7.6.1 Terrestrial Biological Resources

This section describes the environmental setting, potential impacts, and mitigation measures for terrestrial biological impacts that may result from changes in hydrology or changes in water supply. Implementation of the proposed Plan amendments is expected to improve flow and water quality conditions over a large geographic area, particularly for fish and wildlife beneficial uses in the Sacramento River watershed, Delta eastside tributaries and Delta regions (*Sacramento/Delta*). Consequently, conditions for terrestrial biological resources that are associated with healthy rivers, healthy estuaries, and a functioning watershed are expected to be improved as a result of the proposed Plan amendments.

Refer to Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*, for information on the importance of the natural flow regime in protecting the aquatic ecosystem that supports fish and wildlife beneficial uses.

Changes in hydrology and changes in water supply may affect some terrestrial biological resources by reducing habitat associated with the conversion or loss of certain agricultural crops and potential changes to the amount of wetland habitat at wildlife refuges, changes in reservoir levels, and lower groundwater levels.

Section 7.1, *Introduction, Project Description, and Approach to Environmental Analysis*, describes reasonably foreseeable methods of compliance and response actions, including actions that would require construction. These actions are analyzed for potential environmental effects in Section 7.21, *Habitat Restoration and Other Ecosystem Projects*, and Section 7.22, *New or Modified Facilities*.

7.6.1.1 Environmental Checklist

IV. Terrestrial Biological Resources	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
Would the project:				
a. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☒	☐	☐	☐
b. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Game* or U.S. Fish and Wildlife Service?	☒	☐	☐	☐

IV. Terrestrial Biological Resources	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
c. Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marshes, vernal pools, coastal wetlands, etc.) through direct removal, filling, hydrological interruption, or other means?	☒	☐	☐	☐
d. Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☒	☐	☐	☐
e. Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒
f. Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☒	☐

*California Department of Fish and Game is now California Department of Fish and Wildlife.

Sections 7.6.1.2, *Environmental Setting*, and 7.6.1.3, *Regulatory Setting*, describe background information on terrestrial biological resources and the regulatory setting related to special-status species, their habitat, and sensitive natural communities to inform the impact discussion presented in this section and in Section 7.21, *Habitat Restoration and Other Ecosystem Projects*; Section 7.22, *New or Modified Facilities*; and Chapter 9, *Proposed Voluntary Agreements*.

7.6.1.2 Environmental Setting

The Bay-Delta watershed supports an exceptionally diverse array of migratory and resident fish, birds, and other valued wildlife and plants. The information presented in this section focuses on terrestrial habitats and species potentially affected by implementation of the proposed Plan amendments.

Many natural communities and terrestrial species occur in the study area. The Sacramento River watershed supports extensive agriculture on the valley floor and in some mountain valleys (Figure 7.4-4a). The dominant agricultural crop in the Sacramento Valley is rice, which represents approximately one-third of croplands in the region. The Sacramento Valley also contains annual grassland and vernal pool complexes that are largely used for cattle grazing. As shown in Figure 7.6.1-1a, the Sacramento River watershed also contains wetlands and shrub/grasslands in the valley and foothills, and forested lands in the upper watershed.

The Delta eastside tributaries region contains similar land cover types as the Sacramento River watershed. The Delta eastside tributaries region contains vineyards, grains and other crops, and rangeland on the valley floor (Figure 7.4-4a). The foothill portions of the Delta eastside tributaries

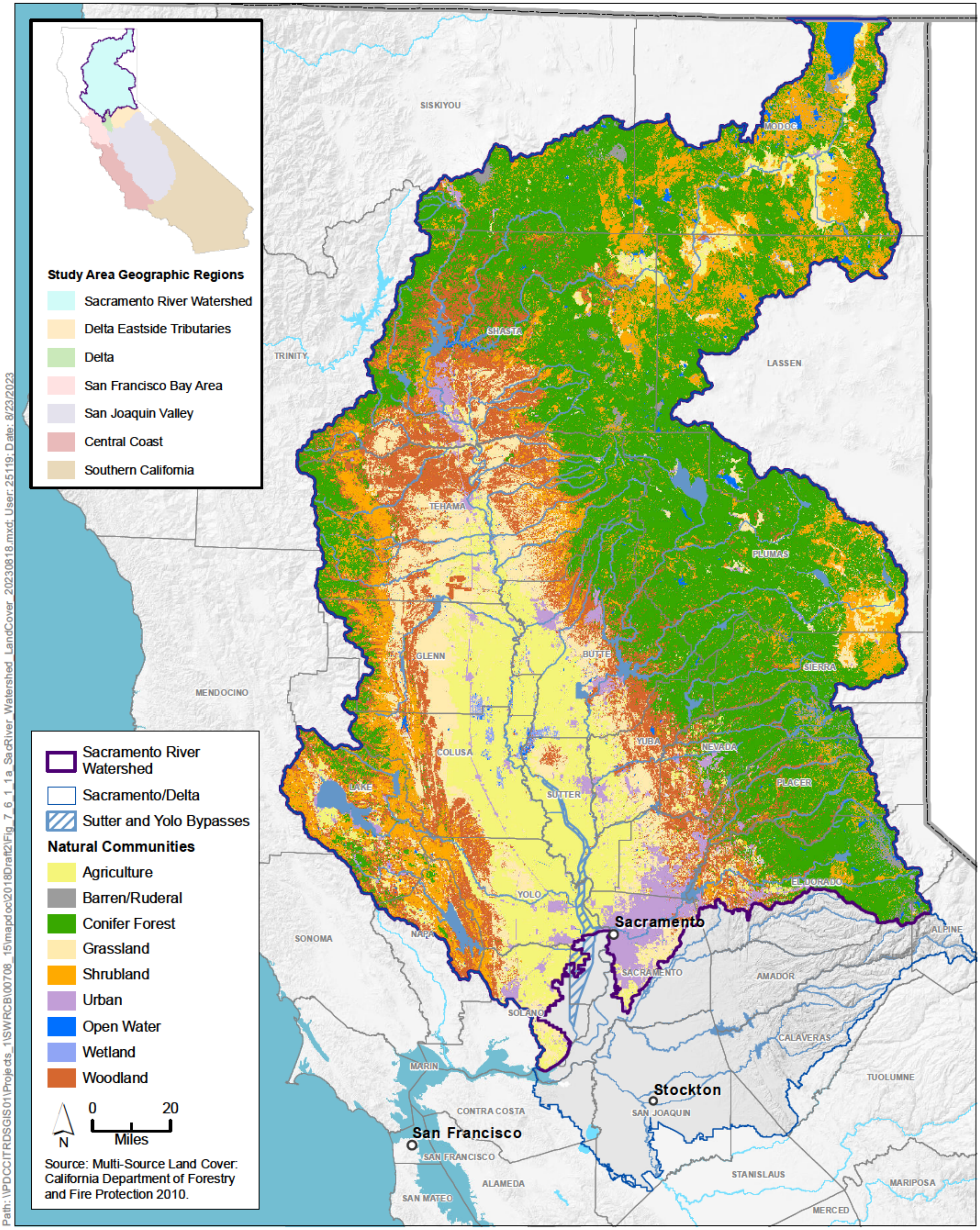

Figure 7.6.1-1a
Natural Communities in the Sacramento River Watershed

region contain primarily grassland, and higher elevations contain primarily forested lands (Figure 7.6.1-1b).

The Delta is the largest estuary in the United States along the Pacific Coast. Freshwater from the Sacramento River and Delta eastside tributaries enters the Delta and flows west through the Carquinez Strait into the San Francisco Bay, mixing with ocean salt water to create unique and diverse semi-aquatic and terrestrial ecosystems. Once a vast system of wetlands and uplands, the Delta has been transformed by more than a century of levee building into a maze of interconnected waterways and low, reclaimed islands (California State Lands Commission 1991; SFEI 2014). Habitat within the Delta has been highly altered through the conversion of lands from natural landscapes to agricultural lands (DSC 2013). Several crop types, such as corn and other grains, are grown in the Delta (Figure 7.4-4a). The Delta also contains wetland and open water habitat, as well as developed areas (Figure 7.6.1-1c). Wetland and agricultural habitats in the Delta are used by terrestrial species, such as migratory and wintering waterfowl, shorebirds, and other waterbirds (Shuford et al. 1998; ^Whipple et al. 2012).

The San Joaquin Valley region largely consists of agricultural lands on the valley floor (Figure 7.6.1-1d). Numerous crops, such as row crops, tree crops, and vineyards, are cultivated in the San Joaquin Valley (Figure 7.4-4b). The San Joaquin Valley also contains urban areas and some natural communities, such as annual grasslands, vernal pools, alkali seasonal wetlands, and alkali scrub. In the San Joaquin Valley region, forests occur in the Sierra Nevada.

The San Francisco Bay Area (Bay Area) region is highly urbanized, but also contains grasslands, agricultural lands, shrubland, mixed-oak woodlands, and coniferous forests (Figure 7.6.1-1e). The shoreline of San Pablo Bay is undeveloped, with many salt marshes and mudflats with natural communities similar to the Delta and Suisun Marsh. San Pablo Bay is a wintering stop for waterfowl and other migratory species along the Pacific Flyway, and much of the northern shore of the bay is protected as part of the San Pablo Bay National Wildlife Refuge (NWR).

Situated between the Delta to the east and San Francisco Bay to the west, Suisun Marsh is the largest expanse of tidal marsh in the Bay-Delta and is the largest remaining brackish wetland in western North America (^O'Rear and Moyle 2009; ^Reclamation et al. 2013). The marsh provides important habitat for many birds, mammals, and reptiles, and more than 40 fish species (^O'Rear and Moyle 2009; ^Reclamation et al. 2013). It also provides important tidal rearing areas for juvenile salmonids (Suisun Ecological Workgroup 2001). Suisun Marsh currently consists of a variety of habitats, including managed diked wetlands, unmanaged seasonal wetlands, tidal wetlands, sloughs, and upland grasslands. It encompasses more than 10 percent of California's remaining natural wetlands (^Reclamation et al. 2013) with 7,672 acres of its total 116,000 acres in tidal wetlands (^Reclamation et al. 2013; Suisun Ecological Workgroup 2001). As a result of diminished freshwater inflow into Suisun Marsh, increased salinity intrusion has reduced primary productivity and biodiversity (Sommer et al. 2020).

The Central Coast region contains several land cover types, including grasslands, wetlands, shrublands, forested areas, croplands, and some urban areas (Figure 7.6.1-1f). Annual grasslands, chaparral, oak woodlands, mixed oak-coniferous forests, and coniferous forests occur in the region. Several crops, such as vineyards, row crops, and grains, also occur in the Central Coast region (Figures 7.4-4a and 7.4-4b).

The Southern California region contains large areas of developed land, primarily in coastal areas (Figure 7.6.1-1g). Inland areas are more sparsely populated and contain other land cover types, such as grasslands, shrublands, and scattered woodlands and forests. Natural communities in the Southern California region are diverse and range from desert scrub, coastal sage scrub, annual grassland, and oak woodland to coniferous forests. Agricultural lands also occur in several areas in the region, such as in the Imperial Valley (Figure 7.4-4b).

Sensitive Natural Communities

Sensitive natural communities are natural communities that are considered rare or threatened, or both. The California Natural Diversity Database (CNDDB) is an inventory of the status and locations of rare plants and wildlife in California; it identifies the locations of specific vegetation communities that are recognized by the California Department of Fish and Wildlife (CDFW). Natural communities with CNDDB State Ranks of S1, S2, and S3 (Critically Imperiled, Imperiled, and Vulnerable) are considered sensitive natural communities.

Numerous sensitive natural communities are known to occur or have the potential to occur within the study area. Table 7.6.1-1 presents wetland, riparian, and aquatic sensitive natural communities that are hydrologically connected to rivers and streams in the study area (CDFW 2022). Vernal pool sensitive natural communities (e.g., northern vernal pools) also have the potential to occur or are known to occur in the study area. These are excluded from Table 7.6.1-1 because they form in depressions over a restrictive layer such as hardpan, claypan, or basalt; are fed by direct rainfall; and are isolated from groundwater (Holland and Keil 1995). Vernal pools often are hydrologically isolated from rivers and streams, do not receive water from rivers and streams, and are not groundwater-dependent ecosystems; therefore, they would not be affected by changes in hydrology or changes in water supply. The vegetation classification and naming for sensitive natural communities in Table 7.6.1-1 follows that presented in CNDDB (CDFW 2022), which generally follows the *Preliminary Descriptions of the Terrestrial Vegetation Communities of California* (Holland 1986).

Table 7.6.1-1. Sensitive Natural Communities with Potential to Occur or Known to Occur in the Study Area

Sensitive Natural Community	State Rank [a]	Study Area Geographic Region
Alkali meadow	S2.1	Sacramento River watershed, San Francisco Bay Area
Alkali seep	S2.1	Sacramento River watershed, San Francisco Bay Area, San Joaquin Valley, Central Coast, Southern California
Central coast arroyo willow riparian forest	S3.2	Central Coast
Cismontane alkali marsh	S1.1	San Francisco Bay Area, San Joaquin Valley, Southern California
Coastal and valley freshwater marsh	S2.1	Sacramento River watershed, San Francisco Bay Area, Delta, San Joaquin Valley, Central Coast, Southern California
Coastal brackish marsh	S2.1	San Francisco Bay Area, Central Coast, Southern California
Darlingtonia seep	S3.2	Sacramento River watershed
Fen	S1.2	Sacramento River watershed

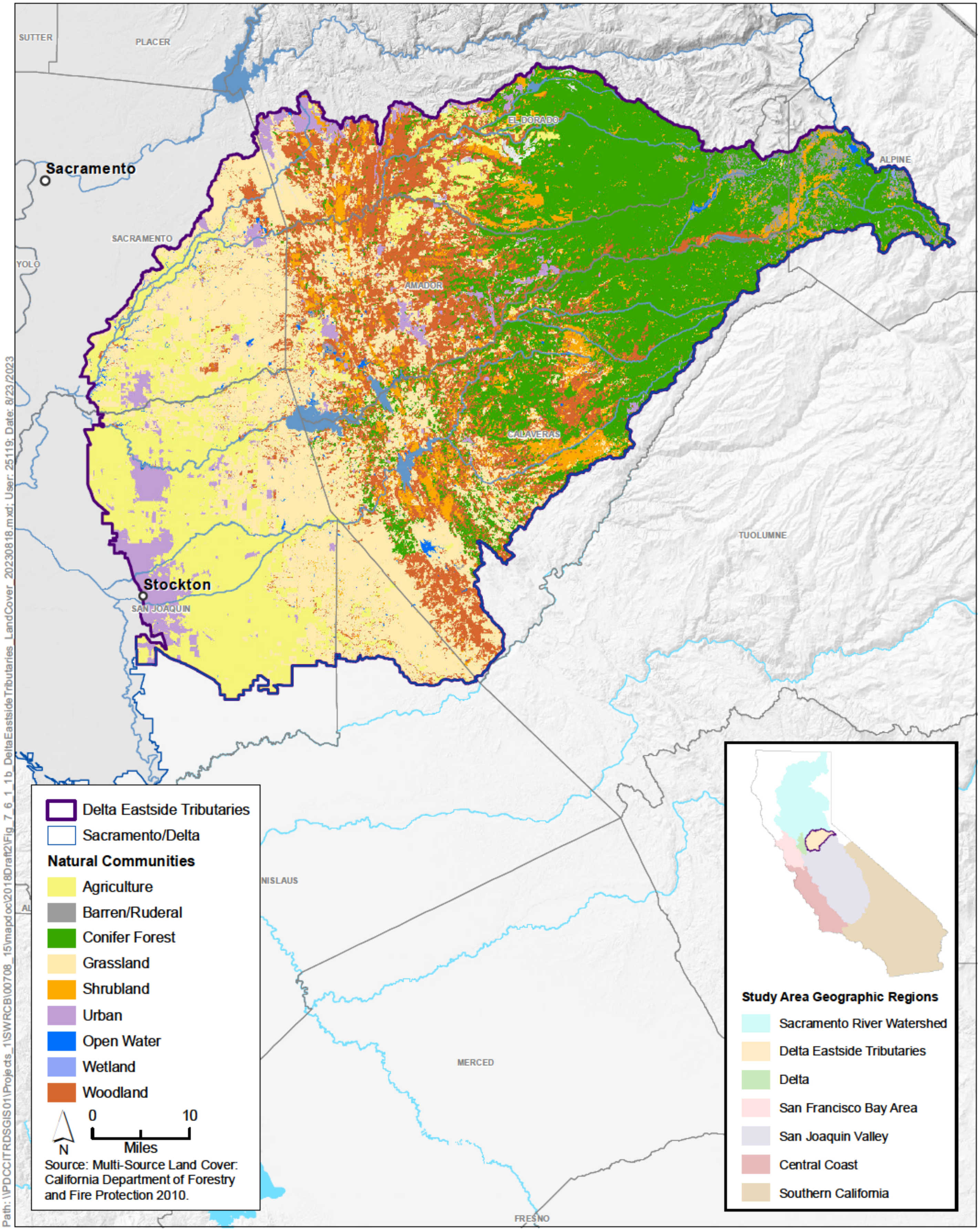

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Figure 7.6.1-1b
Natural Communities in the Delta Eastside Tributaries

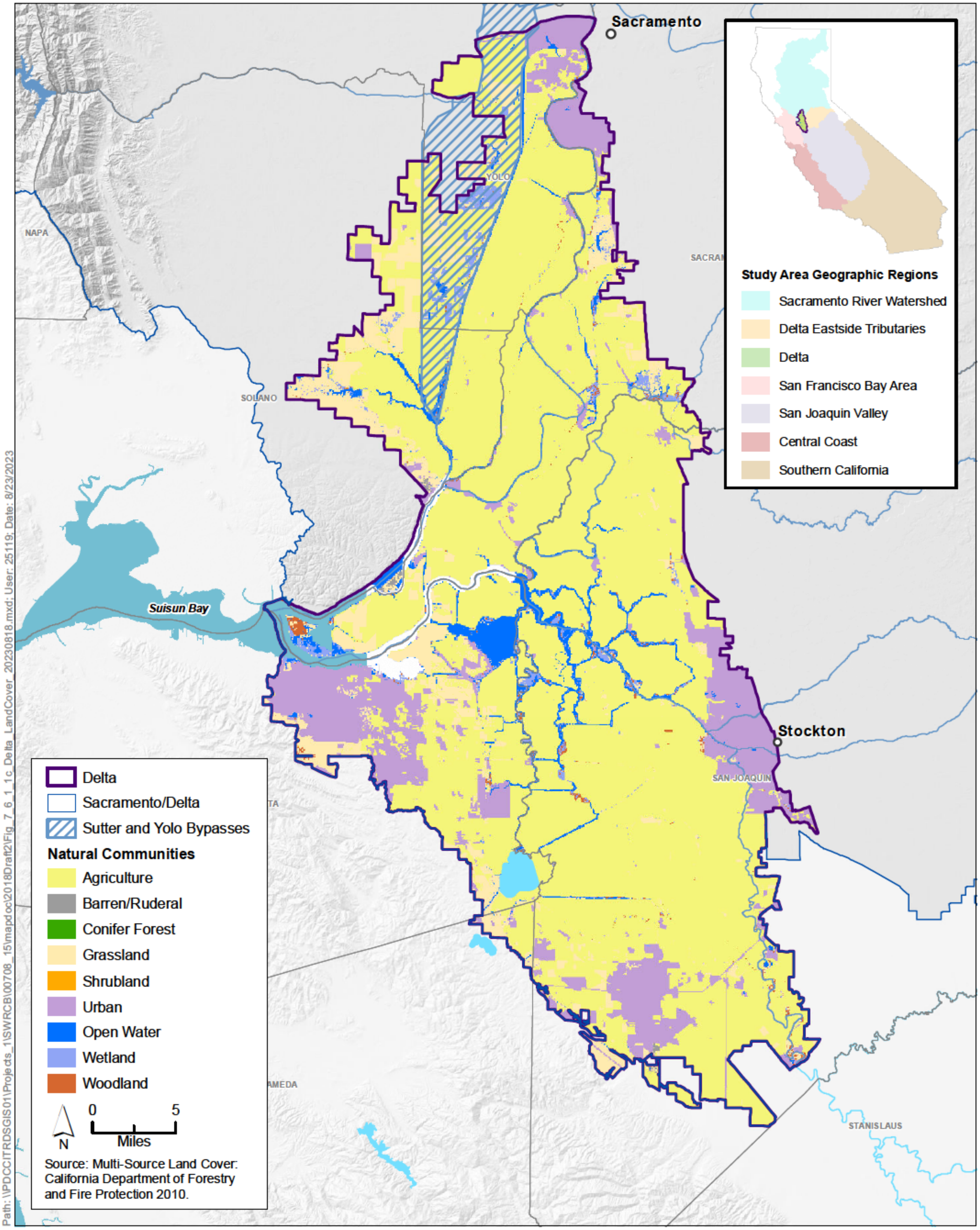

Figure 7.6.1-1c
Natural Communities in the Delta

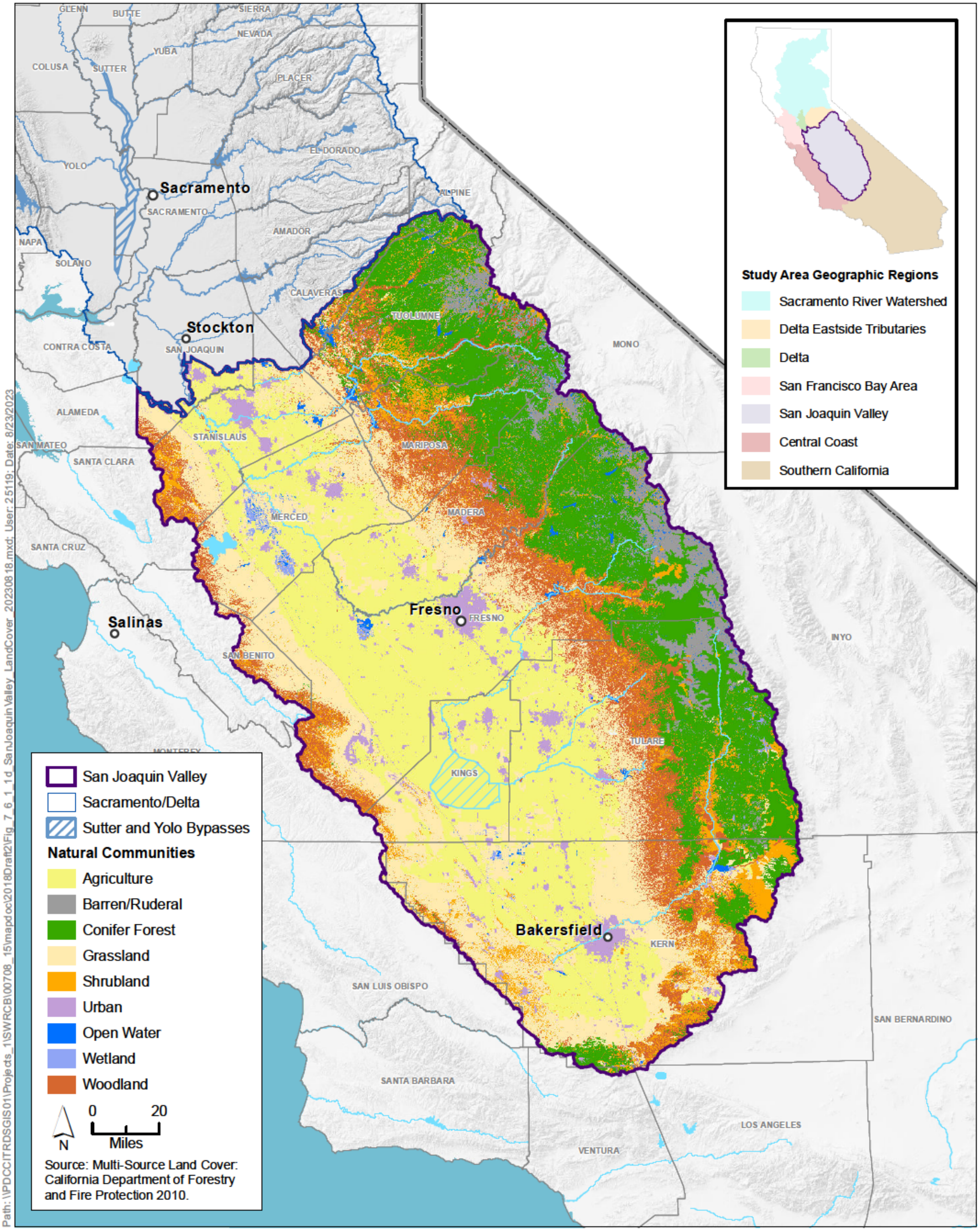

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Figure 7.6.1-1d
Natural Communities in the San Joaquin Valley

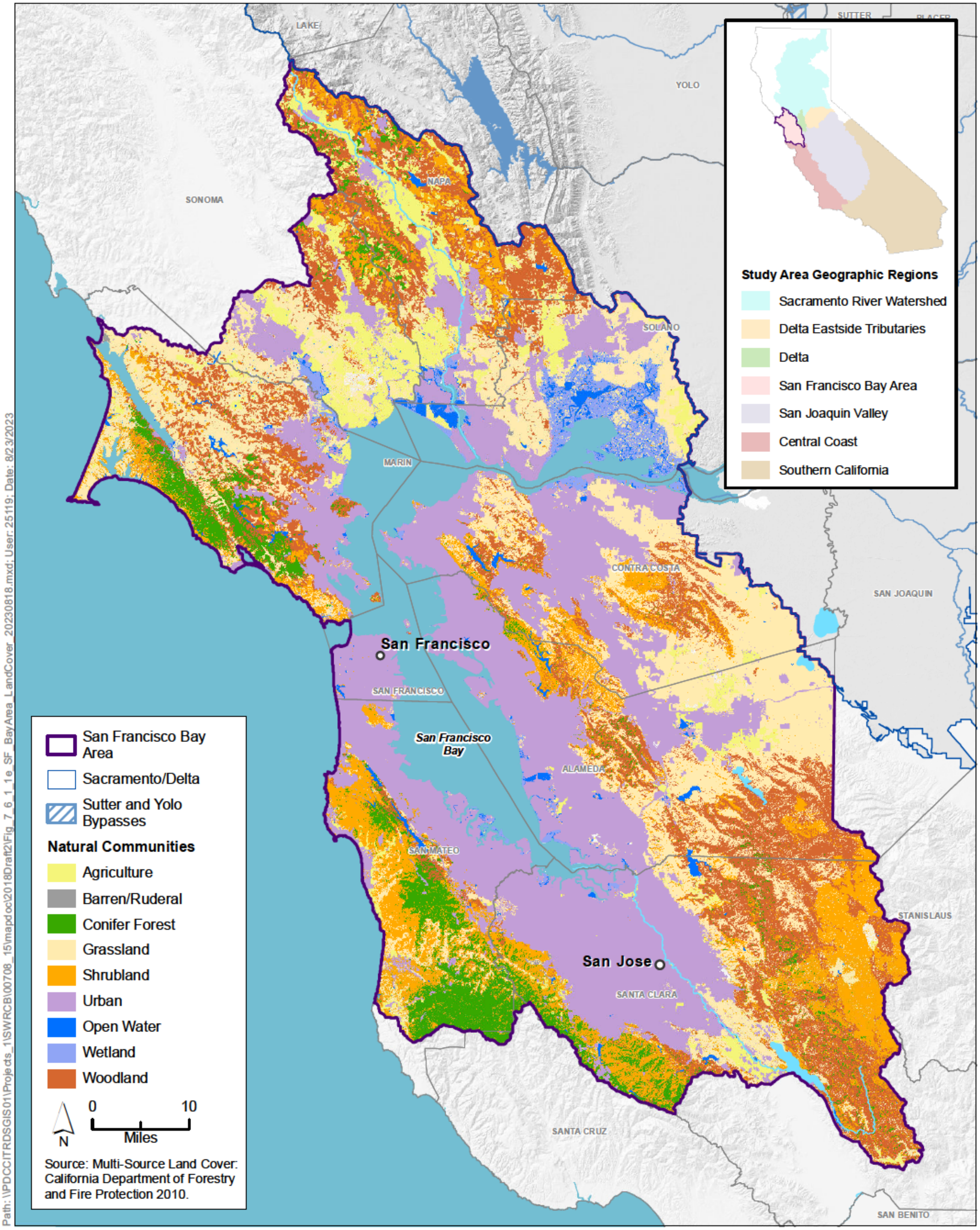


Figure 7.6.1-1e
Natural Communities in the San Francisco Bay Area

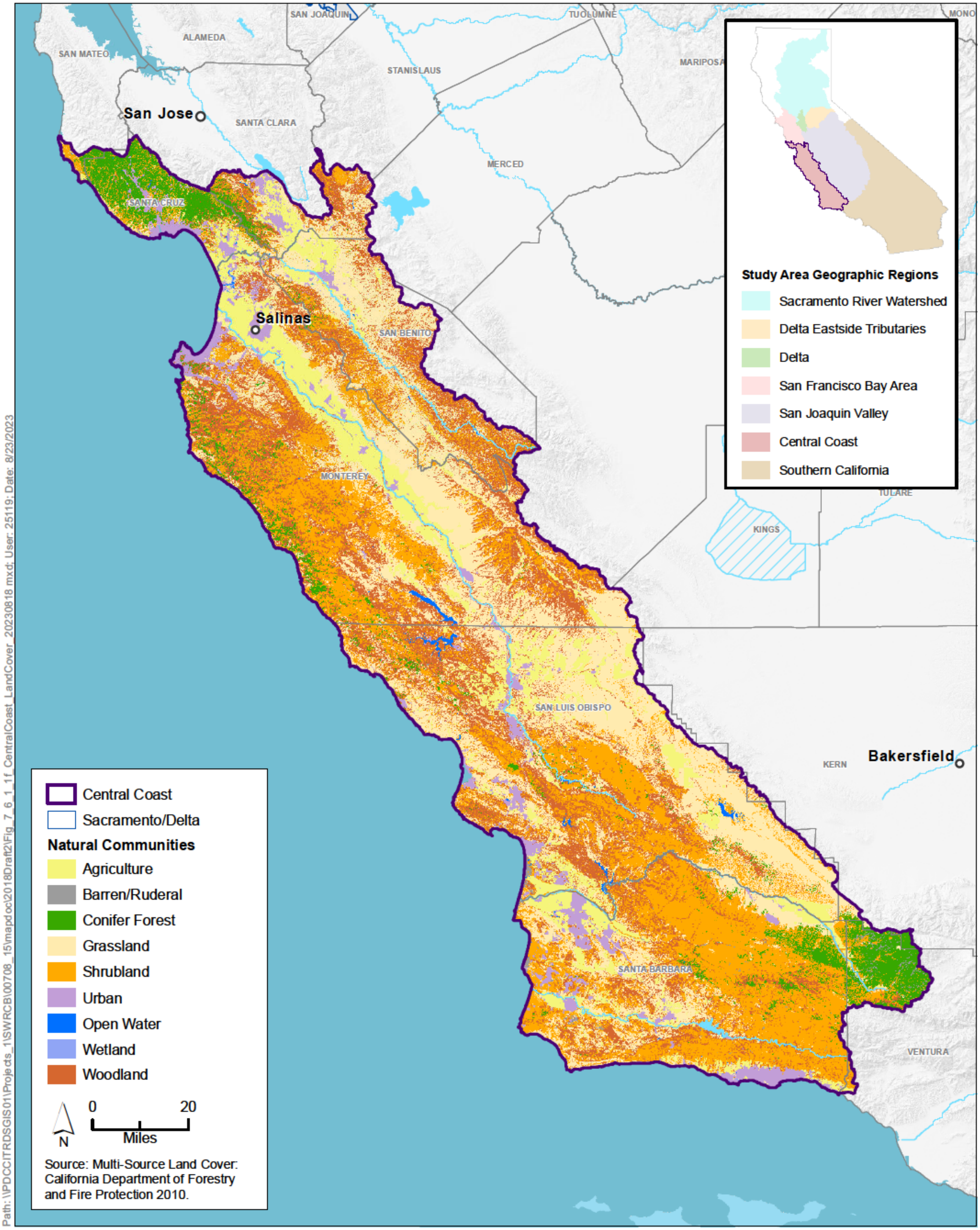
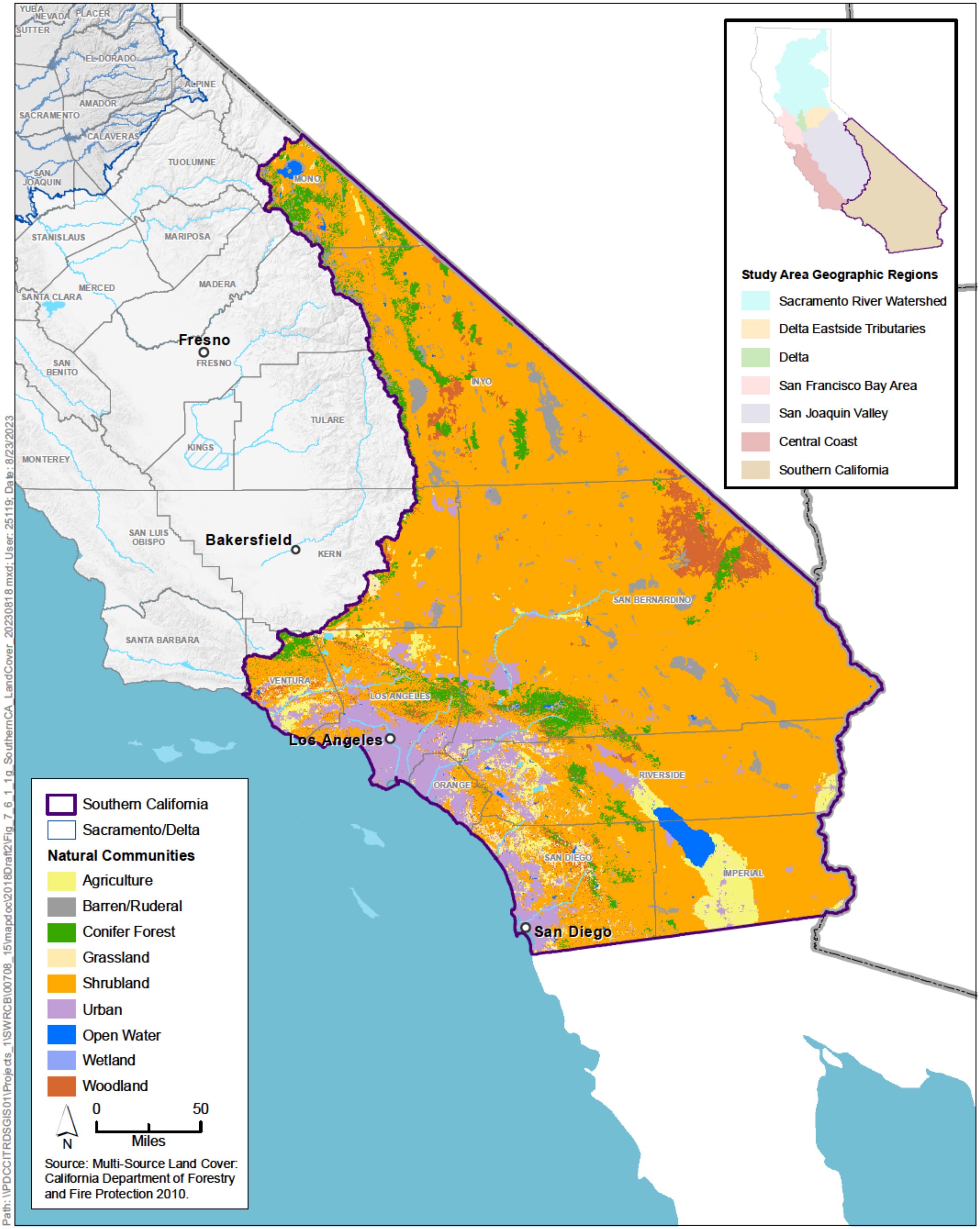


Figure 7.6.1-1f
Natural Communities in the Central Coast



Path: \\PDCCITRDSGIS01\Projects_1\SWRCB\00708_15\mapdoc\2018Draft2\Fig_7_6_1_1g_SouthernCA_LandCover_20230818.mxd; User: 25119; Date: 8/23/2023

Figure 7.6.1-1g
Natural Communities in Southern California

Sensitive Natural Community	State Rank [a]	Study Area Geographic Region
Great Valley cottonwood riparian forest	S2.1	Sacramento River watershed, San Joaquin Valley
Great Valley mesquite scrub	S1.1	San Joaquin Valley
Great Valley mixed riparian forest	S2.2	Sacramento River watershed, Delta eastside tributaries, San Joaquin Valley
Great Valley valley oak riparian forest	S1.1	Sacramento River watershed, Delta eastside tributaries, San Joaquin Valley
Great Valley willow scrub	S3.2	Sacramento River watershed
Mesquite bosque	S2.1	Southern California
Mojave riparian forest	S1.1	Southern California
Montane freshwater marsh	S3.2	Sacramento River watershed
Northern coastal salt marsh	S3.2	San Francisco Bay Area, Central Coast
Southern coastal salt marsh	S2.1	Southern California
Sonoran cottonwood willow riparian forest	S1.1	Southern California
Southern cottonwood willow riparian forest	S3.2	Central Coast, Southern California
Southern mixed riparian forest	S2.1	Southern California
Southern riparian scrub	S3.2	Southern California
Southern willow scrub	S2.1	Central Coast, Southern California
Sphagnum bog	S1.2	Sacramento River watershed
Sycamore alluvial woodland	S1.1	San Francisco Bay Area, Central Coast, San Joaquin Valley
Transmontane alkali marsh	S2.1	Southern California
Valley oak woodland	S2.1	Sacramento River watershed, Delta eastside tributaries, San Francisco Bay Area, Central Coast, San Joaquin Valley, Southern California

[a] State Rank Descriptions:

S1 = Critically Imperiled—Critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state.

