's black willow, Oregon ash, and California sycamore. Immediately along the water's edge, white alder occurs in the upper reaches of the San Joaquin River. Typical shrubs include red willow, arroyo willow, and California buttonbush.

Tree-dominated habitats with an open-to-closed canopy are typically found on the higher portions of the floodplain (DWR and Reclamation 2002; Reclamation and DWR 2011). These areas are exposed to less flood-related disturbance than areas lower on the floodplain. Valley oak is the dominant tree species while California sycamore, Oregon ash, and Fremont cottonwood are present in small numbers. Typical understory species include creeping wild rye, California wild rose, Himalayan blackberry, California wild grape, and California blackberry.

Dense stands of willow shrubs frequently occur within the active floodplain of the river in areas subject to more frequent scouring flows and often occupy stable sand and gravel point bars immediately above the active channel (DWR and Reclamation 2002; Reclamation and DWR 2011). Dominant species include sandbar willow, arroyo willow, and red willow. Occasional emergent Fremont cottonwood may also be present.

Other areas have vegetation consisting of woody shrubs and herbaceous species dominated by different species depending on river reach. Some areas are dominated by mugwort, together with stinging nettle and various tall weedy herbs. Other areas are dominated either by blackberry (usually the introduced Himalayan blackberry) or wild rose in dense thickets, with or without scattered small emergent willows.

Areas with fine-textured, rich alluvium located outside the active channels but in areas that are subject to periodic flooding contain a shrub-dominated community characterized by widely spaced blue elderberry shrubs (DWR and Reclamation 2002; Reclamation and DWR 2011). The herbaceous understory is typically dominated by nonnative grasses and forbs that are characteristic of annual grassland communities, including ripgut brome, foxtail fescue, foxtail barley, red-stemmed filaree, and horseweed.

Emergent wetlands typically occur in the river bottom immediately adjacent to the low-flow channel (DWR and Reclamation 2002; Reclamation and DWR 2011). Backwaters and sloughs where water is present through much of the year support

emergent marsh vegetation, such as tule and cattails. More ephemeral wetlands, especially along the margins of the river and in swales adjacent to the river, support native and nonnative herbaceous species.

Prevalent invasive species found in this portion of the San Joaquin River corridor include red sesbania, tamarisk, giant reed, Chinese tallow, Tree-of-heaven, and perennial pepperweed (Reclamation and DWR 2011). Water hyacinth, water milfoil, Parrot's feather, curly-leaf pondweed, and sponge plant occur within the streams, especially in areas with slow or ponded water.

The riparian forest trees and understory provide habitat for raptors, cavity-nesting birds, and songbirds, including Red-Tailed Hawk, Red-Shouldered Hawk, Swainson's Hawk, White-Tailed Hawk, Downy Woodpecker, Wood Duck, Northern Flicker, Ash-Throated Flycatcher, Pacific-Slope Flycatcher, Olive Sided Flycatcher, Tree Swallow, Oak Titmouse, White-Breasted Nuthatch, Western Wood-Pewee, Warbling Vireo, Orange-Crowned Warbler, Yellow Warbler, Bullock's Oriole, and Spotted Towhee (DWR and Reclamation 2002; Reclamation and DWR 2011). Western Wood-Pewee, Bushtit, Bewick's Wren, Lazuli Bunting, Blue Grosbeak, and American Goldfinch inhabit the riparian scrub vegetation. Song Sparrow, Common Yellowthroat, Marsh Wren, and Red-Winged Blackbird inhabit the emergent wetlands. Coyote, River Otter, raccoon, Desert Cottontail, and Striped Skunk occur in the riparian forest and shrub communities. Shorebirds, such as Killdeer; Mallard Duck; California Vole; Common Muskrat; Norway Rat; Pacific Chorus Frog; Western Pond Turtle; and Western Terrestrial Garter Snake occur near the river.

San Joaquin River from Merced River to the Delta

Downstream of the Merced River confluence, vegetation and wildlife resources along the San Joaquin River are similar to the upstream reaches described above (DWR and Reclamation 2002; Reclamation and DWR 2011). The reach of the San Joaquin River immediately downstream of the Merced River is more incised than areas further downstream and has a less developed riparian area with less understory vegetation. Between the Merced River and the Delta, agricultural land use has encroached on the riparian areas, leaving only a narrow band of riparian habitat. Near the confluence with tributary rivers, in cutoff oxbows, and in the San Joaquin River NWR, there are more extensive riparian habitat areas. Remnant cattail-dominated marshes and tules occur in these areas.

Wildlife species are similar to those found in the reaches upstream of the Merced River described above (DWR and Reclamation 2002; Reclamation and DWR 2011).

10.3.3.3.2 Stanislaus River

The upper Stanislaus River watershed has a drainage area of approximately 980 square miles (Reclamation 2010b). The North, Middle, and South forks of the Stanislaus River converge upstream of the CVP New Melones Reservoir. Water from New Melones Reservoir flows into Tulloch Reservoir. Downstream

of Tulloch Reservoir, the Stanislaus River flows to Goodwin Dam and then approximately 40 miles to the confluence with the San Joaquin River.

New Melones Reservoir

Several broad categories of vegetation have been described in other studies around the New Melones Reservoir, including blue oak woodland and blue oak-foothill pine woodland, grasslands, chaparral, wetlands, and serpentine-based communities (Reclamation 2010b). The montane hardwood and montane hardwood-conifer woodlands occur at higher elevations substantially above the reservoir open water, especially along the eastern portion of the New Melones Reservoir; and are not anticipated to be affected by changes in CVP and SWP operations.

Blue oak woodland vegetation occurs in the western and southwestern portion of New Melones Reservoir, especially on rocky slopes and along riparian corridors (Reclamation 2010b). Oak trees that are established along the shoreline during drier periods are frequently killed when the reservoir fills to the maximum elevation. The blue oak woodland community also includes ponderosa pine, California buckeye, manzanita, ceanothus, yerba santa, foothill pine, scrub oak, black oak, valley oak, interior live oak, coffeeberry, redberry, holly-leaved cherry, and needlegrass. The blue oak-foothill pine woodland occurs at higher elevations along the western and southern areas of the New Melones Reservoir, and includes understory species, including poison oak, woodland star, sugar cup, shooting star, Chinese house, and gooseberry. The oak woodland supports woodpecker, mourning doves, wild turkey, California quail, mule deer, black-tailed deer, western grey squirrel, gray fox, raccoon, feral pig, striped skunk, mountain lion, and bobcat. The transition chaparral zones between the oak woodlands and grasslands support California Thrasher, quail, wrentit, bobcat, Deer Mouse, feral pig, and Fence Lizard.

Annual grasslands occur along adjacent plains and foothills on the western and southern portions of New Melones Reservoir (Reclamation 2010b). The annual plant species, including wild oats, soft chess, ripgut, fiddleneck, longbeak stork's bill, and redstem stork's bill. Perennial grass species include triple-awned grass, wheat grass, bent grass, wild-rye, melic grass, needle-grass, and muhly. The area also includes foothill pine, blue oak, California poppy, and lupines. Grasslands support Meadowlark, Horned Lark, sparrow, quail, mouse, and vole. Raptors that forage in the grasslands include White-Tailed Kite, Northern Harrier, Great Horned Owl, Red-Tailed Hawk, and Swainson's Hawk.

Little riparian vegetation exists along the shoreline of New Melones Reservoir because fluctuating water levels limit the establishment of riparian vegetation (Reclamation 2010b). Riparian vegetation is generally found in the upstream reaches of some of the perennial drainages that flow into the reservoir. Wetland vegetation is found in some locations along the edges of the lake and in moist canyons. There are many riparian communities, seeps, and wet meadows in the upper reaches of streams that are tributaries of the lake. Species in the valley and foothill riparian woodlands include boxelder, Fremont cottonwood, willows, white alder, and big-leaf maple. The wet meadow species include short-hair

sedge, gentian-aster, few-flowered spikerush, carpet clover, bentgrass, pull-up muhly, beaked sedge, Nebraska sedge, Kentucky bluegrass, longstalk clover, and tufted hairgrass.

The open water of New Melones Lake, along with associated shoreline vegetation, provides foraging and resting habitat for a variety of waterfowl and shorebirds (Reclamation 2010b). Several fish-eating bird species, such as grebe, forage in the open water; other species, such as ducks, herons, and egrets, dabble along the shoreline foraging on seeds and small fish in shallow areas. Trees along the shoreline provide nesting areas for osprey. Riparian areas along larger tributaries to New Melones Reservoir provide food, cover, water, and nesting habitat for a variety of wildlife species and serve as travel corridors for species such as black-tailed deer.

Limestone caves are located in portions of the upper reaches of New Melones Reservoir, especially along the Stanislaus River (Reclamation 2010b). Bats use the caves for roosting and breeding. A type of rare spider, New Melones harvestman, was transplanted from caves that were to be inundated through the filling of New Melones Reservoir into neighboring caves.

Tulloch Reservoir

Many vegetation community types characteristic of the New Melones Reservoir and other portions of the Sierra foothills are found around Tulloch Reservoir, including blue oak woodland, chaparral, grassland, various tree-shrub communities dominated by pines, and grasslands (Tri-Dam Project 2008). The elderberry shrub (*Sambucus* species) occurs at multiple locations around the reservoir and may provide habitat for the Valley Elderberry Longhorn Beetle. A number of nonnative weedy species have been documented around the reservoir including Himalayan blackberry, red brome, tree-of-heaven, slenderflower thistle, yellow star thistle, pampas grass, Bermuda grass, and the aquatic parrot's feather. The vegetation along the water edge is affected by daily and seasonal water elevation variability. Wildlife supported by the vegetative community are similar to wildlife communities near New Melones Reservoir as well as Western Pond Turtle, bat, river otter, and mink (Goodwin Power 2013).

Goodwin Dam

Downstream of Tulloch Dam, the Stanislaus River flows to Goodwin Dam, and then continues approximately 40 miles to the confluence with the San Joaquin River. Goodwin Dam serves as a diversion dam for Oakdale Irrigation District, South San Joaquin Irrigation District, and Stockton East Water District, as described in Chapter 5, Surface Water Resources and Water Supplies (Tri-Dam Project 2003, 2007). The Goodwin Dam impounds 502 acre-feet of water along the Stanislaus River approximately 1.6 miles downstream of Tulloch Dam and 8.3 miles downstream of New Melones Dam. Water surface elevations are relatively constant upstream of Goodwin Dam.

The vegetation communities in this area of the Stanislaus River are similar to the vegetation near Tulloch Dam, including hardwood and oak woodlands with blue oak, interior live oak, gray pine, California buckeye, toyon, tree of heaven, and

California black walnut (Tri-Dam 2003). Near the Stanislaus River, the vegetation is characterized by riparian woodland with cottonwood, willows, white alder, blue elderberry, and Himalayan berry. Some low-gradient areas along the shoreline of Goodwin Lake, especially in coves, support small patches of emergent aquatic vegetation such as bulrush and cattail (Goodwin Power 2013). Wildlife occurrences are similar to conditions near Tulloch Reservoir.

Stanislaus River from Goodwin Dam to the Confluence with the San Joaquin River

From Goodwin Dam to Knight's Ferry, the Stanislaus River flows through a bedrock canyon with nearly vertical walls and rock outcrops (DFG 1995). The riparian edge includes valley foothill riparian vegetation in a very narrow band for the entire length of this reach. This habitat is characterized by a canopy layer of cottonwood, California sycamore, and valley oak. Subcanopy cover trees are white alder, boxelder, and Oregon ash. Typical understory shrub layer plants include wild grape, wild rose, California blackberry, elderberry, button brush, and willow. The herbaceous layer consists of sedges, rushes, grasses, miner's lettuce, poison-hemlock, and stinging nettle.

From Knights Ferry to the Orange Blossom Bridge, located to the east of the City of Oakdale, the valley foothill riparian habitat continues along the river (DFG 1995). Further away from the river, vegetation is dominated by blue oak-digger pine woodland and shrub, including California redbud, California buckeye, ceanothus, manzanita, poison oak, and grasslands. Vernal pools and vernal pool complexes are found within adjacent grasslands.

Downstream of the Orange Blossom Bridge, the riparian corridor is virtually nonexistent in some areas with agricultural land uses extending into the riparian corridor (DFG 1995). In a few areas the riparian corridor is wide, such as within Caswell Memorial State Park. The major habitats include valley foothill riparian along the Stanislaus River with annual grasslands and fresh emergent wetlands amount the agricultural and urban developments.

10.3.3.3.3 San Luis Reservoir Complex

The San Luis Reservoir complex, consisting of San Luis Reservoir, O'Neill Forebay, and Los Banos Creek Reservoir, is located in northwestern San Joaquin Valley and is part of the water storage and delivery system for the CVP and SWP. The area is located within several vegetative communities (Reclamation and State Parks 2013). The northern and western portion of the San Luis Reservoir is located within the coastal foothills with blue oak-foothill pine woodlands. The O'Neill Forebay and parts of Los Banos Creek Reservoir are located within the San Joaquin Valley with valley oak habitat.

The vegetation around the San Luis Reservoir complex and wildlife management areas consists of riparian woodlands, blue oak woodlands and savanna, coast live oak woodland, ornamental trees, California sagebrush scrub, grasslands, wetlands, alkali sink scrub, and nonnative and weedy plant communities (Reclamation and State Parks 2013). The riparian woodland and wetland communities occur at the

edge of the reservoirs and along watercourses. The San Luis Wildlife Area also contains blue oak woodland, blue oak savanna, coast live oak woodland, and California sycamore riparian woodland. California sagebrush scrub occurs on hillsides above and to the west of Los Banos Creek Reservoir. Iodine bush scrub occurs at Salt Spring, a tributary to Los Banos Creek Reservoir. Native purple needlegrass occurs throughout the complex.

Along the shorelines, riparian vegetation remains in an early successional stage because either the extreme fluctuation of the water level inundates the vegetation or the vegetation does not receive enough water during the dry season (Reclamation and State Parks 2013). Areas at the edges of O'Neill Forebay and Los Banos Creek Reservoir appear to be slowly changing to riparian vegetation.

A herd of more than 200 tule elk occurs towards the western shoreline of San Luis Reservoir within and near Pacheco State Park (Reclamation and State Park 2013). The herd moves down towards the water edge within the reservoir inundation area when the water elevation is low. Another herd of approximately 60 individuals occur around B.F. Sisk Dam which forms San Luis Reservoir; and approximately 70 tule elk occur throughout other areas in the complex.