S2 = Imperiled—Imperiled in the state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state.

S3 = Vulnerable—Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

Decimals:

.1 = Indicates very threatened status.

.2 = Indicates moderate threat.

Special-Status Species

Special-status species are those species considered sufficiently rare that they require special consideration or protection and should be legally protected or are otherwise considered sensitive by federal, state, or local resource agencies. Special-status species are species, subspecies, or varieties that fall into one or more of the following categories.

- Listed as threatened or endangered under the federal Endangered Species Act (ESA).
- Proposed or candidates for listing under the ESA.

- Listed as threatened or endangered under the California Endangered Species Act (CESA).
- Plants listed as rare under the California Native Plant Protection Act (NPPA).
- Candidates for listing under CESA.
- California Species of Special Concern.
- California Fully Protected species.
- Plants identified by the California Native Plant Society (CNPS) and CDFW as rare, threatened, or endangered in California (California Rare Plant Ranks 1B and 2B).

Many special-status plants and wildlife are known to occur or have the potential to occur in the study area, including many species of plants as well as birds, mammals, amphibians, reptiles, insects, arachnids, fish, crustaceans, and mollusks. Table 7.6.1-2 and Table 7.6.1-3 present special-status plants and wildlife that are known to or have the potential to occur in wetland, riparian, or aquatic habitats that are hydrologically connected to rivers and streams in the study area. Special-status species that do not occur in wetland, riparian, and aquatic habitats and species that occur only in vernal pools and isolated wetlands (e.g., vernal pool fairy shrimp) are excluded from Table 7.6.1-2 and Table 7.6.1-3. These species are included in Table C.2-1 in Appendix C, *Supplemental Special-Status Species Lists for Plants and Wildlife*. Special-status fish species are described in Section 7.6.2, *Aquatic Biological Resources*.

The special-status species lists were generated based on information obtained from several sources, including (1) a list generated by querying the CNDDB for species that have been reported in the counties within the study area (^CDFW 2021); and (2) a list of species with the potential to occur within the study area as identified by the U.S. Fish and Wildlife Service's (USFWS) Information for Planning and Consultation website (^USFWS 2021). These lists were then assessed based on the potential for each species to occur in wetland, riparian, or aquatic habitats that are hydrologically connected to rivers and streams. The species status listings were reviewed and updated according to the *State and Federally Listed Endangered, Threatened, and Rare Plants of California* (^CDFW 2023a), *Special Vascular Plants, Bryophytes, and Lichens List* (^CDFW 2023b), *State and Federally Listed Endangered and Threatened Animals of California* (^CDFW 2023c), and *Special Animals List* (^CDFW 2023d).

Table 7.6.1-2. Special-Status Plants with Potential to Occur or Known to Occur in the Study Area

Common and Scientific Name	Legal Status [a] Federal/State /CRPR	General Habitat	Study Area Geographic Region
Grass alisma *Alisma gramineum*	–/–/2B.2	Wetland, ponds	Sacramento River watershed
Singlewhorl burrobrush *Ambrosia monogyra*	–/–/2B.2	Riparian, dry washes	Southern California
Marsh sandwort *Arenaria paludicola*	FE/SE/1B.1	Wetland, wet meadow, marshes	Central Coast, Southern California
Horn's milk-vetch *Astragalus hornii* var. *hornii*	–/–/1B.1	Wetland, lake shores	San Joaquin Valley, Southern California
Ventura Marsh milk-vetch *Astragalus pycnostachyus* var. *lanosissimus*	FE/SE/1B.1	Wetland, seeps	Southern California

Common and Scientific Name	Legal Status [a] Federal/State /CRPR	General Habitat	Study Area Geographic Region
Coastal marsh milk-vetch *Astragalus pycnostachyus* var. *pycnostachyus*	–/–/1B.2	Wetland, streams, marshes	Southern California
Watershield *Brasenia schreberi*	–/–/2B.3	Aquatic, wetland, sloughs	Sacramento River watershed
Bristly sedge *Carex comosa*	–/–/2B.1	Wetland, riparian	Sacramento River watershed, Delta, San Joaquin Valley
Salt marsh bird's-beak *Chloropyron maritimum* ssp. *maritimum*	FE/SE/1B.2	Marshes, sloughs	Southern California
Soft bird's-beak *Chloropyron molle* ssp. *molle*	FE/SR/1B.2	Wetland, marshes	San Francisco Bay Area (Suisun Marsh)
Slough thistle *Cirsium crassicaule*	–/–/1B.1	Wetland, riparian areas, marshes, sloughs	San Joaquin Valley, Delta
Suisun thistle *Cirsium hydrophilum* var. *hydrophilum*	FE/–/1B.1	Wetland, marshes	San Francisco Bay Area (Suisun Marsh)
La Graciosa thistle *Cirsium scariosum* var. *loncholepis*	FE/ST/1B.1	Wetland, marshes	Central Coast
California saw-grass *Cladium californicum*	–/–/2B.2	Wetland, marshes	Central Coast, Southern California
Silky cryptantha *Cryptantha crinita*	–/–/1B.2	Riparian, dry streambeds	Sacramento River watershed
Peruvian dodder *Cuscuta obtusiflora* var. *glandulosa*	–/–/2B.2	Wetland, marshes	Sacramento River watershed, San Joaquin Valley
Mojave monkeyflower *Diplacus mohavensis*	–/–/1B.2	Dry washes	Southern California
Woolly rose-mallow *Hibiscus lasiocarpos* var. *occidentalis*	–/–/1B.2	Wetland, marshes, sloughs, canals	Sacramento River watershed, Delta
California satintail *Imperata brevifolia*	–/–/2B.1	Wetland, riparian	Sacramento River watershed, San Joaquin Valley, Southern California
San Diego marsh-elder *Iva hayesiana*	–/–/2B.2	Wetland, riparian	Southern California
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	–/–/1B.2	Wetland, marshes	Delta, San Francisco Bay Area (Suisun Marsh)
Mason's lilaeopsis *Lilaeopsis masonii*	–/SR/1B.1	Wetland, marshes	Delta, San Francisco Bay Area (Suisun Marsh)
Delta mudwort *Limosella australis*	–/–/2B.1	Wetland, marshes	Delta, San Francisco Bay Area (Suisun Marsh)
Mountain Springs bush lupine *Lupinus albifrons* var. *medius*	–/–/1B.3	Desert washes	Southern California

Common and Scientific Name	Legal Status [a] Federal/State /CRPR	General Habitat	Study Area Geographic Region
Mud nama *Nama stenocarpa*	–/–/2B.2	Wetland, margins of lakes, ponds, reservoirs	San Joaquin Valley, Southern California
White rabbit-tobacco *Pseudognaphalium leucocephalum*	–/–/2B.2	Riparian, dry washes	Southern California
Sanford's arrowhead *Sagittaria sanfordii*	–/–/1B.2	Wetland, streams, canals	Sacramento River watershed, Delta eastside tributaries, Delta, San Joaquin Valley, Southern California
Marsh skullcap *Scutellaria galericulata*	–/–/2B.2	Wetland, streambanks	Sacramento River watershed, Delta
Side-flowering skullcap *Scutellaria lateriflora*	–/–/2B.2	Wetland, marshes	Delta
California seablite *Suaeda californica*	FE/–/1B.1	Wetland, marshes	San Francisco Bay Area, Central Coast
Estuary seablite *Suaeda esteroa*	–/–/1B.2	Wetland, marshes	Southern California
Suisun Marsh aster *Symphyotrichum lentum*	–/–/1B.2	Wetland, marshes	Sacramento River watershed, Delta, San Francisco Bay (Suisun Marsh)
Wright's trichocoronis *Trichocoronis wrightii* var. *wrightii*	–/–/2B.1	Wetland, riparian areas, floodplains	Sacramento River watershed, San Joaquin Valley, Southern California
Brazilian watermeal *Wolffia brasiliensis*	–/–/2B.3	Aquatic, wetland, sloughs, canals	Sacramento River watershed

[a] Status explanations:
Federal Listing Categories:
FE = listed as endangered under the federal Endangered Species Act.
FT = listed as threatened under the federal Endangered Species Act.
– = no listing.
State Listing Categories:
SE = listed as endangered under the California Endangered Species Act.
ST = listed as threatened under the California Endangered Species Act.
SR = listed as rare under the California Native Plant Protection Act.
– = no listing.
California Rare Plant Rank (CRPR) Listing Categories:
1B = rare, threatened, or endangered in California and elsewhere.
2B = rare, threatened, or endangered in California but more common elsewhere.
.1 = seriously threatened in California.
.2 = fairly threatened in California.
.3 = not very threatened in California.

Table 7.6.1-3. Special-Status Wildlife (excluding Fish and Vernal Pool Branchiopods) with Potential to Occur or Known to Occur in the Study Area

Common and Scientific Name	Status [a] Federal/State	General Habitat Type	Study Area Geographic Region
Invertebrates			
Shasta crayfish *Pacifastacus fortis*	FE/SE	Streams	Sacramento River watershed

Common and Scientific Name	Status [a] Federal/State	General Habitat Type	Study Area Geographic Region
Monarch butterfly California overwintering population *Danaus plexippus plexippus* pop. 1	FC/–	Riparian, upland	Sacramento River watershed, Delta eastside tributaries, Delta, San Francisco Bay Area, San Joaquin Valley, Central Coast
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	FT/–	Riparian, upland	Sacramento River watershed, Delta eastside tributaries, Delta, San Joaquin Valley
Amphibians			
California tiger salamander, Central California DPS *Ambystoma californiense*	FT/ST	Wetland, upland	Sacramento River watershed, Delta eastside tributaries, Delta, San Francisco Bay Area, San Joaquin Valley, Central Coast
Yosemite toad *Anaxyrus canorus*	FT/SSC	Wet meadows, marshes	San Joaquin Valley, Southern California
Black toad *Anaxyrus exsul*	–/ST	Wet meadows, marshes	Southern California
Santa Cruz long-toed salamander *Ambystoma macrodactylum croceum*	FE/SE, FP	Wetland	Central Coast
Arroyo toad *Anaxyrus californicus*	FE/SSC	Streams, wetland, upland	Central Coast, Southern California
Pacific tailed frog *Ascaphus truei*	–/SSC	Upland, streams	Sacramento River Watershed
Inyo Mountains slender salamander *Batrachoseps campi*	–/SSC	Riparian, streams	Southern California
Kern Canyon slender salamander *Batrachoseps simatus*	FPT/ST	Seeps and springs, riparian and woodland	San Joaquin Valley
California giant salamander *Dicamptodon ensatus*	–/SSC	Riparian, streams	San Francisco Bay Area, Central Coast
Northern leopard frog *Lithobates pipiens*	–/SSC	Wetland	Sacramento River Watershed
Foothill yellow-legged frog - Feather River DPS *Rana boylii* pop. 2	FPT/ST	Streams	Sacramento River watershed, Delta eastside tributaries, San Joaquin Valley
Foothill yellow-legged frog – north Sierra DPS *Rana boylii* pop. 3	–/ST	Streams	Sacramento River watershed, Delta eastside tributaries, San Joaquin Valley
Foothill yellow-legged frog – central coast DPS *Rana boylii* pop. 4	FPT/SE	Streams	San Francisco Bay Area, Central Coast

Common and Scientific Name	Status [a] Federal/State	General Habitat Type	Study Area Geographic Region
Foothill yellow-legged frog – south Sierra DPS *Rana boylii* pop. 5	FPE/SE	Streams	Delta eastside tributaries, San Joaquin Valley
Foothill yellow-legged frog – south coast DPS *Rana boylii* pop. 6	FPE/SE	Streams	Central Coast, Southern California
Cascades frog *Rana cascadae*	–/CE, SSC	Wetland, streams, upland	Sacramento River watershed
California red-legged frog *Rana draytonii*	FT/SSC	Streams, wetland, riparian, upland	Sacramento River watershed, Delta eastside tributaries, Delta, San Joaquin Valley, San Francisco Bay Area, Central Coast, Southern California
Southern mountain yellow-legged frog *Rana mucosa*	FE/SE	Streams, riparian	Southern California
Oregon spotted frog [b] *Rana pretiosa*	FT/SSC	Streams, wetland	Sacramento River watershed
Sierra Nevada yellow-legged frog *Rana sierrae*	FE/ST	Streams, riparian	Sacramento River watershed, Delta eastside tributaries, San Joaquin Valley
Red-bellied newt *Taricha rivularis*	–/SSC	Streams, riparian	Sacramento River watershed, San Francisco Bay Area
Coast Range newt *Taricha torosa*	–/SSC	Streams	Central Coast, Southern California
Reptiles			
Western pond turtle *Emys marmorata*	–/SSC	Streams, wetland, ponds, riparian, upland	Sacramento River watershed, Delta eastside tributaries, Delta, San Francisco Bay Area, San Joaquin Valley, Central Coast, Southern California
Giant gartersnake *Thamnophis gigas*	FT/ST	Wetland, upland, agricultural	Sacramento River watershed, Delta, Delta eastside tributaries, San Joaquin Valley
Two-striped gartersnake *Thamnophis hammondii*	–/SSC	Streams, riparian, wetland	Central Coast, Southern California
San Francisco gartersnake *Thamnophis sirtalis tetraaenia*	FE/SE, FP	Wetland	San Francisco Bay Area, Central Coast
South Coast gartersnake *Thamnophis sirtalis* ssp. *infernalis*	–/SSC	Streams, riparian, wetland	Southern California
Birds			
Burrowing owl *Athene cunicularia*	–/SSC	Upland, agricultural	Sacramento River watershed, Delta eastside tributaries, Delta, San Francisco Bay Area, San

Common and Scientific Name	Status [a] Federal/State	General Habitat Type	Study Area Geographic Region
			Joaquin Valley, Central Coast, Southern California
Tricolored blackbird *Agelaius tricolor*	–/ST, SSC	Riparian, wetland, agricultural	Sacramento River watershed, Delta eastside tributaries, Delta, San Francisco Bay Area, Central Coast, San Joaquin Valley, Southern California
Long-eared owl *Asio otus*	–/SSC	Upland, riparian	Sacramento River watershed, Delta eastside tributaries, San Francisco Bay Area, Central Coast, Southern California
Swainson's hawk *Buteo swainsoni*	–/ST	Upland, agricultural, riparian, oak woodland	Sacramento River watershed, Delta eastside tributaries, Delta, San Joaquin Valley, Southern California
Western snowy plover (Interior population) *Charadrisu nivosus nivosus*	–/SSC	Alkaline lake, shoreline	Sacramento River watershed, San Joaquin Valley, Southern California
Black tern *Chlidonias niger*	–/SSC	Wetland	Sacramento River watershed, Delta eastside tributaries, San Joaquin Valley
Northern harrier *Circus hudsonius*	–/SSC	Upland, agricultural, wetland	Sacramento River watershed, Delta eastside tributaries, Delta, San Francisco Bay Area, San Joaquin Valley, Central Coast, Southern California
Clark's marsh wren *Cistothorus palustris clarkae*	–/SSC	Marsh	Southern California
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	FT/SE	Riparian	Sacramento River watershed, San Joaquin Valley, Central Coast, Southern California
Yellow rail *Coturnicops noveboracensis*	–/SSC	Wetland	Sacramento River watershed, San Francisco Bay Area
Black swift *Cypseloides niger*	–/SSC	Upland, riparian	Sacramento River watershed, San Joaquin Valley, San Francisco Bay Area, Central Coast, Southern California
Fulvous whistling-duck *Dendrocygna bicolor*	–/SSC	Wetland, agricultural	San Joaquin Valley, Southern California
White-tailed kite *Elanus leucurus*	–/FP	Riparian, oak woodland, wetland, upland, agricultural	Sacramento River watershed, Delta, San Francisco Bay Area, San Joaquin Valley, Central Coast, Southern California
Willow flycatcher *Empidonax traillii*	–/SE	Riparian, wetland	Sacramento River watershed, Delta eastside tributaries, San Joaquin Valley

Common and Scientific Name	Status [a] Federal/State	General Habitat Type	Study Area Geographic Region
Southwestern willow flycatcher *Empidonax traillii extimus*	FE/SE	Riparian	Central Coast, San Joaquin Valley, Southern California
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	–/SSC	Wetland	San Francisco Bay Area (Suisun Marsh), Central Coast
Greater sandhill crane *Grus canadensis tabida*	–/ST, FP	Wetland, agricultural	Sacramento River watershed, Delta eastside tributaries, Delta, San Joaquin Valley, Southern California
Lesser sandhill crane *Grus canadensis canadensis*	–/SSC	Wetland, agricultural	Sacramento River watershed, Delta eastside tributaries, Delta, San Joaquin Valley, Southern California
Bald eagle *Haliaeetus leucocephalus*	–/SE, FP	Forages in large rivers, lakes, and reservoirs	Sacramento River watershed, Delta eastside tributaries, San Joaquin Valley, Central Coast, Southern California,
Harlequin duck *Histrionicus histrionicus*	–/SSC	Rivers, coastal zone	Sacramento River watershed, Delta eastside tributaries, San Joaquin Valley
Yellow-breasted chat *Icteria virens*	–/SSC	Riparian	Sacramento River Watershed, Delta eastside tributaries, Delta, San Joaquin Valley, San Francisco Bay Area, Central Coast, Southern California
Least bittern *Ixobrychus exilis*	–/SSC	Wetland	Sacramento River watershed, Delta, San Joaquin Valley, Central Coast, Southern California
California black rail *Laterallus jamaicensis coturniculus*	–/ST, FP	Wetland	Sacramento River watershed, Delta, San Francisco Bay Area, Central Coast, Southern California
Song sparrow “Modesto population” *Melospiza meloida*	–/SSC	Wetland	Sacramento River watershed, Delta, Delta eastside tributaries, San Joaquin Valley
Suisun song sparrow *Melospiza melodia maxillaris*	/SSC	Wetland	San Francisco Bay Area (Suisun Marsh)
Alameda song sparrow *Melospiza melodia pusillula*	–/SSC	Wetland	San Francisco Bay Area
San Pablo Bay song sparrow *Melospiza melodia samuelis*	–/SSC	Wetland	San Francisco Bay Area (San Pablo Bay)
Belding’s savannah sparrow *Passerculus sandwichensis belding*	–/SE	Wetlands – salt marsh	Southern California
American white pelican *Pelecanus erythrorhynchos*	–/SSC	Large lakes	Sacramento River watershed, Delta, Delta eastside tributaries, San Francisco Bay Area, San

Common and Scientific Name	Status [a] Federal/State	General Habitat Type	Study Area Geographic Region
			Joaquin Valley, Central Coast, Southern California
Inyo California towhee *Pipilo crissalis eremophilus*	FT/SE	Riparian, upland	Southern California
Summer tanager *Piranga rubra*	–/SSC	Riparian	Southern California
Vermilion flycatcher *Pyrocephalus rubinus*	–/SSC	Riparian	Southern California
California Ridgway's rail *Rallus obsoletus obsoletus*	FE/SE, FP	Wetland	San Francisco Bay Area, Central Coast
Bank swallow *Riparia riparia*	–/ST	Riparian (stream banks), upland	Sacramento River watershed, Delta, San Francisco Bay Area, Delta eastside tributaries, San Joaquin Valley, Central Coast, Southern California
Black skimmer *Rynchops niger*	–/SSC	Lakes, river mouths, coastal estuaries	Central Coast, Southern California
Yellow warbler *Setophaga petechia*	–/SSC	Riparian	Sacramento River watershed, Delta, San Francisco Bay Area, Delta eastside tributaries, San Joaquin Valley, Central Coast, Southern California
California least tern *Sterna antillarum browni*	FE/SE, FP	Wetland	Delta, San Francisco Bay Area, Central Coast, Southern California
Crissal thrasher *Toxostoma crissale*	–/SSC	Riparian	Southern California
Least Bell's vireo *Vireo bellii pusillus*	FE/SE	Riparian	Sacramento River watershed, Delta, Delta eastside tributaries, San Joaquin Valley, Central Coast, Southern California
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	–/SSC	Wetland, agricultural	Sacramento River watershed, Delta, San Francisco Bay Area, San Joaquin Valley, Central Coast, Southern California
Mammals			
Point Reyes mountain beaver *Aplodontia rufa phaea*	–/SSC	Upland, riparian	San Francisco Bay Area
Sierra Nevada mountain beaver *Aplodontia rufa californica*	–/SSC	Upland, riparian	Sacramento River watershed, Delta eastside tributaries, San Joaquin Valley
Mexican long-tongued bat *Choeronycteris mexicana*	–/SSC	Riparian, oak woodland	Southern California
Western red bat *Lasiurus blossevillii*	–/SSC	Upland, riparian, oak woodland, agricultural	Sacramento River watershed, Delta eastside tributaries, Delta, San Francisco Bay Area, San

Common and Scientific Name	Status [a] Federal/State	General Habitat Type	Study Area Geographic Region
			Joaquin Valley, Central Coast, Southern California
Oregon snowshoe hare *Lepus americanus klamathensis*	–/SSC	Riparian	Sacramento River watershed
Sierra Nevada snowshoe hare *Lepus americanus tahoensis*	–/SSC	Riparian	Sacramento River watershed, Delta eastside tributaries, San Joaquin Valley
Southwestern river otter [c] *Lontra canadensis sonora*	–/SSC	Aquatic, riparian	Southern California
California leaf-nosed bat *Macrotus californicus*	–/SSC	Riparian, oak woodland	Southern California
San Pablo vole *Microtus californicus sanpaloensis*	–/SSC	Wetland	San Francisco Bay Area (San Pablo Bay)
Mohave River vole *Microtus californicus mohavensis*	–/SSC	Riparian, wetland, oak woodland	Southern California
Amargosa vole *Microtus californicus scirpensis*	FE/SE	Wetland	Southern California
Riparian (=San Joaquin Valley) woodrat *Neotoma fuscipes riparia*	FE/SSC	Riparian	San Joaquin Valley
San Francisco dusky-footed woodrat *Neotoma fuscipes annectens*	-/SSC	Riparian	San Francisco Bay Area, Central Coast
Monterey dusky-footed woodrat *Neotoma macrotis luciana*	–/SSC	Riparian	Central Coast
Salt-marsh harvest mouse *Reithrodontomys raviventris*	FE/SE, FP	Wetland	Delta, San Francisco Bay Area
Buena Vista Lake ornate shrew *Sorex ornatus relictus*	FE/SSC	Riparian, wetland	San Joaquin Valley, Southern California
Monterey shrew *Sorex ornatus salarius*	–/SSC	Riparian, wetland	San Francisco Bay Area, Central Coast
Suisun shrew *Sorex ornatus sinuosus*	–/SSC	Wetland	Delta, San Francisco Bay Area
Salt marsh wandering shrew *Sorex vagrans halicoetes*	–/SSC	Wetland	San Francisco Bay Area
Riparian brush rabbit *Sylvilagus bachmani riparius*	FE/SE	Riparian	Delta, San Joaquin Valley

pop. = population; referring to the DPS of the species
DPS = distinct population segment
[a] Federal Listing Categories:

FE = Listed as endangered under the federal Endangered Species Act.
FT = Listed as threatened under the federal Endangered Species Act.
FPE = Proposed to be listed as endangered under the federal Endangered Species Act.
FPT = Proposed to be listed as threatened under the federal Endangered Species Act.
FC = Candidate for protection under the federal Endangered Species Act.
– = No status.
State Listing Categories:
SE = Listed as endangered under the California Endangered Species Act.
ST = Listed as threatened under the California Endangered Species Act.
CE = Candidate for protection under the California Endangered Species Act as endangered.
CT = Candidate for protection under the California Endangered Species Act as threatened.
FP = Fully Protected under the California Fish and Game Code.
SSC = Designated as a California Species of Special Concern.
– = No status.
[b] Oregon spotted frog has not been detected in California since 1918 and may be extirpated from California. However, there has been limited survey effort of potential habitat in California (79 Fed. Reg. 51658).
[c] Based on the absence of observations and trapping records since 1975, the species may be extirpated from California (Kucera 1998).

Natural Communities, Habitats, and Species

Mapped natural communities for each geographic region are presented in Figures 7.6.1-1a through 7.6.1-1g and display the broadest categories in the 2002 Multi-Source Land Cover Data by California Department of Forestry and Fire Protection. The descriptions below generally follow the classification of the communities following the California Wildlife Habitat Relationship System. Natural communities that are hydrologically connected to streams and rivers are presented first, followed by upland natural communities, habitats, and species that are not directly hydrologically connected to streams and rivers.

Riparian

Riparian habitats are plant communities found along rivers, streams, and creeks. Riparian vegetation functions as a transition zone between aquatic and upland terrestrial habitat. The water body provides soil moisture that is greater than typically available through precipitation, which potentially supports the growth of vegetation. Riparian habitat is a broad vegetation category, and many types of riparian habitats occur in California (Riparian Habitat Joint Venture 2004). Multiple riparian sensitive natural communities are known to occur or have the potential to occur in the study area (Table 7.6.1-1), including Central Coast arroyo willow riparian forest, Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, Great Valley valley oak riparian forest, Mojave riparian forest, southern cottonwood willow riparian forest, southern mixed riparian forest, and southern riparian scrub (^CDFW 2021).

Riparian habitat provides food, cover, nesting habitat, and migration corridors for many terrestrial wildlife species. Over 225 species of birds, mammals, amphibians, and reptiles depend on California's riparian habitats (Riparian Habitat Joint Venture 2004). Riparian habitat is used for nesting and roosting by numerous raptors, such as red-tailed hawk (*Buteo jamaicenesis*), red-shouldered hawk (*B. lineatus*), Swainson's hawk (*B. swainsoni*), white-tailed kite (*Elanus leucurus*), barn owl (*Tyto alba*), great horned owl (*Bubo virginianus*), and American kestrel (*Falco sparverius*). (^CDFW 2021). Riparian forest trees also provide nesting habitat for cavity-nesting species, such as downy woodpecker (*Picoides pubescens*), northern flicker (*Colaptes auratus*), ash-throated flycatcher (*Myiarchus cinerascens*), oak titmouse (*Baeolophus inornatus*), tree swallow (*Tachycineta bicolor*), and white-breasted nuthatch (*Sitta carolinensis*). Riparian forests support large populations of insects that are prey for migratory and resident birds, including willow flycatcher (*Empidonax* *traillii*), western wood-pewee (*Contopus sordidulus*), western kingbird (*Tyrannus verticalis*), warbling vireo (*Vireo gilvus*), song sparrow (*Melospiza melodia*), yellow warbler (*Dendroica petechia*), Bullock's oriole (*Icterus bullockii*), and spotted towhee (*Pipilo maculatus*). Milkweeds (*Asclepias* spp.), the primary host plants for monarch butterfly, often are associated with riparian corridors (USFWS 2020a). Several mammal species also use riparian forests, including bobcat (*Felis rufus*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), red fox (*Vulpes vulpes*), Virginia opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), and striped skunk (*Mephitis mephitis*) (Riparian Habitat Joint Venture 2004).

Riparian habitats in the Sacramento/Delta and elsewhere in California have greatly diminished over the past 150 years. Many factors, such as agricultural conversions, livestock grazing, reservoir construction, channelization projects, timber harvest, gravel and gold mining, water quality impacts, and introduction of nonnative species, have contributed to riparian habitat destruction (Riparian Habitat Joint Venture 2004; Knopf et al. 1988). The destruction of riparian habitat is a key cause of land bird species population declines in western North America (DeSante and George 1994). Historically, the Sacramento River system and surrounding tributaries contained significant vegetated riparian areas, including stands of oak, cottonwood, and other deciduous and coniferous trees (Gibson 1975; Smith 1980), in addition to vines, shrubs, and grasses that sprung up when fluvial and alluvial sediments and their associated flows were more prevalent (^Whipple et al. 2012). Riparian forests also historically occurred along the Delta eastside tributaries and along rivers in the San Joaquin Valley (Katibah 1984). Riparian habitat along the Sacramento River and elsewhere in the Central Valley is a remnant of the extensive riparian forest that historically existed (Gibson 1975; Katibah 1984). Riparian habitat now generally occurs in narrow, discontinuous patches and can include remnants of riparian forest. Remaining riparian forest patches are located along many of the major and minor waterways, oxbows, and levees in the Central Valley. Similarly, in the Delta, remaining riparian forest and woodland communities are mostly limited to narrow bands along sloughs, channels, rivers, and other freshwater features. Riparian forest communities now occur in the Delta most often as long, linear patches bordering agricultural or urban land or in low-lying, flood-prone patches near river bends, canals, or breached levees. Some riparian plant species, such as cottonwood and willow species, depend upon specifically timed flooding for their recruitment (Stromberg 2001; Rood et al. 2003; The Nature Conservancy et al. 2008). The timing of flood flows, especially the recession limb of the hydrograph (Mahoney and Rood), is critical for seedbed preparation, germination, and establishment; and some riparian plant species have co-evolved to release seeds when flood waters recede (Griggs and Lorenzato 2020). Soil moisture from flooding stimulates germination, but these seeds also require oxygen available in those drying soils. If the seeds fall on dry ground, they desiccate and die; but if they are subjected to repeated flooding, they are starved for oxygen and die (Griggs and Lorenzato 2020). As such, flood water must recede slowly enough to allow for high survival of seeding (Stromberg 2001). In addition, sediment deposition resulting from flood flows creates *nursery bars* for the establishment of riparian vegetation that is adapted to colonizing these newly formed bars (Stromberg 2001; Griggs and Lorenzato 2020). Depending on the period of water recessions following winter flood peaks, both spring-seeding and summer-seeding riparian plant species can benefit from flooding events (Stromberg 2001; Griggs and Lorenzato 2020).

Riverine

Rivers, streams, and creeks are present throughout California and can occur in association with many terrestrial habitats, including freshwater emergent wetland, lacustrine, and riparian habitats.

Many perennial, intermittent, and ephemeral streams occur throughout the study area. The many rivers, streams, and creeks in the Sacramento/Delta range from headwater streams in the upper watersheds to major rivers on the valley floor. The rivers in the Sacramento/Delta with the highest mean annual runoff are the Sacramento, Feather, Yuba, and American Rivers.

Many other rivers, streams, and creeks occur in other geographic regions of the study area. The on-stream export reservoirs in the San Francisco Bay Area, Central Coast, and Southern California regions that receive Sacramento/Delta supplies are identified in Section 7.6.2, *Aquatic Biological Resources*. The rivers and streams below these reservoirs include Coyote Creek (San Francisco Bay Area), Arroyo Valle (San Francisco Bay Area), Santa Ynez River (Central Coast), Piru Creek (Southern California), Castaic Creek (Southern California), West Fork Mojave River (Southern California), and Warm Springs Creek (Southern California).

Alluvial rivers alternate between relatively stable, straight sections to more sinuous, dynamic sections (Sacramento River Advisory Council 2003) with the potential to migrate during times of high flow. Migration creates floodplains, basins, terraces, active and remnant channels, and oxbow sloughs that sustain riparian vegetation. Highly regulated flow regimes inhibit bank scour and sediment deposition, and declining spring hydrographs inhibit regeneration of riparian species. In areas constrained by levees, urbanization, or agriculture, riparian vegetation is only a thin band of trees with little to no understory. Some levees are set back from the water's edge, affording opportunities for the maintenance of larger areas of riparian habitat. As the river gradient decreases, channels become narrower and deeper, with continuous levees along both sides. Lower reaches can be influenced by tidal action during much of the year (USFWS 2004).

Many rivers, streams, and creeks in California exhibit impaired hydrologic regimes as a result of diversions and reservoir operations. In addition, some streams in California receive municipal and agricultural discharges. Some streams that historically were intermittent are now perennial due to municipal discharges and other artificial inputs. These impaired waterways often support nonnative wildlife, such as American bullfrog (*Lithobates catesbeiana*) and signal crayfish (*Pacifastacus leniusculus*) that are adapted to perennial systems and now compete with and prey on native wildlife. Altered flow regimes negatively affect aquatic ecosystems (^Pringle et al. 2000; ^Freeman et al. 2001; ^Bunn and Arthington 2002; ^Moyle and Mount 2007). An assessment of streams across the conterminous United States shows a strong correlation between simplified or diminished streamflows and impaired biological communities including fish (^Carlisle et al. 2011). Native communities of fish and other aquatic species are adapted to spatial and temporal variations in river flows under which those species evolved, including extreme events such as floods and droughts (^Sparks 1995; ^Lytle and Poff 2004). On the other hand, permanent or more constant flows, created by damming or diverting river flows, favor introduced species (^Moyle and Mount 2007; ^Poff et al. 2007; ^Pringle et al. 2000;^Brown and Bauer 2009; ^Kiernan et al. 2012). More natural flow regimes support the various life history characteristics of native aquatic organisms that are adapted to the natural flow regime (^Bunn and Arthington 2002; ^Lytle and Poff 2004).

Many fish and wildlife species use riverine habitat. Section 7.6.2, *Aquatic Biological Resource*s, discusses special-status fish species and their habitats. Many species of insectivorous birds, such as flycatchers, swifts, and swallows, hunt over water. Some larger birds, such as gulls, terns, osprey (*Pandion haliaetus*), and bald eagle (*Haliaeetus leucocephalus*), hunt in open water. Large rivers can provide resting and escape cover for waterfowl. Amphibians utilize streams, rivers, and smaller ponds and lakes as habitat. Some mammals found in riverine habitats include river otter (*Lontra canadensis pacifica*) and American beaver (*Castor canadensis*). Benthic macroinvertebrates, which comprise mostly aquatic insect larva but also include crustaceans, mollusks, and worms, live at the bottom of rivers and streams. Several special-status wildlife species identified in Table 7.6.1-3 are known to occur or have the potential to occur in riverine habitat within the study area.

The bank swallow (*Riparia riparia*) is a colonial-breeding migrant that nests along rivers, streams, and other waters. The bank swallow arrives in California during mid-March and departs for its wintering grounds by August (CDFG 1992; Garrison 2004). Bank swallows require fine-textured sandy soils to create their burrows in vertical banks along rivers, streams, or other water. The species is dependent on bank erosion from high winter river flows to create suitable burrow substrate (Garrison 2004). Bank swallows arrive in California each spring to seek suitable colony locations, excavate burrows, and form pairs (Bank Swallow Technical Advisory Committee 2013). Peak egg-laying occurs from mid-April to mid-May, and most juveniles fledge by mid-July (Bank Swallow Technical Advisory Committee 2013). Approximately 70 to 90 percent of the known bank swallow population in California nests in colonies along the Sacramento and Feather Rivers (Bank Swallow Technical Advisory Committee 2013). The greatest threat to bank swallow populations in California has been the gradual loss of river processes that provide habitat for the species. Bank swallow nesting habitat has been largely affected by bank stabilization through the placement of rock revetment, which prevents the formation of steep, cut sandy banks along streams and rivers (Bank Swallow Technical Advisory Committee 2013). The species also has been affected by dam operations that have altered the timing, magnitude, duration, and frequency of winter high-flow events on the Sacramento and Feather Rivers that lead to channel migration and formation of cut banks (Bank Swallow Technical Advisory Committee 2013).

Oak Woodlands

Oaks are found in diverse habitat types in California, including the Central Valley, lower-elevation foothills, mixed coniferous zones, and coastal mountains. Many deciduous and evergreen oaks occur in California's oak woodlands. Oak woodlands also support many other plant and wildlife species. Five California oak woodland vegetation types are used in the California Wildlife Habitat Relationships System based on the dominant tree species: blue oak woodland, blue oak-foothill pine woodland, coastal oak woodland, montane hardwood forest, and valley oak woodland.

Blue oak woodlands are oak woodlands dominated by blue oaks (*Quercus douglasii*). Other oaks that commonly occur in blue oak woodlands include coast live oak (*Q. agrifolia*) in the Coast Ranges, interior live oak (*Q. wiselizeni*) in the Sierra Nevada, and valley oak (*Q. lobata*) and western juniper (*Juniperus occidentalis*) in the Cascade Range. Other plants in blue oak woodlands include various shrub species as well as annuals that provide ground cover. Blue oak woodlands generally occur in the foothills around the Central Valley, including the western foothills of the Sierra Nevada and Cascade Range, the Tehachapi Mountains, and the eastern foothills of the Coast Ranges. Blue oak woodland habitat generally occurs between elevations of 250 and 4,500 feet. (Ritter 1988a.)

Blue oak-foothill pine woodlands contain a mix of conifers, hardwoods, and shrubs, with an overstory typically composed of blue oaks and foothill pines. Other tree species in blue oak-foothill pine woodlands include interior live oak (in the Sierra Nevada), California buckeye (*Aesculus californica*) (in the Sierra Nevada and Coast Ranges), coast live oak (in the Coast Ranges), and valley oak (in the Coast Ranges). Annual grasses, forbs, and shrubs can also be found in blue oak-foothill pine woodlands. Many wildlife species use blue oak-foothill pine woodlands, such as cavity-nesting birds. Blue oak-foothill pine woodland habitat generally occurs in a discontinuous ring around the Central Valley, in the foothills between elevations of 500 and 3,000 feet. (Verner 1988.)

Coastal oak woodlands are a diverse habitat type that are commonly dominated by coast live oak. Other trees in coastal oak woodlands include California bay (*Umbellularia californica*), madrone (*Arbutus menziesii*), tanbark oak (*Notholithocarpus densiflorus*), and canyon live oak (*Q. chrysolepis*). On drier, interior sites, coastal oak woodlands can include valley oak, blue oak, and foothill pine (*Pinus sabiniana*). Other plants in coastal oak woodlands include shrubs and grassland species. Coastal oak woodlands provide habitat for many wildlife species, including many mammals and birds. Coastal oak woodlands are present in the coastal foothills and valleys from Trinity and Humboldt Counties south to Baja California, at elevations that range from sea level near the coast to approximately 5,000 feet in interior regions. (Holland 2005.)

Montane hardwood forests are a variable habitat type that typically contains a hardwood tree layer. Oaks that characteristically are found in montane hardwood forests include canyon live oak, interior live oak, California black oak (*Q. kelloggii*), and Oregon white oak (*Q. garryana*). Other tree species in montane hardwood forests can include pine, fir, and Douglas-fir (*Pseudotsuga menziesii*). Woody shrubs and forbs can occur in the understory. Many wildlife species are present in montane hardwood forests, such as species that disseminate and use acorns as a major food source. Montane hardwood forests are located at elevations of 300 to 9,000 feet. (Verner 1988.)

Valley oak woodlands are dominated by valley oaks. Valley oak woodlands vary from savanna-like to forest-like stands with partially closed canopies. Other trees in valley oak woodlands in the Central Valley can include California sycamore (*Platanus racemosa*), black walnut (*Juglans sp.*), interior live oak, boxelder (*Acer negund*o), and blue oak. In the Coast Ranges, coast live oak and foothill pine can occur in valley oak woodlands. Denser stands typically grow in valley soils along natural drainages and may be considered groundwater-dependent vegetation. Tree density decreases with the transition from lowlands to the less fertile soils of drier uplands. Similarly, the shrub layer is best developed along natural drainages, becoming insignificant in the uplands with more open stands of oaks. Valley oak stands with little or no grazing tend to develop a partial shrub layer of bird-disseminated species, such as poison oak (*Toxicodendron diversilobum*), toyon (*Heteromeles arbutifolia*), and coffeeberry (*Rhamnus californica*). Valley oak woodlands provide food and cover for many species of wildlife. Oaks have long been considered important to some birds and mammals as a food resource (i.e., acorns and browse) (Ritter 1988b). Many birds, such as red-shouldered hawk, use valley oak woodlands as breeding habitat. Valley oak woodlands also provide food and shelter to many mammals, such as gray fox, western gray squirrel (*Sciurus griseus)*, and mule deer (*Odocoileus hemionus*). Several species identified in Table 7.6.1-3 are known to occur or have the potential to occur in valley oak woodlands, such as Swainson's hawk, white-tailed kite, and western red bat (*Lasiurus blossevillii*), Mexican long-tongued bat (*Choeronycteris mexicana*) (Southern California region only), and California leaf-nosed bat (*Macrotus californicus*) (Southern California region only).

Valley oaks are large deciduous trees endemic to California. Valley oak habitat is best developed on deep, well-drained alluvial soils, usually in valley bottoms. Valley oaks are thought to be dependent on water table access (Callaway 1990). Valley oaks take up water through deep taproots and extensive horizontal roots; vertical root depths have been reported as deep as 80 feet (Howard 1992). Valley oaks are also resistant to short-term drought; mature trees primarily suffer drought damage when a series of dry seasons lowers water tables to extreme depths (Howard 1992). Valley oak may be restricted to habitats with accessible water tables by the physiologic intolerance to high water stress and inability to survive on the limited water available in shallow soils during summer (Callaway 1990).Valley oak woodlands occur in the Sacramento Valley south of Redding, the San Joaquin Valley, the Tehachapi Mountains, and the valleys of the Coast Ranges, typically at elevations below 2,000 feet. The distribution of valley oak woodlands has decreased substantially due to land use changes. Up to 90 percent of historical valley oak woodlands in the Central Valley have been cleared for agricultural or urban development (University of California 2018). Remnant patches are found in isolated spots in the Central Valley north of the City of Woodland, north of Stockton in Oak Grove Regional Park, and near Mokelumne City at the confluence of the Cosumnes and Mokelumne Rivers (^CDFW 2021)—as well as individual trees that may be associated with rural residences or along fence lines.

Lakes and Reservoirs

Lacustrine habitats contain standing water areas that vary from a few centimeters to hundreds of meters in depth. These habitats include permanently flooded lakes and reservoirs, intermittent lakes, and ponds. Lacustrine habitats are used by many mammals, birds, reptiles, and amphibians for food, water, and cover. For example, bald eagle feed on fish and birds taken from lakes. Some amphibians require ponds for breeding.

There are numerous reservoirs in the Sacramento/Delta and other geographic regions of the study area. Many Sacramento/Delta tributaries have at least one major storage reservoir. Rim reservoirs in the Sacramento/Delta with the largest storage capacities are Lake Shasta (on the mainstem Sacramento River), Oroville Reservoir (on the Feather River), Folsom Reservoir (on the American River), New Bullards Bar Reservoir (on the Yuba River), and Lake Berryessa (on Putah Creek). Many other smaller capacity reservoirs are located in the Sacramento/Delta, including several additional rim reservoirs and numerous reservoirs in the upper watershed above the rim reservoirs (upper watershed reservoirs). Some natural lakes, such as Clear Lake located on Cache Creek and Upper and Lower Blue Lakes located in the upper North Fork Mokelumne River watershed, are natural lakes with expanded capacity by the addition of dams.

Many reservoirs exist in the San Francisco Bay Area, Central Coast, and Southern California regions, including several reservoirs that receive Sacramento/Delta water supplies. The on-stream reservoirs in these regions that receive Sacramento/Delta supply are identified in Table 6.3-5. These include Lake Del Valle, Anderson Lake, Lake Cachuma, Pyramid Lake, Lake Piru, Castaic Lake, Silverwood Lake, and Diamond Valley Lake. Some other export reservoirs, such as San Luis Reservoir in the San Joaquin Valley region and Lake Perris in the Southern California region, also receive Sacramento/Delta supplies; however, these reservoirs do not impound a natural waterway and are considered off-stream storage reservoirs. These reservoirs release water directly into aqueducts or pipelines, and the reservoir releases do not affect local streams.

Reservoirs can provide habitat for certain terrestrial wildlife species, such as waterfowl that use the open water areas for roosting, loafing, and foraging. In addition, shorebirds can use some reservoir shorelines for nesting if they are relatively wide and have gradual inclines. Some birds, including osprey and bald eagle, forage for fish in the open water over reservoirs. Terrestrial mammals may utilize reservoirs as a water source and for foraging along the shoreline. Western pond turtle (*Emys marmorata*), a California Species of Special Concern, also utilizes reservoirs. Amphibians utilize streams, rivers, and smaller ponds and lakes as habitat; however, the presence of large game fish and the lack of microhabitat conditions needed by amphibians (e.g., shallower areas with emergent vegetation, areas for rearing tadpoles) create conditions not conducive to the establishment of native amphibian populations in larger reservoirs. Suitable habitat may be present in the interface between drainages and reservoirs.

Some special-status species identified in Table 7.6.1-3 are known to occur at reservoirs within the Sacramento/Delta. Western pond turtle has been documented in Shasta Lake, Whiskeytown Reservoir, and Lake Berryessa (^CDFW 2021). There are no records of special-status amphibians in the Sacramento/Delta reservoirs modeled in the Sacramento Water Allocation Model (SacWAM) (^CDFW 2020). Bald eagle is known to forage and nest in proximity to multiple reservoirs, such as Shasta Lake, Clair Engle Lake, Lake Almanor, Mountain Meadows Reservoir, Lake Oroville, New Bullards Bar Reservoir, Indian Valley Reservoir, Lake Berryessa, Lake Hennessy, Folsom Lake, and New Hogan Lake within the Sacramento River watershed and Delta eastside tributaries regions. Shasta Lake supports the largest nesting population associated with reservoirs in these regions. There are 45 records of bald eagles nesting in proximity to Shasta Lake (^CDFW 2020), and 25 pairs were at Shasta Lake as of 2012 (USFS 2012).

Some riverine and wetland habitats occur in association with lacustrine habitats. Larger reservoirs generally are constructed in steep terrain and generally lack substantial shallow shorelines to support emergent vegetation. In smaller reservoirs and on-stream reservoirs, riparian vegetation can be found along the mouth of the streams flowing into reservoirs as well as in shallower coves where vegetation is protected from the erosive action of waves. Wetlands may form in these shallow coves but may occur only periodically because the reservoirs often fluctuate in elevation during and between years. Smaller reservoirs also may contain areas with shallow shorelines and emergent vegetation. The extent of riparian and wetland vegetation along the mouths of streams feeding into reservoirs will periodically change, expanding as reservoir levels drop and being lost as open water covers these communities.

Export reservoirs in the San Joaquin Valley, San Francisco Bay Area, Central Coast, and Southern California regions may support several sensitive species, including western pond turtle and bald eagle. These reservoirs receive a large portion of total inflow from SWP deliveries rather than water originating in the reservoirs' watersheds (^DWR and LADWP 2016). Several of these reservoirs are located on streams and rivers that are naturally intermittent. Bald eagles have been expanding throughout central and southern California in recent decades, recovering from the population drop in the mid-1900s resulting from bioaccumulation effects from extensive use of organochloride pesticides including DDT. Bald eagles are now widespread in California in suitable lake and reservoir habitat (eBird 2023). Bald eagles have been reported from the vicinity of export reservoirs, including Anderson Lake, Lake Del Valle, CVP canals to San Luis Reservoir, Lake Cachuma, Pyramid Lake, Lake Piru, Castaic Lake, Silverwood Lake, Lake Perris, and Diamond Valley Lake (^CDFW 2020; eBird 2023). Export reservoirs are suitable habitat for western pond turtle, and the species is currently known from reservoirs including Lake Dell Valle, Anderson Lake, Castaic Dam, Lake Cachuma, Lake Piru, and Castaic Lake. Habitat immediately downstream of these on-stream reservoirs is typically an alluvial scrub that becomes replaced by riparian vegetation. Other special-status species, such as California red-legged frog (*Rana draytonii*), arroyo toad (*Anaxyrus californicus*), two-striped gartersnake (*Thamnophis hammondii*), least Bell's vireo (*Vireo bellii pusillus*), and yellow warbler, also occur in the upstream and downstream wetland and riparian areas associated with many of these reservoirs (^CDFW 2021; DWR 2017; DWR and LADWP 2017a; DWR and LADWP 2017b).

Wetlands

Wetlands are areas where water covers the soil or is present at or near the soil surface year-round or for varying periods during the year. Wetlands can vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors (e.g., human disturbance). The amount of water present in a wetland also varies greatly; some wetlands are permanently flooded, while others are only seasonally flooded but retain saturated soil throughout much of the unflooded year. Water saturation largely determines the types of plant and animal communities living in wetlands. Generally, two broad categories of wetlands are recognized: coastal or tidal wetlands and inland or non-tidal wetlands. Coastal/tidal wetlands are found along coastal waters and estuaries where sea water mixes with fresh water to form an environment of varying salinities. Inland/non-tidal wetlands are most common on floodplains along rivers and streams (e.g., riparian wetlands), in isolated depressions surrounded by dry land (e.g., basins, playas, marsh, wet meadow), along the margins of lakes and ponds, and in other low-lying areas where groundwater intercepts the soil surface or where precipitation saturates the soil (e.g., vernal pools, bogs).

Profound historical wetland losses have occurred in California. Over 90 percent of the wetlands that existed at the time of European settlement are now gone—a higher rate of loss than for any other state (SWRCB 2019). Most wetland destruction has been the result of conversion of wetland areas to agriculture or urban uses. Central Valley wetlands are an example of this conversion. The Central Valley originally contained over 4 million acres of wetlands, or over 30 percent of the total 13 million acres in the region. However, since the mid-1800s, over 95 percent of these wetlands have been destroyed (SWRCB 2019). Today, just over 205,000 acres of wetlands remain in the Central Valley, and two-thirds of the wetlands are under private ownership (SWRCB 2019).

Tidal Freshwater Emergent Wetland

The tidal freshwater emergent wetland natural community is typically a transitional community between tidal perennial aquatic and riparian or terrestrial upland communities across a range of hydrologic and soil conditions. In the Delta, the tidal freshwater emergent wetland community often occurs at the shallow, slow-moving, or stagnant edges of freshwater waterways or ponds in the intertidal zone and is subject to frequent long-duration flooding. Tidal freshwater emergent wetland is regularly and occasionally flooded tidal marshlands with very low levels of soil salinity. These communities can be categorized as low-elevation, middle-elevation, and high-elevation tidal freshwater emergent wetlands, based on their frequency of inundation.

Low-elevation tidal freshwater emergent wetlands are influenced by the daily tides, are flooded more times than not, typically are dominated by tules (*Schoenoplectus* spp.), and occasionally include species of cattails (*Typha* spp.). They are highly productive but support few species other than tules that tolerate deep, prolonged tidal flooding. Middle-elevation tidal freshwater emergent wetlands are regularly flooded, but the soil is exposed above the water level for many hours each day. These wetlands are less abundant than low-elevation tidal freshwater emergent wetlands and often represent a more mature marsh condition, with long periods of peat accumulation or sediment deposition. Much of this natural community has been converted to other land uses, such as agriculture. Invasive nonnative plants, such as yellow flag iris (*Iris pseudacorus*) and purple loosestrife (*Lythrum salicaria*), tend to invade this species-rich freshwater zone. The middle-elevation tidal freshwater emergent wetland zone grades into the uppermost end of tidal freshwater marsh (high-elevation intertidal marsh zone).

High-elevation tidal freshwater emergent wetlands are occasionally flooded by tides or flood events but include depressions that remain flooded after tides recede. High-elevation tidal freshwater emergent marshes are rare but are well developed in a few locations in the Delta. The high-elevation tidal freshwater emergent wetland zone can be dominated by grass and grasslike species, such as

Baltic rush (*Juncus balticus*), creeping wildrye (*Leymus triticoides*), and saltgrass (*Distichlis spicata*). These marshes typically include large patches of yerba mansa (*Anemopsis californica*) and wild heliotrope (*Phacelia distans*). Special-status plant species commonly found in this natural community include Suisun Marsh aster (*Symphyotrichum lentum*) and woolly rose-mallow (*Hibiscus lasiocarpos* var. *occidentalis*). Large thickets of nonnative Himalayan blackberry (*Rubus armeniacus*) can invade high-elevation tidal freshwater emergent wetland, converting the marsh to riparian scrub thickets. High-elevation tidal freshwater emergent wetland may naturally grade into low-elevation grasslands (dense stands of saltgrass and creeping wildrye) or seasonal wetland transition zones—or may end abruptly at the edges of steep levees or eroded riverbanks. Tidal freshwater emergent marsh in the Delta provides habitat for wildlife species that use these wetlands as foraging habitat and as cover. These species include wading birds (egrets and herons), waterfowl (ducks, geese, and swans), shorebirds (rails, plovers, sandpipers), and perching birds. Common nesting birds in tidal freshwater emergent marsh include red-winged blackbird (*Agelaius phoeniceus*), marsh wren (*Cistothorus palustris*), saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*), and black-crowned night-heron (*Nycticorax nycticorax*). American beaver and muskrat (*Ondatra zibethicus*) forage on marsh plants and use them for cover and den material. Several special-status plant species identified in Table 7.6.1-2 may occur in tidal freshwater emergent wetlands in the Delta, including but not limited to, Delta tule pea (*Lathyrus jepsonii jepsonii*), Mason's lilaeopsis (*Lilaeopsis masonii*), Delta mudwort (*Limosella australis*), Sanford's arrowhead (*Sagittaria sanfordii*), marsh skullcap (*Scutellaria galericulata*), and Suisun Marsh aster. Several special-status wildlife species identified in Table 7.6.1-3 may use tidal freshwater emergent wetlands in the Delta, including but not limited to, western pond turtle, giant gartersnake (*Thamnophis gigas*), tricolored blackbird (*Agelaius tricolor*), northern harrier (*Circus hudsonius)*, white-tailed kite, least bittern (*Ixobrychus exilis*), California black rail (*Laterallus jamaicenses coturniculus*), Suisun song sparrow (*Melospiza melodia maxillaris*), and yellow-headed blackbird (*Xanthocephalus xanthocephalus*).

Tidal Brackish Emergent Marsh

The tidal brackish emergent marsh is a transitional community between tidal perennial aquatic and terrestrial upland communities. Tidal brackish emergent marsh exists in the San Francisco Bay saltwater/Delta freshwater mixing zone that extends from near Collinsville westward to the Carquinez Straight. Tidal brackish emergent marsh is characterized by tall herbaceous wetland plant species that line the channels down to the depth of mean lower low tide. Dominant plant species include hard-stem bulrush (*Schoenoplectus acutus*), California bulrush (*S. californicus*), common reed (*Phragmites australis*), and common cattail (*Typha latifolia*) (Suisun Ecological Workgroup 2001; Grewell et al. 2007). Dominant species present between the channels and the marsh plain include pickleweed (*Salicornia pacifica*), saltgrass (*Distichlis spicata*), salt marsh dodder (*Cuscuta salina*), spearscale (*Atriplex patula*), and Baltic rush. Channels in tidal brackish emergent wetland may be flooded or exposed, depending on tidal stage. The marsh plain is usually free of standing water but may be flooded at very high tides. Tidal brackish emergent wetland is present on the south side of Suisun Bay and on islands in midchannel but is most extensive in Suisun Marsh. This natural community is found in undiked areas of Suisun Marsh, such as Rush Ranch and Hill Slough; along undiked shorelines on the south shore of Suisun Bay; and on undiked in-channel islands, such as Browns Island. Suisun Marsh provides habitat for several special-status plant and wildlife species identified in Table 7.6.1-2 and Table 7.6.1-3. Special-status species that may occur in Suisun Marsh include Suisun thistle (*Circium hydrophilum* var. *hydrophilum*), soft bird's-beak (*Chloropyron molle* ssp*. molle*), Delta tule pea, Mason's lilaeopsis, Delta mudwort, Suisun Marsh aster, California black rail, California Ridgway's rail (*Rallus obsoletus obsoletus*), saltmarsh common yellowthroat, Suisun song sparrow, salt-marsh harvest mouse (*Reithrodontomys raviventris*), and Suisun shrew (*Sorex ornatus sinuosus*).

Tidal Salt Marsh

Tidal salt marsh habitat is found throughout the coast of California and is characterized by daily inundation of saline water. Tidal salt marsh provides habitat for aquatic and terrestrial species of wildlife; stabilizes shorelines, thereby preventing flooding; and cycles nutrients (USFWS 2013). As a result of a periodically saline habitat, tidal salt marshes support a highly adaptive variety of wildlife and plants. Dominant plant species adapted for tidal salt marsh conditions include cordgrasses (*Spartina* spp.), pickleweed, and saltmeadow rush (*J. gerardii*) (FGDC). Endangered plant species, including Suisun thistle, soft bird's beak, salt marsh bird's beak (*Chloropyron maritinum* ssp. *maritinum*), and California sea-blite (*Suaeda californica*), are found within this habitat type (USFWS 2013; Holland and Keil 1995). Many of California's coastal tidal salt marshes have been altered or lost due to historical and current dredging, draining, and other human disturbances or are imperiled by the invasion of nonnative plant and wildlife species (USFWS 2013).

Tidal salt marshes provide foraging, breeding, resting, and sheltering habitat for birds, mammals, reptiles, and invertebrates. Mammals known to inhabit this habitat include saltmarsh harvest mouse, salt marsh wandering shrew (*Sorex vagrans halicoetes*), Suisun shrew, San Pablo vole (*Microtis californicus sanpabloensis*), red fox, California ground squirrel (*Otospermophilus beechyii*), long-tailed weasel (*Mustela frenata*), raccoon, opossum (*Didelphus virginianus*), and striped skunk (USFWS 2013). Bird species commonly found in this habitat include migratory species of waterfowl and shorebirds; raptors, including northern harrier; passerines, including song sparrow, fox sparrow (*Passarella iliaca*), and white-crowned sparrow (*Zonotrichia leucophrys*); the federally and state-listed endangered California Ridgway's rail; and state-listed threatened California black rail. Gopher snake (*Pituophis melaoleucus*) is a commonly encountered species within tidal salt marshes that also has been observed predating on California Ridgway's rail nests (USFWS 2013).

Freshwater Emergent Wetlands

Freshwater emergent wetlands are found in low-lying basins or depressions that are flooded frequently enough to create anaerobic soils. They also can occur within rivers and streams wherever water slows down and accumulates, even on a temporary or seasonal basis, and on the edges of lakes. Freshwater emergent wetlands contain shallow water that often is clogged with dense masses of vegetation, resulting in deep peaty soils. They contain hydrophytic vegetation adapted for saturated soil conditions (Kramer 1988). Most freshwater emergent wetlands support native and nonnative annual and perennial herbaceous species, such as common tule (*S. acutus*), sedges (*Carex* spp.) cattails, western goldenrod (*Euthamia occidentalis*), smartweeds/knotweeds (*Polygonum* spp.), rushes (*Juncus* spp.), cocklebur (*Xanthium strumarium*), curly dock (*Rumex crispus*), common spikerush (*Eleocharis palustris*), rabbit-foot grass (*Polypogon monspeliensis*), and dallis grass (*Paspalum dilatatum*) (Kramer 1988).

Coastal and valley freshwater marsh occurs in the study area and is a sensitive natural community. Coastal and valley freshwater marsh occurs in coastal drainages in the study area and predominately consists of the same plant species as freshwater emergent wetlands.

Freshwater emergent wetlands support a variety of plant species. Several special-status plants identified in Table 7.6.1-2 may occur in freshwater emergent wetland in the Sacramento/Delta, including but not limited to, grass alisma (*Alisma gramineum*), watershield (*Brasenia schreberi*), bristly sedge (*Carex comosa*), Peruvian dodder (*Cuscuta obtusiflora* var. *glandulosa*), woolly rose-mallow, Sanford's arrowhead (*Sagittaria sanfordii*), marsh skullcap (*Scutellaria galericulata*), side-flowering skullcap (*Scutellaria lateriflora*), Wright's trichocoronis (*Trichocoronis wrightii* var. *wrightii*), and Brazilian watermeal (*Wolffia brasiliensis*). Several special-status plants identified in Table 7.6.1-2 may occur in freshwater emergent wetland in the San Joaquin Valley, including but not limited to, Horn's milk-vetch (*Astragalus hornii* var. *hornii*), bristly sedge, slough thistle (*Cirsium crassicaule*), Peruvian dodder, California satintail (*Imperata brevifolia*), mud nama (*Nama stenocarpa*), Sanford's arrowhead, and Wright's trichocoronis. Several special-status plants identified in Table 7.6.1-2 may occur in freshwater emergent wetland in the Central Coast, including but not limited to, marsh sandwort (*Arenaria paludicola*), La Graciosa thistle (*Cirsium scariosum* var. *loncholepis*), and California saw-grass (*Cladium californicum*). Several special-status plants identified in Table 7.6.1-2 may occur in freshwater emergent wetland in the Southern California region, including but not limited to, marsh sandwort, California saw-grass, San Diego marsh-elder (*Iva hayesiana*), California satintail, mud nama, Sanford's arrowhead, and Wright's trichocoronis.

Freshwater emergent wetlands support a wide variety of wildlife, including many birds, mammals, reptiles, and amphibians. Birds commonly inhabiting these wetlands including sparrows (*Melospiza* spp.), saltmarsh common yellowthroat, wrens (*Cistothorus*, *Troglodytes*, and *Thryomanes*), and red-winged blackbird (Reclamation et al. 2011). Mammal species that use this habitat include beaver, voles (*Microtus* spp.), muskrat, and Norway rat (*Rattus norvegicus*). Emergent wetlands also sustain a variety of amphibians, especially Pacific chorus frog (*Pseudacris regilla*), American bullfrog, and terrestrial gartersnake (*Thamnophis elegans*) (CDFG 2007). Several special-status wildlife identified in Table 7.6.1-3 may occur in freshwater emergent wetlands, including but not limited to, northern leopard frog (*Lithobates pipiens*), Cascades frog (*Rana cascadae*), California red-legged frog, Oregon spotted frog (*Rana pretiosa*), Sierra Nevada yellow-legged frog (*Rana sierrae*), Yosemite toad (*Anaxyrus canorus*), western pond turtle, giant gartersnake, two-striped gartersnake, South Coast gartersnake (*Thamnophis sirtalis* ssp. *infernalis*), tricolored blackbird, black tern (*Chlidonias niger*), northern harrier, white-tailed kite, greater sandhill crane (*Grus canadensis tabida*), lesser sandhill crane (*Grus canadensis canadensis*), least bittern, fulvous whistling-duck (*Dendrocygna bicolor*), California black rail, and yellow-headed blackbird.

Populations of many terrestrial species, such as giant gartersnake, have decreased because of the profound historical loss of wetlands in California. The giant gartersnake is a semi-aquatic species, endemic to tule marshes, sloughs, and other freshwater wetlands throughout the Central Valley (USFWS 2012). The current known range of the giant gartersnake extends from Butte County to Mendota Wildlife Area (WA) in Fresno County (USFWS 2020b). Habitat loss and fragmentation are the primary threats to giant gartersnake throughout the Central Valley; approximately 95 percent of the giant gartersnake's historical wetland habitat has been converted to agriculture or urban land uses (USFWS 2017). As a result, the giant gartersnake now primarily inhabits irrigation ditches; drainage canals; rice fields and adjacent uplands; and remnant marshes, ponds, and low-gradient streams. Wylie et al. (2010) identified that giant gartersnake densities tend to be higher in natural wetlands compared to rice lands. However, in the absence of higher-quality wetlands, rice land agriculture with interconnected water conveyance structures provides alternative habitat (USFWS 2017). Giant gartersnakes also occur at multiple Central Valley wildlife refuges. The giant gartersnake's distribution is limited by relatively poor dispersal and colonization abilities (Fouts et al. 2020).

Other special-status species, such as California black rail, also inhabit wetlands. California black rails have a patchy distribution throughout California; the species is most abundant in the northern San

Francisco Bay estuary, which supports approximately 90 percent of the statewide population (Evens et al. 1991). A small, genetically-distinct California black rail population inhabits the lower western slopes of the Sierra Nevada foothills in Butte, Yuba, Nevada, Placer, and San Joaquin Counties (Richmond et al. 2008; Hall and Beissinger 2017). This population inhabits shallow wetlands associated with water sources such as springs, streams, intentional irrigation water inputs, and unintentional irrigation ditch leaks (Richmond et al. 2008). Irrigation water in this area is used mainly for flood irrigation of pastures and for livestock grazing; irrigation water provides the most common water source for Sierra Nevada foothill marshes with California black rails (Richmond et al. 2008). Habitat loss attributed to the clearing, overgrazing, and conversion of ranches to urban areas is a major threat to the California black rail population in the Sierra Nevada foothills (Evens et al. 1991).

Seasonal Wetlands

Several types of seasonal wetlands, such as vernal pools, vernal swales, snowmelt ponds, and seasonal ponds/stock ponds occur throughout the study area. This section does not address floodplain wetlands because they make up only a very small portion of the seasonal wetlands in the study area. The CNDDB identifies several sensitive natural communities that fall under this wetland type, including northern basalt flow vernal pool, northern claypan vernal pool, northern hardpan vernal pool, northern vernal pool, northern volcanic ash vernal pool, northern volcanic mud flow vernal pool, San Diego mesa claypan vernal pool, San Diego hardpan vernal pool, southern interior basalt flow vernal pool, and southern vernal pool, that are present in the study area. Seasonal wetlands depend on seasonal surface water and seasonally saturated soils from water perched above a restrictive layer, such as hardpans.