10.3.3.3.4 Agricultural Lands in the San Joaquin Valley

The Study Area in the San Joaquin Valley includes the counties of Stanislaus, Merced, Madera, San Joaquin, Fresno, Kings, Tulare, and Kern counties. As described in Chapter 12, Agricultural Resources, field and forage crops dominate the irrigated acreage in the San Joaquin Valley with over 5.5 million agricultural acres. Hay, cotton, and silage are the largest acreages. Second to field and forage crops are orchards and vineyards, making up roughly 35 percent of total acreage. Almonds and grapes are the largest acreages in this category.

Typical terrestrial resources of these crops are described in subsection 10.3.4.1.4, Agricultural Lands. In the grassland and pasture areas, areas not dominated by crops include nonnative grasses, foxtail barley, and forbs (Reclamation and DWR 2011). The grassland and pasture support Northern Harrier, Ring-Necked Pheasant, Mourning Dove, Burrowing Owl, Loggerhead Shrike, Deer Mouse, California Vole, California Ground Squirrel, Botta's Pocket Gopher, American Badger, coyote, Western Toad, Western Fence Lizard, Western Racer, and Gopher Snake. The cropland provides foraging areas for raptors and supports Ground Squirrel, American Crow, Brewer's Blackbird, and European Starling.

10.3.3.3.5 Wildlife Refuges in the San Joaquin Valley

The San Joaquin Valley historically supported three major landscape types: wetlands, grassland-prairies, and riparian woodlands (Reclamation et al 2001b). 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. 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 American Peregrine Falcon, Bald Eagle, Aleutian Canada Goose, Giant Garter Snake, and California Tiger Salamander.

CVP water supplies are provided to the San Luis NWR Complex which includes the Merced NWR, San Luis NWR (including the San Luis Unit, West Bear Creek Unit, East Bear Creek Unit, Freitas Unit, Blue Goose Unit, and Kesterson Unit), and Grasslands Wildlife Management Area (Reclamation 2012; USFWS 2012b, 2013b). The San Luis NWR Complex also includes the San Joaquin River NWR which is influenced by CVP operations; however, this refuge does not specifically receive CVP water under a contract. CVP water supplies are also provided to the Los Banos Wildlife Area; Volta Wildlife Area; Mendota Wildlife Area; and North Grasslands Wildlife Area (including China Island Unit and Salt Slough Unit) (Reclamation 2012b). In the southern San Joaquin Valley, the Kern and Pixley NWRs provide wildlife viewing opportunities.

San Luis National Wildlife Refuge Complex

The San Luis NWR Complex includes wetlands, riparian forests, native grasslands, and vernal pools (USFWS 2012a, 2012b). The refuge is a major wintering ground and migratory stopover point for a wide range of waterfowl, shorebirds, and other waterbirds. The refuge is host to significant assemblages of birds, mammals, reptiles, amphibians, insects, and plants, some of which, such as the California Tiger Salamander and San Joaquin Kit Fox, are endangered species. Riparian woodlands occur along rivers and sloughs with willow, cottonwood, and oak to support egrets, herons, cormorants, raptors, and songbirds (USFWS 2012b). Wetlands occur on over 25 percent of the San Luis NWR Complex lands and provide nesting habitat for coots, grebes, blackbirds, bitterns, ibis, and marsh wrens; and seasonal wetlands for ducks, geese, shorebirds, and other waterbirds. Grasslands occur on over 70 percent of the lands, including the native creeping wild Rye and alkali sacaton, to support elk, Black-Tailed Deer, Desert Cottontail Rabbit, Black-Tailed Jackrabbit, voles, and songbirds. Vernal pools occur in some areas during the spring, especially in the Kesterson NWR and West Bear Creek Unit. Artificial dens and other habitat structures have been constructed on the refuge, including nest boxes for songbirds, owls, and wood ducks; and dens for kit foxes (USFWS 2012a).

San Luis National Wildlife Refuge

The San Luis NWR contains approximately 26,800 acres of wetlands, riparian forests, native grasslands, and vernal pools (USFWS 2012c). Saline and alkaline conditions on portions of the upland habitat support a rich botanical community of

native bunchgrasses, native and nonnative annual grasses, forbs, and native shrubs. Wintering habitat is provided for numerous waterbirds, including green-winged teal, northern shoveler, mallard, gadwall, wigeon, cinnamon teal, northern pintail, ring-necked, canvasback, and ruddy ducks; snow, Ross', and white-fronted geese. Shorebirds include sandpipers and plovers. Tule elk occur in the upland habitats.

Merced National Wildlife Refuge

The Merced NWR contains approximately 10,250 acres of wetlands, native grasslands, vernal pools and riparian areas (USFWS 2012d). In addition to providing breeding habitat for Swainson's Hawk, Tricolored Blackbird, Marsh Wren, and Burrowing Owl; the refuge is host to the largest wintering populations along the Pacific flyway of Lesser Sandhill Crane and Ross' Goose. Mammals such as coyote, Ground Squirrel, rabbit, and beaver are found year-round. Vernal pools are a component of the refuge and are home to many species of vernal pool plants and invertebrates as well as the California Tiger Salamander. Merced NWR also includes approximately 300 acres of cultivated corn and winter wheat crops and more than 500 acres of irrigated pasture for wildlife.

San Joaquin River National Wildlife Refuge

The San Joaquin River NWR encompasses approximately 7,000 acres located where Tuolumne, Stanislaus, and San Joaquin rivers join, creating a mix of habitats for terrestrial wildlife and plan species. Initially established to protect and manage habitat for the Aleutian Cackling Goose, the refuge is currently managed to provide habitat for migratory birds and endangered wildlife species (USFWS 2012e, 2012f). The refuge includes a mosaic of valley oak riparian forest, riverine and slough habitats, seasonal and permanent wetlands, vernal pools, natural uplands, and agricultural fields. Over 500,000 native trees and shrubs such as willow, cottonwood, oak, blackberry, and rose have been planted across 2,200 acres of river floodplain within the refuge, creating the largest block of contiguous riparian woodland in the San Joaquin Valley. Endangered riparian brush rabbits have been re-introduced to this restored habitat from captive-reared populations. These woodlands also support a diversity of breeding songbirds including grosbeak, oriole, flycatcher, warbler, and Least Bell's Vireo; and a heron/egret rookery. The refuge also provides winter and migration habitat for Lesser Sandhill Cranes, Greater Sandhill Cranes, Snow Geese, Ross' Geese, and White-Fronted Goose.

Several nonnative invasive plants influence the quality of wildlife habitat on the refuge including yellow star thistle, perennial pepperweed, poison hemlock, Russian thistle, milk thistle, and bull thistle. According to the Comprehensive Conservation Plan for the refuge (USFWS 2006), infestations are greatest in fallow agricultural fields, roadsides, canal banks, and undergrazed pastures, as well as other disturbed sites. Perennial pepperweed is established throughout the riparian areas of the refuge and stands of giant reed are scattered along the banks of the San Joaquin River. Infestations of water hyacinth seasonally disrupt water delivery and create impenetrable surfaces in the streams, sloughs, oxbows, and canals.

Grasslands Wildlife Management Area

The Grasslands Wildlife Management Area is composed entirely of privately owned lands with perpetual conservation easements to preserve wetland and grassland habitats, and wildlife-friendly agricultural lands along the San Joaquin River (GRCD 2014; USFWS 2013c). The Grassland Resource Conservation District, located within the western portion of the Wildlife Management Area, contains approximately 75,000 acres of private wetlands and associated grasslands, and over 30,000 acres of federal National Wildlife Refuges and State Wildlife Management Area. The area constitutes 30 percent of the remaining wetland habitat in the Central Valley and is a major wintering ground for migratory waterfowl and shorebirds of the Pacific Flyway.

Grassland Resource Conservation District provides habitat for waterfowl, shorebirds, wading birds, songbirds, raptors, and other wildlife species (GRCD 2014; USFWS 2013c). The Grassland Resource Conservation District specifically manages a program to encourage production of natural food plants (such as swamp grass, smartweed, and watergrass). Habitats include seasonally flooded wetlands, moist soil impoundments, permanent wetland, irrigated pasture, and croplands.

Los Banos Wildlife Area

The Los Banos Wildlife Area, located approximately 4 miles northeast of Los Banos, contains more than 6,200 acres in the San Joaquin River floodplain and is dominated by seasonal wetlands (CDFW 2014a; Reclamation 2001b). Permanent and semi-permanent wetlands are also present, along with areas of riparian vegetation. The Los Banos Wildlife Area also supports native and nonnative grasslands. Irrigated pasture and croplands are maintained to provide food, resting, and nesting habitat for waterfowl and other wildlife. Western Pond Turtle, raccoon, Striped Skunk, beaver, muskrat, and mink; as well as over 200 species of waterfowl, shore birds, upland game birds, and song birds occur seasonally throughout the area. Seasonal marshes provide habitat for a wide range of waterbirds, upland birds, and seasonal migrants, including American bittern, snowy egret, killdeer, American avocet, wood duck, and mallard.

Volta Wildlife Area

The Volta Wildlife Area consists of approximately 2,900 acres. The Wildlife Area is partially in the Grassland Resource Conservation District (CDFW 2014b; Reclamation et al. 2001b). The Wildlife Area supports permanent and seasonal wetlands and valley alkali shrub. Irrigated pasture and crops are grown to provide food and nesting cover for migratory waterfowl. Beaver, coyote, cottontail, and 150 species of birds, including a wide range of waterfowl and shorebirds, are found on the Volta Wildlife Area.

Mendota Wildlife Area

The Mendota Wildlife Area contains more than 12,000 acres of flatlands and floodplain (Huddleston 2001; Reclamation et al. 2001b). The Mendota Wildlife Area has been managed primarily to provide seasonal wetland habitat. Water is used to irrigate natural food crops, such as swamp grass, alkali bulrush,

smartweed, and millet, and to flood seasonal and semi-permanent wetlands. Small grains, corn, and pasture are also irrigated in the upland areas. The Wildlife Area has significant white-faced ibis and great-blue heron rookeries. Shorebirds, songbirds, raptors, waterfowl, and wading birds use the wetlands habitat. Mammals that use the refuge include coyote, muskrat, beaver, mink, raccoon, weasel, Black-Tailed jackrabbit, Cottontail Rabbit, Spotted Skunk, Striped Skunks, and Ground Squirrel.

North Grasslands Wildlife Area

The North Grasslands Wildlife Area includes the China Island, Salt Slough, and Galdwall units which encompass 7,069 acres of wetlands, riparian habitat, and uplands (CDFW 2014c). Restoration and enhancement actions have focused on increasing seasonal wetlands, permanent and semi-permanent wetlands, and riparian habitat on the unit, including habitat for the Swainson's hawk and sandhill crane.

The China Island Unit of the North Grasslands Wildlife Area borders the San Joaquin River southwest of the confluence with the Merced River (DFG 2011b). The Salt Slough Unit is located on the west side of Salt Slough, adjacent to the San Luis NWR Complex and Los Banos Wildlife Area. Before its acquisition, the unit consisted mainly of irrigated pasture and was managed as a cattle ranch (DFG 2011c). Habitat on both units includes permanent wetlands that are flooded continuously; semi-permanent wetlands that are flooded in the spring and summer; moist soil vegetation to produce seeds and sustain invertebrates, including swamp timothy, watergrass, and smartweed; seasonal wetlands to provided flooded areas in the fall for waterfowl; riparian habitat, nesting habitat for resident breeding birds, including Short-Eared Owl, Northern Harrier, ducks, and pheasants; upland foraging areas; and pasture which provides late winter and early spring habitat for geese, and other habitat areas for sandhill crane, pheasants, and raptors.

Kern National Wildlife Refuge Complex

The Kern NWR Complex consists of the Kern NWR and Pixley NWR (USFWS 2013d). The Kern NWR contains approximately 11,249 acres including seasonal marsh; moist soil units; and uplands (e.g., grasslands, alkali playa, and valley sink scrub) (USFWS 2013e). Wetlands on the refuge are seasonal in nature. Fall flooding begins in mid-August, with a peak in flooded marsh habitat by January. This habitat is maintained through February, after which the wetland areas are slowly drained. Selected units are irrigated during late spring and early summer to encourage plants to grow, to provide food for wintering and migrating birds the following fall (USFWS 2013e). The refuge is the largest wetland area in the Southern San Joaquin Valley and plays a vital role in the Pacific Flyway for migrating waterfowl, shorebirds, and songbirds. Uplands occupy the northeastern and northwestern portions of the refuge, used by threatened and endangered species, such as San Joaquin Kit Fox, Tipton Kangaroo Rat, and Blunt-Nosed Leopard Lizard. Artificial dens have been built for endangered San Joaquin Kit Foxes and artificial burrows have been provided for Burrowing Owls.

The Pixley NWR contains 6,389 acres of grasslands, vernal pools, and playas along the historic Tulare Lake boundaries (USFWS 2014ak). The refuge includes approximately 300 acres of managed wetlands for waterfowl and shorebirds. San Joaquin Kit Fox, Blunt-Nosed Leopard Lizard, and Tipton Kangaroo rat use the upland areas. Vernal pools also occur on the refuge.

10.3.3.4 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 of 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 of the confluence between the Sacramento and Feather rivers to the confluence of Cache Slough and the Sacramento River in the Delta upstream of Rio Vista and Suisun Marsh. The Delta and Suisun Marsh have a complex web of channels and islands and is located at the confluence of the Sacramento and San Joaquin rivers. As described below in subsection 10.3.4.4.1, 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 2009a).

As described in subsection 10.3.2, Overview of Species with Special Status, A listing of wildlife and plant species with special status that occur or may occur in portions of the Study Area affected by the long-term coordinated operation of the CVP and SWP is provided in Appendix 10A.

10.3.3.4.1 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/Sacramento–San Joaquin Delta (Bay-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 2009a).

The Delta was once composed of extensive freshwater and brackish marshes, with tules and cattails, broad riparian thickets of scrub willows, buttonwillow, 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 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, dallis grass, Bermuda grass, barnyard grass, and Italian ryegrass.

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 saltgrass, alkali weed, saltbush, alkali heath, and iodine bush. 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, common reed, and cattails. The low tidal wetland zone provides foraging habitat for waterfowl and shorebirds, California Ridgway's Rail, California Black Rail, 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, saltgrass, and bulrush. Other species occurring in the middle tidal marsh are fleshy jaumea, sea milkwort, rushes, salt marsh dodder, alkali heath, cattail, sneezeweed, and marsh gumplant (Siegel et al. 2010b). The middle tidal wetland zone provides foraging habitat for salt marsh harvest mouse and Suisun shrew, 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 and Salt Marsh Common Yellowthroat (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 saltgrass, pickleweed, and Baltic rush, and nonnative species, including perennial pepperweed, poison hemlock, and fennel. Other species occurring in the high tidal marsh are saltmarsh dodder, fleshy jaumea, seaside arrowgrass, alkali heath, brass button, and rabbitsfoot grass.

The high tidal marsh provides habitat for special status plants, including Suisun Marsh aster, Soft bird’s beak, and Suisun thistle (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, and brass buttons are typical in the higher elevations of the managed wetlands. In marshes with higher soil salinity, pickleweed, saltgrass, and other salt-tolerant species are dominant. Managed wetlands are managed specifically as habitat for wintering waterfowl species, including Northern Pintail, Mallard, American Wigeon, Green-Winged Teal, Northern Shoveler, Gadwall, Cinnamon Teal, Ruddy, and Canvasback ducks; White-Fronted Goose, 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 in central California. Valley oak and 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, blackberry, buttonbush, mulefat, 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, and Valley Elderberry Longhorn Beetle.

10.3.3.4.2 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 5, Surface Water Resources and Water Supplies, the Yolo Bypass generally extends north to south from Fremont Weir along the Sacramento River (near Verona) to upstream of 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 USACE has developed criteria for managing emergent vegetation (e.g., cattails and bulrushes) in the Yolo Bypass to maintain flood capacity, including no more than 5 percent of the vegetation in seasonal wetlands can be emergent wetlands; no more than 50 percent of the vegetation in permanent wetlands can be emergent wetlands; and riparian vegetation can only occur in specified areas to maintain flood capacity (DFG and Yolo Basin Foundation 2008).

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, eucalyptus, giant reed, and black oak. The understory is typically sparse in this community with limited areas of California grape, blackberry, poison oak, mugwort, grasses, and forbs. The woodland canopy provides habitat for hawks, owls, American Crow, Great Egret, Great Blue Heron, Red-Tailed Kite, Yellow-Rumped Warbler, Black Phoebe, woodpecker, Wood Duck, bat, 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 Central Valley. The species include alder, elderberry, cottonwood, wild rose, blackberry, and boxelder. This habitat supports Black-Crowned Night Heron, Snowy Egret, Belted Kingfisher, Black Phoebe, Swallow, and bat. Riparian scrub habitat frequently occurs adjacent to nonwoody riparian habitat, including false bamboo, cocklebur, weedy annual grasses, sedges, rushes, mustard, sweet clover, thistle, and other weedy species. The nonwoody riparian habitat supports Savannah Sparrow, House Finch, American Goldfinch, California Ground Squirrel, Gopher Snake, and pond turtle.

Remnants of valley oak woodlands and savanna occur on floodplain terraces in fragmented areas, including downstream of Fremont Weir and along the southern portion of the Toe Drain (CALFED et al. 2001). The habitat also includes sycamore, black walnut, wild grape, poison oak, elderberry, blackberry, grass, and sedge.

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 down 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 grebe, ibis, heron, egret, bittern, coot, rails, raptors, muskrat, raccoon, opossum, beaver, Ring-Necked Pheasant, garter snake, Pacific Tree Frog, and 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, water hyacinth. 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, watergrass, smartweed, and cocklebur. These plants are then managed through the timing, duration or absence of summer irrigation. The mudflats support sandpiper, plover, avocet, stilt, and other 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, and Goldeneye; and other water birds, including Pied-Billed Grebe, coot, and moorhen. 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 egret.

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.

10.3.3.4.3 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, harvested, and flooded 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).

10.3.3.4.4 Wildlife Refuges in the Delta, Suisun Marsh, and Yolo Bypass

A number of wildlife areas that could be affected by changes in long-term operations of CVP and SWP 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 and an approximately 9,000-acres "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 ranges of mammals, birds, reptiles, and amphibians similar to those described for other sections of the Sacramento Valley (USFWS 2007). The grasslands, pastures, woodlands support White-Faced Ibis, Geese, Black-Bellied Plover, 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, Bald Eagle, Golden Eagle, American Kestral, Prarie Falcon, Tree Swallow, Barn Swallow, Cliff Swallow, 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, White-Fronted Goose, Snow Goose, 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, coot, Cormorant, and American White Pelican. Other wildlife species on this refuge include coyote, Deer Mouse, Pocket Gopher, Black Tailed Hare, California Vole, California Ground Squirrel, Pacific Tree Frog, bullfrog, pond

turtle, Pond Slider Turtle, Western Fence Lizard, Western Terrestrial Garter Snake, Gopher Snake, Common Garter Snake, California King Snake, and Western Toad.

The riparian cottonwood forests include Fremont cottonwood, Gooding's willow, California grape, California boxelder, California blackberry, white-stemmed raspberry, buttonbush, 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 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 2014d). 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 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 5, Surface Water Resources and Water Supplies. CDFW owns the northernmost 33 acres of Decker Island and has been working with the California Department of Water Resources (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 river otter, mink, beaver, coyote, mice, and voles. Various species of raptors, waterfowl, songbirds, and shorebirds have also been observed. Amphibians and reptiles such as Pacific Tree Frog, Western Fence Lizard, and Gopher Snake have been seen. Invasive plants such as perennial pepperweed, yellow star thistle, water hyacinth, Brazilian water weed and Egeria 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, red alder, and California wild rose. The invasive nonnative, 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 saltgrass. 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, squirrel, voles, Pocket Gopher, feral cats, fox, and coyote. Muskrat and beaver may be found in the marsh vegetation. Typical reptiles and amphibians include Western Fence Lizard, snake, frog, and toad.

Rhode Island Wildlife Area

Rhode Island Wildlife Area is a 67-acre island, located in Contra Costa County that is managed by CDFW (CDFW 2014e). 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; egrets; and Mallard, Cinnamon Teal, and Wood ducks.

White Slough Wildlife Area

The White Slough Wildlife Area, west of Lodi and north of Stockton, is an 880-acre area refuge with open water, freshwater marsh, grassland/upland area, and riparian habitats (CDFW 2014f). The area supports upland game birds such as Ring-Necked Pheasant, California Quail, Mourning Dove, and a range of waterfowl species similar to those described for the Delta and Yolo Bypass.

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 2014g). The area supports a wide variety of waterfowl, including Northern Pintail, Mallard, Northern Shoveler, and Green-Winged Teal ducks; and American wigeon. Ferruginous Hawks and Rough-Legged Hawks winter in the area while year-round residents such as

Golden Eagle, Northern Harrier, and Red-Tailed Hawk which forage over the ponds and upland areas. Mammals including raccoon, jackrabbit, and voles are found here and are preyed upon by the coyotes that hunt and live in the wildlife area.

Grizzly Island Wildlife Area

Grizzly Island Wildlife Area is administered by CDFW and consists approximately 15,300 acres of tidal wetlands and managed marshes within Suisun Marsh (CDFW 2014h, 2014i). 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 Widgeon, Tule Goose, egret, Great Blue Heron, Snowy Egret, Black-Crowned Night Heron, Yellowthroat, Marsh Wren, Suisun Song Sparrow, American White Pelican, Ferruginous Hawk, Sharp-Shinned Hawk, 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 Plush River Otter and Tule Elk.

Point Edith Wildlife Area

Point Edith Wildlife Area is located in Contra Costa County, approximately 2.5 miles east of Martinez. The Point Edith Wildlife Area includes approximately 760 acres of marshes which is accessed by boat. The habitat includes open water and tidal wetlands that support waterfowl, including coot and moorhen (CDFW 2014j).

Fremont Weir Wildlife Area

The Fremont Weir Wildlife Area is located within the Yolo Bypass from the Sacramento River to downstream of 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 5, Surface Water Resources and Water Supplies. The 1,461-acre refuge includes valley oak, willow, cottonwood, brush, and weedy vegetation (CDFW 2014k). The area supports pheasant, Valley Quail, Mourning Dove, a range of waterfowl species similar to those described for the Yolo Bypass, Cottontail Rabbit, and 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 5, Surface Water Resources and Water Supplies. The 360-acre refuge includes valley oak, willow, cottonwood, and weedy vegetation (CDFW 2014l). The area supports raptors, songbirds, 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 and is only accessed by boat through Lindsay Slough (CDFW 2014m). Vegetation in Calhoun Cut includes grasslands, marshes, and riparian vegetation (Witham and Karacfelas 1994). The grasslands include native purple needlegrass grasslands and vernal pools.

10.3.4 San Francisco Bay Area Region

The San Francisco Bay Area Region includes portions of Contra Costa, Alameda, Santa Clara, San Benito, and Napa counties that are within the CVP and SWP service areas. The CVP and SWP water supplies are used in the San Francisco Bay Region by Contra Costa Water District, East Bay Municipal Utility District, Zone 7 Water Agency, Alameda County Water District, Santa Clara Valley Water District, San Benito County Flood Control and Water Conservation District, and Napa County Flood Control and Water Conservation District. The majority of the CVP and SWP water uses in the San Francisco Bay Area Region are for municipal and industrial land uses. Agricultural areas that use CVP and SWP water are located within coastal valleys, especially within the Livermore-Amador valleys of Alameda County, southern Santa Clara County, and northern San Benito County.

Many of these agencies store the CVP and/or SWP water supplies in surface water reservoirs, including CVP Contra Loma and San Justo reservoirs; the SWP Bethany Reservoir and Lake Del Valle; the Contra Costa Water District Los Vaqueros Reservoir; and the East Bay Municipal Utility District Upper San Leandro, San Pablo, Briones, and Lafayette reservoirs and Lake Chabot. CVP and SWP are generally not stored in reservoirs within Santa Clara County (SCVWD 2010). Operation of the reservoirs is dependent upon the volume of CVP and/or SWP water blended with other water supplies used by these agencies. Surface water streams are not used to convey the water from the CVP and/or SWP facilities to the reservoirs. As described in subsection 10.3.2, Overview of Species with Special Status, A listing of wildlife and plant species with special status that occur or may occur in portions of the Study Area affected by the long-term coordinated operation of the CVP and SWP is provided in Appendix 10A.

The USFWS has approved two habitat conservation plans in the areas served by CVP and SWP water supplies, including the East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan and the Santa Clara Valley Habitat Plan (ECCCHCPA 2006; Reclamation et al. 2009; Santa Clara County et al. 2012).

10.3.4.1 Central Valley Project Reservoirs

The CVP reservoirs in the San Francisco Bay Area Region include Contra Loma and San Justo reservoirs.

10.3.4.1.1 Contra Loma Reservoir

The Contra Loma Reservoir is a CVP facility in Contra Costa County that provides offstream storage along the Contra Costa Canal, as described in Chapter 5, Surface Water Resources and Water Supplies. The 80-acre reservoir is part of 661-acre Contra Loma Regional Park and Antioch Community Park (Reclamation 2014a). The Contra Loma Reservoir area includes open space and recreation facilities. In the open space, vegetative communities include grasslands, blue oak woodland, valley foothill riparian, fresh emergent wetlands, riverine, and open water communities. The annual grasslands include smooth brome, slender wild oats, Italian ryegrass, yellow star thistle, white-stem filaree, and mouse-ear chickweed. Valley foothill riparian occurs along intermittent streams and includes valley oaks, cottonwoods, red willows, Himalayan blackberry, poison oak, and mulefat. The riverine and fresh emergent wetland communities include ryegrass, curly dock, hyssop, loosestrife, Baltic rush, flowering quillwort, cattails, rushes, dallisgrass, nutsedge, and cocklebur. Watermilfoil occurs along portions of the shoreline. Recreation areas include urban trees with Oregon ash, black walnut, Fremont cottonwood, blue oak, valley oak, interior live oak, fig, and eucalyptus. East Bay Regional Parks District has initiated restoration actions to improve native grasslands and riparian and provide habitat for quail.

Wildlife in the grasslands areas include Burrowing Owl, Horned Lark, Western Meadowlark, Turkey Vulture, Northern Harrier, American Kestrel, White-Tailed Kite, Red-Tailed Hawk, Brewer's Blackbird, Mourning Dove, Western Fence Lizard, Common Garter Snake, Western Rattlesnake, Black-Tailed Jackrabbit, California Ground Squirrel, Botta's Pocket Gopher, Western Harvest Mouse, California Vole, American Badger, Mule Deer, and coyote (Reclamation 2014a). The valley foothill riparian and blue oak woodland vegetation support a wide range of birds including Northern Flicker, Yellow Warbler, Acorn Woodpeckers, Western Scrub Jay, White-Tailed kite, Cooper's Hawk, Red-Shouldered Hawk, American Kestrel, Great Horned Owl, Song Sparrow, Black Phoebe, European Starling, Western Bluebird, and Tree Swallow. The valley foothill riparian and blue oak woodland vegetation also support Pacific Tree Frog, Red-legged Frog, Sharp-Tailed Snake, California Alligator Lizard, Common Garter Snake, Mule Deer, Raccoon, Coyote, Striped Skunk, Deer Mouse, Harvest Mouse, Dusky-Footed Woodrat, and Gray Fox. Riverine and wetlands, and open water support Brewer's Blackbird, Red-Winged Blackbird, Brown-Headed Cowbird, Great Blue Heron, Great Egret, ducks, American Coot, Common Merganser, Double-Crested Cormorant, American Wigeon, Canada Goose, Western Grebe, and gull; Pacific Tree Frog, Red-legged Frog, Bullfrog, California Tiger Salamander, Western Pond Turtle, Western Toad, and Garter Snake; Deer Mouse, California Vole, Long-Tailed Weasel, and other mammals that use the adjacent woodlands and grasslands.

10.3.4.1.2 San Justo Reservoir

The San Justo Reservoir is a CVP facility in San Benito County that provides offstream storage as part of the San Felipe Division, as described in Chapter 5, Surface Water Resources and Water Supplies. The reservoir is surrounded by steep hills with recreational facilities on the northeast side reservoir and intermittent streams, wetlands, and open water downslope of the reservoir (SBCWD 2012). Adjacent land uses are dominated by irrigated row crops, orchards, and rangeland. Vegetation and wildlife resources of the reservoir area are consistent with grasslands vegetation on uplands.

10.3.4.2 State Water Project Reservoirs

Bethany Reservoir, Patterson Reservoir, and Lake Del Valle are SWP facilities associated with the South Bay Aqueduct in Alameda County, as described in Chapter 5, Surface Water Resources and Water Supplies.