Seasonal ponds form during winter and spring in areas that receive direct rainfall and seasonal flooding. These wetlands are characterized by ponded or saturated soil conditions during winter and spring and by dry soil conditions throughout summer and fall until the first substantial rainfall. The vegetation in these seasonal wetlands typically is composed of wetland generalist species such as hyssop loosestrife (*Lythrum hyssopifolia*), cocklebur, dallisgrass, Bermuda grass (*Cynodon dactylon*), barnyard grass (*Echinochloa crus-galli*), and Italian ryegrass (*Festuca perennis*) that usually occur in frequently disturbed sites.

Other seasonal wetlands such as vernal pools and alkali seasonal wetlands are dependent on direct rainfall and perched water above restrictive soils layers, such as hardpans and claypans. During winter and spring (when seasonal wetlands are filled with water, plants, and aquatic life), the wetlands act as an important foraging and occasional breeding habitat for a variety of common species. These include dabbling ducks (Anatinae), herons and egrets (Ardeidae), and shorebirds (Silveira 1998); and reptiles and amphibians, such as common gartersnake (*Thamnophis sirtalis*) and Sierran treefrog (*Pseudacris sierra*).

Seasonal wetlands within the study area may provide habitat for several special-status species identified in Table 7.6.1-3, including but not limited to, Wright's trichocoronis, Cascades frog, two-striped gartersnake, South Coast gartersnake, California red-legged frog, Oregon spotted frog, and Sierra Nevada yellow-legged frog. Sensitive species that occur in vernal pools or isolated wetlands are listed in Appendix C, *Supplemental Special-Status Species Lists for Plants and Wildlife.* Most of the amphibians listed in Table 7.6.1-3 use seasonal wetlands only for foraging and cover; they are not likely to use the seasonal wetlands for breeding because of the relatively short period of inundation that would not be sufficient for their egg and larval development.

Seeps, Springs, and Meadows

Seeps, springs, and meadows are wetlands that rely on groundwater to maintain ecological structure and function (Murray et al. 2006; Howard and Merrifield 2010). Seeps, springs, and meadows generally occur at higher elevations in the Sacramento River watershed and Delta eastside tributaries region. Sensitive natural communities identified in the study area that fall under these wetland types include alkali seep, alkali meadow, Darlingtonia seep, fen, and sphagnum bog.

Seeps, springs, and meadows contain a great variety of plant species. Grasses, sedges, and shrubs are common to meadows in California, including several genera such as *Agrostis, Carex, Danthonia, Juncus, Salix*, and *Scirpus*. Grass and grasslike species that occur in these areas include thingrass (*Agrostis pallens*), abruptbeak sedge (*Carex abrupta*), beaked sedge (*Carex utriculata*), Nebraska sedge (*Carex nebrascensis*), tufted hairgrass (*Deschampsia cespitosa*), needle spikerush (*Eleocharis acicularis*), few-flowered spikerush (*Eleocharis quinqueflora*), common spikerush (*Eleocharis palustris*), Baltic rush, Nevada rush (*Juncus nevadensis*), iris-leaf rush (*Juncus xiphioides*), pull-up muhly (*Muhlenbergia filiformis*), and panicled bulrush (*Scirpus microcarpus*). Forbs that occur in these areas include Anderson aster (*Oreostemma alpigenum*), Jeffrey shootingstar (*Primula jeffreyi*), trailing Saint-Johnswort (*Hypericum humifusum*), hairy pepperwort (*Marsilea vestita*), primrose monkeyflower (*Erythranthe linearifolia*), western cowbane (*Oxypolis occidentalis*), American bistort (*Bistorta bistortoides*), cows clover (*Trifolium wormskioldii*), and small white violet (*Viola blanda*). Willow (*Salix* spp.) and bilberry (*Vaccinium* spp.) are the only shrubs found in much abundance. Fewer species occur as surface water depth increases during spring runoff. Special-status plant species identified in Table 7.6.1-2 with the potential to occur in some seeps, springs, and meadows within the study area include California satintail, marsh skullcap, and Wright's trichocoronis.

Seeps, springs, and meadows are used by many wildlife species. For example, some meadow habitats can contain nesting habitat for birds (e.g., tricolored blackbird), depending on their structure and plant composition, as well as foraging habitat for birds. Depending on their location, seeps, springs, and meadows also may provide habitat for several special-status wildlife species, such as northern leopard frog, Oregon spotted frog, Cascades frog, California red-legged frog, Sierra Nevada yellow-legged frog, black tern, tricolored blackbird, northern harrier, yellow rail (*Coturnicops noveboracensis*), willow flycatcher, white-tailed kite, greater sandhill crane, lesser sandhill crane, and California black rail.

Managed Wetlands

Managed wetlands include many of the wetlands on wildlife refuges, wetlands created by duck clubs, some rice fields managed for multiple uses, and flood bypasses. Wetlands with an artificial water supply also may be referred to as "managed wetlands." Managed wetlands occur in the Sacramento/Delta and San Francisco Bay Area and San Joaquin Valley regions and include many of the wetlands maintained by national wildlife refuges (NWR) and state WAs; flood bypasses; privately owned wetlands, such as those managed by duck clubs; and some agricultural croplands that are managed for multiple uses, including waterfowl habitat. They typically comprise seasonally flooded wetlands and summer wetlands. Seasonally flooded wetlands are typically wet from fall through spring and dry during summer; summer wetlands include permanent and semi-permanent wetlands that provide wetland habitat during all or part of summer.

Wildlife Refuges and Wildlife Areas

Approximately 34 federal NWRs and 110 state WAs are in California, including 28 NWRs and 77 state WAs areas in the study area. Federal NWRs and state WAs are a network of lands and water managed for the conservation and restoration of fish, wildlife, and plant resources and their habitats for the benefit of human use. Refuges and wildlife areas protect native grasslands, deserts, prairies, forests, wetlands, and aquatic resources (rivers, streams, and creeks). Seasonally flooded wetlands at wildlife refuges in the Central Valley provide wintering habitat for migratory waterfowl along the Pacific Flyway as well as food and cover for many resident waterfowl and shorebirds and other wildlife. Native wildlife conservation is the driving purpose for federal NWRs and state WAs.

Within the Central Valley, the Central Valley Project Improvement Act (CVPIA) mandates that firm water supplies be provided to maintain and improve wetlands on units of the NWR system and certain state wildlife management areas (WMA) (Figures 7.4-3a and 7.4-3b). CVPIA refuges in the Sacramento Valley are the Sacramento NWR, Delevan NWR, Colusa NWR, Sutter NWR, and Gray Lodge WA. Sacramento NWR, Delevan NWR, Colusa NWR, and Sutter NWR are components of the Sacramento NWR Complex, which is managed by USFWS. Gray Lodge WA is managed by CDFW. CVPIA refuges in the San Joaquin Valley include eight federal wildlife refuge units (Kern NWR, Pixley NWR, Merced NWR, San Luis NWR-East Bear Unit, San Luis NWR- Kesterson Unit, San Luis NWR-Freitas Unit, San Luis NWR-San Luis Unit, and San Luis NWR-West Bear Creek Unit), five state WA units (Los Banos WA, Mendota WA, North Grasslands WA-China Island Unit, North Grasslands WA-Salt Slough Unit, and Volta WA), and one privately-owned complex within the Grasslands Resource Conservation District (GRCD). Most of these wildlife refuges receive some Sacramento/Delta water supplies. South-of-Delta Refuge Water Supply Program wildlife refuge units that do not receive Sacramento/Delta water supplies include San Luis NWR- East Bear Creek Unit, Merced NWR, and Pixley NWR.

The Sacramento NWR Complex (10,775 acres) includes the Sacramento, Delevan, Colusa, and Sutter NWR and three WMAs (Willow Creek-Lurline, Butte Sink, and Steve Thompson North Central Valleys WMAs). The complex contains seasonal wetlands, permanent/semi-permanent wetlands, upland/grasslands, vernal pool/alkali meadows, and riparian habitat and is host to a wide variety of special-status plants and wildlife. The seasonally flooded wetlands account for approximately 85 to 90 percent of the total wetlands with an artificial water supply (USFWS 2009), and the summer wetlands account for approximately 10 to 15 percent of the wetlands within the complex with an artificial water supply (USFWS 2009). These wetlands are an important water source for wildlife during summer, and they provide breeding habitat for waterfowl and other wetland-dependent species.

Plants typically found within these wetlands include emergent plant species, such as hardstem bulrush, cattail, and bulrush (*Schoenoplectus* spp.); and wildlife forage species, including swamp timothy (*Crypsis schoenoides*), smartweeds, and watergrass (*Echinochloa crus-galli*) (USFWS 2009). Some species are present seasonally and some are present year-round. The Sacramento, Delevan, Colusa, and Sutter NWRs primarily provide wintering habitat for waterfowl and partially reduce crop damage by waterfowl. Waterfowl include ducks and geese such as snow and Ross's geese (*Anser caerulescens* and *A. rossii*), mallard (*Anas platyrhynchos*), American wigeon (*Mareca americana*), bufflehead (*Bucephala albeola*), and ruddy duck (*Oxyura jamaicensis*). Shorebirds include sandpipers (Scolopacidae), dowitchers (*Limnodromus* spp.), dunlin (*Calidris alpine*), American avocets (*Recurvirostra americana*), and black-necked stilts (*Himantopus mexicanus*). Resident wildlife includes grebes (*Podiceps* spp.), herons, blackbirds (*Agelaius* spp.), golden eagle

(*Aquila chrysaetos*), beaver, muskrat, mule deer, and other species typical of upland and wetland habitats. The Sacramento NWR also protects and restores riparian habitat along the Sacramento River between Red Bluff and Colusa, providing habitat for special-status species such as Swainson's hawk and bank swallow. The Sacramento NWR Complex WMAs preserve wetland habitat for wintering waterfowl and other wetland-dependent wildlife, such as tricolored blackbird and giant gartersnake. Other listed species that have occurred at the Sacramento NWR Complex include transplanted colonies of palmate-bracted bird's beak (*Chloropyron palmatum*) and several species of fairy shrimp (*Branchinecta* spp. and *Linderiella* spp.) and vernal pool tadpole shrimp (*Lepidurus packardi*).

Gray Lodge WA (9,100 acres) in Butte and Sutter Counties contains seasonally flooded freshwater emergent wetlands, annual grasslands, pasture, perennial grassland, oak woodland, and valley riparian areas for more than 300 species of resident and migrant birds and mammals. Gray Lodge WA also includes 600 acres of riparian woodlands with Fremont cottonwood, valley oak, mixed willow, blackberry, and wild grape vegetation. Special-status species that occur at Gray Lodge WA include giant garter snake, western pond turtle, purple martin (*Progne subis*), ringtail (*Bassariscus astutus*), and mountain lion (*Puma concolor*). Common waterfowl observed at Gray Lodge WA includes various species of ducks and geese (Anatidae), gulls (Laridae), and American white pelican (*Pelecanus erythrorhychos*). Migratory birds include numerous species of songbirds and raptors; common mammal species include mule deer, coyote (*Canis latrans*), rabbits (*Lepomorpha*), and gray fox.

The San Luis NWR Complex is composed of the San Luis NWR and Grasslands WMA. The complex is an administrative group that is based on the refuges or management areas that occur in a similar ecological region (e.g., watershed or habitat type) or have a related purpose and management need.

The San Luis NWR (26,800 acres) contains permanent and seasonal wetlands, riparian forests, annual and perennial grasslands, and vernal pools. The NWR supports native bunchgrasses, native and exotic annual grasses, forbs, and native shrubs. The habitats at the complex are characterized by saline and alkaline conditions; Valley oak, cottonwood, and mixed willows are found along riparian corridors. The refuge supports birds, mammals, reptiles, amphibians, insects, and plants; these include several special-status species, such as longhorn fairy shrimp (*Branchinecta longiantenna*), California tiger salamander (*Ambystoma californiense*), San Joaquin kit fox (*Vulpes macrotis mutica*), and tule elk (*Cervus canadensis nannodes*). The San Luis NWR's seasonal and permanent wetlands are a wintering ground and migratory stopover for large concentrations of waterfowl, shorebirds, and other waterbirds. Other wildlife species that utilize the complex's upland habitat include coyotes, desert cottontail (*Sylvilagus audubonii*), northern harrier, and other raptors.

San Joaquin River NWR (7,000 acres) is located where the Tuolumne, Stanislaus, and San Joaquin Rivers join in the San Joaquin Valley, creating a variety of habitats (wetlands, croplands, and grasslands) that provide highly suitable habitat for plants and wildlife. The refuge is managed to provide habitat for migratory birds and listed species and is an important wintering ground for the Aleutian cackling goose (*Branta hutchinsii leucopareia*). Along the borders of the San Joaquin NWR is one of California's largest riparian forest restoration projects, creating the largest block of contiguous riparian woodland in the San Joaquin Valley. Special-status species such as Swainson's hawk, riparian brush rabbit (*Sylvilagus bachmani riparius*), riparian woodrat (*Neotoma fuscipes riparia*), least Bell's vireo, and tule elk have been documented at the refuge.

Grasslands WMA is a part of the San Luis NWR Complex. Unlike other NWRs, the Grassland WMA consists entirely of privately owned lands with a perpetual conservation easement. The WMA preserves seasonally flooded wetlands, semi-permanent marshes, riparian habitat, wet meadows, vernal pools, native uplands and grasslands, and pasture habitat—as well as some wildlife-friendly agricultural lands. In addition to waterfowl, habitat at the Grassland WMA supports shorebirds, wading birds, songbirds, raptors, and listed plant and wildlife species. The San Joaquin River divides the Grassland WMA into an eastern division and western division, with the GRCD residing in the western division.

The Kern National Wildlife Complex, which includes Kern NWR (11,249 acres) and Pixley NWR (6,989 acres) (USFWS 2005), contains seasonal wetland habitat, riparian habitat, and upland areas with grassland, alkali playa, northern claypan vernal pool, and valley sink scrub habitats. Kern NWR also includes natural desert upland, relict riparian corridor, and developed freshwater marsh (USFWS 2005). Upland areas in the Kern NWR Complex support threatened and endangered terrestrial species such as the San Joaquin kit fox, Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), and blunt-nosed leopard lizard (*Gamelia sila*); wetland areas provide wintering habitat for migratory waterfowl and water birds, summer water for colonial nesting birds such as herons and white-faced ibis (*Plegadis chihi*), and late summer water for early migrant ducks and geese (USFWS 2005). Valley saltbrush scrub, Great Valley willow scrub, and some of the last significant acres of Southern San Joaquin Valley grassland habitat are also present at Pixley NWR. Some special-status species that have been documented at Pixley NWR include San Joaquin kit fox, Tipton kangaroo rat, burrowing owl (*Athene cunicularia*), and sandhill cranes (USFWS 2005). Common wildlife observed at Pixley includes migrating and wintering songbirds, waterfowl, shorebirds, raptors, 16 species of mammals, and 13 species of reptiles and amphibians. Pixley NWR does not receive Sacramento/Delta water.

Los Banos WA (6,200 acres) includes lake, sloughs, irrigated pasture and managed seasonal and semi-permanent wetlands, and shrublands. The wildlife area is managed to provide wintering waterfowl habitat. Old-growth riparian occurs along some slough channels. Western pond turtles, raccoons, striped skunk, beaver, and muskrats, as well as over 200 species of birds are among the many animals found here.

Volta WA (3,800 acres), located just west of Los Banos WA, contains seasonally flooded wetland and valley alkali shrub habitat. The wildlife area is managed to provide habitat for migratory waterfowl and associated species. Common wildlife at Volta WA includes beaver, coyote, and cottontail rabbit. Over 150 species of birds, including large numbers of wintering waterfowl and shorebirds, and the special-status species giant gartersnake, also utilize the wetlands at Volta WA.

Mendota WA (11,800 acres) consists of flatlands and floodplain, with seasonal freshwater emergent wetland, valley foothill riparian, and alkali sink scrub habitat. Wildlife species at Mendota WA include a variety of migratory waterfowl, ring-necked pheasant (*Phasianus colchicus*), and colony and rookery nesting birds; common small mammals include coyotes, raccoons, black-tailed jackrabbits (*Lepus californicus*), weasels, and muskrats. The wildlife area is also habitat for several listed plant and wildlife species, including tricolored blackbird.

North Grasslands WA (7,400 acres) contains seasonal wetland, riparian thickets, and managed upland areas that provide habitat for Swainson's hawk, greater and lesser sandhill cranes, tricolored blackbird, winter roost for white-faced ibis, and wintering waterfowl. Together with other wildlife areas (e.g., Los Banos WA, Volta WA, West Hilmar WA) and other protected lands nearby in Merced

County, the grassland is an important bird area notable for its native valley grassland and abundance of wintering waterfowl.

GRCD (75,000 acres) is the largest contiguous block of wetland remaining in the Central Valley. The district is composed primarily of privately owned hunting clubs and wildlife-beneficial agriculture preserved under permanent wetland conservation easements and several state WAs. Lands within the GRCD include seasonally flooded wetlands, permanent wetlands, and irrigated pasture. GRCD comprises several state WAs that include Volta WA; Los Banos WA; and the Mud Slough, Gadwall, and Salt Slough Units of the North Grassland WMA. Federal wildlife refuges in GRCD include portions of the San Luis NWR, including the Freitas, Kesterson, and Blue Goose Units. GRCD provides wintering grounds for migratory waterfowl, shorebirds, and wading birds; habitat for upland game species and raptors; and habitat for a variety of fish and mammals.

Additional discussion of the CVPIA and Refuge Water Supply Program is provided in Section 7.6.1.3, *Regulatory Setting*.

Flood Bypasses

The Sacramento River watershed contains the Sutter and Yolo Bypasses, which are used primarily for agriculture and wildlife management but also receive floodwaters under high-flow conditions (DWR 2010). When flooded, the bypasses provide important habitat for juvenile fish and wintering waterfowl (USFWS 2009; ^CDFG 2008a). Sutter Bypass begins in northern Sutter County near the Sutter Buttes and extends south to the Sacramento River. Yolo Bypass starts just south of Sutter Bypass, crosses the Sacramento River, and continues through eastern Yolo County to the Delta.

Sutter Bypass is an approximately 15,500-acre area that provides floodwater conveyance in addition to wildlife habitat and agricultural production (^Feyrer et al. 2006; USFWS 2009). Sutter Bypass includes Sutter NWR and Sutter Bypass WA. Sutter NWR is a 2,591-acre refuge established by USFWS as a refuge and breeding ground for migratory waterfowl and other wildlife; the refuge comprises managed wetlands, seasonal wetlands, grasslands, riparian, and other habitats (USFWS 2009). Sutter Bypass WA, managed by CDFW, occurs along portions of both levees of the Sutter Bypass and the channels running along the toe of the levees. The remainder of Sutter Bypass is dominated by rice fields and private duck clubs. Sutter Bypass provides habitat for bird species such as wintering waterfowl, white-faced ibis, great blue heron, and great egret (*Ardea alba*); and several special-status wildlife species such as giant gartersnake, western pond turtle, Swainson's hawk, and western yellow-billed cuckoo (*Coccyzus americanus occidentalis)* (USFWS 2009; ^CDFW 2021).

Yolo Bypass is an approximately 60,000-acre engineered floodplain that conveys flood flows from the Sacramento River, Feather River, American River, Sutter Bypass, Cache Creek, and Putah Creek (^Harrell and Sommer 2003). Yolo Bypass consists of agricultural lands, seasonal wetlands, freshwater emergent marsh, managed wetlands, grassland, and riparian vegetation (^CDFG 2008a). As described in Section 7.4, *Agriculture and Forest Resources*, several agricultural crops are grown in the Yolo Bypass, and portions of the bypass are used for cattle grazing (^CDFG 2008a). Yolo Bypass also includes the Fremont Weir WA and Yolo Bypass WA, which are managed by CDFW. Fremont Weir WA consists of approximately 1,500 acres of tall weedy vegetation, brush, valley oaks, willows, and cottonwood trees (CDFW 2023). Yolo Bypass WA comprises approximately 16,770 acres of managed wildlife habitat and agricultural land (^CDFG 2008a). Yolo Bypass provides habitat for several special-status species such as giant gartersnake, western pond turtle, western burrowing owl, tricolored blackbird, Swainson's hawk, and white-tailed kite (^CDFG 2008a; CDFW 2021).

During winter flood flow inundation, the managed wetland areas in the Yolo Bypass floodplain can provide spawning and rearing habitat for Sacramento splittail (*Pogonichthys macrolepidotus*) and refuge habitat for other fish species (Sommer et al. 2001).

Duck Clubs

Duck clubs essentially act as managed wetland (i.e., human-made impoundments with borrow canals around the perimeter that may include open water, moist soil, exposed sand/mud flats, emergent vegetation with varying amounts and management regimes) natural community; they consist of areas that are intentionally flooded and managed during specific seasonal periods to enhance habitat values for specific wildlife species, generally waterfowl (e.g., ducks, geese) and other birds migrating along the Pacific Flyway (USFWS 2007; Kleinschmidt 2008). Duck clubs, or managed wetland natural community, fits into the fresh emergent wetland classification from the California Wildlife Habitat Relationships (Kramer 1988).

Although duck clubs focus on providing habitat for duck and geese, the diverse plant assemblages and invertebrate populations that are found in this habitat also provide important food resources for wildlife species that include bats, sandhill crane, California black rail, western pond turtle, and giant gartersnake.

Groundwater-Dependent Ecosystems

Groundwater-dependent ecosystem refers to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. (Cal. Code Regs., tit. 23, § 351, subd. (m).) The term includes ecosystems that are supported by groundwater at or relatively close to the surface and includes wetlands, riparian areas, and drought-intolerant phreatophytic (dependent on water from a permanent ground supply) upland communities such as Great Valley valley oak woodlands. Phreatophytic communities are particularly reliant on groundwater for continued survival during the hot, dry summers in California (Rohde et al. 2018). Groundwater-dependent ecosystems (and the species that rely on them) may be stressed or excluded by drying of surface water and shallow groundwater. Groundwater-dependent ecosystems include a variety of functional groups that respond to varied groundwater conditions differently. Wetlands require water table levels near or slightly above the ground surface and will die off if groundwater levels recede for extended periods of time. Larger woody plants have different maximum rooting depths, hydraulic architecture, and transpiration rates than smaller trees (Maddock et al. 2012). Willow riparian forests rely on relatively shallow groundwater. Larger sycamore and cottonwood riparian forests can rely on slightly deeper groundwater but can be drowned by persistent high-water tables near the soil surface (Maddock et al. 2012). Oak woodlands utilize deeper groundwater than riparian forests and can be excluded by shallow groundwater or areas with significant rapid changes in groundwater depth.

Groundwater-dependent ecosystems include springs, seeps, riparian, deep-rooted oak communities, fens, spring-fed rivers, and groundwater-supported wetlands.[1] Groundwater-dependent ecosystems vary dramatically in how extensively they depend on groundwater, from being entirely dependent to having occasional dependence. The base flows of some rivers and streams also depend on groundwater discharge and bank storage (USFS 2007). On average, up to 40 percent of the flow of many rivers is estimated to be made up of groundwater-fed baseflow. This water may be important

[1] Some wetlands are not supported by groundwater but are formed from water that originates exclusively from precipitation and associated runoff (National Wetlands Working Group 1997).

for in-river and near-river ecosystems, such as riparian habitat. Groundwater-dependent natural communities may be used by terrestrial wildlife as drought refuges; populations of some birds and mammals retreat to these areas during drought and then recolonize drier parts of the landscape following recovery (USFS 2007).

Agricultural Lands and Other Disturbed Areas

Many crops are cultivated in the study area (see Figures 7.4-4a and 7.4-4b in Section 7.4, *Agriculture and Forest Resources*). Substantial areas in California, and particularly within the Sacramento and San Joaquin Valleys, have been converted from natural habitat to agricultural lands.

In 2018, the Sacramento River watershed supported approximately 1.8 million acres of irrigated agriculture, mostly on the valley floor (^Land IQ 2021). In 2018, the Delta eastside tributaries and Delta regions supported approximately 677,500 acres of agriculture (304,500 and 373,000 acres, respectively) (^Land IQ 2021). The San Joaquin Valley is the largest agricultural region in California, supporting roughly 4 million acres of irrigated cropland in 2018 (^Land IQ 2021). The development of large areas for crop production has resulted in historical and substantial losses of native wildlife habitat. Because cropland has largely replaced natural habitat for many wildlife species, some wildlife has adapted to use certain agricultural lands for foraging and, in some cases, for nesting and cover. Wildlife habitat values on agricultural lands fluctuate in response to several variables, including the type of crop grown on a particular property, different crop mixes on a property, and conditions in the area that are influenced by the market and discrete farming decisions and practices. Habitat values also are influenced by common agricultural practices, such as harvesting, spraying, tilling, crop rotation, and fallowing. These activities typically vary within an agricultural season and between years. The value of the habitat varies greatly with crop type and agricultural practices, but agricultural lands typically provide low-value habitat for wildlife (CDFG 2007). For example, some agricultural areas such as orchards, vineyards, and turf farms do not provide suitable habitat for migratory birds. Even though agricultural lands generally provide lower-quality habitat for wildlife compared to natural habitats, certain wildlife species now are heavily reliant on agricultural lands for habitat because the vast majority of natural habitat has been lost. Agricultural lands producing row or field crops are often flexible enough in cropping patterns and management options to provide some form of habitat during a part of the year for certain wildlife species.

The Sacramento River watershed, Delta eastside tributaries, and Delta regions produce a diversity of crops, such as rice, alfalfa, walnuts, almonds, grains, and wine grapes (Figure 7.4-4a). In terms of acreage, the dominant agricultural crop in the Sacramento Valley is rice, which represents approximately one-third of croplands in the region. In 2021, more than 95 percent of the rice produced in California came from the Sacramento Valley, with Colusa, Sutter, Butte, and Glen Counties being the dominant producers (Geisseler and Horwath 2013). Most of the irrigation water for California rice comes from winter rain and snow-fed reservoirs of the Cascade and Klamath Ranges and the Sierra Nevada; less than 10 percent of rice irrigation water is pumped from wells in areas where surface water is not available or as a supplement to surface supplies (Shaffer 2001). The special-status wildlife species most dependent on specific croplands in the Sacramento/Delta are giant gartersnake, Swainson’s hawk, greater sandhill crane, and tricolored blackbird. Several crops are used by these special-status wildlife species, including alfalfa, corn, corn silage, grain (wheat), irrigated pasture, rice, and other field crops (grass hayfields).

Some harvested rice fields are flooded during winter, which also can provide wetland habitat for migratory birds in California. Rice is usually grown in areas that previously supported natural wetlands, and many wetland wildlife species use rice fields—especially waterfowl and shorebirds. The practice of flooding rice fields during winter to allow rice stubble to rot provides a wide variety of ducks and geese an opportunity to loaf or forage in rice fields during winter and foraging habitat for shorebirds. Fallow rice fields also provide habitat for geese, cranes, large herons, and egrets and can provide breeding habitat for waterfowl such as mallards and gadwall (*Mareca strepera)* (CDFG 2007; Shaffer 2001). Waste grain also provides food for species such as ring-necked pheasant and sandhill crane. Other wildlife that use rice fields include giant gartersnake, bullfrog, and wading birds that forage on aquatic invertebrates and small vertebrates such as crayfish and small fishes. Giant gartersnake use rice fields between mid-June and early September and may benefit from fields providing nutritional subsidies to prey species in adjacent canals and/or dispersing predators. Although rice lands provide suboptimal habitat for giant gartersnake, adult giant gartersnake survival was found to have a positive relationship with the amount of rice lands available (Halstead et al. 2019).

The San Joaquin Valley region produces dairy, livestock, and a variety of crops, including grapes, nuts (e.g., almonds, walnuts, pistachios), tomatoes, sugar beets, orchards (e.g., cherries, apples, apricots), blueberries, cotton, alfalfa, and hay (Figure 7.4-4b). In terms of acreage, the dominant agricultural crop in the San Joaquin Valley is almonds. Rice also is produced in the San Joaquin Valley, predominately in the north to central San Joaquin Valley, including San Joaquin, Stanislaus, Merced, and Fresno Counties (Shaffer 2001). Rice production in the San Joaquin Valley is small compared to the Sacramento Valley because other agricultural crops that return a higher income per acre can be grown on the more fertile soils there (Geisseler and Horwath 2013). In addition, water supply is more restricted in the San Joaquin Valley compared to the Sacramento Valley (Geisseler and Horwath 2013; Reclamation 2015). The San Joaquin Valley's agricultural productivity requires heavily irrigated soil; however, heavy irrigation can degrade local water quality. Water quality in the San Joaquin Valley region, particularly the west side of the lower San Joaquin River, is of lower quality than in the Sacramento River watershed, Delta eastside tributaries, and Delta regions. This is partly due to the natural condition of soils (the west side of the San Joaquin Valley has poorly drained and naturally saline soils [Letey 2000; Shaffer 2001]), and the groundwater in the area is shallow. The western San Joaquin Valley is an area of concern where high salinity can harm agricultural productivity and wildlife (Letey 2000). Water quality issues also have been exacerbated by agricultural drainage (Letey 2000). A concern about agricultural drainage is whether salinity in rivers that transport salt from agricultural lands can be kept below levels that may harm downstream uses of water or fish and wildlife. In areas where no outlet to rivers is available, such as the Tulare Lake Basin, drainage water is carried to evaporation ponds. Drainage water is the only source of water for many of these ponds, resulting in high concentrations of salts. Concentrations of other trace elements such as selenium also are elevated in evaporation basins, with a wide degree of variability among basins (Letey 2000). Selenium is known to be harmful and lethal at elevated concentrations; and fish and wildlife, particularly birds, may become exposed to harmful concentrations of the element through bioconcentration and biomagnification (Letey 2000; Ohlendorf and Heinz 2011). The former Kesterson Reservoir was one of 12 evaporation ponds used for agricultural drainage in the San Joaquin Valley. The reservoir, a part of the San Luis NWR, was an important stopping point for migratory waterfowl. Over time, naturally occurring selenium accumulated in the agricultural drainage water and in the reservoir. The high accumulation of selenium in the drainage water was linked to bird deaths and deformities (Tanji et al. 1986).

Three special-status bird species that utilize agricultural lands for habitat are Swainson's hawk, greater sandhill crane, and tricolored blackbird. The Swainson's hawk is a migratory raptor that breeds in the western United States and overwinters in South America. Swainson's hawks require large open areas for foraging and riparian forests and oak woodlands for nesting (Estep 2007). Swainson's hawks also are known to nest at several Central Valley wildlife refuges, including the Sacramento NWR, Upper Butte Basin WA, San Luis NWR, Los Banos NWR, North Grasslands WA, Mendota WA, and Volta WA. Swainson's hawks select for certain tree species such as cottonwoods, oaks, and willows near foraging habitat (Estep 2007). Swainson's hawks historically foraged in California's extensive grasslands. However, the conversion of native habitat to agricultural lands has shifted the foraging behavior of the species to rely more heavily on agricultural crops (Estep 2007). High- to moderate-value foraging habitat for Swainson's hawk includes alfalfa, irrigated pasture, and other grain and hay types (Estep 2007; Swolgaard et al. 2008). Among the crop types used by Swainson's hawk, alfalfa is the highest-valued foraging habitat because it is semi-perennial with a low growth profile and provides a long-term, stable, and abundant source of prey (Hartman and Kyle 2010; Estep 2007; Swolgaard et al. 2008). Habitat loss is a primary threat to Swainson's hawk populations in California (CDFW 2016; Estep 2007). Bloom (1980) also identified habitat loss as a contributing factor in a decline in Swainson's hawk abundance in California. The extensive loss of historical Swainson's hawk riparian habitat is linked to declines in Swainson's hawk abundances (Estep 2007; Woodbridge 1998).

The Central Valley provides the sandhill crane wintering habitat along the Pacific Flyway (Ivey et al. 2016). Greater sandhill cranes begin arriving in the Central Valley during October, and the overwintering population peaks during December and January. Overwintering greater sandhill cranes require suitable roost sites and sufficient nearby foraging habitat (Ivey et al. 2016). Overwintering greater sandhill cranes forage on residue of corn, grain, and wheat crops when fields are flooded to decompose post-harvest stubble of agricultural crops. In the Delta, harvested corn fields are the habitats most used for foraging, along with winter wheat, alfalfa, pasture, and fallow fields (Pogson and Lindstedt 1991). In the Butte Basin, harvested rice fields are the most-used foraging, along with winter wheat, harvested and unharvested corn, fallow fields, and grasslands (Littlefield 2002). These areas serve as high-quality foraging habitat that compensate for loss of historical wetland habitat. Greater sandhill cranes are known to winter at Upper Butte Basin WA, Gray Lodge WA, and Pixley NWR (CDFW 2020). The Cosumnes River floodplain, much of it located in the Cosumnes River Preserve, also supports substantial winter use by sandhill cranes.

The tricolored blackbird is endemic to California. Tricolored blackbirds are colonial; they historically nested in dense cattail or bulrush marshes and adjacent riparian willows. Widespread and ongoing habitat loss has eliminated large portions of the tricolored blackbird's nesting and foraging habitat in the Central Valley and Southern California and has caused steep declines in tricolored blackbird populations in recent years (Beedy 2008). Historically, breeding colonies were strongly associated with emergent marshes with tall, dense cattails or tules (Granholm 2008), but there has been a shift to nonnative vegetation and active agricultural areas (Beedy et al. 2020). Surveys show that an increasing percentage of tricolored blackbird colonies were found in Himalayan blackberry, milk thistles (*Silybum marianum*), wild rose (*Rosa acicularis*), and other thorny vegetation (Beedy et al. 1991; Holyoak et al. 2014; Beedy et al. 2020). With the loss of native marsh nesting and nearby feeding habitat, the species has become dependent on agricultural lands; 95 percent of its breeding population occurs in the Central Valley. Agricultural crops, such as barley (*Hordeum* spp.), winter wheat (*Triticum* spp.), safflower (*Carthamus tinctorius*), desert olive (*Forestiera neomexicana*), lemon (*Citrus limon*) orchard, and fava bean (*Vicia faba*), have less frequently been used as nesting substrate by tricolored blackbird (Beedy et al. 2020). Use of certain agricultural crops, particularly triticale grain, has become especially important for the species nesting in the Central Valley (Meese et al. 2015). These colonies are vulnerable and can be destroyed if fields are harvested while the young are still in the nests, which can result in reproductive failure for tricolored blackbird colonies (Meese et al. 2015). Agreements between agencies and the dairy industry to encourage farmers to delay harvests have saved thousands of tricolored blackbirds. Tricolored blackbirds also are known to nest at several wildlife refuges, including Sacramento NWR, Delevan NWR, Colusa NWR, Sacramento River NWR, and Gray Lodge WA (USFWS 2009). Tricolored blackbirds are primarily granivore, but opportunistically forage on the most available food resource. The replacement of row crops by woody perennial crops, such as vineyards and almond orchards, severely restricts essential foraging habitats and contributes to the species decline.

Grasslands

Grassland natural communities consist of herbaceous vegetation dominated by grasses and forbs. Grasslands provide ecosystem services such as carbon sequestration, nutrient cycling, and agricultural benefits. Grasslands are found in upland topographic locations, generally irrespective of landscape position, slope, and aspect. Grassland natural communities in the study area include annual and perennial grasslands. Perennial grasslands also include serpentine and desert grasslands.

Grasslands typically are found in areas with low and irregular precipitation and long, hot, dry summers unsuitable for woody plant development (Holland and Keil 1995). These characteristics are typical of much of the environment of the Central Valley in California (Holland and Keil 1995). Soils may be clays, sands, or serpentine parent materials that further restrict woody plant growth. Anthropogenic disturbance may remove woody plants, resulting in dominance by grass species. Alternatively, invasive European grasses such as cheat grass (*Bromus tectorum*) may fill in the understory or inter-shrub areas of woody communities, resulting in altered fire dynamics that select against woody plants and results in grassland communities.

Grasslands may broadly be separated into two groups: lands dominated by shallow-rooted annual grass species and areas with an abundance of deep-rooted perennial bunchgrasses. Even in perennial grasslands, annual grass species may be widespread and abundant in the areas between bunchgrasses.

Annual grasslands are largely dominated by nonnative annual grasses, where grasses and forbs occur as extensive stands without an overstory (CDFG 2005a). Vernal pools and seasonal wetlands can be patchily distributed within the annual grassland natural community. Dominant species include wild oat (*Avena* spp.), soft chess (*B. hordeaceus*), ripgut brome (*B. diandrus*), red brome (*B. rubens*), wild barley (*Hordeum* spp.), and rattail fescue (*Festuca myuros*).

Perennial grasslands often are found in moist, lightly grazed, or relic prairie areas. Perennial bunchgrasses in California typically are dominated by native bunchgrasses but occasionally may consist of invasive bunchgrasses such as fountain grass (*Pennisetum rubrum*) or pampas grass (*Cortaderia* spp.). These areas were present in large areas of the Central Valley prior to agricultural conversion. Dominant species may include purple needlegrass (*Stipa pulchra*) and Idaho fescue (*F. idahoensis*). Perennial grassland habitats in areas with strong maritime influence are dominated by perennial grass species such as California oatgrass (*Danthonia californica*), Pacific hairgrass (*Deschampsia cespitosa* ssp. *holciformis*), and sweet vernal grass (*Anthoxanthum odoratum*). Species associated with perennial grassland habitats in areas with weaker maritime influence include redtop (*Agrostis gigantea*), silver hairgrass (*Aira caryophyllea*), sweet vernal grass, coast carex

(*Carex obnupta*), orchardgrass (*Dactylis glomerata*), California oatgrass, Idaho fescue, and red fescue (*F. rubra*), as well as annual grass species and native and nonnative wildflowers (CDFG 2005b).

Serpentine grassland is a mosaic of perennial bunchgrass stands, perennial and annual grasses, and herbaceous wildflower species; it is designated as a sensitive natural community by CDFW (CDFW 2022). The flora is composed primarily of native species and generally is more diverse than the flora of grasslands on non-serpentine substrates (McCarten 1993). Species strongly associated with serpentine soils include jeweled onion (*Allium serra*), Franciscan wallflower (*Erysimum franciscanum*), serpentine leptosiphon (*Leptosiphon ambiguus*), most beautiful jewelflower (*Streptanthus albidus* ssp. *peramoenus*), and smooth lessingia (*Lessingia micradenia* var. *glabrata*). Many plant species occur exclusively or primarily in serpentine grasslands.

Perennial desert grasslands can occur across both upland and lowland landforms and may occur in plains, foothills, alluvial terraces, basins, mesa tops, swales, and playas. Desert grasslands also can occur in a mosaic with desert scrubland. Dominant grasses in this land cover type generally are native perennials and include alkali sacaton (*Sporobolus airoides*), blue bunch wheatgrass (*Elymus spicatus*), blue grama (*Bouteloua gracilis*), galleta (*Hilaria jamesii*), Indian ricegrass (*Stipa hymenoides*), Letterman’s needlegrass (*Stipa lettermanii*), muttongrass (*Poa fendleriana*), needle-and-thread (*Stipa comata*), one-sided bluegrass (*Poa secunda*), purple three-awn (*Aristida purpurea*), Salina Pass wild rye (*Elymus salinua*), and sand dropseed (*Sporobolus cryptandrus*). Cheat grass and Mediterranean grass (*Schismus barbata*) are particularly invasive alien species in this community (Holland and Keil 1995).

Annual and perennial grasslands generally support the same wildlife species, with some variation in local endemics throughout the swath of California (CDFG 2005a; CDFG 2005b). Some wildlife species are strongly associated with breeding and foraging within grasslands, while many other wildlife species use annual grasslands for foraging but may additionally require habitat features such as cliffs, caves, ponds, or habitats with woody plants for breeding, resting, and escape cover. Characteristic reptiles that breed in annual grassland habitats include gopher snake, common garter snake (*Thamnophis sirtalis*), and western rattlesnake (*Crotalus oreganus*). Mammals typically found in this habitat include black-tailed jackrabbit, California ground squirrel, Botta’s pocket gopher (*Thomomys bottae*), California vole (*Microtus californicus*), some species of kangaroo rat (*Dipodomys* spp.), American badger (*Taxidea taxus*), and coyote. San Joaquin kit fox can also occur in this habitat.

Birds strongly associated with grasslands include burrowing owl, horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), grasshopper sparrow (*Ammodramus savannarum*), northern harrier, and ferruginous hawk (*Buteo regalis*) (CDFG 2005a; CDFG 2005b). Other raptor species utilize grasslands for foraging but nest in other habitats, including golden eagle, Swainson’s hawk, short-eared owl (*Asio flammeus*), turkey vulture (*Cathartes aura*), prairie falcon (*Falco mexicanus*). white-tailed kite, and American kestrel.

Shrublands

Shrubland natural communities occur in the warm-temperate Californian Floristic Province, from southwestern Oregon through California, west of the Sierra-Cascades divide and south into northwestern Baja California, Mexico (CalPIF 2004). Shrublands are natural communities that are dominated by woody shrubs generally adapted to drought-like conditions. Shrublands in the study area include chaparral, coastal scrub, sagebrush, desert scrub, and alkali desert scrub habitats. Vegetation in the shrubland natural community generally is found on rocky slopes where there is not enough rain to support tall tree growth. Scrub can be open to densely packed and nearly impenetrable. In open scrub habitat, annual vegetation (e.g., grasses, forbs) can grow between the shrubs.

Chaparral

Chaparral habitat is a vegetation community dominated by drought-resistant shrubs with hard evergreen, thick, stiff, short leaves. The composition of chaparral changes between northern and southern California, as well as with precipitation regime, aspect, and soil type. Plant species that typically dominate chaparral include scrub oak (*Quercus* spp.), ceanothus (*Ceanothus* spp.), and manzanita (*Arctostaphylos* spp.). Other species of shrubs that may be dominant include chamise (*Adenostoma fasciculatum*), redshank (*Adenostoma sparsifolium*), mission manzanita (*Xylococcus bicolor*), birchleaf mountain mahogany (*Cercocarpus betuloides*), silk-tassel (*Garrya elliptica*), toyon, yerba santa (*Eriodictyon californicum*), and California buckeye (Holland 1986).

Chaparral can provide habitat for many wildlife species, particularly birds and small mammals. At least seven wildlife species occur primarily in mature chaparral in California, including brush rabbit (*Sylvilagus bachmani*), California pocket mouse (*Perognathus californicus*), two species of chipmunk (*Eutamias* spp.), and dusky-footed woodrat (*Neotoma fuscipes*) (Quinn 1990). Other species frequently found in chaparral include wrentit (*Chamaea fasciata*), greater roadrunner (*Geococcyx californianus*), spotted towhee, California scrub jay (*Aphelocoma californica*), mule deer, coyote, several species of kangaroo rat, and mountain lion (CalPIF 2004).

Coastal Scrub

Coastal scrub habitat occurs discontinuously in a narrow strip in the central and southern portions of the study area that are under maritime influence. This habitat type generally occurs within 20 miles of the ocean; however, in the Southern California region (e.g., Riverside County), coastal scrub extends more than 50 miles inland (Mayer and Laudenslayer 1988). The vegetation structure of coastal scrub differs among stands, mostly along a gradient that parallels the Pacific coastline; the structure is generally low- to moderate-sized shrubs with mesophytic leaves, semiwoody stems, and a woody base. No single species is typical of all coastal scrub stands, and the composition changes most markedly with progressively more xeric conditions from north to south along the coast. With the change from mesic to xeric sites, dominance appears to shift from evergreen species in the north to drought-deciduous species in the south. Variation in coastal influence at a given latitude produces less-pronounced composition changes (Holland and Keil 1995).

Northern coastal scrub generally is separated into two categories: one dominated by lupine (*Lupinus* spp.) at exposed oceanside sites and a second more common type of northern coastal scrub dominated by coyote bush (*Baccharis pilularis*) at less exposed sites. Other common overstory species are salal (*Gaultheria shallon*), bush monkeyflower (*Diplacus* spp.), blackberry (*Rubus ursinus*), poison oak, and wooly sunflower (*Eriophyllum lanatum*). Bracken fern (*Pteridium aquilinum*) and sword fern (*Polystichum munitum*) are dominant in the understory (Holland and Keil 1995).

Southern coastal scrub, typical of more inland areas, occurs intermittently over a larger area than northern coastal scrub habitat; its composition corresponds to moisture availability. California sagebrush (*Artemisia californica*) is a common species in all types of coastal scrub habitat. Other species typical in southern coastal scrub habitats include sage (*Salvia* spp.), California buckwheat

(*Eriogonum fasciculatum*), brittlebush (*Encelia farninosa*), coyote bush, lemonade berry (*Rhus integrifolia*), laurel sumac (*Malosma laurina*), and coffeeberry (Holland and Keil 1995).

Coastal scrub supports a wide variety of wildlife species. Though vegetation productivity is lower in coastal scrub than in adjacent chaparral habitats associated with it, coastal scrub appears to support numbers of wildlife species roughly equivalent to those in surrounding habitats. The peregrine falcon (*Falco peregrinus*), Morro Bay kangaroo rat (*Dipodomys heermanni morroensis*), and Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*) occur in coastal scrub. Coastal scrub habitat also provides nesting and foraging habitat for a variety of nesting birds and raptors, including southern California rufous-crowned sparrow (*Aimophila ruficeps canescens*) and coastal California gnatcatcher (*Polioptila californica californica*) (CalPIF 2004).

Sagebrush

Sagebrush stands typically are large open stands of big sagebrush (*Artemisia tridentata*), often forming pure stands. Several shrub species can be associated with this community, including saltbush (*Atriplex* spp.), rubber rabbitbush (*Ericameria nauseosa*), Mormon tea (*Ephedra viridis*), hop sage (*Grayia spinosa*), antelope bitterbrush (*Purshia tridentata*), and gray horsebrush (*Tetradymia canescens*). The herbaceous layer of this land cover type varies in density and generally is dominated by perennial grasses (Holland and Keil 1995). This land cover type can occur on a wide range of landforms and on all aspects. Sagebrush stands occur in places ranging from stream terraces, washes, and floodplains to steep rocky slopes and upland terraces. This land cover type is found on a variety of well-drained, deep soils at elevations ranging from 300 to 3,000 meters.

Sagebrush habitat supports a variety of wildlife species. Abundant growth of vegetation during spring and summer provides species of birds, mammals, reptiles, and amphibians with nesting, foraging, and resting habitat. Bird species common to this habitat include greater sage grouse (*Centrocercus urophasianus*), sage thrasher (*Oreoscoptes montanus*), sage sparrow (*Amphispiza belli*), chukar (*Alectoris chukar*), and horned lark. Mammal species that commonly utilize this habitat include pronghorn (*Antilocapra americana*), California black-tailed jackrabbit, and coyote. Colder winters generally limit the number of reptile and amphibian species present within sage scrub habitats (Turner 1982). Sagebrush lizard (*Sceloporus graciosus*), long-nosed leopard lizard (*Gambelia wislizenii*), collared lizard (*Crotaphytus collaris*), northern side-blotched lizard (*Uta stansburiana*), and Great Basin spadefoot toad (*Spea intermontana*) are among the more common representative reptile and amphibian species within this habitat type (Turner 1982).

Desert Scrub

Desert scrub is the most widespread habitat in the California desert (Laudenslayer and Boggs 1988). Desert scrub habitats typically are open, scattered assemblages of broad-leaved evergreen or deciduous microphyll shrubs (Laudenslayer and Boggs 1988). Canopy cover generally is 50 percent or less. Creosote bush (*Larrea tridentata*) often is the dominant desert scrub plant species. Desert scrub habitat tends to have low plant species diversity. However, many plant species, including catclaw acacia (*Senegalia greggii*), desert agave (*Agave deserti*), bladderpod (*Peritoma arborea*), brittlebush, burrobush (*Ambrosia dumosa*), cholla (*Cylindropuntia* spp.), beavertail cactus (*Opuntia basilaris*), and ocotillo (*Fouquieria splendens*), are found in this habitat (Laudenslayer and Boggs 1988). Forbs and grass species present in desert scub may include evening primrose (*Oenothera* spp.), big galleta (*Hilaria rigida*), and Spanish needles (*Bidens bipinnata*). Desert scrub habitats occur at relatively low elevation and are associated with other habitat types such as desert wash and alkali desert scrub (Laudenslayer and Boggs 1988).

Desert scrub habitats support a variety of wildlife species. The presence of standing water in winter and growth of herbaceous plants in spring provide foraging areas and food. Primary resident species are reptiles and rodents; however, other taxa are represented. Typical species include Couch's spadefoot toad (*Scaphiopus couchii*), desert tortoise (*Gopherus agassizii*), a variety of lizards and snakes including the desert iguana (*Dipsosaurus dorsalis*) and common kingsnake (*Lampropeltis getula*), black-throated sparrow (*Amphispiza bilineata*), various pocket mice (*Perognathus* spp.) and kangaroo rats, kit fox (*Vulpes macrotis*), coyote, and bobcat (*Lynx rufus*) (Laudenslayer and Boggs 1988).

Alkali Desert Scrub

Alkali desert scrub is characterized by salt-tolerant shrubs such as iodine bush (*Allenrolfea occidentalis*), big sagebrush, greasewood (*Sarcobatus vermiculatus*), and saltbush. The understory and intershrub spaces can be sparse or dominated by graminoids such as saltgrass spikerush (*Eleocharis* spp.), rushes, pickleweed (*Salicornia* spp.), and alkali sacaton (Rowlands 1988). This land cover type occurs near drainages or on stream terraces or flats and may form rings around dry ponds or playas. Soils are alkaline to saline (depending on soil moisture), which can affect plant species composition. Sites also can experience intermittent, seasonal, or semipermanent flooding, resulting in surface water that is retained into the growing season or throughout the year (except in drought years) (Rowlands 1988).

Alkali desert scrub provides habitat for various species of wildlife. The special-status San Emigdio blue butterfly (*Plebulina emigdionis*) inhabits alkali desert scrub where its host plant, fourwing saltbush (*Atriplex canescens*), occurs (Rowlands 1988). Other special-status species that inhabit alkali desert scrub include desert tortoise, Mojave fringe-toed lizard (*Uma scoparia*), San Joaquin kit fox, San Joaquin kangaroo rat, giant kangaroo rat, and San Joaquin antelope squirrel (*Ammospermophilus nelsoni*). Other reptile species found within this habitat include zebra-tailed lizard (*Callisaurus draconoides*), long-nosed leopard lizard, chuckwalla (*Sauromalus obesus*), and desert iguana. A variety of bird species are found within desert grassland habitat, including Le Conte's thrasher (*Toxostoma lecontei*), ferruginous hawk, and grasshopper sparrow (Rowlands 1988).

Coniferous Forest

Coniferous forest habitats generally contain dense canopy cover, with dominant species largely dependent on the region's elevation and aspect. Pines (*Pinus* spp.) are diverse in California's coniferous forests, and one to several representative species occur per coniferous land cover type. Pine species can include ponderosa pine (*P. ponderosa*), Jeffrey pine (*P. jeffreyi*), and gray pine (*P. sabiniana*). Other common coniferous trees include incense cedar (*Calocedrus decurrens*), fir (*Abies* spp.), and juniper (*Juniperus* spp.). Understory cover varies depending on moisture content within and between land over types. Common understory species include Sierra chinquapin (*Chrysolepis semepervirens*), snowberry (*Symphoricarpos* spp.), and common forbs and grasses (CalPIF 2002).

Wildlife species characteristic of coniferous forests include reptile species such as gopher snake and western fence lizard. Bird species include American kestrel, great horned owl, Clark's nutcracker (*Nucifraga columbiana*), bushtit (*Psaltriparus minimus*), Nuttall's woodpecker (*Picoides nuttallii*), pileated woodpecker (*Dryocopus pileatus*), northern flicker, white-breasted nuthatch, red crossbill (*Loxia curvirostra*), and Steller's jay (*Cyanocitta stelleri*). Mammals include wolverine (*Gulo gulo*), American pine marten (*Martes americana*), fisher (*Pekania pennanti*), chipmunks, and western gray squirrel.

Desert Wash

Desert washes crisscross the deserts of California. These channels rarely carry water but can carry flash flood waters that scour out other upland species. Desert wash vegetation communities develop along channels deep enough to have some subsurface water retention or flow (Holland and Keil 1995). Desert washes are characterized by shrubs from the surrounding desert intermixed with shrubs and trees that require a greater moisture supply. Desert wash vegetation is often taller and denser than the surrounding desert habitat. These communities are typified by particular shrub species in the drier headwaters portions of the washes, with shrubs including singlewhorl burrobrush (*Ambrosia monogyra*), desert lavender (*Hyptis emoryti*), and chuparosa (*Justica californica*) (Holland and Keil 1995). In lower and larger washes, this transitions to desert wash tree species, including cat claw (*Acacia greggii*), desert willow (*Chilopsis linearis*), smoke tree (*Psorothamnus spinosus*), desert ironwood (*Olneya tesota*), mesquite (*Prosopis glandulifera*), and palo verde (*Cercidium floridium*) (Holland and Keil 1995). Most of these species occur on banks and sandbars but not within the flood channel (Holland and Keil 1995).

Desert washes tend to support higher density and diversity of bird species than the surrounding desert (Laudenslayer 1988). Desert species associated with washes include verdin (*Auriparus flaviceps*), Lucy’s warbler (*Leiothlypis luciae*), black-tailed gnatcatcher (*Polioptila melanura*), ruby-crowned kinglet (*Regulus calendula*), phainopepla (*Phainopepla nitens*), Gambel’s quail (*Callipepla gambelii*), and crissal thasher (*Toxostoma crissale*).

7.6.1.3 Regulatory Setting

Federal Plans, Policies, and Regulations

Relevant federal programs, policies, plans, and regulations related to terrestrial biological resources are described below.

Federal Endangered Species Act

The purpose of the ESA is to protect and recover imperiled species and the ecosystems upon which they depend. (16 U.S.C., § 1531 et seq.) The ESA is administered by USFWS and the National Marine Fisheries Service (NMFS). In general, NMFS is responsible for protecting ESA-listed threatened or endangered marine species and anadromous fishes, while other listed species (e.g., freshwater and terrestrial species) are under USFWS jurisdiction. An *endangered species* is defined as “… any species which is in danger of extinction throughout all or a significant portion of its range.” (16 U.S.C., § 1532, subd. (6).) A *threatened species* is defined as “… any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” (16 U.S.C., § 1532, subd. (20).) ESA section 9 makes it illegal to *take* (i.e., harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) any endangered fish or wildlife species. (16 U.S.C. §§ 1538; 1532, subd. (19).) For threatened fish and wildlife species, ESA section 4(d) allows for the adoption of protective regulations, including provisions extending the section 9 take prohibition to that species. (16 U.S.C., § 1538, subd. (d).)

Section 7 of the ESA mandates that all federal agencies consult with USFWS and NMFS to ensure that any action authorized, funded, or carried out by such federal agency does not jeopardize the continued existence of a listed species or destroy or adversely modify its critical habitat. A non-federal entity that seeks to avoid potential take liability from an action may apply to USFWS or NMFS for an incidental take permit (ITP) under section 10 of the ESA. To obtain an ITP, an applicant must prepare a habitat conservation plan (HCP) that meets the following five issuance criteria.

- The taking will be incidental to an otherwise lawful activity.
- The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking.
- The applicant will ensure that adequate funding for HCP implementation will be provided.
- The taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.
- Other measures that USFWS and NMFS require as being necessary or appropriate for purposes of the HCP will be met. (16 U.S.C. § 1539(a)(2)(A).)

Approximately 200 HCPs and NCCPs (together identified as *conservation plans*) have been developed in California. The full list of HCPs in California is available on the USFWS website,[2] and the full list of NCCPs in California is available on the CDFW website.[3] There are numerous approved regional[4] HCPs and NCCPs within the study area (Table 7.6.1-4). Approved HCPs and NCCPs contain conservation strategies composed of a variety of actions or measures that incidental take permittees are required to implement to meet their permit conditions. The primary conservation actions under most HCP and NCCPs are a combination of land preservation through acquisition in fee title or conservation easement and restoration of natural communities.

Table 7.6.1-4. Regional Habitat Conservation Plans and Natural Community Conservation Plans in the Study Area

Conservation Plan	Location (County) and Size (acres)	Plan Preparers	Covered Species
Butte Regional Conservation Plan (HCP/NCCP) *Status: Final (2019)*	Approximately 564,200 acres in Butte County	Butte County; Cities of Oroville, Chico, Biggs, and Gridley; Butte County Association of Governments; California Department of Transportation; Western Canal Water District; Biggs-West Gridley Water District, Butte Water District; Richvale Irrigation District	25 wildlife and plant species, including 7 bird, 2 reptile, 2 amphibian, 4 fish, 4 invertebrate, and 6 plant species
Natomas Basin Habitat Conservation Plan (HCP)	53,537 acres in Sacramento and Sutter Counties	City of Sacramento; Sutter County; Reclamation District No. 1000; Natomas Central	22 wildlife and plant species, including 7 bird, 2 reptile, 2 amphibian, 4 invertebrate, and 7 plant species

[2] https://ecos.fws.gov/ecp0/conservationPlan/.

[3] https://wildlife.ca.gov/Conservation/Planning/NCCP/Plans.

[4] Low-effect HCPs, project HCPs, and HCPs that cover localized areas (e.g., San Bruno Mountain HCP) are not included in the table.

Conservation Plan	Location (County) and Size (acres)	Plan Preparers	Covered Species
Status: Final (2001)		Mutual Water Company; The Natomas Basin Conservancy	
Western Placer County Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP) *Status: Final (2020)*	962,000 acres in Placer County	Placer County; City of Lincoln; South Placer Regional Transportation Authority; Placer County Water Agency; Placer Conservation Authority	14 wildlife and plant species, including 4 bird, 2 reptile, 2 amphibian, 2 fish, and 4 invertebrate species
South Sacramento Habitat Conservation Plan (HCP) *Status: Final (2018)*	317,655 acres in Sacramento County	Sacramento County; Cities of Rancho Cordova and Galt; Sacramento County Water Agency; Southeast Connector Joint Powers Authority	28 wildlife and plant species, including 9 bird, 8 plant, 2 mammal, 2 amphibian, 2 reptile, and 5 invertebrate species
Yolo Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP) *Status: Final (2018)*	Approximately 653,549 acres in Yolo County, and 1,174 acres in Solano County	Yolo Habitat Conservancy	12 wildlife and plant species, including 1 bird, 1 invertebrate, 1 amphibian, 2 reptile, and 7 bird species
East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP) *Status: Final (2006)*	174,018 acres in Contra Costa County	Contra Costa County; Contra Costa County Flood Control and Water Conservation District; East Bay Regional Park District; Cities of Brentwood, Clayton, Oakley, and Pittsburg	28 wildlife and plant species, including 4 bird, 2 mammal, 4 reptile, 3 amphibian, 4 invertebrate, and 11 plant species
PG&E Bay Area Operations and Maintenance Habitat Conservation Plan (HCP) *Status: Final (2017)*	402,440 acres in Napa, Solano, Marin, San Francisco, San Mateo, Sonoma, Contra Costa, Alameda, and Santa Clara Counties	Pacific Gas and Electric Company	31 wildlife and plant species, including 1 bird, 2 mammal, 2 reptile, 3 amphibian, 11 invertebrate, and 13 plant species
PG&E Multiple Region Habitat Conservation Plan (HCP) *Status: Final (2020)*	565, 781 acres in Amador, Butte, Calaveras, Colusa, El Dorado, Fresno, Glenn, Humboldt, Kern, Lake, Lassen, Madera, Mariposa, Mendocino, Modoc,	Pacific Gas and Electric Company	36 wildlife and plant species, including 2 bird, 3 mammal, 2 reptile, 7 amphibian, 10 invertebrate, and 12 plant species

Conservation Plan	Location (County) and Size (acres)	Plan Preparers	Covered Species
	Monterey, Nevada, Placer, Plumas, Sacramento, San Benito, San Luis Obispo, Santa Barbara, Santa Cruz, Shasta, Sierra, Siskiyou, Sutter, Tehama, Trinity, Tulare, Tuolumne, Yolo, and Yuba Counties		
Sierra Pacific Industries Habitat Conservation Plan (HCP) *Status: Final (2020)*	1,566,498 acres in Siskiyou, Trinity, Shasta, Modoc, Lassen, Tehama, Mariposa, Plumas, Butte, Yuba, Sierra, Nevada, Placer, El Dorado, Amador, Calaveras, and Tuolumne Counties	Sierra Pacific Industries	Northern spotted owl and California spotted owl
San Joaquin County Multi-Species Conservation and Open Space Plan (HCP) *Status: Final (2000)*	Over 900,000 acres in San Joaquin County	San Joaquin County; Cities of Stockton, Lodi, Manteca, Tracy, Ripon, Escalon, and Lathrop	97 wildlife and plant species, including 10 invertebrate, 4 fish, 4 amphibian, 4 reptile, 33 bird, 14 mammal, and 28 plant species
Solano Multispecies Conservation Plan (HCP) *Status: Final (2012)*	577,000 acres in Solano County and approximately 8,000 acres in Yolo County	Solano County Water Agency; Cities of Vacaville, Fairfield, Suisun City, Vallejo, Rio Vista, and Dixon; Solano Irrigation District; Maine Prairie Water District; Reclamation District No. 2068; Dixon Resource Conservation District; Dixon Regional Watershed Joint Powers Authority; Vallejo Sanitation and Flood Control District; Fairfield-Suisun Sewer District	31 wildlife and plant species, including 6 invertebrate, 5 bird, 12 plant, 6 fish, 1 mammal, and 1 reptile species
Santa Clara Valley Habitat Plan (HCP/NCCP) *Status: Final (2012)*	519,506 acres in Santa Clara County	County of Santa Clara; Santa Clara Valley Water District; Santa Clara Valley Transportation Authority; Cities of Gilroy, Morgan Hill, and San Jose	18 wildlife and plant species, including 1 invertebrate, 3 amphibian, 1 reptile, 3 bird, 1 mammal, and 9 plant species
PG&E San Joaquin Valley Operation	276,350 acres in San Joaquin,	Pacific Gas and Electric Company	65 wildlife and plant species, including 7 mammal, 7 bird,

Conservation Plan	Location (County) and Size (acres)	Plan Preparers	Covered Species
and Maintenance Habitat Conservation Plan (HCP) *Status: Final (2006)*	Stanislaus, Merced, Fresno, Kings, Kern, Mariposa, Madera, and Tulare Counties		2 reptile, 3 amphibian, 4 invertebrate, and 42 plant species
Kern Water Bank Authority Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP) *Status: Final (1997)*	19,900 acres in Kern County	Kern Water Bank Authority	21 wildlife and plant species, including 6 plant, 5 bird, 3 mammal, 5 invertebrate, and 2 reptile species
Metropolitan Bakersfield Habitat Conservation Plan (HCP) *Status: Final (1994)*	261,160 acres in Kern County	City of Bakersfield, Kern County	17 wildlife and plant species, including 6 mammal, 1 reptile, and 10 plant species
Western Riverside County Multiple Species Habitat Conservation Plan (HCP/NCCP) *Status: Final (2003)*	1.26 million acres in western Riverside County	Riverside County; Cities of Temecula, Murrieta, Lake Elsinore, Canyon Lake, Norco, Corona, Riverside, Moreno Valley, Banning, Beaumont, Calimesa, Perris, Hemet, and San Jacinto	146 wildlife and plant species, including 5 amphibian, 46 bird, 2 fish, 5 invertebrate, 14 mammal, 12 reptile, and 62 plant species
Coachella Valley Multiple Species Habitat Conservation Plan (HCP/NCCP) *Status: Final (2008)*	1.2 million acres in eastern Riverside County	Cities of Cathedral, Coachella, Desert Hot Springs, Indian Wells, Indio, La Quinta, Palm Desert, Palm Springs, and Rancho Mirage; Riverside County; California Department of Transportation; Coachella Valley Water District; Imperial Irrigation District; Riverside County Flood Control and Water Conservation District; Riverside County Regional Park and Open Space District; Riverside County Waste Resources Management District; California Department of Parks and Recreation; Coachella Valley Mountains Conservancy	27 wildlife and plant species, including 5 plant, 2 invertebrate, 1 fish, 1 amphibian, 3 reptile, 11 bird, and 4 mammal species

Conservation Plan	Location (County) and Size (acres)	Plan Preparers	Covered Species
Orange County Transportation Authority (HCP/NCCP) *Status: Final (2016)*	511,476 acres in Orange County	Orange County Transportation Authority	13 wildlife and plant species, including 3 plant, 1 fish, 3 reptile, 4 bird, and 2 mammal species
County of Orange Central/Coastal Subregion (HCP/NCCP) *Status: Final (1996)*	132, 000 acres in Orange County and the Cleveland National Forest	Orange County; Rancho Mission Viejo; Santa Margarita Water District	32 wildlife and plant species, including: 12 bird, 2 amphibian, 7 reptile, 2 fish, 2 invertebrate, and 7 plant species
San Diego Multiple Habitat Conservation Program (HCP/NCCP) *Status: Final (2003)*	111,908 acres in northwestern San Diego County	San Diego Association of Governments; Cities of Carlsbad, Escondido, Encinitas, Oceanside, San Marcos, Vista, and Solano Beach	50 wildlife and plant species, including 20 plant, 3 invertebrate, 1 amphibian, 2 reptile, 19 bird, and 5 mammal species
San Diego County Water Authority Natural Community Conservation Plan/ Habitat Conservation Plan (HCP/NCCP) *Status: Final (2011)*	992,000 acres in western San Diego and southwestern Riverside Counties	San Diego County Water Authority	63 wildlife and plant species, including 26 plant, 5 invertebrate, 2 amphibian, 9 reptile, 13 bird, and 8 mammal species
San Diego Gas and Electric Subregional Natural Community Conservation Plan (HCP/NCCP) *Status: Final (1995)*	Western San Diego and southwestern Riverside Counties	San Diego Gas and Electric	110 wildlife and plant species, including 52 plant, 28 bird, 4 invertebrate, 13 reptile, and 13 mammal species
San Diego Multiple Species Conservation Program (HCP/NCCP) *Status: Final (1998)*	583,243 acres in southwestern San Diego County	County of San Diego; Cities of Santee, San Diego, Poway, La Mesa, and Chula Vista	85 wildlife and plant species, including 46 plant, 4 invertebrate, 2 amphibian, 3 reptile, 27 bird, and 3 mammal species

Clean Water Act Section 404

Section 404 of the Clean Water Act requires a project applicant to obtain a permit from the U.S. Army Corps of Engineers (USACE) before engaging in any activity that involves any discharge of dredged or fill material into waters of the United States, including wetlands. Section 401 of the Clean

Water Act is administered by state agencies (see discussion under *State Plans, Policies, and Regulations*). Wetlands are defined by USACE and the U.S. Environmental Protection Agency as those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. The analysis presented under Impact TER-b and Impact TER-c, broadly considers wetlands within the study area and is not limited to jurisdictional wetlands specifically.

Central Valley Project Improvement Act

The CVPIA was enacted in 1992 to balance the needs of fish and wildlife resources with other uses of CVP water. The CVPIA mandated changes in management of the CVP, particularly for the protection, restoration, and enhancement of fish and wildlife through the dedication of water to fish, wildlife, and habitat restoration on an annual basis. The CVPIA requires firm water supplies of suitable quality to maintain and improve wetland habitat areas on certain wildlife refuges and wildlife areas in the Central Valley. The CVPIA also created the Refuge Water Supply Program to acquire and deliver water to 19 wetland habitat areas in the Central Valley. These Refuge Water Supply Program refuges are described in Section 7.6.1.2, *Environmental Setting*, and include 12 federal refuge units managed by USFWS, 6 state WA units managed by CDFW, and 1 privately managed complex within GRCD (Figures 7.6.1-1a and 7.6.1-1b). Overview information about these wildlife refuges is presented in Section 7.6.1.2, *Environmental Setting* under *Wildlife Refuges and Wildlife Areas.*

The CVPIA added mitigation, protection, and restoration of fish and wildlife to the purposes of the CVP; purportedly dedicated 800,000 acre-feet of CVP yield for the primary purpose of implementing fish, wildlife, and habitat restoration; and created a Central Valley Project Restoration Fund to carry out CVPIA programs, projects, plans, and habitat restoration, improvement, and acquisition provisions. Section 3406(d) of the act requires the Secretary of the Interior to:

> …provide, either directly or through contractual agreements with other appropriate parties, firm water supplies of suitable quality to maintain and improve wetland habitat areas on units of the National Wildlife Refuge System in the Central Valley; on Gray Lodge, Los Banos, Volta, North Grasslands, and Mendota state wildlife management areas; and on the Grasslands Resources Conservation District in the Central Valley of California.