Vegetative communities around Bethany Reservoir are characterized by nonnative grasses with several areas of woodland habitat (DWR 2014). The grassland habitat includes slender oat, ripgut brome, soft chess, wild barley, Italian ryegrass, black mustard, bull thistle, redstem filaree, dissected geranium, English plantain, and tumble mustard; and forbs, including sweet fennel, Great Valley gumweed, Mediterranean linseed, and Ithuriel's spear. The woodland habitat includes white ironbark, Casuarina, and Bishop pine. Coyote bush occurs along the water edge. The grasslands provide habitat for Mourning Dove, Western Scrub-Jay, Finches, Sparrows, Owls, Hawks, California Ground Squirrel, Black-Tailed Jackrabbit, Audubon's Cottontail, Botta's Pocket Gopher, California vole, mice, frogs, toads, salamanders, snakes, lizards, and turtles. The woodlands support Red-Tailed Hawk, Osprey, Owls, Black Phoebe, Bullock's Oriole, Yellow Warbler, amphibians and reptiles, and coyote. Emergent vegetation does not occur along the shoreline at Bethany Reservoir (DWR 2005).

Patterson Reservoir is a small, 100-acre-foot, SWP reservoir located along the South Bay Aqueduct between Bethany Reservoir and Lake Del Valle. Vegetation around Patterson Reservoir is characterized by grasslands and upland habitat. Red-legged Frog has been observed in the vicinity of Patterson Reservoir (DWR 2014).

Lake Del Valle is a 77,100 acre-foot SWP facility located along the South Bay Aqueduct (DWR 2001). Vegetation around Lake Del Valle includes grasslands, chaparral, shrub, oak woodland, and riparian and freshwater habitats (EBRPD 1996, 2001, 2012, 2013). The grasslands include nonnative grasses and native perennial bunchgrass. The nonnative grasslands include grasses such as wild oats, bromes, ryegrass, wild barley, silver hairgrass, and dogtail grass; forbs, including filaree, clover, and plantain; and lupine, yarrow, and soap plant. Native grasses include annual and perennial fescues, needlegrass, wild ryes, junegrass, and California bromegrass. The coastal scrub and chaparral vegetation includes coyote brush-scrub, California sagebrush, manzanita, black sage, cream bush, California coffeeberry, yerba santa, blackberry, bush monkeyflower, and poison oak. The oak woodlands and riparian woodlands include coast live oak, black

oak, valley oak, scrub oak, California bay, and California buckeye. Mixed deciduous riparian woodland occur along perennial streams, including white alder, big-leaf maple, western sycamore, willow, and Fremont cottonwood. Along springs and seeps, the vegetation includes rabbitsfoot grass, saltgrass, bentgrasses, rushes, tules, sedges, horsetails, and cattail, buttercup, brass-button, mint, duckweed, pondweed, and ferns.

10.3.4.3 Contra Costa Water District Los Vaqueros Reservoir

Los Vaqueros Reservoir is a Contra Costa Water District offstream storage facility in Contra Costa County, as described in Chapter 5, Surface Water Resources and Water Supplies. The area around the Los Vaqueros reservoir includes grasslands, upland scrub, valley and foothill woodlands, freshwater wetlands, and open water habitats (Reclamation et al. 2009). The grasslands include perennial and alkali habitats with wild oats, ripgut brome, yellow star thistle, fescue, filaree, mustard, fiddleneck, lupine, popcorn flower, and California poppy. The grasslands support Northern Harrier, Burrowing Owl, Western Meadowlark, California Horned Lark, Turkey Vulture, Red-Tailed Hawk, American Kestrel, White-Tailed Kite, Western Fence Lizard, Common Garter Snake, Western Rattlesnake, California Tiger Salamander, Western Harvest Mouse, California Ground Squirrel, Black-Tailed Jackrabbit, Black-Tailed Deer, and San Joaquin Kit Fox.

The upland scrub habitat is dominated by evergreen chaparral species and coastal scrub, including chamise, California sagebrush, black sage, poison oak, bush monkeyflower, and California buckwheat underlain by annual grasses and purple needlegrass (Reclamation et al. 2009). This habitat supports California Quail, Western Scrub-Jay, Bushtit, California Thrasher, Spotted Towhee, Sage Sparrow, Western Fence Lizard, Common Garter Snake, Common King Snake, Western Rattlesnake, California Mouse, Deer Mouse, and feral pig.

The valley and foothill woodlands and riparian woodlands includes willow, Fremont cottonwood, valley oak, sycamore, black walnut, California buckeye, Mexican elderberry, and Himalayan blackberry which occur along much of Kellogg Creek (Reclamation et al. 2009). This habitat supports many birds, reptiles, amphibians, and mammals, including red-legged frog. The freshwater emergent habitat includes meadows with wetland species and stream channels. The vegetation includes tules, bulrushes, and cattail. Wildlife that occurs in this area include Marsh Wren, Common Yellowthroat, Red-Winged Blackbird, Red-legged Frog, and Western Pond Turtle. The open water habitat of the Los Vaqueros Reservoir provides forage, winter, and brood habitat for Canada Goose; American Wigeon; Wood,, Gadwall, Mallard, Northern Shoveler, Northern Pintail, Green-Winged Teal, Canvasback, Redhead, Ring-Necked, Greater Scaup, Lesser Scaup, Bufflehead, Common Goldeneye, Hooded Merganser, Common Merganser, and Ruddy ducks; and other habitat values for grebe, sandpiper, pelican, cormorant, egret, heron, and gull.

10.3.4.4 East Bay Municipal Utility District Reservoirs

The East Bay Municipal Utility District reservoirs in Alameda and Contra Costa County used to store water within and near the East Bay Municipal Utility District service area include Briones Reservoir, San Pablo Reservoir, Lafayette Reservoir, Upper San Leandro Reservoir, and Lake Chabot. Water stored in these reservoirs includes water from local watersheds, the Mokelumne River watershed, and CVP water supplies, as described in Chapter 5, Surface Water Resources and Water Supplies.

The Briones Reservoir watershed is characterized by grasslands, chaparral, coastal scrub, oak and bay woodlands, riparian, and freshwater wetlands (EBMUD 1999; EBRPD 1996, 2001, 2013). The San Pablo Reservoir watershed is characterized by grasslands, hardwood forest, coastal scrub, Monterey pine planted along the reservoir shoreline, riparian woodland, and eucalyptus. The Lafayette Reservoir watershed is characterized by grasslands, oak and bay woodland, and coastal scrub. The Upper San Leandro Reservoir watershed includes grasslands, chamise-black sage chaparral, coastal scrub, oak and bay woodland, redwood forest, knobcone forest with a dense manzanita understory, and an 18-acre freshwater marsh. The Lake Chabot watershed includes grasslands, coastal scrub, oak and bay woodland, and riparian and freshwater vegetation.

The grasslands vegetative communities generally include nonnative grasses and native perennial bunchgrass (EBMUD 1999; EBRPD 1996, 2001). The nonnative grasslands include grasses such as wild oat, bromegrass, ryegrass, wild barley, bluegrass, silver hairgrass, and dogtail grass; forbs, including filaree, bur clover, clovers, owls clover, cat's ear, and English plantain; and brodiaeas, lupine, mariposa lilies, mule's ear, yarrow, farewell to spring, and soap plant. Native grasses include annual and perennial fescues, needlegrass, wild rye, California oatgrass, junegrass, bluegrass, squirreltail, meadow barley, and California bromegrass. Grasslands are used by wildlife similar to those described for other San Francisco Bay Area reservoirs, including hawks, owls, shrikes, swallows, turkey vulture, reptiles, coyote, fox, bobcat, and mice.

The coastal scrub and chaparral vegetation includes coyote brush-scrub, California sagebrush, bitter cherry scrub, manzanita, chamise-black sage, cream bush, California coffeeberry, wild lilac, yerba santa, blackberry, bush monkeyflower, and poison oak (EBMUD 1999; EBRPD 1996, 2001). The woodlands include native and nonnative plants. The native redwood and knobcone pine forests are located at Upper San Leandro Reservoir and provide unique habitat. Nonnative eucalyptus and Monterey pine forests occur at San Pablo Reservoir and Lake Chabot. The eucalyptus trees provide specific habitat for hummingbird, Bald Eagle, Great Blue Heron, and Great Egret. The oak and bay woodlands and oak savannas include coast live oak, black oak, valley oak, blue oak, interior live oak, canyon live oak, California bay, California buckeye, and madrone.

Mixed deciduous riparian woodland occur along perennial streams, including white alder, big-leaf maple, western sycamore, Fremont cottonwood, and black cottonwood that supports frogs, newts, and other amphibians; coast live oak, California bay, and willow woodlands on steep slopes along intermittent streams; and willow riparian scrub along perennial and intermittent streams (EBMUD 1999; EBRPD 1996, 2001). Along springs and seeps, the vegetation includes grasses, includes rabbitsfoot grass, saltgrass, bentgrasses, rushes, tules, sedges, horsetails, and cattail; and forbs includes buttercup, watercress, stinging nettle, brass-buttons, mints, duckweed, and pondweed.

10.3.5 Central Coast Region

The Central Coast Region includes portions of San Luis Obispo and Santa Barbara counties served by the SWP. The SWP water is provided to the Central Coast Region by the Central Coast Water Authority (CCWA 2013). The facilities divert water from the SWP California Aqueduct at Devil's Den and convey the water to a water treatment plant at Polonto Pass. The treated water is conveyed to municipal water users in San Luis Obispo and Santa Barbara counties to reduce groundwater overdraft in these areas. Water is delivered to southern Santa Barbara County communities through Cachuma Lake.

As described in subsection 10.3.2, Overview of Species with Special Status, A listing of wildlife and plant species with special status that occur or may occur in portions of the Study Area affected by the long-term coordinated operation of the CVP and SWP is provided in Appendix 10A.

10.3.5.1 Cachuma Lake

Cachuma Lake is a facility owned and operated by Reclamation in Santa Barbara County, as described in Chapter 5, Surface Water Resources and Water Supplies. The Cachuma Lake watershed is located in the Coast Range and extends into the Los Padres National Forest. The primary habitats include hardwood woodland, chaparral, coastal sage scrub, nonnative grassland, and riparian woodland and scrub (Reclamation 2010c). The hardwood woodlands includes oak woodland, oak savannah, and pine woodland with blue oak, coast live oak, gray pine, skunk brush, and poison oak. The chaparral and coastal sage scrub includes mountain mahogany, greenbark ceonothus, blue oak, interior live oak, scrub oak, holly leaf redberry, buck brush, toyon, chaparral mallow, chamise, California sage brush, purple sage, deer weed, and coyote brush-scrub with understory of grasses and forbs. Birds that use the hardwood woodlands and savannah include Turkey Vulture; raptors including Red-Tailed Hawk and Bald Eagle; woodpecker, California Quail, Rufous-Crowned Sparrow, wrentit, California Thrasher, and Spotted Towhee. Nonnative grasslands are dominated by rip-gut brome and dove weed. Native grasses include purple needlegrass, blue-eyed grass, Johnny-jump-up, Chinese houses, rusty popcorn flower, slender cottonseed, forget-me-not, lupine, mountain dandelion, checkerbloom, narrow-leaved milkweed, fleabane, vinegar weed, California milkweed, and verbena.

Riparian habitat along streams and stream terraces include arroyo willow, red willow, yellow willow, black willow, sycamore, oak, cottonwood, Pacific blackberry, California rose, poison oak, elderberry, mulefat, California goldenrod, California brome, black mustard, mugwort, clover, stinging nettle, red brome, and California buckwheat (Reclamation 2010c). Habitat near the shoreline of Cachuma Lake includes willows, tamarisk, cattail, mulefat, and mugwort. Disturbed lands around the lake are characterized by weedy species, including yellow star thistle, Spanish broom, tamarisk, giant reed, pampas grass, scotch broom, veldt grass, perennial pepperweed, red brome, fennel, and cheatgrass. Marginal vegetation, reedy marshes, and riparian woodland support killdeer, spotted Sandpiper, Red-Winged Blackbird, Common Yellowthroat, Song Sparrow, Marsh Wren, Warbling Vireo, Yellow Warbler, Yellow-Breasted Chat, and Brown-Headed Cowbird. The open water of Cachuma Lake supports diving birds, including diving duck, American Coot, Pied-Billed Grebe, Western Grebe, Clark's Grebe, Double-Crested Cormorant, Heron, Egret, pelican, Osprey, and Bald Eagle. Amphibians and reptiles that occur near Cachuma Lake include Monterey Salamander, California Slender Salamander, Western Spadefoot, California Toad, Pacific Tree Frog, Bullfrog, Red-legged Frog, Yellow-Legged Frog, Southwestern Pond Turtle, Western Skink, and Southern Alligator Lizard. Mammals which depend upon habitat near Cachuma Lake include bat, hare, rabbit, pika, bear, coyote, fox, weasel, raccoon, cats, chipmunk, squirrel, marmot, shrew, mice, rat, mule deer, and feral pig.

10.3.6 Southern California Region

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

As described in subsection 10.3.2, Overview of Species with Special Status, A listing of wildlife and plant species with special status that occur or may occur in portions of the Study Area affected by the long-term coordinated operation of the CVP and SWP is provided in Appendix 10A.

The USFWS has approved several habitat conservation plans in the Southern California Region within areas served by CVP and SWP water, including the following plans (County of Orange 1996; Riverside County 2003; Riverside County Habitat Conservation Agency 2014; SDCWA and USFWS 2010; San Diego County 2014a, 2014b, 2015; SANDAG 2003; CVAG 2007).

- County of Orange Central and Coastal Subregion Natural Community Conservation Plan and Habitat Conservation Plan.
- Western Riverside County Multiple Species Conservation Plan.
- Habitat Conservation Plan for the Stephen's Kangaroo Rat in Western Riverside County which is administered by the Riverside County Habitat Conservation Agency for Riverside County and the cities of Corona, Hemet, Lake Elsinore, Menifee, Moreno Valley, Murrieta, Perris, Riverside, Temecula, and Vail Lake, and which includes areas around Diamond Valley Lake and Lake Skinner.
- San Diego County Water Authority Subregional Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP).
- San Diego County Multiple Species Conservation Plan including the initial area which includes the lands served by the City of San Diego Wastewater Sewer System; future North County Plan expansion (extends from the areas near the cities of Oceanside, Encinitas, San Marcos, Vista, and Escondido to the Cleveland National Forest and Riverside County boundary), and remaining land within the county (including lands from Alpine east to the Imperial and Riverside counties boundaries).
- Multiple Habitat Conservation Program for the cities of Carlsbad, Encinitas, Escondido, Oceanside, San Marcos, Solana Beach, and Vista.
- Coachella Valley Multiple Species Habitat Conservation Plan.