The volumes of water necessary are divided into Level 2 water supply needs that are to be made immediately available and Level 4 water supply needs that are to be made available no later than 10 years after CVPIA's enactment. Level 2 water supplies represent the historical average amount of water deliveries prior to CVPIA enactment in 1992 and are the baseline water required for wildlife habitat management; Level 4 water supplies represent the additional increment of water required for optimal wetland habitat development. Firm water supplies allow for optimum habitat management on the existing refuge units.

The CVPIA and section 210(b) of the Reclamation Reform Act of 1982 (§§ 201–230 of Pub. L. 97–293, Oct. 12, 1982, 96 Stat. 1263) also require the preparation and submittal of Water Management Plans from certain entities that enter into repayment contracts or water service contracts with the U.S. Bureau of Reclamation (Reclamation) (2007). Several Water Management Plans were completed for CVPIA refuges in 2011 that identified suppliers, sources, and amounts of Level 2 and Level 4 water contracts. In some cases, no firm water supplies were identified. In addition, infrastructure limitations hinder Reclamation's ability to deliver water to several refuges, despite the 2002 deadline in the CVPIA. For example, Reclamation water deliveries to the Sutter

NWR are limited by a lack of a conveyance route with sufficient capacity to meet the refuge's water schedule needs. To supply Sutter NWR, USFWS has continued to divert water from Butte Creek to provide limited amounts of surface water to the refuge. In 2017, Reclamation entered into a 2-year agreement to use Reclamation District 1004's conveyance system to deliver CVP water to Sutter NWR (Reclamation 2017). Similarly, at Gray Lodge WA, surface water is conveyed through the Biggs-West Gridley Water District canals via a long-term conveyance agreement, but deliveries are limited by canal capacities and maintenance constraints (NCWA and Feather River Water Suppliers 2015). The Gray Lodge WA Water Supply Project aims to improve the water supply to Gray Lodge WA (NCWA and Feather River Water Suppliers 2015). Some south-of-Delta refuge water deliveries also are hindered by infrastructure limitations; for example, Pixley NWR is not connected to CVP facilities and relies on groundwater supplies (USFWS 2011; Singh 2015).

National Wildlife Refuge System Improvement Act

Under the requirements of the National Wildlife Refuge Improvement Act of 1997, every refuge is required to develop a comprehensive conservation plan and revise it every 15 years, as needed. A comprehensive conservation plan provides a description of the desired future conditions and long-range guidance necessary for meeting refuge purposes. It also guides management decisions and sets forth strategies for achieving refuge goals and objectives within a 15-year timeframe.

Comprehensive conservation plans have been developed or are in development for multiple Central Valley wildlife refuges. The Final Comprehensive Conservation Plan for the Sacramento NWR Complex, which includes Sacramento, Delevan, Colusa, and Sutter NWRs, was completed in March 2009 (USFWS 2009). The Final Comprehensive Conservation Plan for the Kern NWR Complex, which includes Kern and Pixley NWRs, was completed in February 2005 (USFWS 2005). In addition, a comprehensive conservation plan for San Luis NWR, Merced NWR, and Grasslands WA is being finalized.

Federal Power Act

Under the Federal Power Act (FPA), the Federal Energy Regulatory Commission (FERC) is responsible for determining under what conditions to issue licenses, or relicense, non-federal hydropower projects. Under the provisions of section 10(j) of the FPA, each hydropower license issued by FERC is required to include conditions for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. These required conditions are to be based on recommendations of federal and state fish and wildlife agencies. FERC may reject or alter the recommendations on several grounds, including if FERC determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. The State Water Board exercises authority over hydropower projects through section 401 of the Clean Water Act, which requires an applicant for a federal license or permit that conducts an activity resulting in a discharge into the navigable waters of the United States to apply for a certification from the state that the discharge will comply with state and federal water quality standards.

Under FPA section 4(e), federal land management agencies can also require measures for the protection, mitigation, and enhancement of fish and wildlife resources, including for the protection of terrestrial habitat. In many instances, this has resulted in hydropower operators regulated by FERC developing invasive species management plans and other wildlife management plans.

North American Waterfowl Management Plan and Central Valley Joint Venture

In 1986, the United States and Canada signed the North American Waterfowl Management Plan (NAWMP). It provides a broad framework for waterfowl management and includes recommendations for wetland and upland habitat protection, restoration, and enhancement. Implementing the NAWMP is the responsibility of designated joint ventures. The Central Valley Habitat Joint Venture formally organized in 1988 as one of the original six priority joint ventures formed under the NAWMP. Renamed the Central Valley Joint Venture in 2004, the organization has a management board that oversees the membership of 21 federal and state agencies and conservation organizations. The organization's 2006 Implementation Plan broadens the scope of conservation activities to include objectives for shorebirds, waterbirds, and riparian songbirds.

Sierra Resource Management Plan

Under the Federal Land Policy and Management Act of 1976, the Sierra Resource Management Plan guides Bureau of Land Management (BLM) management activities within the 15 counties in which there is BLM surface ownership, specifically Yuba, Sutter, Colusa, Nevada, Placer, El Dorado, Alpine, Amador, Calaveras, San Joaquin, Tuolumne, Mariposa, Sacramento, Stanislaus, and Merced Counties. The rapid population growth in the foothills and the changes in zoning patterns in the counties created a need for adaptive management. The Sierra Resource Management Plan emphasizes maintenance of the ecological integrity of foothill ecosystems through protection or improvement of habitat connectivity in the face of urban growth and residential development. Fuels reduction in heavily used recreation areas, around communities at risk, and for special-status species habitat is prioritized. The Sierra Resource Management Plan adopts and incorporates all existing community-based and other plans and a number of recovery plans for species listed under the ESA. In addition, the Sierra Resource Management Plan incorporates the Comprehensive Management Plan on the 45,000-acre Cosumnes River Preserve and Ecological Reserve lands (BLM 2007). The Cosumnes River Preserve contains wildlife habitat and agricultural lands located along the Cosumnes River, east of Interstate 5 near the town of Walnut Grove. The Cosumnes River Preserve Management Plan is designed to (1) restore and maintain native biological communities and the resident and migratory species dependent on them to sustainable conditions and populations; and (2) improve stewardship of the lands in the Cosumnes River watershed through compatible use. CDFW manages lands at the Cosumnes River Preserve with BLM and six other partners under a Cooperative Management Agreement.

Executive Order 11990: Protection of Wetlands

Executive Order 11990 (May 24, 1977) requires federal agencies to avoid long- and short-term adverse impacts associated with the destruction or modification of wetlands; avoid support of new construction in wetlands; minimize the destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial values of wetlands; and involve the public throughout wetlands protection decision-making processes.

Executive Order 13112: Invasive Species

Executive Order 13112 (February 3, 1999) established a national Invasive Species Council composed of federal agencies and departments, as well as a supporting Invasive Species Advisory Committee composed of state, local, and private entities. The council and advisory committee oversee and facilitate implementation of the executive order, including preparation of the National

Invasive Species Management Plan. Federal activities addressing invasive aquatic species are now coordinated through this council and through the National Aquatic Nuisance Species Task Force.

State Plans, Policies, and Regulations

Relevant state programs, policies, plans, and regulations related to terrestrial biological resources are described below.

California Endangered Species Act

CESA (Fish & G. Code, § 2050 et seq; Cal. Code Regs, tit. 14, § 783 et seq.) expresses state policy to conserve, protect, restore, and enhance any endangered or threatened species or its habitat. Under CESA, the California Fish and Game Commission is responsible for maintaining a list of threatened and endangered species. (Fish & G. Code, § 2070.) CESA generally prohibits *take* (defined, in part, as hunt, pursue, catch, capture, or kill) of listed species, although it may allow for take incidental to otherwise lawful activities. (Fish & G. Code, § 2080 et seq.) CDFW also maintains lists of species of special concern that are intended to designate species at conservation risk, stimulate research on poorly known species, and achieve conservation and recovery of species before they are listed under CESA.

Protections under Other Provisions of the California Fish and Game Code

California Fish and Game Code section 1385 et seq. (known as the California Riparian Habitat Conservation Act) requires that preservation and enhancement of riparian habitat shall be a primary concern of state agencies whose activities affect riparian habitat. (Fish & G. Code, § 1389.) The California Fish and Game Code also designates certain mammal, amphibian, reptile, fish, and bird species as "fully protected," making it unlawful to take or possess these species except under certain circumstances. Several species identified in Table 7.6.1-3 are identified as fully protected species. (Fish & G. Code, §§ 3511 [birds], 4700 [mammals], 5050 [reptiles and amphibians], 5515 [fish].) According to CDFW, most fully protected species also have been listed as threatened or endangered. Fish and Game Code sections 3503, 3503.5, and 3800 prohibit the possession, take, or needless destruction of the nests or eggs of any bird and the take of any nongame bird. Under California Fish and Game Code sections 1600–1616, CDFW requires a Lake and Streambed Alteration Agreement when it determines that an activity will substantially alter a river, stream, or lake and may substantially adversely affect existing fish or wildlife resources.

California Native Plant Protection Act

The California NPPA (Fish & G. Code, §§ 1900–1913) gives the Fish and Game Commission the authority to designate native plants as endangered or rare and prohibits the take of designated plants, with some exceptions. Under California Fish and Game Code section 1901, a species, subspecies, or variety of native plant is *endangered* when its prospects for survival and reproduction are in immediate jeopardy from one or more causes. A species, subspecies, or variety of native plant is *rare* when, although not threatened with immediate extinction, it exists in such small numbers throughout its range that it may become endangered if its present environment worsens.

CNPS has developed and maintains lists of rare plants in California; several plants identified in Table 7.6.1-2 are identified as rare plants.

California Invasive Species Plans

Several state invasive species plans address controlling the infiltration of invasive species and reducing their prevalence. Various state agencies, including CDFW, the California Department of Food and Agriculture (CDFA), California Department of Parks and Recreation, and California State Lands Commission, have oversight over invasive species. Existing state invasive species control programs include the following.

- The California Department of Parks and Recreation, Division of Boating and Waterways (CDBW) is the lead agency for survey and control of Brazilian waterweed, water hyacinth, and South American spongeplant in the Delta, its tributaries, and Suisun Marsh.
- CDFA maintains a list of noxious weeds that are considered threats to the well-being of the state. At the time that CDFA lists a species, the species also receives a rating of A, B, C, D, or Q. These ratings reflect CDFA's view of the statewide importance of the pest, the likelihood that eradication or control efforts would be successful, and the present distribution of the pest within the state.
- California Invasive Plant Council's (Cal-IPC) mission is to protect California's environment and economy from invasive plants). Cal-IPC works closely with agencies, industry, and nonprofit organizations to support research, restoration work, and public education. Cal-IPC provides the Cal-IPC Inventory, which categorizes plants that threaten California's natural areas. Cal-IPC also operates the CalWeedMapper online database that describes, maps, and identifies management opportunities for controlling invasive plants in California.

Natural Communities Conservation Planning Act

The Natural Communities Conservation Planning Act (Fish & G. Code, §§ 2800–2835) identifies the policy of the state to conserve, protect, restore, and enhance natural communities. NCCPs developed in accordance with the Natural Communities Conservation Planning Act are intended to identify and provide measures necessary to conserve and manage natural biological diversity while allowing for growth and development. Several NCCPs are in place or proposed within the plan area (see Table 7.6.1-4).

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act) is the principal law governing water quality regulation in California. The Porter-Cologne Act applies to surface waters, wetlands, and ground water and to both point and nonpoint sources of pollution. Pursuant to the Porter-Cologne Act (Wat. Code, § 13000 et seq.), the policy of the state is as follows: (1) that the quality of all the waters of the state shall be protected; (2) that all activities and factors affecting the quality of water shall be regulated to attain the highest water quality within reason; and (3) that the state must be prepared to exercise its full power and jurisdiction to protect the quality of water in the state from degradation. Under the Porter-Cologne Act, *waters of the state* are defined as "any surface water or groundwater, including saline waters, within the boundaries of the state." Under the Porter-Cologne Act, the State Water Board has the authority to administer any program that a state may administer under the federal Clean Water Act. Although all waters of the United States that are within the borders of California are also waters of the state, the reverse is not true. Therefore, California retains authority to regulate discharges of waste into any waters of the state, regardless of whether USACE has concurrent jurisdiction under Clean Water Act Section 404 and defines *discharges to receiving waters* more broadly than does the Clean Water Act.

Waters of the state fall under the jurisdiction of the nine regional water quality control boards (regional water boards). Under this act, each regional water board must prepare and periodically update water quality control basin plans. Each basin plan sets forth water quality standards for surface water and groundwater, as well as actions to control nonpoint and point sources of pollution. California Water Code section 13260 requires any person discharging waste, or proposing to discharge waste, in any region that could affect the waters of the state to file a report of discharge (an application for waste discharge requirements) with the applicable regional water board.

State Wetland Definition and Procedures for Discharges of Dredged or Fill Material to Waters of the State

In accordance with Executive Order W-58-93, commonly referred to as the "no net loss" policy for wetlands, the State Water Board in 2019 adopted a *State Wetland Definition and Procedures for Discharges of Dredged or Fill Material to Waters of the State* (Procedures) for inclusion in the *Water Quality Control Plan for Inland Surface Waters and Enclosed Bays and Estuaries and Ocean Waters of California*. The Procedures became effective in April 2019. The Procedures contain four major elements: (1) a wetland definition; (2) a framework for determining whether a feature that meets the wetland definition is a water of the state; (3) wetland delineation procedures; and (4) procedures for the submittal, review, and approval of applications for Clean Water Act 401 Water Quality Certifications and Waste Discharge Requirements (National Pollutant Discharge Eliminate System [NPDES] permit) for dredge or fill activities. The State Water Board defines an area as a wetland if, under normal circumstances: (1) the area has continuous or recurrent saturation of the upper substrate caused by groundwater, or shallow surface water, or both; (2) the duration of such saturation is sufficient to cause anaerobic conditions in the upper substrate; and (3) the area's vegetation is dominated by hydrophytes or the area lacks vegetation.

The State Water Board adopted the Procedures to address several important issues. There is need to strengthen protection of waters of the state that are no longer protected under the Clean Water Act due to U.S. Supreme Court decisions, since the Water Boards historically have relied on Clean Water Act protections in dredged or fill discharge permitting practices. Second, there is inconsistency across the regional water boards in requirements for discharges of dredged or fill material into waters of the state, including wetlands. There is no single accepted definition of wetlands at the state level, and the regional water boards may have different requirements and levels of analysis regarding issuance of water quality certifications. Finally, current regulations have not been adequate to prevent losses in the quantity and quality of wetlands in California, where there have been especially profound historical losses of wetlands.

California Wetlands Conservation Policy

The goals of the California Wetlands Conservation Policy, adopted in 1993 (Executive Order W-59-93), are to ensure no overall net loss and to achieve a long-term net gain in the quantity, quality, and permanence of wetlands in California; to reduce procedural complexity in the administration of wetlands conservation programs; and to make landowner incentive programs and cooperative planning efforts the primary focus of wetlands conservation and restoration.

The Suisun Marsh Habitat Management, Preservation, and Restoration Plan

The Suisun Marsh Habitat Management, Preservation, and Restoration Plan is a 30-year plan to restore and enhance tidal wetlands in Suisun Marsh (Reclamation 2014). The plan's objectives include improving habitat for special-status species, maintaining recreational opportunities such as waterfowl hunting, improving water quality, and improving and maintaining the levee system to provide flood protection. The plan also creates a framework for restoration of 5,000 to 7,000 acres of tidal wetlands and protection and enhancement of over 40,000 acres of managed wetlands in Suisun Marsh.

California EcoRestore

California EcoRestore (EcoRestore) is a multi-agency initiative led by the California Natural Resources Agency to advance the restoration of more than 30,000 acres of habitat in the Delta, Suisun Marsh, and Yolo Bypass. The initiative consists of a variety of habitat restoration actions to meet the goal of restoring 9,000 acres of tidal and sub-tidal habitat, 17,500 acres of floodplain, 3,500 acres of managed wetlands, and up to 1,000 acres of Proposition 1- and 1E-funded restoration projects (^California Natural Resources Agency 2016). EcoRestore initiatives also support other related actions such as fish passage improvement projects, levee infrastructure maintenance, and fish rescue facility improvements. Several EcoRestore projects have already been completed, including the Knight's Landing Outfall Gates positive fish barrier project, the Dutch Slough tidal habitat restoration project, and the Fremont Weir Adult Fish Passage Modification project. Funding for up to 25,000 acres of habitat restoration is required to mitigate the ecological impacts associated with the SWP and CVP. Additional funding for the remaining 5,000 acres of restoration habitat is provided by Propositions 1 and 1E; the Assembly Bill 32 Greenhouse Gas Reduction Fund; and local, federal, and private investments.

Local Plans

Multiple counties and cities have general plans that designate land for residential, commercial, industrial, public facility, agricultural, and other uses. General plans contain policies for urban development, describe strategies to recognize and preserve areas of open space and natural resources, and identify measures for preservation of productive farm resources. In reviewing and making decisions on applications for various land use entitlements and development projects, the local government agency typically must make findings that the proposed activity (e.g., a conditional use permit or a subdivision of real property) is consistent with the applicable general plan.

In addition to general plans, the 1992 Delta Protection Act designates the primary and secondary land management zones in the Delta that consist of portions of Contra Costa, Sacramento, San Joaquin, Solano, Yolo, and Alameda Counties; several cities; and unincorporated towns and communities (Wat. Code, § 12220.) In areas close to or overlapping the Delta, plans contain policies that apply specifically to the Delta and to Suisun Marsh. For example, under Contra Costa County's general plan, all public and private land management and development activities within the Primary Zone of the Delta are required to be consistent with the goals, policies, and provisions of the Land Use and Resource Management Plan for the Primary Zone of the Delta as adopted and as may be amended by the Delta Protection Commission (Contra Costa County 2005). Similarly, Solano County is required to bring its general plan into conformity with the provisions of the Suisun Marsh Preservation Act of 1977 and the Suisun Marsh Protection Plan (Solano County 2012).

7.6.1.4 Impact Analysis

The analysis of potential effects on terrestrial biological resources involved review SacWAM results (see Chapter 6, *Changes in Hydrology and Water Supply*, and Appendix A1, *Sacramento Water Allocation Model Methods and Results*)*;* Statewide Agricultural Production (SWAP) model results (see

Appendix A3, *Agricultural Economic Analysis: SWAP Methodology and Modeling Results*); and the results of analyses in Section 7.4, *Agriculture and Forest Resources*, Section 7.12.1, *Surface Water*, and Section 7.12.2, *Groundwater*, to determine whether the changes in hydrology and changes in water supply could result in impacts on terrestrial biological resources.

Chapter 6, *Changes in Hydrology and Water Supply*, includes SacWAM results for instream flow changes in increments of 10 percent, from 35 percent unimpaired flow up to 75 percent unimpaired flow (referred to as numbered flow scenarios such as *35 scenario*, *45 scenario*). The proposed program of implementation for the Plan amendments provides for a range of flow scenarios from 45 to 65 percent unimpaired flow, with default implementation starting at the 55 scenario. The 35 and 75 flow scenarios also are presented to inform the analyses of low and high flow alternatives in Section 7.24, *Alternatives Analysis*. SacWAM results were reviewed to determine how projected changes in Sacramento/Delta water supplies would affect Sacramento/Delta supplies to wildlife refuges. SacWAM also was used to estimate the changes in flow conditions and reservoir levels that could occur as a result of the proposed Plan amendments, which have the potential to affect terrestrial biological resources that use habitat in or associated with streams and reservoirs.

SWAP results were reviewed to determine whether projected changes in cropping patterns due to changes in water supply have a potential to affect special-status wildlife species that use certain agricultural lands as habitat. SWAP was modeled for agricultural uses in the Sacramento River watershed, Delta, Delta eastside tributaries, and San Joaquin Valley regions.

Results from Section 7.12.2, *Groundwater*, also were assessed to evaluate potential impacts on groundwater-dependent ecosystems and species.

Changes in hydrology are expected to result in streamflows that more closely resemble the natural flow regime (i.e., magnitude, frequency, timing, duration, rate of change of flow conditions) to which native aquatic and aquatic-dependent species have adapted, including special-status species. Changes in hydrology would improve habitat conditions for riparian and wetland habitat and natural communities, including sensitive natural communities such as Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, Great Valley valley oak riparian forest, and coastal and valley freshwater marsh. Changes in hydrology could reduce the water level in reservoir levels and streamflows below export reservoirs, which could affect some sensitive riparian habitat.

Changes in water supply could benefit some special-status plants and wildlife. Changes in water supply could negatively affect certain special-status wildlife species and habitat that rely on Sacramento/Delta water supplied to wildlife refuges and certain agricultural lands, including but not limited to, giant gartersnake, tricolored blackbird, Swainson's hawk, northern harrier, black tern, fulvous whistling duck, white-tailed kite, greater sandhill crane, lesser sandhill crane, western burrowing owl, western red bat, and yellow-headed blackbird. In addition, changes in water supply may affect sensitive riparian and wetland habitat and other natural communities that receive agricultural and municipal discharges. Reduced groundwater levels could have localized effects on groundwater-dependent ecosystems. Other water management actions, including groundwater storage and recovery, water transfers, increased use of recycled water, and water conservation, also are evaluated.

Section 7.21, *Habitat Restoration and Other Ecosystem Projects*, and Section 7.22, *New or Modified Facilities,* describe and analyze potential impacts on terrestrial biological resources from various actions that involve construction.

Impact TER-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service

Changes in Hydrology

Generally, changes in hydrology in the Sacramento/Delta would result in a more natural flow regime that would be expected to benefit special-status species that are adapted to these hydrologic conditions. These flows would be expected to restore and maintain natural processes, such as sediment deposition, marsh accretion, nutrient transport, seed dispersal, and flow-related disturbance, which would maintain and improve habitat conditions for native freshwater wetland and riparian species. This benefit would include any special-status plants and wildlife found in these habitats, including freshwater emergent wetlands; seasonal wetlands; seeps, springs, and meadows; and managed wetlands. In addition, increased instream flows for the benefit of fish and wildlife would tend to increase the surface water and shallow groundwater supplies to many groundwater-dependent ecosystems, including obligate wetland, shallow-rooted riparian, and transitional riparian ecosystems, and associated species in some locations.

Changes in hydrology would result in increased riverine flows in the Sacramento/Delta that are similar to or greater than baseline flows during spring. Increased flows during the spring riparian recruitment period have the potential to help establish new vegetation and maintain the viability of this habitat; riparian habitat is key for the continued existence of many special-status plant and wildlife species because the loss of riparian vegetation has been an important factor in their decline. Changes in hydrology also likely would increase the amount of inundated floodplain habitat in the Sacramento/Delta during the wet season months (see Section 6.3.1.2, *Sacramento Valley Flood Bypasses* and Appendix A8, *Salmonid Tributary Habitat Analysis*), which likely would benefit a variety of aquatic and terrestrial species. Special-status riparian and freshwater marsh plant species would generally benefit, including but not limited to, watershield, bristly sedge, slough thistle, silky cryptantha (*Cryptantha crinite*), woolly rose-mallow, California satintail, northern California black walnut (*Juglans hindsii*), Sandford's arrowhead, marsh skullcap, Brazilian watermeal, and Wright's trichocoronis. Special-status wildlife species that occur in riparian and freshwater wetland habitat in these regions also may benefit from the proposed flow requirements, including but not limited to, Shasta crayfish (*Pacifastacus fortis*), valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), Pacific tailed frog (*Ascaphus truei*), foothill yellow-legged frog (*Rana boylii*), Cascades frog, California red-legged frog, Sierra Nevada yellow-legged frog, western pond turtle, tricolored blackbird, long-eared owl (*Asio otus*), Swainson's hawk, northern harrier, western yellow-billed cuckoo, black swift (*Cypseloides niger*), white-tailed kite, willow flycatcher, bald eagle, yellow-breasted chat (*Icteria virens*), harlequin duck (*Histrionicus histrionicus*), California black rail, yellow warbler, least Bell's vireo, yellow-headed blackbird, Sierra Nevada mountain beaver (*Aplodontia rufa californica*), western red bat, Oregon snowshoe hare (*Lepus americanus klamathensis*), and Sierra Nevada snowshoe hare (*Lepus americanus tahoensis*).

In the Sacramento/Delta, the timing of natural hydrologic events and associated instream processes such as peak flows and sediment and gravel transport that would result from changes in hydrology would more closely resemble natural conditions in streams relative to baseline conditions. These changes generally would improve instream habitat conditions for fish and wildlife that are adapted to the natural flow regime, with peak flows occurring during winter and spring and flows receding into summer. Special-status wildlife species that occur in rivers and streams would benefit from these flows and associated instream processes, including but not limited to, Shasta crayfish, Pacific tailed frog, foothill yellow-legged frog, Cascades frog, California red-legged frog, Sierra Nevada yellow-legged frog, and western pond turtle. Although changes in hydrology are expected to generally benefit native aquatic and aquatic-dependent species, a more natural flow regime could result in an increased potential for high-flow events and inundation that could affect bank swallows, which is discussed further in the following section.

Changes in hydrology would provide for a more natural flow regime that, in addition to benefiting native species, could contribute to the control of invasive species in the Sacramento/Delta in combination with invasive species control efforts. As discussed in Chapter 4, *Other Aquatic Ecosystem Stressors*, a more variable flow pattern that allows for periodic low Delta outflow and some saltwater intrusion into the western Delta, along with other periods of cooler water temperatures, could naturally restrict the distribution of some invasive aquatic plants (^Boyer and Sutula 2015). A more natural flow regime, including variable flow conditions, also could provide native species a competitive advantage over invasive species because native species have adapted historically to the variations in the natural hydrologic cycle.

Bank Swallow Nesting Habitat

SacWAM results were analyzed for the potential for changes in hydrology to affect bank swallow habitat on the Sacramento and Feather Rivers. Bank swallow nesting habitat can be positively or negatively affected by streamflows. High flows during the late spring and summer nesting season can be detrimental to bank swallows because of direct inundation of burrows or loss of nests caused by localized bank sloughing (Bank Swallow Technical Advisory Committee 2013). Flows in the range of 14,000 to 30,000 cubic feet per second (cfs) during the bank swallow breeding season of April through July have been associated with localized bank collapse events that resulted in partial or complete colony failure (Bank Swallow Technical Advisory Committee 2013). In contrast, during the non-breeding season, flows of more than 50,000 cfs on the Sacramento River can cause extensive bank erosion, which benefits bank swallows by creating new substrate for nest construction (Bank Swallow Technical Advisory Committee 2013).

For the lower Feather River, SacWAM results indicate that under baseline conditions monthly flows above 14,000 cfs occur under only the wettest hydrology (90th to 100th percentile of flows) during April through June and do not exceed 14,000 cfs during July. In the low to middle range of flows (45 and 55 scenarios), Feather River monthly flows above 14,000 cfs would occur slightly more frequently (2% more frequently) during bank swallow breeding season compared with baseline conditions; therefore, the 45 and 55 scenarios would have no significant effect on bank swallows. Under the 65 scenario, the likelihood of high flows during the breeding season increases slightly for certain months and locations but would continue to occur only under wetter hydrology (75th to 100th percentile of flows). Because the likelihood of potential nest inundation is increased only slightly, the 65 scenario would not significantly affect bank swallow nesting success in the lower Feather River. Mean and median (50th percentile) lower Feather River monthly flows remain below 14,000 cfs during all months of the bank swallow's breeding season.

On the Sacramento River, known bank swallow nesting colonies occur between Bend Bridge and Verona (^CDFW 2020). On the Sacramento River at Verona, SacWAM results indicate that under baseline conditions monthly flows during July exceed 14,000 cfs under most hydrologic conditions (25th to 100th percentile of flows), which suggests that baseline Sacramento River flows may result in bank collapse that precludes the establishment of bank swallow colonies below Verona. The stretch of the Sacramento River below Verona also may lack conditions for nesting habitat establishment because it is relatively straight, presents few opportunities for cut banks to establish, and has well protected levees. SacWAM results indicate that under baseline conditions monthly flows between Bend Bridge and Knights Landing exceed 14,000 cfs under wetter hydrology (75th to 100th percentile of flows) during bank swallow breeding season. Under the proposed Plan amendments, Sacramento River monthly flows at locations between Bend Bridge and Knights Landing would continue to exceed 14,000 cfs only under wetter hydrology (75th to 100th percentile of flows). During July on the Sacramento River at Butte City, monthly flows exceed 14,000 cfs under baseline conditions only under the wettest hydrology (100th percentile of flows) and under the flow requirements (45 to 65 scenarios). Additionally, median monthly flows would remain below 14,000 cfs on the Sacramento River between Bend Bridge and Knights Landing during all months of the bank swallow's breeding season. Because baseline conditions on the Sacramento River below Verona preclude establishment of bank swallow nesting colonies, any increase in flows would not significantly affect nesting colonies.

Increased winter flows under the proposed Plan amendments have the potential to benefit bank swallows when flows exceed 50,000 cfs by creating new cut bank surfaces and removing debris piles at the base of banks, resulting in potentially beneficial effects. Although Sacramento River flows would generally increase from baseline during winter, SacWAM results indicate that the proposed Plan amendments would not result in an increased likelihood of habitat-creating flows greater than 50,000 cfs. The overall effect on bank swallows from changes in hydrology on the Sacramento and Feather Rivers would be less than significant.

Floodplain Habitat

Increases in the frequency and duration of floodplain inundation in the Sutter and Yolo Bypasses and other floodplains in the Sacramento/Delta would generally improve habitat for wintering waterfowl and may benefit some other wildlife species that occur in floodplains (see Section 6.3.1.2, *Sacramento Valley Flood Bypasses* and Appendix A8, *Salmonid Tributary Habitat Analysis*). These changes would not adversely affect the wetlands and riparian habitat in floodplains, including the Sutter and Yolo Bypasses, because these areas are already subject to seasonal inundation and the vegetation and wildlife species that utilize these areas are adapted to seasonal flooding. Special-status species that are known to or could occur in the Yolo and Sutter Bypasses include, but are not limited to, woolly rose-mallow, grass alisma, watershield, bristly sedge, giant gartersnake, western pond turtle, Swainson's hawk, white-tailed kite, and tricolored blackbird.

Changes in streamflows on the lower Sacramento River, Cache Creek, and Putah Creek would likely cause an increase in the frequency and duration of flooding in the Yolo and Sutter Bypasses, which could affect natural communities and agriculture there—in particular, in the lower half of the Yolo Bypass below Putah Creek (see Figure 7.4-4a in Section 7.4, *Agriculture and Forest Resources*). As discussed in Section 7.4, when Yolo Bypass inundation occurs before early April, the effect on agriculture is much smaller than if inundation occurs after early April, when planting begins. There would be occasional increases in some flow scenarios between April and June; the most frequent increases would occur between December and March, before the planting season. Delays in planting crops, as well as the increased inundation of natural communities in the bypass, could affect special-status wildlife species that utilize these areas (e.g., giant gartersnake, western burrowing owl, white-tailed kite, Swainson's hawk, tricolored blackbird) by making these habitats less available; these effects are expected to be less than significant when compared with baseline flooding conditions. However, these changes could result in increased floodplain inundation during the planting season compared with baseline conditions, which could lead some farmers in the area to convert land to nonagricultural uses. If some crops are no longer planted in portions of the Yolo Bypass due to extended periods of flooding, such as suggested in Section 7.4, this could result in a reduction in agricultural habitat for special-status wildlife species (e.g., giant gartersnake, Swainson's hawk, white-tailed kite, tricolored blackbird), which could be a potentially significant impact.

Implementation of Mitigation Measure MM-TER-a: 1 will reduce or avoid impacts on special-status species that use agricultural habitat in the Sutter and Yolo Bypasses. Mitigation Measure MM-TER-a: 1 incorporates Mitigation Measures MM-AG-a,e: 4 and 8 to reduce or avoid disruptions of agricultural operations and associated potential land use conversions due to increased inundation in the Sutter and Yolo Bypasses (see Section 7.4, *Agriculture and Forest Resources*). Increased acquisition of conservation easements is one method to encourage continued use of land for agricultural purposes in the bypasses. Another is to communicate and collaborate with farmers to maintain economic feasibility of continued use of land for agricultural purposes in the bypasses. An interagency coordination group such as the Yolo Bypass and Cache Slough Partnership could serve as a forum for expanding existing efforts and developing additional planning and implementation measures to reduce the impacts on agricultural operations associated with increased floodplain inundation during the planting season. These measures could be implemented in conjunction with planned habitat restoration and other efforts, which could promote multiple beneficial uses within the Yolo Bypass. However, the State Water Board cannot guarantee such implementation. Unless and until mitigation is implemented, the impact remains potentially significant.

Freshwater Marshes and Tidal Marshes

Changes in Delta inflows and Delta outflows would likely benefit freshwater marshes and tidal marshes in the Delta and Suisun Bay. As described in Chapter 6, *Changes in Hydrology and Water Supply*, SacWAM results indicate that under the flow requirements (45 to 65 scenarios), Delta inflows would generally increase during December through June and generally decrease in July through September. SacWAM results also indicate that Delta outflows would generally increase during all months, except for reductions during August under the 45 to 55 scenarios and September under the 55 to 65 scenarios. The changes in Delta inflows and Delta outflows would likely change the balance of fresh water and brackish water in the transition area between the Delta and San Francisco Bay and could result in conversion of some tidal brackish emergent marsh to tidal freshwater emergent marsh. However, these changes in Delta inflows and Delta outflows would more closely resemble the natural flow regime to which native species have adapted and would be expected to generally improve habitat conditions for tidal freshwater marsh species in the Delta and Suisun Marsh. Increased Delta inflows and Delta outflows during winter and spring would be expected to support natural processes such as sediment deposition and marsh accretion and may benefit special-status plant species in these habitats, including but not limited to, Delta tule pea, Mason's lilaeopsis, Delta mudwort, and Suisun Marsh aster. Special-status wildlife species that occur in these habitats also may benefit, including but not limited to, western pond turtle, giant gartersnake, tricolored blackbird, northern harrier, white-tailed kite, least bittern, Suisun song sparrow, California black rail, and yellow-headed blackbird.