10.3.6.1 State Water Project Reservoirs

The SWP reservoirs include Quail Lake, Pyramid Lake, and Castaic Lake in Los Angeles County; Silverwood Lake and Crafton Hills Reservoir in San Bernardino County; and Lake Perris in Riverside County, as described in Chapter 5, Surface Water Resources and Water Supplies.

Quail Lake was formed by seismic activity on the San Andres Fault and enlarged by the Department of Water Resources (DWR) as part of the West Branch of the SWP (DWR 1997). Quail Lake is bordered by the Tehachapi and Liebre Mountains. The area is characterized by cottonwood and oak woodlands that support Crested Sparrow, Red-Winged Blackbird, Golden Eagle, Red-Tailed Hawk, fox, coyote, deer, squirrel, and Pronghorn Antelope. The open water habitat support Canada Geese, egrets and Blue Herons

Pyramid Lake is located in the Angeles and Los Padres National Forests, as described in Chapter 15, Recreation Resources. Upland areas around Pyramid Lake are assumed to be similar to upland areas around Middle Piru Creek downstream of Pyramid Dam (DWR 2004c). The vegetative communities include coastal sage scrub and chaparral with oak woodlands and nonnative grasslands. Water is released from Pyramid Lake to provide habitat flows in Piru Creek, including flows to support habitat for the Arroyo Toad.

Terrestrial resources for Castaic Lake include coastal scrub, red shank-chamise chaparral, and chaparral scrub (DWR 2007b). Castaic Lagoon is located immediately downstream of Castaic Dam and is surrounded by coastal scrub. Vegetation includes pines, eucalyptus, and nonnative and native grasses. The habitat is used by Western Grebe, Canada Goose, Mallard Duck, gull, American Coot, Bald Eagle, and Western Mastiff Bat.

Silverwood Lake is located in the San Bernardino National Forest and surrounded by the Silverwood Lake State Recreation Area at the edge of the Mojave Desert and at the base of the San Bernardino Mountains. The area contains a wide variety of vegetative communities including live oak and scrub oak woodlands, ponderosa pine and Douglas-fir forests, mixed scrub, chaparral, and riparian hardwood (State Parks 2006, 2009). Chamise, interior live oak, manzanita, mountain mahogany, and ceanothus are found along the shoreline and willow, alders, and sycamores grow along area streams. The forest, chaparral, and riparian woodland habitats support a wide variety of small mammals, reptiles, and amphibians including rabbit, squirrel, woodrat, Western Fence Lizard, Rattlesnake, Pacific Tree Frog, California Toad, coyote, Mule Deer, bobcat, beaver, and skunk. The open water supports Great Blue Heron, Western Grebe, Avocet, Egret, Canada Goose, and ducks. A number of raptors are found around the lake including Bald Eagle, Osprey, owls, Cooper's Hawk, and Red-Tailed hawk.

The Crafton Hills Reservoir area includes 4.5 acres of open water and 1.9 acres of open space (DWR 2009b). The open space is characterized by chaparral scrub and grass species, including chamise, golden yarrow, hoaryleaf ceanothus, brittlebush, California sagebush, California buckwheat, deerweed, black sage, purple needlegrass, heartleaf penstemon, ripgut grass, soft chess, foxtail chess, wild oat, Italian thistle, tocalote, short-pod mustard, and wild oat. The area is used by Mallard Duck, Killdeer, Red-Tailed Hawk, Cassin's Kingbird, and Wrentit; California Toad, Pacific Tree Frog, Western Fence Lizard, Common Side-Blotched Lizard, and California Kingsnake; and Desert Cottontail, Desert Woodrat, coyote, raccoon, and bobcat.

Lake Perris is located adjacent to the cities of Moreno Valley and Perris and the Perris Fairgrounds which includes a motor sports complex (DWR 2010a). Lake Perris is located within the Lake Perris State Recreation Area which provides extensive recreational opportunities, as described in Chapter 15, Recreation Resources. The open space areas are characterized by willow and sage scrub, willow and eucalyptus woodland, and nonnative grassland. The scrub areas include California sagebrush, lemonadeberry, sugarbush, yellow bush penstemon, coyote brush, Mexican elderberry, sweetbush, boxthorn, tall prickly-pear, California buckwheat, red brome, bur ragweed, California aster, ripgut brome, sticky monkeyflower, prickly sow thistle, and Russian thistle. The willow woodland includes Goodding's black willow, red willow, narrow leaved willow, Fremont's cottonwood, California sycamore, gooseberry, mulefat, tarragon, curley dock, ragweed, southwestern spinyrush, and bromes. Eucalyptus woodland includes eucalyptus underlain by nonnative grassland. Nonnative

grasslands includes soft chess, wild oat, foxtail barley, mustard, sweet fennel, California sagebrush, and California buckwheat. Habitat has been restored within the grasslands to provide habitat for the Stephen's Kangaroo Rat. Mourning Dove, Anna's Hummingbird, raven, California Kingsnake, Raccoon, Black-Tailed Deer, Striped Skunk, coyote, and bobcat use the shoreline. The woodland is used by Ash-Throated Flycatcher, Western Kingbird, Least Bell's Vireo, House Wren, California Towhee, Spotted Towhee, Black-Headed Grosbeak, Blue Grosbeak, Song Sparrow, Bullock's Oriole, House Finch, Lesser Goldfinch, Nuttal's Woodpecker, Red-Tailed Hawk, Red-Shouldered Hawk, Cooper's Hawk, Cottontail Rabbit, Black-Tailed Jackrabbit, raccoon, and Long-Tailed Weasel. The scrub supports California Quail, Greater Roadrunner, White-Throated Swift, Rock Wren, California Towhee, Western Fence Lizard, Gopher Snake, Red Diamond Rattlesnake, Southern Pacific Rattlesnake, Side Blotched Lizard, Granite Spiny Lizard, Coastal Western Whiptail, Black-Tailed Jackrabbit, bobcat, coyote, and rodents.

10.3.6.2 Non-SWP Reservoirs in Riverside County

Non-SWP reservoirs in Riverside County that store SWP water include Diamond Valley Lake and Lake Skinner that are owned and operated by Metropolitan Water District of Southern California, and Vail Lake that is owned and operated by Rancho California Water District, as described in Chapter 5, Surface Water Resources and Water Supplies.

Diamond Valley Lake is located adjacent to the City of Hemet along the northern boundary, and adjacent to pasture and dairies along the eastern and western boundaries (City of Hemet 2012). Sage scrub and nonnative grasslands occur between the lake and the City of Hemet. Chaparral with sage scrub occur along the southern boundary of the lake. Riversidean sage scrub includes California sagebrush, flat top buckwheat, black sage, and California encelia. Wildlife movement corridors occur around Diamond Valley Lake. Open space around Lake Skinner is also characterized by grassland and sage scrub vegetation (USFWS 2004).

Diamond Valley Lake and Lake Skinner are located within the Southwestern Riverside County Multi-Species Reserve, an area of 11,000 acres surrounding and connecting Diamond Valley Lake and Lake Skinner through the Dr. Roy Shipley Reserve (MWD 2014). At least eight types of habitat are found in the reserve, but coastal sage scrub, nonnative grassland, and chaparral are dominant. There are smaller areas of coast live oak woodland, willow scrub with live oak, and cottonwood-willow riparian forests. The reserve is home to the California Gnatcatcher, Bell's Sage Sparrow, San Diego Horned Lizard, Payson's Jewelflower, and Parry's Spineflower.

Areas around Vail Lake support habitat for Bald Eagle, Golden Eagle, and Great Blue Heron (RCWD 2015).

10.3.6.3 Non-SWP Reservoir in Ventura County

Lake Piru, located in Ventura County, is used to store SWP water by United Water Conservation District, as described in Chapter 5, Surface Water Resources and Water Supplies (UWCD 1999, 2014). The area surrounding the lake is characterized by chaparral on the hills and coast live oak woodlands along the stream channels.

10.3.6.4 Non-SWP Reservoirs in San Diego County

Reservoirs in San Diego County that are used to store SWP water include the City of Escondido Dixon Lake; City of San Diego San Vicente, El Capitan, Lower Otay, and Lake Hodges reservoirs; Lake Jennings owned by Helix Water District; and Sweetwater Reservoir owned by Sweetwater Authority.

Dixon Lake is located in the hills above the City of Escondido within the Escondido Multiple Habitat Conservation Plan area (City of Escondido 2012). Habitat around Lake Dixon is characterized by coastal sage scrub and chaparral. The coastal sage scrub includes California sagebrush, flat-top buckwheat, white sage, laurel sumac, black sage, California encelia, San Diego County viguiera, goldenbush, coast prickly-pear, and lemonadeberry and sugarbush. Chaparral includes chamise, scrub oak, toyon, thick-leaf ceanothus, black sage, wild cucumber, morning glory, saw-toothed goldenbush, and nonnative grasses.

The San Vicente Reservoir is characterized by rocky or coarse sand, with occasional willow trees and mulefat (SDCWA and USACE 2008). The constantly fluctuating water levels make it difficult for wetland or riparian vegetation to become established. Much of the shoreline around San Vicente Reservoir, therefore, is a non-vegetated fringe. Outside of the fringe, the area around the reservoir is primarily sage scrub with nonnative grassland and coast live oak woodland. Along the stream channel, vegetation includes southern willow scrub and live oak riparian forest with chaparral. Submerged aquatic vegetation occurs in an intermittent band surrounding almost the entire reservoir. Freshwater marsh vegetation of cattail, bulrush, and sedges occurs between the open water and lakeshore fringe. Birds associated with the open water include grebe, cormorant, heron, egret, ducks and geese, coot, plover, sandpiper, gull, and tern. Other birds associated with open water and riparian habitats include the bald eagle, osprey, and kingfisher. The uplands support rabbit, snakes, lizards, ground squirrel, pocket gopher, raccoon, mule deer, bats, mice, fox, skunk, bobcat, and mountain lion.

El Capitan Reservoir is located within Diegan coastal sage scrub with areas of oak woodlands and chaparral (San Diego County 2011; SDRWWG 2005; SDRP 2015). The Lower Otay Reservoir, Lake Hodges, and Lake Jennings are located within coastal sage scrub. Sweetwater Reservoir is surrounded by coastal sage scrub and chaparral with riparian forest along stream channels.

10.3.6.5 Non-SWP Reservoir in San Bernardino County

Lake Arrowhead, in San Bernardino County, is used to store SWP water by the Lake Arrowhead Community Services District (County of San Bernardino 2011; LACSD 2014a, 2014b). Lake Arrowhead is located within chaparral, sage scrub, oak woodlands, oak and sycamore woodlands, dogwood tree along the lake, cottonwood and willow forests along stream channels, Ponderosa pine forests, and wetlands. The habitat supports Stellar Jay, blue jay, quail, ducks, western Tanager, Northern Tanager, woodpecker, chickadee, Barn Owl, Bald Eagle, hawks, rattlesnake, coyote, bobcat, Black Bear, Gray Squirrel, Ground Squirrel, chipmunk, raccoon, mountain lion, skunk, and cougar.

10.4 Impact Analysis

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

10.4.1 Potential Mechanisms for Change and Analytical Methods

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

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

10.4.1.1 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 of barren zones through reservoir drawdown can also affect the ability of wildlife species to access water, which could cause them to be more vulnerable to predation.

As described in Chapter 5, Surface Water Resources and Water Supplies, surface water elevations would be similar in all months and all water year types at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir under Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison. Surface water elevations would change at San Luis Reservoir under Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison. However, it does not appear that nesting fish-eating raptors or ground-nesting waterfowl use the San Luis Reservoir shoreline during these nesting lifestages (Reclamation 2013). Therefore, changes in CVP and SWP operations under the alternatives would

result in similar conditions (within 5 percent change) for terrestrial resources at CVP and SWP reservoirs; and these factors are not analyzed in this EIS.

10.4.1.2 Changes in Rivers Downstream of the CVP and SWP Reservoirs

Operation of the CVP and SWP would influence flow regimes that renew and support adjacent riparian and wetland plant and wildlife communities. For example, certain riparian plants (e.g., willows) 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. The analysis is focused on Trinity, Sacramento, Feather, American, and Stanislaus rivers because these rivers are used to convey water from the reservoirs to CVP and SWP water users. Therefore, changes in CVP and SWP operations could result in substantial changes in flow patterns in these rivers. At other reservoirs that are used to store CVP and SWP water supplies (e.g., San Luis Reservoir), the CVP and SWP water are conveyed from the reservoirs in canals or pipelines. The reservoirs may be operated to provide minimum flows to support habitat in streams adjacent to these reservoirs; however, changes in CVP and SWP operations would not affect the minimum instream flow releases. Therefore, changes in terrestrial resources in these streams is not analyzed in this EIS.

Channel maintenance flows to improve adjacent floodplain habitat conditions would occur along Clear Creek under the No Action Alternative and Alternatives 2 and 5, to the extent possible. The high-flow, short-duration pulse flows would be released, if physically possible, from Whiskeytown Lake to mobilize streambed material in Clear Creek in accordance with the 2009 NMFS Biological Opinion (BO).

10.4.1.3 Changes in Sacramento, American, and Stanislaus Rivers Habitats due to Fish Passage at Dams

Fish passage would be provided under the No Action Alternative and Alternative 5 around Shasta, Folsom, and New Melones dams. Salmon runs play an important role in the transfer of large quantities of marine-derived nutrients to adjacent forest ecosystems with profound effects on plant and wildlife production. Spawning salmon contribute to the release of nutrients into streams through normal metabolic processes, release of gametes during spawning, decay of their carcasses following death, and through consumption of their flesh by predators and scavengers (Merz and Moyle 2006). Returning fish to the upper stream segments, fish passage could influence the forest ecosystem and associated wildlife in the upper watersheds and result in less nutrients along the rivers downstream of the dams. This analysis would assume that the objectives of the 2009 NMFS BO were achieved by 2030, including implementation of fish passage at these CVP reservoirs. However, any changes in nutrients in the stream corridors are expected to be minimal. Therefore, habitat conditions related to changes in nutrient loading associated with fish passage actions would be the same under Alternatives 1 through 5 as under the No Action Alternative and the

Second Basis of Comparison. Therefore, this potential change is not analyzed in this EIS.

10.4.1.4 Changes in River and Delta Floodplains

Alternative 4 assumes additional institutional requirements for development within the floodplain and floodways that would require compliance with Endangered Species Act in defining floodplain map revisions, allow for improvements in floodplain management criteria to support natural and beneficial functions, and prohibit new development and substantial improvements to existing development within any designated floodway or within 170 feet of the ordinary high water line of any floodway. However, as described in Chapter 13, Land Use, in 2030, development along major river corridors in the Central 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 and the Second Basis of Comparison, would prevent development within the Delta floodplains and floodways and in the Sacramento, Feather, American, and San Joaquin rivers corridors upstream of the Delta, as described in Chapter 13. Provisions in Alternative 4 would require additional setbacks along the floodways as compared to other alternatives and the Second Basis of Comparison. The qualitative analysis considers the potential changes in habitat due to these changes in floodplain and floodway development regulations.

Another potential change in Delta habitat would occur under Alternative 4, additional vegetation would remain along the levees in the Delta as compared to conditions under the other alternatives, the No Action Alternative, and the Second Basis of Comparison, as described in Chapter 3, Description of Alternatives. Under Alternatives 1, 2, 3, and 5; the No Action Alternative; and the Second Basis of Comparison existing vegetation would remain along the Delta levees until the levees are repaired. Following repairs, vegetation would be removed along the riparian corridor to improve the structural reliability of the levees in accordance with USACE requirements. It is assumed that by 2030, much of the vegetation would be removed from the levees due to levee repairs.

10.4.1.5 Changes in Flows over Fremont Weir into the Yolo Bypass

All of the alternatives, including the No Action Alternative and the Second Basis of Comparison, include operations of an operable gate at Fremont Weir, as described in Chapter 3, Description of Alternatives. However, the flow patterns into the Yolo Bypass would change based upon the magnitude of flows in the Sacramento River at Fremont Weir.

10.4.1.6 Changes in Wetlands Habitat

The No Action Alternative, Alternatives 1 through 5, and Second Basis of Comparison all include implementation of restoration of more than 10,000 acres of intertidal and associated subtidal wetlands in Suisun Marsh and Cache Slough; 17,000 to 20,000 acres of seasonal floodplain restoration in the Yolo Bypass; and continued delivery of refuge water supplies under the Central Valley Project Improvement Act. There would be no changes in wetlands habitat between Alternatives 1 through 5 as compared to the No Action Alternative, and the Second Basis of Comparison. Therefore, changes to wetland habitats are not analyzed in this EIS.

10.4.1.7 Changes in Delta Habitat

Changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison would change the Delta salinity which could affect survival of riparian vegetation. The analysis evaluates changes in salinity by comparing the end of month X2 position.

Another potential change in Delta habitat would occur under Alternative 4, due to additional vegetation along the levees in the Delta as compared to conditions under the other alternatives, the No Action Alternative, and the Second Basis of Comparison, as described in Chapter 3, Description of Alternatives.

10.4.1.8 Changes in Irrigated Agricultural Acreage Habitats in Areas that use CVP and SWP Water

As described in Section 10.3, Affected Environment, agricultural lands provide considerable value to terrestrial wildlife, which varies with crop type and wildlife species. Generally, rice production provides high habitat value for some species because it supports many of the attributes of wetlands. Most notably, flooded rice fields during the growing season provide foraging and nesting habitat for waterfowl and shorebirds, as well as habitat for the federally listed Giant Garter Snake. In the fall and early winter, flooding for rice straw decomposition plays an important role in providing habitat for migrating waterbirds. Other crops, such as alfalfa and irrigated pasture, also provide habitat value, primarily because of their perennial nature and the application of flood irrigation. These crops provide valuable foraging habitat for species such as the state-listed Swainson's Hawk. Grain crops provide seasonal value to species such as Greater Sandhill Crane and others, but orchards, vineyards, vegetable, and truck crops generally provide relatively low habitat value for terrestrial species.

Changes in CVP and SWP operations under the alternatives could change the extent of irrigated acreage and associated habitats over the long-term average condition and in dry and critical dry years as compared to the No Action Alternative and Second Basis of Comparison, as described in Chapter 12, Agricultural Resources. However, irrigated acreage under Alternatives 1 through 5 would be similar (within 5 percent change) to irrigated acreage under the No Action Alternative and the Second Basis of Comparison. Therefore, there would be no change in terrestrial habitat at the irrigated acreage; and this factor is not analyzed in this EIS.

10.4.1.9 Effects due to Cross Delta Water Transfers

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

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

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

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

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

This EIS includes two bases of comparison, as described in Chapter 3, Description of Alternatives: the No Action Alternative and the Second Basis of Comparison. Both of these bases are evaluated at 2030 conditions.

Changes that would occur over the next 15 years without implementation of the alternatives are not analyzed in this EIS. However, the changes to terrestrial resources that are assumed to occur by 2030 under the No Action Alternative and the Second Basis of Comparison are summarized in this section. Many of the changed conditions would occur in the same manner under both the No Action Alternative and the Second Basis of Comparison.

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

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

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

10.4.2.1.1 Climate Change and Sea Level Rise

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

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

The Delta estuarine habitat is complex due to the freshwater-saltwater interface that supports numerous terrestrial species that require freshwater conditions primarily in the winter and spring and may withstand periods of higher salinity in the late summer and fall months. Climate change and sea level rise and CVP and SWP operations would change the location of the freshwater-saltwater interface in the Delta which would affect the survivability of vegetation within that area, especially in the western Delta and Suisun Marsh. Operations of the CVP and SWP would continue to maintain freshwater conditions in the spring in accordance with the State Water Resources Control Board Decision 1641. However, higher salinity conditions would occur in the summer months and in the fall of drier years which would affect the types of riparian vegetation in the western Delta and in Suisun Marsh under the No Action Alternative and Second Basis of Comparison in 2030 as compared to recent historical conditions.

10.4.2.1.2 Reasonable and Foreseeable Projects and Programs

Under the No Action Alternative and the Second Basis of Comparison, land uses in 2030 would occur in accordance with adopted general plans. Development under the general plans would change terrestrial resources, especially near municipal areas.

The No Action Alternative and the Second Basis of Comparison assumes completion of water resources management and environmental restoration projects that would have occurred without implementation of Alternatives 1 through 5, including regional and local recycling projects, surface water and groundwater storage projects, conveyance improvement projects, and desalination projects, as described in Chapter 3, Description of Alternatives. The No Action Alternative and the Second Basis of Comparison also assumes implementation of actions included in the 2008 U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BO) and 2009 National Marine Fisheries Service (NMFS) BO that would have been implemented without the BOs by 2030, as described in Chapter 3, Description of Alternatives. These projects would include several projects that would affect terrestrial resources, including:

- Habitat Restoration includes restoration of more than 10,000 acres of intertidal and associated subtidal wetlands in Suisun Marsh and Cache Slough; and at least 17,000 to 20,000 acres of seasonal floodplain restoration in Yolo Bypass.
- Sacramento River, American River, and Clear Creek Spawning Gravel Augmentation.
- Battle Creek Restoration.
- Lower American River Flow Management Standard.

10.4.2.1.3 Changes in River and Delta Floodplains

It is assumed that under the No Action Alternative and the Second Basis of Comparison, the State of California would continue to implement flood management projects to reduce flood risks along the Sacramento and San Joaquin rivers and in the Delta (DWR 2013b). These programs would be implemented in a manner that would be coordinated with opportunities to restore or maintain the function of natural systems with consideration of future conditions with climate change and sea level rise. However, terrestrial resources would be changed by 2030 as compared to recent historical conditions.

Terrestrial resources along Delta levees also would be affected through implementation of USACE policies for vegetation on levees. Historically, the USACE has allowed brush and small trees to be located on the waterside of federal flood management project levees if the vegetation would preserve, protect, and/or enhance natural resources, and/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). This policy requires federally authorized levee systems that have maintenance agreements with the USACE (including Delta levees along the Sacramento and San Joaquin rivers) and other levees that are eligible for the federal Rehabilitation and Inspection Program (Public Law 84-99) to remove vegetation in the following manner.

- Removal of all vegetation from the upper third of the waterside slope of the levee, the top of the levee, landside slope of the levee, or within 15 feet of the toe of the levee on the landside ("toe" is where the levee slope meets the ground surfaces).
- Removal of all vegetation over 2 inches in diameter on the lower two-thirds of the waterside slope of the levee and within 15 feet of the toe of the levee on the waterside along benches above the water surface.

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. 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 2013). By 2030, it is anticipated that much of the existing vegetation on the upper third of the waterside slopes, tops, landside slopes, and within 15 feet of the landside toe of the levees would be removed.

By 2030 under the No Action Alternative and the Second Basis of Comparison, development along major river corridors in the Central 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 would continue to be 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 requirements would prevent development within the Delta floodplains and floodways and in the Sacramento, Feather, American, and San Joaquin rivers corridors upstream of the Delta.

10.4.3 Evaluation of Alternatives

As described in Chapter 4, Approach to Environmental Analysis, Alternatives 1 through 5 have been compared to the No Action Alternative; and the No Action Alternative and Alternatives 1 through 5 have been compared to the Second Basis of Comparison.

10.4.3.1 No Action Alternative

As described in Chapter 4, Approach to Environmental Analysis, the No Action Alternative is compared to the Second Basis of Comparison.

10.4.3.1.1 Trinity River Region

Changes in Rivers Downstream of CVP and SWP Reservoirs

River flows in Trinity River downstream of Lewiston Dam in the critical period for terrestrial resources of March through May would be similar under the No Action Alternative and the Second Basis of Comparison, as described in Chapter 5, Surface Water Resources and Water Supplies. Therefore, terrestrial resources habitat conditions along the Trinity River and lower Klamath River riparian corridors would be similar under the No Action Alternative and Second Basis of Comparison.

10.4.3.1.2 Central Valley Region

Changes in Rivers Downstream of CVP and SWP Reservoirs

Flows in the spring months would be similar in the Sacramento River at Keswick and Freeport and American River downstream of Nimbus Dam; increased flows in the Stanislaus River downstream of Goodwin Dam (over 100 percent); and reduced in the Feather River downstream of Thermalito Complex (25 to 30 percent) under the No Action Alternative as compared to the Second Basis of Comparison. This analysis does not include site specific evaluation of all terrestrial resources along these riparian corridors. However, the changes in flows are indicative of the potential for change in the terrestrial resources. Therefore, under the No Action Alternative as compared to the Second Basis of Comparison, the potential for similar or improved terrestrial resources would occur along the Sacramento, American, and Stanislaus rivers; and the potential for reduced terrestrial resources would occur along the Feather River.

Monthly Clear Creek flows under the No Action Alternative as compared to the Second Basis of Comparison are identical except in May. In May, under the No Action Alternative, flows are up to 40.7 percent higher than under the Second Basis of Comparison in accordance with the 2009 NMFS BO. The increased flows would be released for channel maintenance and floodplain habitat restoration; therefore, terrestrial resources habitat in the floodplains of lower Clear Creek would be improved under the No Action Alternative as compared to the Second Basis of Comparison.

Potential Effects on Special Status Species

Habitat changes along the riparian corridors related to changes in spring flows that support riparian vegetation recruitment would affect numerous bird species that use the riparian corridor, including Black Tern, Least Bell's Vireo, Least Bittern, Swainson's Hawk, Tricolored Blackbird, Western Yellow-billed Cuckoo, White-tailed Kite, Yellow Warbler, Ringtail, Western Pond Turtle, Valley Elderberry Longhorn Beetle, and Delta Button-celery. Potential adverse effects could occur to these species due to reduced flows in the spring months on the Feather River.

Under the No Action Alternative as compared to the Second Basis of Comparison, the channel maintenance flows and actions in Clear Creek would improve terrestrial resources habitat for species that use the floodplain, including

habitat used by the Bald Eagle, Bank Swallow, Foothill Yellow-legged Frog, Little Willow Flycatcher, Western Yellow-billed Cuckoo, Northwestern Pond Turtle, Pacific Fisher, and Valley Elderberry Longhorn Beetle.

Changes in River and Delta Floodplains

It is assumed that under the No Action Alternative and the Second Basis of Comparison, the State of California would continue to implement flood management projects to reduce flood risks along the Sacramento and San Joaquin rivers and in the Delta with consideration for opportunities to restore or maintain the function of natural ecosystems. The related terrestrial habitat conditions would be similar under the No Action Alternative and the Second Basis of Comparison.

Changes in Flows over Fremont Weir into the Yolo Bypass

Flows from the Sacramento River into the Yolo Bypass at Fremont Weir are similar under the No Action Alternative and the Second Basis of Comparison; therefore, terrestrial habitat could be similar.

Changes in Delta Habitat due to Changes in Water Quality

Under the No Action Alternative, the freshwater interface would be similar to conditions under the Second Basis of Comparison in all months in below normal, dry, and critical dry years; and from January through August in wet and above normal years. In the fall months in wet years, the X2 location would be 9 to 14 kilometers towards the west in September through December under the No Action Alternative as compared to the Second Basis of Comparison.

Potential Effects on Special Status Species

Lower Delta salinity under the No Action Alternative as compared to the Second Basis of Comparison would improve habitat for Bolander's Water Hemlock, Delta Button-celery, Delta Tule Pea, Mason's Lilaeopsis, Soft Birds-beak, Suisun Marsh Aster, Salt Marsh Harvest Mouse, and Suisun Shrew.

Effects Related to Cross Delta Water Transfers

Potential effects to terrestrial resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014d). Potential effects to terrestrial resources were identified as changes in stream flows due declining groundwater levels along streams due to the use of groundwater substitution to provide transfer water. The analysis indicated that these potential impacts would not be substantial due to the inclusion of a monitoring and mitigation program.

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

10.4.3.2 Alternative 1

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

10.4.3.2.1 Alternative 1 Compared to the No Action Alternative

Trinity River Region

Changes in Rivers Downstream of CVP and SWP Reservoirs

River flows in Trinity River downstream of Lewiston Dam in the critical period for terrestrial resources of March through May would be similar under Alternative 1 and the No Action Alternative. Therefore, terrestrial resources habitat conditions along the Trinity River and lower Klamath River riparian corridors would be similar under Alternative 1 as compared to the No Action Alternative.

Central Valley Region

Changes in Rivers Downstream of CVP and SWP Reservoirs

Flows in the spring months would be similar in the Sacramento River at Keswick and Freeport and American River downstream of Nimbus Dam; increased in the Feather River downstream of Thermalito Complex (35 percent); and reduced flows in the Stanislaus River downstream of Goodwin Dam (60 percent) under Alternative 1 as compared to the No Action Alternative. This analysis does not include site specific evaluation of all terrestrial resources along these riparian corridors. However, the changes in flows are indicative of the potential for change in the terrestrial resources. Therefore, under Alternative 1 as compared to the No Action Alternative, the potential for similar or improved terrestrial resources would occur along the Sacramento, American, and Feather rivers; and the potential for reduced terrestrial resources would occur along the Stanislaus River.