Changes in Delta outflows that would occur as a result of the proposed Plan amendments would provide for more natural salinity conditions in Suisun Marsh, which would likely benefit special-status plant and wildlife species in Suisun Marsh. Changes would likely benefit special-status plant species including but not limited to, soft bird's-beak, Suisun thistle, Delta tule pea, Mason's lilaeopsis, Delta mudwort, and Suisun Marsh aster. These changes also would likely benefit special-status wildlife, including but not limited to, California black rail, California Ridgway's rail, saltmarsh common yellowthroat, Suisun song sparrow, salt-marsh harvest mouse, and Suisun shrew. The proposed flow requirements also would complement the planned tidal marsh restoration and management and enhancement of managed wetlands, including those actions identified under the Suisun Marsh Habitat Management, Preservation, and Restoration Plan (^Reclamation et al. 2013). The restoration activities in Suisun Marsh are expected to create more saline areas in the western portion of the marsh, allowing for restored areas in the eastern portion of Suisun Marsh to remain fresher. The proposed flow requirements would further enhance the natural salinity gradient across Suisun Marsh.

Changes in Reservoir Levels

Chapter 6, *Changes in Hydrology and Water Supply*, describes the types of changes in reservoir water levels that could result from implementation of the proposed Plan amendments. In the Sacramento/Delta, little or no change to reservoir water levels would be expected for many reservoirs, moderate changes would be expected for some, and large changes would be expected for a few reservoirs. Water levels in re-regulatory reservoirs below rim dams are not expected to change. Similarly, upper watershed reservoirs that are not associated with interbasin diversion projects are generally not expected to have large changes. Some large reservoirs are expected to be full less frequently in spring but are not expected to be drawn down as low at the end of summer. The largest changes in reservoir water levels are expected in upper watershed reservoirs that are associated with interbasin diversions and large reservoirs on tributaries that historically are most impaired, as described in Chapter 2, *Hydrology and Water Supply*. (SacWAM results are available in Appendix A1, *Sacramento Water Allocation Model Methods and Results*.)

Sacramento/Delta water also is supplied to export reservoirs in the Bay Area, San Joaquin Valley, Central Coast, and Southern California regions. Decreases in Sacramento/Delta water supplies to these regions may result in changes in reservoir storage in export reservoirs. Historical observations of storage in export reservoirs during periods of lower Sacramento/Delta water supplies show lower storage patterns for some reservoirs (see Section 6.3.2.5, *Reservoirs in Other Regions* in Chapter 6, *Changes in Hydrology and Water Supply*). Several special-status wildlife species could be affected by large changes in reservoir water levels, as discussed in the following sections.

Bald Eagle

Changes in reservoir water levels in the Sacramento River watershed and Delta eastside tributaries regions were evaluated for effects on bald eagles. Bald eagles use reservoirs in these regions, including Shasta Lake, Lake Berryessa, Lake Oroville, and Folsom Lake, for foraging habitat where they prey on fish and waterfowl (^CDFW 2021; eBird 2023). Reduced lake levels could reduce the amount of habitat for, and thus the abundance of, these prey species, which could in turn could affect bald eagle populations. Reduced reservoir water levels during spring and summer could affect the biological productivity of the reservoirs and thus affect bald eagles by altering their prey base. Jackman et al. (2007) suggests some potential benefits to bald eagles with seasonal and long-term drawdown of reservoirs, including exposing spawning and foraging fish to eagle predation and the likely release of nutrients and food for rapid fish growth upon re-inundation of the reservoir. On the other hand, the same study suggests that extended drawdown of reservoirs, as during a long-term drought, could adversely affect bald eagles due to a decrease in the standing crop of fish and increased pressures from competition.

Under the proposed Plan amendments, many reservoirs would be expected to have lower water elevations during spring and summer relative to baseline conditions. However, the water elevations generally would be expected to be similar to baseline conditions during fall and winter. Per Jackman et al.'s (2007) reasoning on seasonal drawdowns, this would ensure the re-inundation of fish habitat and release of nutrients and food for fish, which would contribute to sustaining fish populations and a prey base for bald eagles in these areas. In addition, continued management of recreational fisheries in these reservoirs would support bald eagle foraging habitat even with changes in water levels. Changes in export reservoir levels could affect bald eagles, although according to CNDDB records, reservoirs in these regions support a much smaller number of nearby nesting bald eagles than the Sacramento/Delta (^CDFW 2021). Changes in reservoir levels would result in less-than-significant impacts on bald eagle.

American White Pelican

American white pelican also utilizes large lakes and reservoirs but primarily utilizes these areas during fall, winter, and early spring for foraging habitat while migrating to breeding habitat farther north, outside of the plan area (Knopf and Evans 2020). The potential effects on white pelican could be similar to those for bald eagle. As described previously, most reservoir levels during the periods of their use would not change significantly. Reservoirs with water level decreases during all months would not substantially decrease the available surface area for foraging nor would they likely substantially decrease prey availability. Changes in reservoir levels would thus result in less-than-significant impacts on American white pelican.

Western Pond Turtle

Western pond turtle has been documented in Shasta Lake and Lake Berryessa and may use other reservoirs in the study area. Any changes in average reservoir surface elevations would not substantially affect western pond turtle. In lakes and reservoirs, the species uses the shallow margins and shoreline where there are suitable basking sites, such as partially submerged logs, rocks, mats of floating vegetation, and open banks (Morey 2000). Changes in surface elevations are not anticipated to substantially decrease the suitability or the extent of this habitat such that it would result in a decrease in populations in these reservoirs. Thus, changes in reservoir levels would result in less-than-significant impacts on western pond turtle.

Amphibian Species

Changes in reservoir levels may occur in reservoirs that contain shallow shorelines with riparian habitat and wetlands that provide habitat for sensitive amphibians. Smaller reservoirs and associated wetland and riparian habitat exist in the upper watershed areas in the Sacramento River watershed and Delta eastside tributaries regions that may provide habitat for amphibians, including Sierra Nevada yellow-legged frog, northern leopard frog, Cascades frog, and potentially California red-legged frog. Some smaller upper watershed reservoirs contain shallow shorelines with emergent vegetation, which are conducive to basking, breeding, and tadpole rearing. The extent of this habitat and the extent that these smaller reservoirs are used by these species are not fully known, but some impacts on these habitats and associated species are possible. Large storage reservoirs in the Sacramento/Delta would provide less suitable habitat for these amphibian species. These larger reservoirs are generally constructed in steep terrain and may contain bedrock shorelines.

Potential habitat for amphibians, if present, often is concentrated in the bottom of drainages where streams enter into the reservoir. The deposition of sediments at these locations can form micro-topography, including pools, sandbars, shallow inundation, and wetlands, which can benefit breeding and foraging by amphibians. Drawdown of reservoirs generally would not be expected to affect sensitive amphibian species, as potentially suitable basins habitat would be expected to be exposed as the water is drawn out. Raising of water levels during spring could result in inundation of breeding habitat, which could affect egg masses and juveniles. Many reservoirs would be expected to have lower water elevations during spring and summer relative to baseline conditions; therefore, breeding habitat would not be disturbed through inundation. Amphibian species may occur downstream of export reservoirs, but releases from export reservoirs typically occur only after prolonged wet winters once the reservoirs have been filled; therefore, downstream habitat is unlikely to be affected by any changes in hydrology. Given the large amount of rain that can fall during a wet winter relative to the storage capacity of on-stream reservoirs, these releases (1) are likely to occur even if the export reservoir had been low; and (2) often, but not always, occur in winter before amphibians are utilizing streamside resources. The special-status amphibians listed previously need shallow shorelines, usually with emergent wetland vegetation, which these large reservoirs lack. Furthermore, the presence of large game fish would make these areas less suitable for amphibians. Impacts would be less than significant. Effects of changes in reservoir levels on riparian and wetland habitats are evaluated under Impact TER-b and Impact TER-c.

Changes in Streams below Export Reservoirs

Several of the export reservoirs in the Bay Area, Central Coast, and Southern California regions are on-stream reservoirs. It is possible that changes in hydrology will result in changes in streamflow below export reservoirs. However, many of the streams below these reservoirs have streamflow requirements that would not allow for reductions below the historical minimum flows. Other on-stream reservoirs release only after prolonged wet winters.

Riparian and wetland communities may be associated with these downstream waterbodies.
In addition, several special-status species are known to occur or have the potential to occur in these streams and associated riparian habitat, including but not limited to, arroyo toad, California red-legged frog, foothill yellow-legged frog, western pond turtle, two-striped gartersnake, South Coast gartersnake, tricolored blackbird, white-tailed kite, southwestern willow flycatcher, yellow warbler, least Bell's vireo, and western red bat.

Reductions in flow releases from some export reservoirs compared to baseline conditions could result in beneficial effects on special-status terrestrial species below export reservoirs. Several export reservoirs, such as Castaic Lake on Castaic Creek and Lake Cachuma on Santa Ynez Creek, are located on streams that historically were intermittent. In addition, in some locations, export reservoir releases have resulted in a non-natural perennial flow regime that has favored some nonnative fish and amphibian species and negatively affected native terrestrial biological species. For example, on Piru Creek below Pyramid Dam, nonnative predators such as bullfrogs that prey on the arroyo toad thrive under conditions that provide permanent flow. A more natural flow regime, including periods of low or intermittent flows, can help to control bullfrog populations by killing bullfrog tadpoles by desiccation (FERC 2008). Overall, the effects of changes in streamflows below export reservoirs on special-status species would be less than significant.

Changes in Water Supply

Reduced Sacramento/Delta Supply to Refuges and Agriculture

Changes in water supply could benefit some special-status plants and wildlife and negatively affect other special-status wildlife species that rely on Sacramento/Delta water supplied to wildlife refuges and certain agricultural lands, including but not limited to, giant gartersnake, tricolored blackbird, Swainson's hawk, northern harrier, black tern, fulvous whistling duck, white-tailed kite, greater sandhill crane, lesser sandhill crane, western burrowing owl, western red bat, and yellow-headed blackbird.

The species with the greatest potential to be adversely affected by changes in water supply, based on their rarity and dependence on wetland habitat at wildlife refuges and specific crops, are giant gartersnake, Swainson's hawk, greater sandhill crane, tricolored blackbird, and California black rail. Other species also could be affected, but these effects are expected to be less than significant considering the current status of these species, their distributions, and their use of other nonagricultural habitats.

SacWAM results indicate that changes in Sacramento/Delta water supply would, on average, result in reductions in deliveries to wildlife refuges in the Sacramento River watershed and San Joaquin Valley regions. Table 7.6.1-5 presents the SacWAM results for annual average change in refuge water supplies for the Sacramento River watershed and San Joaquin Valley. These changes in Sacramento/Delta water supplies to wildlife refuges would likely result in a reduction in the amount of wetland habitat flooded in a given year and could over time result in changes to vegetation communities—both of which could decrease habitat available for wildlife, including but not limited to, giant gartersnake, Swainson's hawk, greater sandhill crane, and tricolored blackbird.

Table 7.6.1-5. SacWAM Results for Annual Average Reductions in Refuge Water Supplies (TAF/yr) from Sacramento/Delta Water

Geographic Region	35	45	55	65	75
Sacramento River watershed	20	25	43	66	132
San Joaquin Valley	0	0	4	23	56

Source: Table 6.4-1.

The SWAP model used in the agricultural and economic analyses (see Section 7.4, *Agriculture and Forest Resources*, and Chapter 8, *Economic Analysis and Other Considerations*) was used to estimate the changes in crop acreage that could occur as a result of changes in water supply in the valley floor portions of the Sacramento River watershed, Delta eastside tributaries, Delta, and San Joaquin Valley regions. SWAP estimates the cropping pattern that maximizes economic value subject to available resources, including water. As surface water supplies are reduced, SWAP will choose to pump more groundwater if available, shift to less water-intensive crops, deficit irrigate if allowed, or fallow land. SWAP evaluates a range of effects depending on groundwater conditions from no replacement and maximum replacement groundwater pumping. In addition, SWAP was run with an average year water supply and dry year supply.

The SWAP results for percentage change in acreage of crops most important to giant gartersnake, Swainson's hawk, greater sandhill crane, and tricolored blackbird compared with baseline conditions are presented in Figures 7.6.1-2 through 7.6.1-5. For crops most important to giant gartersnake, Swainson's hawk, greater sandhill crane, and tricolored blackbird, modeled changes in crop acreages would be much smaller with maximum replacement groundwater pumping than with no replacement groundwater pumping; and actual changes would be somewhere in the middle of these bookends, depending on the feasibility of additional groundwater pumping in a given area.

Giant Gartersnake

The vast majority of the giant gartersnake's natural wetland habitat has been lost because of land use changes. Despite losing approximately 95 percent of its native wetland habitat (USFWS 2017), the giant gartersnake has persisted in agricultural areas dominated by rice production (Reyes et al. 2017), which provides alternative habitat for the giant gartersnake in the absence of wetlands (USFWS 2017). Giant gartersnakes could be affected by changes in rice acreage resulting from reduced Sacramento/Delta water supplies. Giant gartersnakes also use wetland habitat on wildlife refuges and wildlife areas and could be affected by decreased Sacramento/Delta water supplies to wildlife refuges in the Sacramento River watershed and San Joaquin Valley regions. Figure 7.6.1-2 shows the potential percent change in acreage of giant gartersnake habitat in the Sacramento/Delta and San Joaquin Valley region under the 35 through 75 scenarios for average and dry year conditions with and without replacement groundwater pumping, compared with baseline conditions.

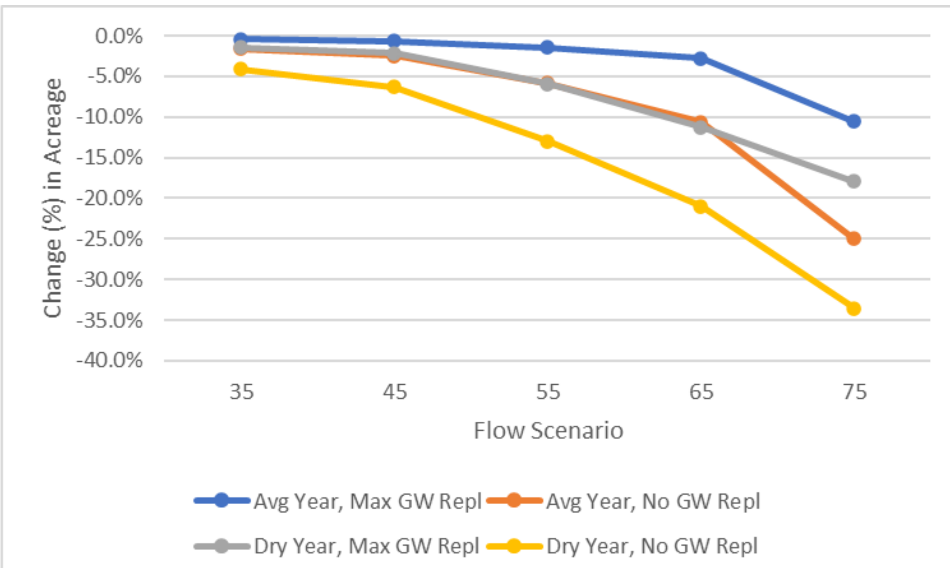


Figure 7.6.1-2. Giant Gartersnake Habitat Change from Baseline in the Sacramento/Delta and San Joaquin Valley Region

In the Sacramento/Delta and San Joaquin Valley region, the change in acreage of the crop most important as giant gartersnake habitat (rice) would range between less than 1 percent decrease and up to a decrease of 11 percent from baseline conditions for the SWAP average year model run or up to 21 percent decrease from baseline conditions for the SWAP dry year model run, depending on the flow scenario (45, 55, or 65 scenario) and replacement groundwater pumping assumptions (Figure 7.6.1-2). Under a 55 scenario with no replacement groundwater pumping, SWAP indicates a reduction in giant gartersnake habitat in the Sacramento/Delta and San Joaquin Valley region of 6 percent for the average year model run compared to baseline conditions. In addition, as discussed in Section 7.4, *Agriculture and Forest Resources*, an increase in inundation in the Yolo Bypass during the spring planting season could lead some farmers to convert land to nonagricultural use that could result in a reduction in rice acreage over time.

Nearly all of California's rice acreage is located in the Sacramento River watershed, where the majority of the impacts of changes in rice acreage on giant gartersnake would occur (a small acreage change would occur in the San Joaquin Valley as well). Changes in refuge water supplies also would affect giant gartersnakes in the Sacramento River watershed and San Joaquin Valley regions. Giant gartersnakes do not occur in the Bay Area, Central Coast, or Southern California regions; therefore, changes in Sacramento/Delta water supplies to these regions would not affect giant gartersnakes.

Overall, the effects on giant gartersnakes resulting from changes in Sacramento/Delta water supplies would range from less than significant (if maximum replacement groundwater pumping is used) to potentially significant (if no replacement groundwater pumping is used to supply rice lands and wetlands at wildlife refuges affected by changes in surface water supply). Restoration of wetland habitat would benefit the giant gartersnake and could offset habitat loss associated with decreased Sacramento/Delta water supplies to wildlife refuges and decreased rice production. Wetland habitat restoration projects are currently planned under EcoRestore and other efforts. It is anticipated that EcoRestore restoration projects will be conducted in a variety of habitats, including tidal channels, grasslands, vernal pools, and non-tidal marshes. Habitat improvements in the Delta as part of EcoRestore are expected to include restoration and management of wetlands, which would benefit giant gartersnake populations and would help to offset potential decreases in rice habitat associated with the proposed Plan amendments.

Swainson's Hawk

Swainson's hawk native foraging habitat has been largely converted to agricultural and urban lands. As a result, Swainson's hawks are now largely reliant on certain agricultural lands for foraging habitat. Changes in Sacramento/Delta water supplies could result in a decrease in the amount of agricultural foraging habitat available to Swainson's hawks and potentially a reduction in nesting habitat in wildlife refuges. Figure 7.6.1-3 shows the potential change in acreage of Swainson's hawk habitat in the Sacramento/Delta and San Joaquin Valley region under the 35 through 75 scenarios for average and dry year conditions with and without replacement groundwater pumping compared with baseline conditions.

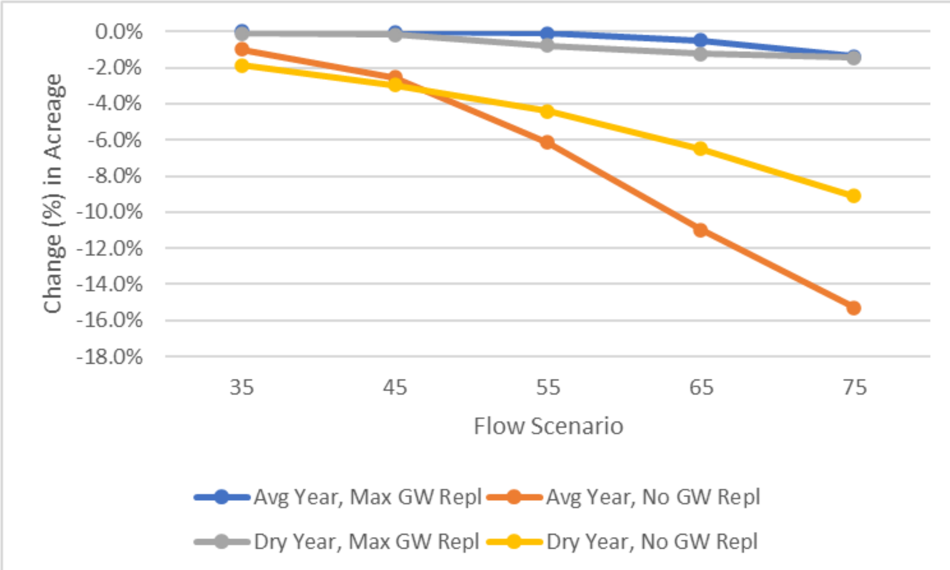


Figure 7.6.1-3. Swainson's Hawk Habitat Change from Baseline in the Sacramento/Delta and San Joaquin Valley Region

In the Sacramento/Delta and San Joaquin Valley region, the change in acreage of the crops most important to Swainson's hawks as foraging habitat (alfalfa, irrigated pasture, and other field-grass hay) would range between negligible change and up to a decrease of 11 percent for the SWAP average year model run or 7 percent for the SWAP dry year model run, depending on the flow scenario (45 to 65 scenarios) and replacement groundwater pumping assumptions (Figure 7.6.1-3). Under a 55 scenario with no replacement groundwater pumping, the average year SWAP model run indicates a reduction in Swainson's hawk habitat of 6 percent for the Sacramento Delta and San Joaquin Valley regions.

Swainson's hawks also occur in the Southern California region, including in the Owens Valley and Antelope Valley. As described in Section 7.4, *Agriculture and Forest Resources*, SacWAM estimates that Sacramento/Delta water supplies to the Southern California region are primarily used for municipal uses, with only a small amount of Sacramento/Delta supplies used for agriculture. However, it is possible that some changes in crop acreages may occur in localized areas in the Southern California region, which could affect associated special-status species, including Swainson's hawks.

Reductions in Sacramento/Delta water supplies to wildlife refuges could over time result in a reduction in Swainson's hawk nesting habitat (riparian vegetation that occurs around ponds, earthen canals, and wetlands) at wildlife refuges and wildlife areas. Reduced Sacramento/Delta deliveries could result in conditions that no longer support riparian vegetation, which would reduce available nesting habitat in these areas. However, the proposed Plan amendments would provide for a more natural flow regime in the Sacramento River watershed, Delta, and Delta eastside tributaries regions that would be expected to benefit riparian species and associated Swainson's hawk riparian nesting habitat. For example, hydrologic impairments, such as reduced magnitudes and frequency of overbank flows, can limit the reestablishment of cottonwood trees in riparian areas (Mahoney and Rood 1998; Stella et al. 2010). The changes in hydrology under the proposed Plan amendments would be expected to result in a more natural hydrologic regime that would increase the frequency of overbank flows into riparian areas, which would enhance hydrologic conditions for germination of riparian vegetation, such as cottonwood trees. A more natural hydrologic regime would also increase habitat connectivity, providing riparian and floodplain areas with nutrients, organic matter, organisms, and sediment that rejuvenate riparian habitats and benefit associated food webs (Poff et al. 1997).

Overall, the effects on Swainson's hawk resulting from changes in Sacramento/Delta water supplies would range from less than significant (if maximum replacement groundwater pumping is used) to potentially significant (if no replacement groundwater pumping is used to supply agricultural areas and wildlife refuges affected by changes in water supply). These impacts could be partially offset by benefits to riparian habitat in the Sacramento/Delta that would occur from changes in hydrology. Habitat restoration projects also would likely benefit Swainson's hawks and could help to offset impacts associated with changes in water supply, although it is not known whether these projects would fully offset potential losses in habitat that could occur because of changes in Sacramento/Delta water supply.

Greater Sandhill Crane

Greater sandhill cranes forage on residue of corn, grain, and wheat crops when fields are flooded to decompose post-harvest stubble of agricultural crops; they roost in shallowly flooded open fields or wetlands, which includes habitat at wildlife refuges. Changes in Sacramento/Delta water supplies could result in a decrease in the amount of agricultural foraging habitat available to greater sandhill cranes. Reductions in Sacramento/Delta water supplies to wildlife refuges in the Sacramento River watershed and San Joaquin Valley regions could also result in a reduction in greater sandhill crane wintering habitat over time. Figure 7.6.1-4 shows the potential change in acreage of greater sandhill crane habitat in the Sacramento/Delta and San Joaquin Valley region under the 35 through 75 scenarios for average and dry year conditions with and without replacement groundwater pumping compared with baseline conditions.

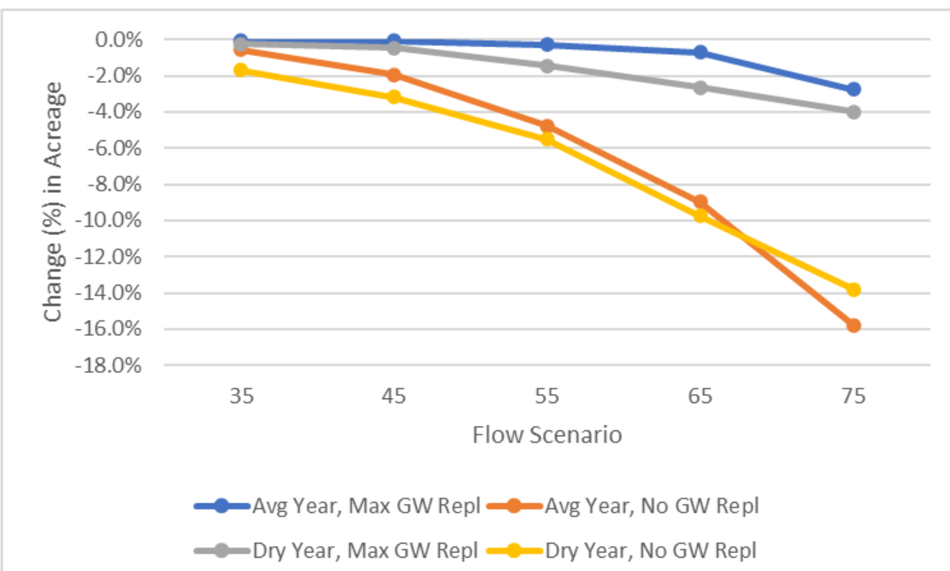


Figure 7.6.1-4. Greater Sandhill Crane Habitat Change from Baseline in the Sacramento/Delta and San Joaquin Valley Region

In the Sacramento/Delta and San Joaquin Valley region, the change in acreage of crops most important to greater sandhill crane as foraging habitat (alfalfa, corn, corn silage, grain, irrigated pasture, rice, and other field-grass hay) would range between a negligible change and up to a decrease of 9 percent for the SWAP average year model run or 10 percent for the SWAP dry year model run, depending on the flow scenario and replacement groundwater pumping assumptions (Figure 7.6.1-4). Under a 55 scenario with no replacement groundwater pumping, for the average water year condition, there would be a reduction in greater sandhill crane habitat of 5 percent for the Sacramento/Delta and San Joaquin Valley region.

Greater sandhill cranes do not occur in the Bay Area or Central Coast regions. Small numbers of greater sandhill cranes also occur in the Southern California region, including in the Imperial Valley and along the Colorado River. Sacramento/Delta supplies to Southern California are primarily used for municipal uses, with only a small amount of the region's Sacramento/Delta water supplies used for agriculture. However, it is possible that some changes in crop acreage may occur in localized areas in the Southern California region, which could affect associated special-status species, including greater sandhill crane.

Overall, the effects on greater sandhill crane would range from less than significant (if maximum replacement groundwater pumping is used) to potentially significant (if no replacement groundwater pumping is used for agricultural areas and wildlife refuges affected by reductions in Sacramento/Delta supply). These impacts could be partially offset by benefits to wetland habitat in the Sacramento/Delta that would occur as a result of changes in hydrology. The proposed Plan amendments would be expected to result in an increased frequency of floodplain inundation during winter and spring, which may provide wetland habitat for greater sandhill cranes. Wetland restoration projects, including some EcoRestore and other restoration projects, also may improve greater sandhill crane roosting and foraging habitat, although it is not known whether these projects would fully offset potential losses in habitat that could occur as a result of changes in Sacramento/Delta water supply.

Tricolored Blackbird

Tricolored blackbird populations have become dependent on agricultural lands for nesting and foraging habitat due to a loss of native marsh nesting and nearby feeding habitat. Changes in Sacramento/Delta water supplies could result in a decrease in the amount of nesting and foraging habitat available to tricolored blackbirds on agricultural lands and wildlife refuges. Figure 7.6.1-5 shows the potential change in acreage of tricolored blackbird habitat in the Sacramento/Delta and San Joaquin Valley region under the 35 through 75 scenarios for average and dry year conditions with and without replacement groundwater pumping compared with baseline conditions.

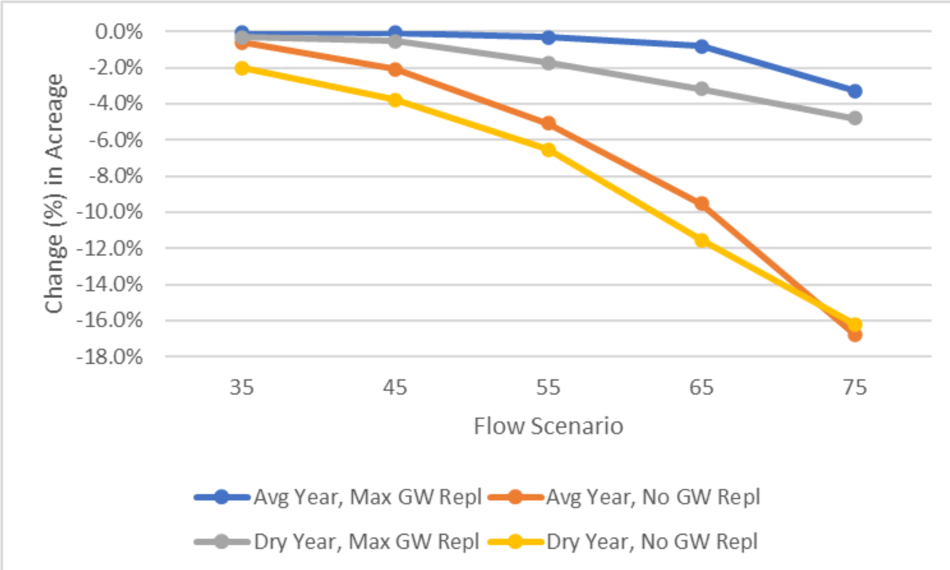


Figure 7.6.1-5. Tricolored Blackbird Habitat Change from Baseline in the Sacramento/Delta and San Joaquin Valley Region

In the Sacramento/Delta and San Joaquin Valley region, the change in acreage of crops most important to tricolored blackbird as nesting and foraging habitat (alfalfa, corn, corn silage, grain, irrigated pasture, and rice) would range between a negligible decrease and 10 percent for the SWAP average year model run and up to 12 percent for the SWAP dry year model run, depending on the flow scenario and replacement groundwater pumping assumptions (45 to 65 scenarios). Under a 55 scenario and no replacement groundwater pumping, the average year SWAP model run indicates a reduction in tricolored blackbird habitat of 5 percent for the Sacramento/Delta and San Joaquin Valley region.

Tricolored blackbirds also occur elsewhere in the Central Coast, Bay Area, and Southern California regions. These regions support some agricultural lands that could be used by tricolored blackbird for foraging, but most of the Sacramento/Delta water supplies to these regions is for municipal uses (see Chapter 6, *Changes in Hydrology and Water Supply*). However, it is possible that changes in Sacramento/Delta water supply may result in some changes in crop acreage in localized areas in these regions that could affect special-status species, including tricolored blackbirds.

Reduced Sacramento/Delta water supplies to wildlife refuges and wildlife areas could result in a reduction in nesting and foraging habitat for tricolored blackbird. Decreased water deliveries to the refuges would result in a decrease in the amount of habitat available for tricolored blackbird, particularly nesting habitat.

Overall, the effects on tricolored blackbird resulting from changes in Sacramento/Delta water supply would range from less than significant (if maximum replacement groundwater pumping is used) to potentially significant (if no replacement groundwater pumping is used for agricultural areas and wildlife refuges affected by reduced deliveries). These impacts could be partially offset by benefits to wetland habitat in the Sacramento/Delta that would occur as a result of changes in hydrology. Wetland restoration projects as part of EcoRestore and other efforts also may improve nesting and foraging habitat for tricolored blackbirds, although it is not known whether these projects would fully offset potential losses in habitat that could occur as a result of changes in Sacramento/Delta water supply.

California Black Rail

Reduced Sacramento/Delta water supplies are not expected to result in any measurable or direct effects on the population of California black rail in the northern San Francisco Bay estuary. Changes in hydrology would likely result in benefits to this population. Reduced supplies could affect wetland habitat for the Sierra Nevada population of the California black rail. As described in the *Environmental Setting*, most of the Sierra Nevada foothill marshes that support California black rails occur in habitat that receives irrigation water from intentional irrigation water inputs and unintentional irrigation ditch leaks—although some of the population's marsh habitat is dependent on natural water sources such as springs and streams (Richmond et al. 2008). Reduced Sacramento/Delta agricultural water supplies in the portions of the Sierra Nevada foothills that currently support California black rail habitat could result in a reduction of habitat available for California black rails over time.

SacWAM modeling does not provide quantitative specificity on how crop acreage may change in the Sierra Nevada foothills; however, agricultural water supplies to the Sierra Nevada foothills could be reduced, which could include some of the pasture and alfalfa hay fields that are served by open irrigation ditches. Even though the potential for reduction of surface supplies is low, because of the rarity of this species, the impact on the Sierra Nevada population of California black rail would be considered potentially significant.

Overall, reduced Sacramento/Delta water supply to wildlife refuges and wildlife areas in the Sacramento River watershed and San Joaquin Valley regions could result in a reduction in habitat for giant gartersnake, Swainson's hawk, greater sandhill crane, and tricolored blackbird. In addition, changes in crop acreages could result in a reduction of habitat for giant gartersnake, Swainson's hawk, greater sandhill crane, and tricolored blackbird; and reduced irrigation water in the foothills could reduce habitat for the California black rail. These impacts would be potentially significant.

Potentially significant impacts on terrestrial species resulting from habitat loss from reduced Sacramento/Delta water supply to refuges and agriculture could be avoided or reduced through implementation of Mitigation Measures MM-TER-a: 2 through 5. The proposed Plan amendments are intended to be implemented in an integrated fashion with habitat restoration and other non-flow measures that would provide benefits for both aquatic and terrestrial species, including actions identified in the program of implementation. Specifically, the proposed program of implementation identifies habitat restoration actions through EcoRestore and other efforts, as well as other non-flow actions that others should take to protect fish and wildlife. The proposed Plan amendments also allow for and encourage voluntary implementation plans that would facilitate a combination of flow and non-flow actions to promote habitat restoration to amplify the ecological benefit of new and existing flows. Voluntary implementation plans with proven effective habitat restoration may also allow flow requirements lower in the range, therefore reducing the potential impacts associated with reduced Sacramento/Delta water supply to refuges and agriculture and associated impacts on terrestrial species. Voluntary implementation plans are required to include measures to avoid or minimize impacts on terrestrial species of concern.