Monthly Clear Creek flows under Alternative 1 as compared to the No Action Alternative are identical except in May. In May, under Alternative 1, flows are up to 29 percent lower as compared to the No Action Alternative. The decreased flows could result in less floodplain habitat restoration; therefore, terrestrial resources habitat in the floodplains of lower Clear Creek would be decreased under Alternative 1 as compared to the No Action Alternative.

Potential Effects on Special Status Species

Habitat changes along the riparian corridors related to changes in spring flows that support riparian vegetation recruitment would affect numerous bird species that use the riparian corridor, including Black Tern, Least Bell's Vireo, Least Bittern, Swainson's Hawk, Tricolored Blackbird, Western Yellow-billed Cuckoo, White-tailed Kite, Yellow Warbler, Ringtail, Western Pond Turtle, Valley Elderberry Longhorn Beetle, and Delta Button-celery. Potential adverse effects

could occur to these species due to reduced flows in the spring months on the Stanislaus River.

Under the Alternative 1 as compared to the No Action Alternative, the lack of channel maintenance flows and actions in Clear Creek would reduce terrestrial resources habitat for species that use the floodplain, including habitat used by the Bald Eagle, Bank Swallow, Foothill Yellow-legged Frog, Little Willow Flycatcher, Western Yellow-billed Cuckoo, Northwestern Pond Turtle, Pacific Fisher, and Valley Elderberry Longhorn Beetle.

Changes in River and Delta Floodplains

It is assumed that under Alternative 1 and the No Action Alternative, the State of California would continue to implement flood management projects to reduce flood risks along the Sacramento and San Joaquin rivers and in the Delta with consideration for opportunities to restore or maintain the function of natural ecosystems. The related terrestrial habitat conditions that would occur due to implementation of the flood management projects would be the same under Alternative 1 and the No Action Alternative.

Changes in Flows over Fremont Weir into the Yolo Bypass

Flows from the Sacramento River into the Yolo Bypass at Fremont Weir would be similar or higher under Alternative 1 as compared to the No Action Alternative; therefore, terrestrial habitat could be similar or increased depending upon the flow pattern.

Changes in Delta Habitat due to Changes in Water Quality

Under Alternative 1, the freshwater interface would be similar to conditions under the No Action Alternative in all months in below normal, dry, and critical dry years; and from January through August in wet and above normal years. In the fall months in wet years, the X2 location would be 9 to 14 kilometers towards the east in September through December under Alternative 1 as compared to the No Action Alternative. This could adversely affect terrestrial species that have acclimated to freshwater conditions.

Potential Effects on Special Status Species

Higher Delta salinity under Alternative 1 as compared to the No Action Alternative would reduce habitat conditions for Bolander's Water Hemlock, Delta Button-celery, Delta Tule Pea, Mason's Lilaeopsis, Soft Birds-beak, Suisun Marsh Aster, Salt Marsh Harvest Mouse, and Suisun Shrew.

Effects Related to Cross Delta Water Transfers

Potential effects to terrestrial resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014d). Potential effects to terrestrial resources were identified as changes in stream flows due declining groundwater levels along streams due to the use of groundwater substitution to provide transfer water. The analysis indicated that these potential impacts would not be substantial due to the inclusion of a monitoring and mitigation program.

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

10.4.3.2.2 Alternative 1 Compared to the Second Basis of Comparison

Alternative 1 is identical to the Second Basis of Comparison.

10.4.3.3 Alternative 2

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

10.4.3.3.1 Alternative 2 Compared to the Second Basis of Comparison

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative. Therefore, changes in terrestrial resources under Alternative 2 as compared to the Second Basis of Comparison would be the same as the impacts described in Section 10.4.3.1, No Action Alternative.

10.4.3.4 Alternative 3

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

10.4.3.4.1 Alternative 3 Compared to the No Action Alternative

Trinity River Region

Changes in Rivers Downstream of CVP and SWP Reservoirs

River flows in Trinity River downstream of Lewiston Dam in the critical period for terrestrial resources of March through May would be similar under Alternative conditions along the Trinity River and lower Klamath River riparian corridors would be similar under Alternative 3 as compared to the No Action Alternative.

Central Valley Region

Changes in Rivers Downstream of CVP and SWP Reservoirs

Flows in the spring months would be similar in the Sacramento River at Keswick and Freeport and American River downstream of Nimbus Dam; increased in the Feather River downstream of Thermalito Complex (25 to 35 percent); and reduced flows in the Stanislaus River downstream of Goodwin Dam (60 percent) under Alternative 3 as compared to the No Action Alternative. This analysis does not include site specific evaluation of all terrestrial resources along these riparian

corridors. However, the changes in flows are indicative of the potential for change in the terrestrial resources. Therefore, under Alternative 3 as compared to the No Action Alternative, the potential for similar or improved terrestrial resources would occur along the Sacramento, American, and Feather rivers; and the potential for reduced terrestrial resources would occur along the Stanislaus River.

Monthly Clear Creek flows under Alternative 3 as compared to the No Action Alternative are identical except in May. In May, under Alternative 3, flows are up to 29 percent lower as compared to the No Action Alternative. The decreased flows could result in less floodplain habitat restoration; therefore, terrestrial resources habitat in the floodplains of lower Clear Creek would be decreased under Alternative 3 as compared to the No Action Alternative.

Potential Effects on Special Status Species

Habitat changes along the riparian corridors related to changes in spring flows that support riparian vegetation recruitment would affect numerous bird species that use the riparian corridor, including Black Tern, Least Bell's Vireo, Least Bittern, Swainson's Hawk, Tricolored Blackbird, Western Yellow-billed Cuckoo, White-tailed Kite, Yellow Warbler, Ringtail, Western Pond Turtle, Valley Elderberry Longhorn Beetle, and Delta Button-celery. Potential adverse effects could occur to these species due to reduced flows in the spring months on the Stanislaus River.

Under the Alternative 3 as compared to the No Action Alternative, the lack of channel maintenance flows and actions in Clear Creek would reduce terrestrial resources habitat for the species that use the floodplain, including habitat used by the Bald Eagle, Bank Swallow, Foothill Yellow-legged Frog, Little Willow Flycatcher, Western Yellow-billed Cuckoo, Northwestern Pond Turtle, Pacific Fisher, and Valley Elderberry Longhorn Beetle.

Changes in River and Delta Floodplains

It is assumed that under Alternative 3 and the No Action Alternative, the State of California would continue to implement flood management projects to reduce flood risks along the Sacramento and San Joaquin rivers and in the Delta with consideration for opportunities to restore or maintain the function of natural ecosystems. The related terrestrial habitat that would occur due to implementation of the flood management projects would be the same under Alternative 3 and the No Action Alternative.

Changes in Flows over Fremont Weir into the Yolo Bypass

Flows from the Sacramento River into the Yolo Bypass at Fremont Weir would be similar or higher (10 to 30 percent) under Alternative 3 as compared to the No Action Alternative. Terrestrial habitat could be similar or increased due to the flow patterns.

Changes in Delta Habitat due to Changes in Water Quality

Under Alternative 3, the freshwater interface would be similar to conditions under the No Action Alternative in all months in below normal, dry, and critical dry years; and from January through August in wet and above normal years. In the fall months in wet years, the X2 location would be 9 to 14 kilometers towards the east in September through December under Alternative 3 as compared to the No Action Alternative.

Potential Effects on Special Status Species

Higher Delta salinity under Alternative 3 as compared to the No Action Alternative would reduce habitat conditions for Bolander's Water Hemlock, Delta Button-celery, Delta Tule Pea, Mason's Lilaeopsis, Soft Birds-beak, Suisun Marsh Aster, Salt Marsh Harvest Mouse, and Suisun Shrew.

Effects Related to Cross Delta Water Transfers

Potential effects to terrestrial resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014d). Potential effects to terrestrial resources were identified as changes in stream flows due declining groundwater levels along streams due to the use of groundwater substitution to provide transfer water. The analysis indicated that these potential impacts would not be substantial due to the inclusion of a monitoring and mitigation program.

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

10.4.3.4.2 Alternative 3 Compared to the Second Basis of Comparison

Trinity River Region

Changes in Rivers Downstream of CVP and SWP Reservoirs

River flows in Trinity River downstream of Lewiston Dam in the critical period for terrestrial resources of March through May would be similar under Alternative 3 and the Second Basis of Comparison. Therefore, terrestrial resources habitat conditions along the Trinity River and lower Klamath River riparian corridors would be similar under Alternative 3 as compared to the Second Basis of Comparison.

Central Valley Region

Changes in Rivers Downstream of CVP and SWP Reservoirs

Flows in the spring months would be similar in the Sacramento River at Keswick and Freeport, Feather River downstream of Thermalito Complex, and American River downstream of Nimbus Dam; and reduced flows in the Stanislaus River downstream of Goodwin Dam (6 to 52 percent, depending upon water year type)

under Alternative 3 as compared to the Second Basis of Comparison. This analysis does not include site specific evaluation of all terrestrial resources along these riparian corridors. However, the changes in flows are indicative of the potential for change in the terrestrial resources. Therefore, under Alternative 3 as compared to the Second Basis of Comparison, the potential for similar terrestrial resources habitat would occur along the Sacramento, American, and Feather rivers; and the potential for reduced terrestrial resources would occur along the Stanislaus River.

Monthly Clear Creek flows under Alternative 3 as compared to the Second Basis of Comparison are identical under Alternative 3; therefore, terrestrial resources habitat in the floodplains of lower Clear Creek would be similar under Alternative 3 as compared to the Second Basis of Comparison.

Potential Effects on Special Status Species

Habitat changes along the riparian corridors related to changes in spring flows that support riparian vegetation recruitment would affect numerous bird species that use the riparian corridor, including Black Tern, Least Bell's Vireo, Least Bittern, Swainson's Hawk, Tricolored Blackbird, Western Yellow-billed Cuckoo, White-tailed Kite, Yellow Warbler, Ringtail, Western Pond Turtle, Valley Elderberry Longhorn Beetle, and Delta Button-celery. Potential adverse effects could occur to these species due to reduced flows in the spring months on the Stanislaus River.

Under the Alternative 3 as compared to the Second Basis of Comparison, terrestrial resources habitat would be similar for species that use the floodplain, including habitat used by the Bald Eagle, Bank Swallow, Foothill Yellow-legged Frog, Little Willow Flycatcher, Western Yellow-billed Cuckoo, Northwestern Pond Turtle, Pacific Fisher, and Valley Elderberry Longhorn Beetle.

Changes in River and Delta Floodplains

It is assumed that under Alternative 3 and the Second Basis of Comparison, the State of California would continue to implement flood management projects to reduce flood risks along the Sacramento and San Joaquin rivers and in the Delta with consideration for opportunities to restore or maintain the function of natural ecosystems. The related terrestrial habitat conditions that would occur due to implementation of the flood management projects would be the same under Alternative 3 and the Second Basis of Comparison.

Changes in Flows over Fremont Weir into the Yolo Bypass

Flows from the Sacramento River into the Yolo Bypass at Fremont Weir and associated terrestrial habitat would be similar under Alternative 3 as compared to the Second Basis of Comparison.

Changes in Delta Habitat due to Changes in Water Quality

Under Alternative 3, the freshwater-saltwater interface would be similar to conditions under the Second Basis of Comparison in all months and in all water year types.

Potential Effects on Special Status Species

Delta salinity under Alternative 3 as compared to the Second Basis of Comparison would result in similar habitat conditions for Bolander's Water Hemlock, Delta Button-celery, Delta Tule Pea, Mason's Lilaeopsis, Soft Birds-beak, Suisun Marsh Aster, Salt Marsh Harvest Mouse, and Suisun Shrew.

Effects Related to Cross Delta Water Transfers

Potential effects to terrestrial resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014d). Potential effects to terrestrial resources were identified as changes in stream flows due declining groundwater levels along streams due to the use of groundwater substitution to provide transfer water. The analysis indicated that these potential impacts would not be substantial due to the inclusion of a monitoring and mitigation program.

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

10.4.3.5 Alternative 4

The CVP and SWP operations under Alternative 4 are identical to the CVP and SWP operations under the Second Basis of Comparison and Alternative 1. Alternative 4 also includes additional institutional requirements for development within the floodplain and floodways, including the following items.

- Compliance with Endangered Species Act in defining floodplain map revisions.
- Improvements in floodplain management criteria to support natural and beneficial functions.
- Prohibition of new development and substantial improvements to existing development within any designated floodway or within 170 feet of the ordinary high water line of any floodway.
- Modification of USACE requirements to remove vegetation along portions of the waterside of levees, as described in Section 10.4.3.1, No Action Alternative.

Alternative 4 is compared to the No Action Alternative and the Second Basis of Comparison.

10.4.3.5.1 Alternative 4 Compared to the No Action Alternative

These actions would not change CVP and SWP operations; and would only affect the Changes in River and Delta Floodplains. Therefore, changes in terrestrial resources due to changes in CVP and SWP under Alternative 4 as compared to the No Action Alternative would be the same as the impacts described in Section 10.4.3.2.1, Alternative 1 Compared to the No Action Alternative.

Changes in River and Delta Floodplains

It is assumed that under the No Action Alternative, the State of California would continue to implement flood management projects to reduce flood risks along the Sacramento and San Joaquin rivers and in the Delta with consideration for opportunities to restore or maintain the function of natural ecosystems. The USACE policies for vegetation on levees would be implemented; and by 2030, much of the vegetation along Delta channels would have been removed.

Under Alternative 4, implementation of institutional provisions would result in development of the floodplains and floodways, especially in the Delta, that would be similar to development under the No Action Alternative. Under the No Action Alternative, as described in Chapter 13, Land Use, development along major river corridors in the Central Valley would 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 would prevent development within the Delta floodplains and floodways and in the Sacramento, Feather, American, and San Joaquin rivers corridors upstream of the Delta. Under Alternative 4, development would be prevented within 170 feet from the ordinary high water line of any floodway. This setback area could provide opportunities to establish vegetative corridors.

Under Alternative 4 and the No Action Alternative, vegetation management along the Delta levees would include removal of all vegetation from the upper third of the waterside slope of the levee, the top of the levee, landside slope of the levee, and within 15 feet on the landside of the toe of the levee ("toe" is where the levee slope meets the ground surfaces). Under Alternative 4, vegetation could be maintained on the lower two-thirds of the waterside slope of the levee and within 15 feet of the toe of the levee on the waterside along benches above the water surface. This would provide shaded riverine aquatic habitat and riparian vegetation along many of the Delta channels as compared to the No Action Alternative.

Overall, Alternative 4 would result in increased vegetation along the riparian corridors related to recruitment of riparian vegetation in the Delta watershed as compared to the No Action Alternative.

10.4.3.5.2 Alternative 4 Compared to the Second Basis of Comparison

The changes in river and Delta floodplain actions would not change CVP and SWP operations which would be identical under Alternative 4 and under the Second Basis of Comparison.

Changes in River and Delta Floodplains

It is assumed that under the Second Basis of Comparison, the State of California would continue to implement flood management projects to reduce flood risks along the Sacramento and San Joaquin rivers and in the Delta with consideration for opportunities to restore or maintain the function of natural ecosystems. The

USACE policies for vegetation on levees would be implemented; and by 2030, much of the vegetation along Delta channels would have been removed.

Under Alternative 4, implementation of institutional provisions would result in development of the floodplains and floodways, especially in the Delta, that would be similar to development under the Second Basis of Comparison. Under the Second Basis of Comparison, as described in Chapter 13, Land Use, development along major river corridors in the Central Valley would 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 would prevent development within the Delta floodplains and floodways and in the Sacramento, Feather, American, and San Joaquin rivers corridors upstream of the Delta. Under Alternative 4, development would be prevented within 170 feet from the ordinary high water line of any floodway. This setback area could provide opportunities to establish vegetative corridors.

Under Alternative 4 and the Second Basis of Comparison, vegetation management along the Delta levees would include removal of all vegetation from the upper third of the waterside slope of the levee, the top of the levee, landside slope of the levee, and within 15 feet on the landside of the toe of the levee ("toe" is where the levee slope meets the ground surfaces). Under Alternative 4, vegetation could be maintained on the lower two-thirds of the waterside slope of the levee and within 15 feet of the toe of the levee on the waterside along benches above the water surface. This would provide shaded riverine aquatic habitat and riparian vegetation along many of the Delta channels as compared to the Second Basis of Comparison.

Overall, Alternative 4 would result in increased terrestrial resources along the riparian corridors related to recruitment of riparian vegetation in the Delta watershed as compared to the Second Basis of Comparison.

10.4.3.6 Alternative 5

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

10.4.3.6.1 Alternative 5 Compared to the No Action Alternative

Trinity River Region

Changes in Rivers Downstream of CVP and SWP Reservoirs

River flows in Trinity River downstream of Lewiston Dam in the critical period for terrestrial resources of March through May would be similar under Alternative 5 and the No Action Alternative. Therefore, terrestrial resources habitat conditions along the Trinity River and lower Klamath River riparian

corridors would be similar under Alternative 5 as compared to the No Action Alternative.

Central Valley Region

Changes in Rivers Downstream of CVP and SWP Reservoirs

Flows in the spring months would be similar in the Sacramento River at Keswick and Freeport, Feather River downstream of Thermalito Complex, American River downstream of Nimbus Dam; and flows in the Stanislaus River downstream of Goodwin Dam would increase 22 to 40 percent in some spring months and 8 to 18 percent in other spring months, depending upon water year type under Alternative 5 as compared to the No Action Alternative. This analysis does not include site specific evaluation of all terrestrial resources along these riparian corridors. However, the changes in flows are indicative of the potential for change in the terrestrial resources. Therefore, under Alternative 5 as compared to the No Action Alternative, the potential for similar or improved terrestrial resources habitat would occur along the Sacramento, Feather, and American rivers; and the potential for both increased and reduced terrestrial resources habitat would occur along the Stanislaus River.

Monthly Clear Creek flows would be identical under Alternative 5 as compared to the No Action Alternative; therefore, terrestrial resources habitat in the floodplains of lower Clear Creek would be similar under Alternative 5 as compared to the Second Basis of Comparison.

Potential Effects on Special Status Species

Habitat changes along the riparian corridors related to changes in spring flows that support riparian vegetation recruitment would affect numerous bird species that use the riparian corridor, including Black Tern, Least Bell's Vireo, Least Bittern, Swainson's Hawk, Tricolored Blackbird, Western Yellow-billed Cuckoo, White-tailed Kite, Yellow Warbler, Ringtail, Western Pond Turtle, Valley Elderberry Longhorn Beetle, and Delta Button-celery. Potential adverse effects could occur to these species due to reduced flows in the spring months on the Stanislaus River.

Under Alternative 5 as compared to the Second Basis of Comparison, the channel maintenance flows and actions in Clear Creek would not change terrestrial resources habitat for species that use the floodplain, including habitat used by the Bald Eagle, Bank Swallow, Foothill Yellow-legged Frog, Little Willow Flycatcher, Western Yellow-billed Cuckoo, Northwestern Pond Turtle, Pacific Fisher, and Valley Elderberry Longhorn Beetle.

Changes in River and Delta Floodplains

It is assumed that under Alternative 5 and the No Action Alternative, the State of California would continue to implement flood management projects to reduce flood risks along the Sacramento and San Joaquin rivers and in the Delta with consideration for opportunities to restore or maintain the function of natural ecosystems. The related terrestrial habitat conditions that would occur due to

implementation of the flood management projects would be the same under Alternative 5 and the No Action Alternative.

Changes in Flows over Fremont Weir into the Yolo Bypass

Flows from the Sacramento River into the Yolo Bypass at Fremont Weir and associated terrestrial habitat would be similar under Alternative 5 as compared to the No Action Alternative.

Changes in Delta Habitat due to Changes in Water Quality

Under Alternative 5, the freshwater interface would be similar to conditions under the No Action Alternative in all months and in all water year types.

Potential Effects on Special Status Species

Similar Delta salinity under Alternative 5 as compared to the No Action Alternative would result in similar habitat conditions for Bolander's Water Hemlock, Delta Button-celery, Delta Tule Pea, Mason's Lilaeopsis, Soft Birds-beak, Suisun Marsh Aster, Salt Marsh Harvest Mouse, and Suisun Shrew.

Effects Related to Cross Delta Water Transfers

Potential effects to terrestrial resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014d). Potential effects to terrestrial resources were identified as changes in stream flows due declining groundwater levels along streams due to the use of groundwater substitution to provide transfer water. The analysis indicated that these potential impacts would not be substantial due to the inclusion of a monitoring and mitigation program.

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

10.4.3.6.2 Alternative 5 Compared to the Second Basis of Comparison

Trinity River Region

Changes in Rivers Downstream of CVP and SWP Reservoirs

River flows in Trinity River downstream of Lewiston Dam in the critical period for terrestrial resources of March through May would be similar under Alternative 5 and the Second Basis of Comparison. Therefore, terrestrial resources habitat conditions along the Trinity River and lower Klamath River riparian corridors would be similar under Alternative 5 as compared to the Second Basis of Comparison.

Central Valley Region

Changes in Rivers Downstream of CVP and SWP Reservoirs

Flows in the spring months would be similar in the American River downstream of Nimbus Dam; increased flows in the Stanislaus River downstream of Goodwin Dam (over 100 percent); and reduced in the Sacramento River at Keswick and Freeport and Feather River downstream of Thermalito Complex (8 to 13 percent and 25 to 45 percent, respectively) under Alternative 5 as compared to the Second Basis of Comparison. This analysis does not include site specific evaluation of all terrestrial resources along these riparian corridors. However, the changes in flows are indicative of the potential for change in the terrestrial resources. Therefore, under Alternative 5 as compared to the Second Basis of Comparison, the potential for similar or improved terrestrial resources habitat would occur along the American and Stanislaus rivers; and the potential for reduced terrestrial resources habitat would occur along the Sacramento and Feather rivers.

Monthly Clear Creek flows under Alternative 5 as compared to the Second Basis of Comparison are identical except in May. In May, under Alternative 5, flows are up to 40.7 percent higher than under the Second Basis of Comparison in accordance with the 2009 NMFS BO. The increased flows would be released for channel maintenance and floodplain habitat restoration; therefore, terrestrial resources habitat in the floodplains of lower Clear Creek would be improved under Alternative 5 as compared to the Second Basis of Comparison.

Potential Effects on Special Status Species

Habitat changes along the riparian corridors related to changes in spring flows that support riparian vegetation recruitment would affect numerous bird species that use the riparian corridor, including Black Tern, Least Bell's Vireo, Least Bittern, Swainson's Hawk, Tricolored Blackbird, Western Yellow-billed Cuckoo, White-tailed Kite, Yellow Warbler, Ringtail, Western Pond Turtle, Valley Elderberry Longhorn Beetle, and Delta Button-celery. Potential adverse effects could occur to these species due to reduced flows in the spring months on the Sacramento and Feather rivers.

Under Alternative 5 as compared to the Second Basis of Comparison, the channel maintenance flows and actions in Clear Creek would improve terrestrial resources habitat for species that use the floodplain, including habitat used by the Bald Eagle, Bank Swallow, Foothill Yellow-legged Frog, Little Willow Flycatcher, Western Yellow-billed Cuckoo, Northwestern Pond Turtle, Pacific Fisher, and Valley Elderberry Longhorn Beetle.

Changes in River and Delta Floodplains

It is assumed that under Alternative 5 and the Second Basis of Comparison, the State of California would continue to implement flood management projects to reduce flood risks along the Sacramento and San Joaquin rivers and in the Delta with consideration for opportunities to restore or maintain the function of natural ecosystems. The related terrestrial habitat conditions that would occur due to implementation of the flood management projects would be the same under Alternative 5 and the Second Basis of Comparison.

Changes in Flows over Fremont Weir into the Yolo Bypass

Flows from the Sacramento River into the Yolo Bypass at Fremont Weir would similar or lower (24 percent) under Alternative 5 as compared to the Second Basis of Comparison. The decrease in the extent of flow inundation in the Yolo Bypass could cause degradation of terrestrial habitat as compared to the Second Basis of Comparison.

Changes in Delta Habitat due to Changes in Water Quality

Under Alternative 5, the freshwater interface would be similar to conditions under the Second Basis of Comparison in all months in below normal, dry, and critical dry years; and from January through August in wet and above normal years. In the fall months in wet years, the X2 location would be 9 to 14 kilometers towards the west in September through December under Alternative 5 as compared to the Second Basis of Comparison.

Potential Effects on Special Status Species

Lower Delta salinity under Alternative 5 as compared to the Second Basis of Comparison would improve habitat conditions for Bolander's Water Hemlock, Delta Button-celery, Delta Tule Pea, Mason's Lilaeopsis, Soft Birds-beak, Suisun Marsh Aster, Salt Marsh Harvest Mouse, and Suisun Shrew.

Effects Related to Cross Delta Water Transfers

Potential effects to terrestrial resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014d). Potential effects to terrestrial resources were identified as changes in stream flows due declining groundwater levels along streams due to the use of groundwater substitution to provide transfer water. The analysis indicated that these potential impacts would not be substantial due to the inclusion of a monitoring and mitigation program.

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

10.4.3.7 Summary of Environmental Consequences

The results of the environmental consequences of implementation of Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison are presented in Tables 10.2 and 10.3.

Table 10.2 Comparison of Alternatives 1 through 5 to No Action Alternative

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

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

Table 10.3 Comparison of No Action Alternative and Alternatives 1 through 5 to Second Basis of Comparison

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

10.4.3.8 Potential Mitigation Measures

Changes in CVP and SWP operations under Alternatives 1 through 5 as compared to the No Action Alternative would result in adverse changes in terrestrial resources along rivers when spring flows are less than under the No Action Alternative; and when the salinity increases in the western Delta. Potential mitigation measures that could be considered to reduce the adverse impacts include:

- Coordination of CVP and SWP operations between Reclamation, DWR, USFWS, and NMFS to reduce flow reduction impacts on the Stanislaus River under Alternatives 1, 3, and 4.
- Implement program for gravel augmentation and mechanical modification of floodplain habitat along the lower Clear Creek to reduce floodplain impacts under Alternatives 1, 3, and 4.
- Coordination of CVP and SWP operations between Reclamation, DWR, USFWS, and NMFS to reduce adverse impacts due to increased salinity in the western Delta in the fall months of wet and above normal water year types under Alternatives 1, 3, and 4.

10.4.3.9 Cumulative Effects Analysis

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

The No Action Alternative, Alternatives 1 through 5, and Second Basis of Comparison include climate change and sea level rise, implementation of general plans, and completion of ongoing projects and programs (see Chapter 3, Description of Alternatives). The effects of these items were analyzed quantitatively and qualitatively, as described in the Impact Analysis of this chapter. The discussion below focuses on the qualitative effects of the alternatives and other past, present, and reasonably foreseeable future projects identified for consideration of cumulative effects (see Chapter 3, Description of Alternatives).

10.4.3.9.1 No Action Alternative and Alternatives 1 through 5

Continued coordinated long-term operation of the CVP and SWP under the No Action Alternative would result in reduced CVP and SWP water supply availability as compared to recent conditions due to climate change and sea level rise by 2030. These conditions are included in the analysis presented above.

Future water resource management projects considered in cumulative effects analysis could increase water supply availability, as described in Chapter 5, Surface Water Resources and Water Supplies; and reduce terrestrial resources impacts in the San Francisco Bay Area, Central Coast, and Southern California regions by providing additional water supplies that could be stored in existing reservoirs.

There also are several ongoing programs that could result in reductions in CVP and SWP water supply availability due to changes in flow patterns in the Sacramento and San Joaquin rivers watersheds and the Delta that could reduce availability of CVP and SWP water deliveries as well as local and regional water supplies, as described in Chapter 5, Surface Water Resources and Water Supplies. Reduction in available surface water supplies as compared to projected water supplies under the No Action Alternative and Alternatives 1 through 5 could result in reduction of terrestrial resources conditions at reservoirs in San Francisco Bay Area, Central Coast, and Southern California.

There were be adverse terrestrial resources impacts associated with implementation of the alternatives as compared to the No Action Alternative. Therefore, Alternatives 1 through 5 would contribute cumulative impacts to terrestrial resources, specifically associated with:

- Flow reduction impacts on the Stanislaus River and Clear Creek under Alternatives 1, 3, and 4.
- Increased salinity in the western Delta in the fall months of wet and above normal water year types under Alternatives 1, 3, and 4.
- Entrainment impacts on Delta Smelt and Longfin Smelt under Alternatives 1, 3, and 4.
- Impacts on bass nests at reservoirs on the Sacramento River system under Alternatives 1, 3, and 4.
- Temperature impacts on Striped Bass and Hardhead on the Stanislaus and San Joaquin rivers system under Alternatives 3 and 5.

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