The proposed program of implementation also includes specific provisions related to water supplies provided to refuges, including refuge supplies provided pursuant to the CVPIA. The proposed program of implementation would prioritize refuge water supplies and would direct State Water

Board staff to take measures to implement that prioritization. Specific measures include potentially reducing fees and expediting processing for water transfers to refuges, funding mechanisms, and water right or other regulatory requirements to ensure adequate water supply to refuges, including measures to ensure the delivery of Level 2 water supply at the times needed to support refuges and to provide for full delivery of Level 4 supply.

In addition, management measures exist that agricultural water users can implement to avoid or minimize impacts on special-status species. While the State Water Board has some authority to ensure that mitigation is implemented for some actions, other mitigation measures are largely within the jurisdiction and control of other agencies or depend on how water users respond to the proposed Plan amendments. Accordingly, the State Water Board cannot guarantee that measures will always be adopted or applied to fully mitigate potential impacts on terrestrial species. Unless and until the mitigation is fully implemented, the impacts remain potentially significant.

Reduced Sacramento/Delta Supply to Municipal Use

Reductions in water supply to municipalities, as well as increased water recycling and indoor conservation, could alter the flow and chemical constituent concentrations of WWTP influent and subsequently could affect WWTP effluent discharges to receiving waters. As described in Section 7.12.1, *Surface Water*, several factors could influence the type or degree of these effects. In some locations, these changes may have little or no effect on the facility or receiving waters; in other locations, WWTP operators may need to adjust operations to ensure continued compliance with NPDES discharge requirements to avoid effects on some streams. If operational changes at affected locations are insufficient, modified or additional facilities may be needed. Physical modifications to WWTPs are further discussed in Section 7.20, *Utilities and Service Systems*, and impacts from the construction of new or modified treatment plants are evaluated in Section 7.22, *New or Modified Facilities*.

In locations where WWTP operators are unable to implement proper adjustments to their facilities, changes in WWTP discharges could result in effects on water quality that could affect special-status terrestrial species occurring in association with streams or riparian and emergent marsh habitat in these streams. Affected special-status species could include watershield, grass alisma, bristly sedge, wooly rose-mallow, slough thistle, silky cryptantha, California satintail, Sanford's arrowhead, marsh skullcap, Brazillian watermeal, Wright's trichocoronis, Horn's milk-vetch, Peruvian dodder, San Diego marsh-elder, California satintail, mud nama, marsh sandwort, La Graciosa thistle, California saw-grass, valley elderberry longhorn beetle, foothill yellow-legged frog, arroyo toad, California red-legged frog, western pond turtle, two-striped gartersnake, South Coast gartersnake, vermillion flycatcher, western yellow-billed cuckoo, northern harrier, white-tailed kite, least bittern, willow flycatcher, southwestern willow flycatcher, bald eagle, yellow warbler, least Bell's vireo, and western red bat.

Reduction in Sacramento/Delta water supply for municipal uses could ultimately reduce urban runoff. Water quality in some streams may improve due to reduced pollutant loading associated with urban runoff. In some circumstances, however, reductions in flows could reduce dilution of local sources of contaminants—particularly in streams with low flows that are dominated by relatively high-quality WWTP effluent and have local input of poor-quality water (see Section 7.12.1, *Surface Water*).

A reduction in municipal WWTP discharges to streams and wetlands could reduce nuisance flow and support natural processes and conditions more favorable to wetlands and sensitive natural communities adapted to a natural flow regime, along with the special-status species these habitats support. In streams that are wastewater-effluent-dominated, municipal discharge can provide the hydrology to support riparian vegetation and perennial-stream ecosystems that would not otherwise exist, altering ecosystems. In some situations, reductions of municipal discharges could negatively affect riparian and wetland communities.

For example, in drier regions (e.g., southern California), urban streams have become increasingly dependent on municipal wastewater-effluent (Luthy et al. 2015), supporting riparian habitat where it may not have existed before and alternatively, and degrading other habitat through alteration of ecosystem functions. Some streams that historically were intermittent and are now perennial often support nonnative wildlife, such as bullfrogs and signal crayfish that are adapted to perennial systems and now compete with and prey on native wildlife.

A reduction in flow could be favorable for special-status plants and wildlife that are adapted to non-perennial streams throughout the study area. In some cases, reduced flows from artificial inputs could emulate more natural hydrologic conditions and could benefit certain special-status plants and wildlife that rely on intermittent flow conditions. For example, arroyo toad could benefit from intermittent flow that can reduce breeding opportunities for bullfrogs. Other sensitive terrestrial species that may occur in association with streams and riparian and emergent marsh habitat include watershield, grass alisma, bristly sedge, woolly rose-mallow, slough thistle, silky cryptantha, California satintail, Sanford’s arrowhead, marsh skullcap, Brazillian watermeal, Wright’s trichocoronis, Horn’s milk-vetch, Peruvian dodder, San Diego marsh-elder, mud nama, marsh sandwort, La Graciosa thistle, California saw-grass, valley elderberry longhorn beetle, foothill yellow-legged frog, arroyo toad, California red-legged frog, western pond turtle, two-striped gartersnake, South Coast gartersnake, vermillion flycatcher, western yellow-billed cuckoo, northern harrier, white-tailed kite, least bittern, willow flycatcher, southwestern willow flycatcher, bald eagle, yellow warbler, least Bell’s vireo, and western red bat. Some species such as southwestern willow flycatcher and two-striped gartersnake may be more reliant on these now perennial systems.

Therefore, the effects of a reduction in municipal discharge related to flow for special-status species, associated riparian and wetland habitat, and sensitive natural communities would likely be beneficial in some locations. In other locations, however, some special-status species and riparian and wetland habitat may now be reliant on these now perennial systems and could be affected by reduced dilution capacity that worsens water quality in these streams. These impacts would be potentially significant.

Implementation of Mitigation Measures MM-TER-a: 6 and 7 will reduce potential violations of waste discharge requirements that could alter instream flows or water quality conditions affecting special-status species. Mitigation Measure MM-TER-a: 6 incorporates Mitigation Measure MM-SW-a,f: 1 for regulation of waste discharges that is accomplished primarily through the State Water Board and regional water board waste discharge permits, including NPDES permits for point-source discharges. A variety of funding programs provide loans and grants for capital improvements to WWTPs. The State Water Board and regional water boards will continue to regulate waste discharges and will continue to promote and support future funding sources as appropriate. Additionally, to avoid or minimize impacts associated with reduced wastewater instream, when processing wastewater change petitions pursuant to Water Code section 1211, the State Water Board will ensure that the change in wastewater discharge does not affect instream flows or water quality for special-status species. Unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

Groundwater and Species Habitat

While changes in hydrology would generally result in beneficial effects on groundwater-dependent ecosystems from increases in streamflows, increased groundwater pumping and reduced incidental groundwater recharge could result in potentially significant impacts on groundwater-dependent habitats in some areas and therefore on the special-status species with some or all of their life cycle associated with groundwater-dependent ecosystems. Drawdowns of shallow groundwater systems may make groundwater unavailable to groundwater-dependent ecosystems. If groundwater-dependent ecosystems, such as riparian and valley oak woodland natural communities, are no longer able to access groundwater, they may be adversely affected through stress on or death of vegetation. Impacts on these natural communities in turn affects habitat availability and the long-term survival of plants and wildlife that rely on the groundwater-dependent natural communities to survive (USFS 2007).

The effects of reduced groundwater levels, and thus availability of groundwater to groundwater-dependent ecosystems, varies across the regions in the study area depending on groundwater availability, adjudication, SGMA implementation, and/or unknown local responses of agricultural producers. (See Section 7.12.2, *Groundwater*, for further discussion.) Some riparian communities (e.g., deep-rooted riparian and oak woodlands) that provide habitat for special-status species in the Sacramento River watershed and Delta eastside tributaries regions could be significantly affected from lower groundwater levels. Areas within the western portion of the San Joaquin Valley region have a history of high groundwater pumping rates, making shallow groundwater unavailable to groundwater-dependent ecosystems under baseline conditions and thus making impacts less likely. Similarly, in the Bay Area, Central Coast, and Southern California regions, CNDDB records identify occurrences of valley oak woodlands primarily in riparian and upland areas but not in floodplains. In these areas, impacts on oak woodlands in riparian and upland habitats from lower groundwater levels are expected to be less than significant. As described in Section 7.12.2, the proposed Plan amendments would not be expected to affect groundwater levels in the Delta region; therefore, there would be no impact on valley oak woodlands or associated special-status species in the Delta region.

Although (as discussed under Impact TER-b) valley oak woodlands could be adversely affected, this community is relatively uncommon in the Sacramento River watershed, Delta eastside tributaries, and San Joaquin Valley regions because of past land conversion. Valley oak woodlands do not represent a major source of nesting habitat for special-status species that use this habitat; therefore, the impact on special-status species associated with this community would be less than significant.

Other Water Management Actions

Several strategies could be used at the local or regional level by utilizing existing infrastructure to reduce the potential impacts from reduced Sacramento/Delta surface water supplies, including groundwater storage and recovery, water transfers, water recycling, and water conservation measures. Local conditions would determine which actions are most effective. These responses to reduced Sacramento/Delta supply may affect terrestrial biological resources and are discussed below.

Groundwater Storage and Recovery

Groundwater storage and recovery could benefit native special-status species where groundwater supplies would be available, thereby potentially reducing use of surface water during dry season months and maintaining streamflows during critical periods for some special-status species.

Some groundwater storage and recovery or recharge may result in an increased frequency of intentional flooding of open landscapes. For example, groundwater recharge could flood agricultural lands during nonagricultural seasons (i.e., winter). Flooded agricultural lands and other landscapes during winter could provide increased roosting and foraging habitat for special-status species such as greater sandhill crane, lesser sandhill crane, and many other birds, which would be beneficial to these species.

Water sources for groundwater storage and recovery primarily include surface water supply during above-average years or treated wastewater. Potential impacts from recharging groundwater with treated wastewater that would otherwise remain instream are addressed under *Water Recycling*. Capturing significant quantities of flood flows for groundwater storage and recovery could diminish to some extent the instream ecological benefits of these high-flow events. Natural flow processes, such as sediment deposition, marsh accretion, nutrient transport, seed dispersal, and flow-related disturbance are important for native wetland and riparian plant species and any special-status plants and wildlife found in these natural communities such as Swainson's hawk, willow flycatcher, and arroyo toad. This would be a potentially significant impact.

Implementation of Mitigation Measure MM-TER-a: 8 will reduce potential impacts on instream ecological benefits from increased capture of flood flows for groundwater recharge to less-than-significant levels. Diversion of flood flows would be subject to State Water Board regulation to ensure that enough flow remains instream to protect ecological benefits, including terrestrial species and wetland and riparian habitat.

Water Transfers

Surface water transfers based on cropland idling could affect special-status terrestrial species that use agricultural fields for forage, cover, and nesting habitat. Groundwater substitution transfers also could occur, which could exacerbate the impacts already described related to reduced groundwater levels. The magnitude and severity of the effects of water transfers on special-status terrestrial species that use agricultural lands would depend on the duration of the transfer and the location and extent of affected cropland. Therefore, it is not possible to accurately quantify how a change in supply would result in a change in the distribution and availability of agricultural lands for use by special-status species. As described in Section 7.4, *Agriculture and Forest Resources,* additional cropland idling and groundwater substitution transfers could occur; and it is possible that conversion of agricultural land to nonagricultural purposes could result, including conversion of crop types that are important to giant gartersnake, Swainson's hawk, greater sandhill crane, and tricolored blackbird. The magnitude of the effect is unknown; however, some conversion is foreseeable. The impact on special-status terrestrial species that use agricultural lands would be potentially significant. Implementation of Mitigation Measure MM-TER-a: 9 will avoid or reduce this impact. As discussed in Section 7.1, *Introduction, Project Description, and Approach to Environmental Analysis,* transfers generally require environmental review and approval by different agencies that would be expected to address impacts on biological resources. Transfers based on crop idling approved by the State Water Board and/or facilitated by DWR or Reclamation are required to avoid unreasonable impacts on fish and wildlife and prevent injury to other legal users of water. To avoid or minimize these impacts, when processing petitions for transfers, the State Water Board will ensure that the transfer would not result in diminished habitat for special-status terrestrial species. The State Water Board cannot guarantee mitigation will be implemented for transfers not subject to State Water Board approval. Unless and until the mitigation is fully implemented, the impacts remain potentially significant.

Water Recycling

Increased water recycling could benefit special-status terrestrial species by maximizing the use of existing water supplies and reducing demand for surface water or groundwater. However, increased water recycling could further reduce instream flows where wastewater is recycled instead of being discharged to streams. In some locations, reductions in flow could alter water quality in some streams, particularly in streams with low flows that are dominated by relatively high-quality WWTP effluent and have local input of poor-quality water (see Section 7.12.1, *Surface Water*). These conditions could diminish to some extent the ecological benefits of instream flow, especially in dry seasons and in low-flow conditions where streamflow is dependent on wastewater discharges.

Depending on the volume and timing of these reduced flows, it is possible that changes in streamflow could be beneficial to or adversely affect special-status terrestrial species. This impact would be potentially significant.

Implementation of Mitigation Measure MM-TER-a: 7 will reduce potential impacts on special-status species from increased water recycling to less-than-significant levels. As discussed in Section 7.1, *Introduction, Project Description, and Approach to Environmental Analysis*, various regulatory requirements govern the use of recycled water. To avoid or minimize potential impacts on special-status species, the State Water Board, when processing wastewater change petitions pursuant to Water Code section 1211, will ensure that the change in wastewater discharge does not diminish ecological benefits of instream flows, especially in dry seasons and in low-flow conditions where the stream is dependent on wastewater discharges.

Potential effects associated with increased water recycling also are discussed and mitigation identified under *Reduced Sacramento/Delta Supply to Municipal Use*.

Water Conservation

Increased implementation of water conservation measures, such as reduced water use and tailwater reuse, could result in less runoff from lawns, impervious surfaces, agricultural fields, and other areas. Reduction in this type of drainage or discharge could result in a reduction in contaminants entering surface waters. Where these changes result in water quality improvements, terrestrial biological resources would benefit.

Potential effects associated with indoor water conservation measures are discussed and mitigation identified under *Reduced Sacramento/Delta Supply to Municipal Use*.

Impact TER-b: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service

Impact TER-c: Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marshes, vernal pool, coastal wetlands, etc.) through direct removal, filling, hydrological interruption, or other means

The analyses of effects on sensitive natural communities, including riparian habitat and federally protected wetlands, are closely related and therefore are combined and addressed together under Impact TER-b and Impact TER-c. As these natural communities may serve as habitat for sensitive terrestrial species, the discussions below may reiterate the analysis under Impact TER-a.

Changes in Hydrology

Generally, the proposed Plan amendments would provide for a more natural flow regime and would benefit riverine and associated natural wetland and riparian habitat/communities in the Sacramento/Delta. Changes in hydrology generally would result in riverine flows in the Sacramento/Delta that are similar to or greater than baseline flows during spring. These changes would support natural processes such as sediment deposition, marsh accretion, nutrient transport, seed dispersal, and flow-related disturbance. These changes also would potentially improve functions and services of existing wetlands, such as sediment retention, nutrient uptake, and supporting biological productivity. Increased flows during the spring riparian recruitment period have the potential to help establish new vegetation and maintain the viability of this habitat, which is key for the continued existence of many special-status species. These changes would improve habitat conditions for riparian and wetland habitat and natural communities, including sensitive natural communities such as Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, Great Valley valley oak riparian forest, and coastal and valley freshwater marsh. Special-status species that use these habitats would also benefit.

Floodplain Habitat

Changes in hydrology would likely increase the amount of inundated floodplain habitat in the Sacramento/Delta during the wet season months (see Appendix A8, *Salmonid Tributary Habitat Analysis*), which would likely benefit riparian and wetland habitat served by flow-related ecosystem processes such as seasonal increases in groundwater recharge beneath inundated floodplain areas. Areas of increased inundation would include, but not be limited to, the Sutter and Yolo Bypasses. The increased frequency and duration of inundation in the bypasses would not adversely affect riparian habitats, as they have historically persisted under similar high flows and extended inundation periods. Overall, riparian and wetland habitat and natural communities would likely benefit from changes in hydrology.

Freshwater Marshes and Tidal Marshes

Changes in Delta inflows and Delta outflows would likely benefit freshwater marshes and tidal marshes in the Delta and Suisun Bay. SacWAM results indicate that under the 45 to 65 scenarios Delta inflows would generally increase compared to baseline conditions during December through

June and generally decrease in July through September. SacWAM results also indicate that Delta outflows would generally increase during all months, except for reductions during August under the 45 to 55 scenarios and during September under the 55 to 65 scenarios. These changes in Delta inflows and Delta outflows would more closely resemble the natural flow regime to which native species have adapted and would be expected to generally benefit wetlands and natural communities in the Delta and Suisun Marsh. As described under Impact TER-a, special-status species that use tidal marsh habitat in the Delta and Suisun Marsh also would likely benefit. These changes in Delta inflows and Delta outflows could change the balance of fresh water and brackish water in and near the Delta and Suisun Marsh; however, this change would not result in adverse effects on wetlands and natural communities but rather some potential conversion from one natural community type to another.

Riparian and Wetland Habitats

Changes in Reservoir Levels

Changes in hydrology may result in changes to reservoir levels. These reservoirs may contain shallow shorelines with riparian habitat and wetlands that could be affected.

Under baseline conditions, reservoir levels fluctuate from season to season and between wet and dry years; therefore, any riparian and wetland habitat around reservoirs are subject to fluctuations in reservoir storage levels. SacWAM results for the 45 to 65 scenarios show that fluctuations in rim reservoir levels would be within the historical range of conditions for most reservoirs in the Sacramento River watershed and Delta eastside tributaries regions, but some large rim reservoirs and some upper watershed reservoirs show less fluctuation because they are not filling to capacity as frequently. In addition, historical observations of storage in export reservoirs during periods of lower Sacramento/Delta supplies show lower storage for some reservoirs. Many reservoirs are constructed in steep terrain and many contain bedrock shorelines, which are not conducive to the establishment of riparian and wetland vegetation. However, some reservoirs do contain shallow shorelines with associated riparian vegetation and wetlands. Reservoir operations in the plan area would be addressed through implementation of the cold water habitat objective and other provisions in the program of implementation, such as the ability for several tributaries to work together to meet flow objectives and cold water habitat; however, it is not certain what specific actions reservoir operators and other parties would take to implement the proposed Plan objectives and whether it will be possible to fully mitigate potential impacts on associated riparian habitat and wetlands in all affected locations. The impact of changes in reservoir levels on associated riparian habitat and wetlands would be potentially significant.

Implementation of Mitigation Measure MM-TER-b,c: 1 will reduce potential impacts on riparian and wetland habitat. This mitigation measure incorporates Mitigation Measure MM-AQUA-a,d: 1 for reservoir management (see Section 7.6.2, *Aquatic Biological Resources*). As discussed in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*, the proposed Plan amendments would require large reservoir operators to develop and implement a long-term strategy and annual operation plans that consider the unique structural, operational, and hydrological characteristics and special-status species requirements in individual tributaries in the Sacramento/Delta. As determined by the Executive Director of the State Water Board, reservoir operators in upstream watersheds also may be required to develop their own strategies if their reservoir operations are affecting achievement of the narrative objective for stream segments above the rim reservoirs. A temperature management strategy also may be required if the Executive Director of the State Water

Board determines that the stream segment is not otherwise in compliance with the cold water habitat objective based on information from the fisheries agencies and others. It is likely that a reservoir in the Sacramento River watershed or Delta eastside tributaries region experiencing fluctuations substantial enough to affect riparian and wetland habitat would be subject to these additional implementation provisions. Any required strategies and plans must include measures to avoid or minimize impacts on riparian and wetland habitat. In addition, in exercising its regulatory authorities, the State Water Board will consider terrestrial biological resources needs and ensure that impacts are avoided or minimized. However, because of the flexibility provided in developing and implementing the strategies and plans, there is some uncertainty whether the strategies and plans will avoid all impacts on habitat at all times, and whether all impacts can be reduced to a less-than-significant level. The impacts from changes in reservoir levels on riparian and wetland habitat remain potentially significant.

Changes in Streamflows below Export Reservoirs

Storage in export reservoirs during periods of lower Sacramento/Delta supplies show lower storage patterns for some reservoirs, and reduced exports could result in lower reservoir storage in some export reservoirs. Streamflow requirements of many of the streams below export reservoirs do not allow reductions below historical minimum flows (see Chapter 6, *Changes in Hydrology and Water Supply*). However, some of these streamflow requirements are based on hydrologic conditions or reservoir storage; if reservoir storage is reduced, the streamflow requirements also are reduced. Further, it is possible that existing flow requirements may change in the future. Therefore, there is uncertainty in how reservoir operators may respond to changes in Sacramento/Delta supplies, and it is possible that streamflows below export reservoirs receiving Sacramento/Delta supplies could be reduced.

The effects of changes in streamflows below export reservoirs would not be expected to significantly affect associated riparian habitat and wetlands. Several export reservoirs, such as Castaic Lake on Castaic Creek, are located on stream reaches that were historically intermittent. Returns to more historical seasonal flows downstream of these reservoirs could improve stream functions and services by creating conditions more favorable for native riparian and wetland communities and associated wildlife. Overall, the impact of changes in streamflows below export reservoirs would be less than significant.

Changes in Water Supply

Reduced Sacramento/Delta Supply to Refuges and Agriculture

As described under Impact TER-a, changes in water supply would result in reduced Sacramento/Delta water supplies to wildlife refuges in the Sacramento River watershed and San Joaquin Valley regions, which support sensitive wetland vegetation communities. Sacramento/Delta refuge water supplies typically are used to support seasonally flooded wetlands and summer wetlands at wildlife refuges and wildlife areas, which provide habitat for waterfowl and other wildlife. Decreased Sacramento/Delta water supplies to wildlife refuges could result in a decrease in wetland area at these refuges over time. This impact would be potentially significant. Implementation of Mitigation Measure MM-TER-a: 2 will ensure that habitat protection and restoration actions are implemented to reduce this impact. In particular, Mitigation Measure MM-TER-a: 2.iii identifies the need to prioritize water supplies to refuges. The proposed program of implementation also includes specific provisions related to water supplies provided to refuges, including refuge supplies provided pursuant to the CVPIA. The proposed program of implementation would prioritize refuge water supplies and would direct State Water Board staff to take measures to implement that prioritization. However, unless and until the mitigation measures are fully implemented, the impacts on wetlands at wildlife refuges remain potentially significant.

Reductions in Sacramento/Delta supplies could affect water quality in managed wetlands if those lands receive some or all of their water supply from the Sacramento/Delta. Managed wetlands can include many of the wetlands maintained by NWRs and state WAs; privately owned wetlands such as those managed by duck clubs; and some agricultural croplands that are managed for multiple uses, including waterfowl habitat. The effect is likely to be more substantial in the San Joaquin Valley region, where water quality is already poor. For example, the extensive and ecologically important areas within the Grasslands Ecological Area are fed by a combination of surface water imports, groundwater, and agricultural drainage. As indicated in Chapter 6, *Changes in Hydrology and Water Supply*, there could be reductions of Sacramento/Delta surface water supplies to agriculture, as well as a reduction in Sacramento/Delta supplies to refuges in this region, especially under the higher (55 and 65) scenarios (see Chapter 6, Figures 6.4-13 and 6.4-15). The reductions in agricultural supply could cause reductions in agricultural drainage and lowering of groundwater levels. Agricultural drainage in this area is high in salts and selenium. With less Sacramento/Delta supply, the remaining inflow from agricultural drainage and groundwater could become more degraded, and dilution of this low-quality water with fresh surface water supplies could be reduced (see Section 7.12.1, *Surface Water*). The impacts on wetland habitat from reduced supply to managed wetlands would be potentially significant.

Implementation of Mitigation Measure MM-TER-a: 6 and Mitigation Measures MM-TER-b,c: 2 and 3 will reduce the impacts from changes in water supply to streams and wetlands that receive agricultural and municipal discharges. Mitigation Measure MM-TER-a: 6 incorporates Mitigation Measure MM-SW-a,f: 1 for regulation of waste discharges, which is accomplished primarily through State Water Board and regional water board waste discharge permits. Mitigation Measure MM-TER-b,c: 2 incorporates Mitigation Measures MM-GW-b: 1 through 7 to reduce impacts of lowered groundwater levels (from reduced agricultural discharge) on riparian and wetland habitat. Mitigation Measure MM-b,c: 3 incorporates Mitigation Measure MM-SW-a,f: 7 to ensure ongoing implementation of actions to address poor-quality agricultural discharges. Unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

Reduced Sacramento/Delta Supply to Agriculture and Municipal Use

Changes in water supply, including reduced Sacramento/Delta supply to municipal and agricultural use, increased recycling, and water conservation measures could affect sensitive riparian and wetland habitat and other natural communities where agricultural and municipal discharges incidentally supplement flow. In the Sacramento/Delta, some riparian and associated wetland communities could benefit from the proposed flow requirements and associated changes in Sacramento/Delta supply, which could provide for a more natural flow regime to which these natural communities have adapted. Agricultural and municipal discharges tend to have the largest effect on streamflows during summer, when streams naturally exhibit low baseflows.

A reduction in these discharges during summer would reduce nuisance flow and support natural processes and conditions more favorable to wetlands and sensitive natural communities adapted to a more natural flow regime, which would not significantly affect established riparian and natural communities that are adapted to these more seasonal flows. A decrease in agricultural and municipal discharges during the dry season would benefit wetland communities that are adapted to seasonal ponding and saturation, such as alkali meadow, alkali seep, and cismontane alkali marsh. These wetland communities are dependent on surface water or a saturated upper soil horizon and could benefit from a more natural hydrologic regime, including reduced discharges during summer. These wetlands often are situated on valley floors adjacent to areas that have largely been converted for agricultural uses.

In some waterbodies that receive agricultural and municipal discharges, changes in water supply could result in decreased flows. In drier regions (e.g., Southern California), urban streams have become increasingly dependent on municipal wastewater effluent (Luthy et al. 2015) supporting riparian habitat where it may not have existed before and alternatively, degrading other habitat through alteration of ecosystem functions. Therefore, reduced flows from artificial inputs could emulate more natural hydrologic conditions and the impacts related to riparian and wetland habitat would likely be beneficial.

The effects of a reduction in municipal discharge related to flow for riparian and wetland habitat and sensitive natural communities would likely be beneficial in some locations. In other locations, however, some riparian and wetland habitat may now be reliant on these now perennial systems and could be affected by reduced dilution capacity that worsens water quality in these streams. This would be a potentially significant impact.

Implementation of Mitigation Measure MM-TER-a: 6 and Mitigation Measures MM-TER-b,c: 2 and 3 will reduce the impacts from changes in water supply to streams and wetlands that receive agricultural and municipal discharges. Mitigation Measure MM-TER-a: 6 incorporates Mitigation Measure MM-SW-a,f: 1 for regulation of waste discharges, which is accomplished primarily through the State Water Board and regional water board waste discharge permits. Mitigation Measure MM-TER-b,c: 2 incorporates Mitigation Measures MM-GW-b: 1 through 7 to reduce impacts of lowered groundwater levels (from reduced agricultural discharge) on riparian and wetland habitat. Mitigation Measure MM-b,c: 3 incorporates Mitigation Measure MM-SW-a,f: 7 to ensure ongoing implementation of actions to address poor-quality agricultural discharges. Unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

Groundwater-Dependent Natural Communities

Groundwater-dependent ecosystem refers to ecological communities or species that depend on groundwater emerging from aquifers or occurring near the ground surface; these ecosystems include wetlands, riparian areas, and drought-intolerant upland communities such as Great Valley valley oak woodlands. Groundwater-dependent ecosystems (and the species that rely on them) may be stressed or excluded by drying out of surface and shallow groundwater. While wetlands and riparian areas are groundwater-dependent ecosystems, they are primarily discussed independently under Impact TER-b, *Changes in Hydrology – Riparian and Wetland Habitats*, as the wetlands and riparian areas in the plan area are more strongly associated with surface flows.

The proposed Plan amendments would increase instream flows for the benefit of fish and wildlife, which would tend to increase the surface water and shallow groundwater supplies to many groundwater-dependent ecosystems, including natural wetlands and riparian corridors (as discussed under *Changes in Hydrology – Riparian and Wetland Habitats*). However, changes in supply could result in increased groundwater pumping and reduced incidental groundwater recharge associated with the over-application of agricultural and municipal irrigation water, both of which would result in decreased groundwater levels—particularly in localized areas (see

Section 7.12.2, *Groundwater*). Groundwater-dependent upland communities in floodplain areas and river terraces could be negatively affected by groundwater pumping from shallow wells in floodplain areas. This is unlikely to occur directly within the Delta, because of the high water tables and high inputs from river flows. Deeper wells may affect groundwater aquifers (see Section 7.12.2), but these deeper waters are generally inaccessible to even the deepest rooted of groundwater-dependent ecosystems and therefore are not relevant to discussions of groundwater-dependent ecosystems. Sensitive natural communities that could be affected by reduced groundwater levels include Central Coast arroyo willow riparian forest, Great Valley cottonwood riparian forest, Great Valley mesquite scrub, Great Valley mixed riparian forest, Great Valley oak riparian forest, mesquite bosque, Mohave riparian forest, southern cottonwood willow riparian forest, southern mixed riparian forest, southern riparian scrub, southern willow scrub, sycamore alluvial woodland, and valley oak woodland.

Riparian-associated natural communities generally would not be adversely affected by decreased groundwater levels that could occur as a result of the proposed Plan amendments. Riparian communities rely on localized groundwater inputs from stream-aquifer interactions (streambed seepage), which would continue to support riparian vegetation and natural communities as streamflows are maintained or increased. In some situations, such as riparian vegetation that occurs around ponds and earthen canals within wildlife refuges, groundwater-dependent ecosystems could be affected if no replacement groundwater pumping is used to supply agricultural areas and wildlife refuges. Also, as described in Section 7.12.2, *Groundwater*, groundwater recharge from stream-aquifer interactions would increase compared to baseline conditions in the Sacramento River watershed and Delta eastside tributaries regions. Some riparian communities, including wetlands in the Sacramento River watershed and Delta eastside tributaries regions, could experience and benefit from increased groundwater recharge from stream-aquifer interactions as a result of the proposed Plan amendments. In non-riparian areas, sensitive natural communities (e.g., Great Valley mesquite scrub, mesquite bosque, southern riparian scrub, southern willow scrub, sycamore alluvial woodland, valley oak woodland), and wetlands could be affected by reduced groundwater levels. However, a review of CNDDB records for sensitive natural communities within the study area show that, when not located in floodplain areas, these sensitive natural communities often are located in upland areas (e.g., drainages in hilly or mountainous areas) (^CDFW 2021). These areas would not be affected by groundwater drawdown in floodplain areas; therefore, sensitive natural communities in these areas would not be significantly affected by reduced groundwater levels.

Valley oak woodlands located in non-riparian areas could be affected in localized areas if groundwater levels fall below the depths that valley oak roots can reach for extended periods of time. As described in the *Environmental Setting*, valley oaks take up water through deep taproots and extensive horizontal roots; vertical root depths have been reported as deep as 80 feet (Howard 1992). Valley oaks also are resistant to short-term drought, and mature trees primarily suffer drought damage when a series of dry seasons lowers water tables to extreme depths (Howard 1992). Valley oak woodlands in the study area could be affected if, over time, groundwater levels exceed rooting depth of the trees (80 feet), particularly during periods of drought when seasonal soil moisture in the upper soil horizon is limited. Impacts on valley oak woodlands could occur in the Sacramento River watershed, Delta eastside tributaries, and San Joaquin Valley regions in localized areas if water users choose to increase shallow groundwater pumping in response to the proposed Plan amendments or because of reduced incidental groundwater recharge. Increased draws on deep wells to deeper aquifers in higher areas of the plan area are unlikely to affect surface groundwater tables. Most valley oak woodlands in the Central Valley have been removed because of agricultural conversion. Potential adverse effects on small stands and individual valley oaks in these regions would not rise to a level of significance because of their ability to tolerate periods of drought (e.g., deep rooting depths, extensive horizontal roots). In the Bay Area, Central Coast, and Southern California regions, documented occurrences of valley oak woodlands are primarily in riparian and upland areas, where impacts from reduced groundwater levels would likely be less than significant.

Seasonal wetlands and vernal pools depend on seasonal surface water, seasonally saturated soils, and water perched above hardpans, not deeper groundwater aquifers. In some instances, however, sensitive perennial wetland communities such as fens, bogs, seeps, and marshes could be affected by increased groundwater pumping—particularly in localized areas if water users choose to respond to the proposed Plan amendments by pumping additional groundwater from wells close to the wetlands. Some perennial wetlands could be affected by lower groundwater levels and could convert from perennial to seasonal wetlands, particularly in localized areas close to groundwater. In the Delta, groundwater levels are believed to be shallow and are not expected to change as a result of the proposed Plan amendments (see Section 7.12.2, *Groundwater*), and there would be no impact on perennial wetlands. In the San Joaquin Valley region, most perennial wetlands are managed wetlands and likely would not be significantly affected by changes in groundwater levels. In the Bay Area, Central Coast, and Southern California regions, most wetlands are associated with drainages or would classify as managed wetlands (e.g., Suisun Marsh); effects on these wetlands from increased groundwater pumping typically would be less than significant. In some instances, lowered groundwater levels from increased groundwater pumping could affect groundwater-dependent ecosystems, including riparian and wetland habitat and sensitive natural communities. This would be a potentially significant impact.

Implementation of Mitigation Measure MM-TER-b,c: 2 will reduce impacts of lowered groundwater levels on groundwater-dependent ecosystem habitat. MM-TER-b,c: 2 incorporates Mitigation Measures MM-GW-b: 1 through 7 to ensure oversight and management of actions that could affect groundwater levels. Groundwater impacts and associated impacts on wetlands and sensitive groundwater-dependent natural communities could be reduced by sustainable groundwater management, groundwater storage and recovery, increased use of water recycling from existing facilities, and agricultural and municipal conservation measures. However, unless and until the mitigation is fully implemented, impacts caused by reduced groundwater levels on riparian and wetland habitat and sensitive natural communities remain potentially significant.

Other Water Management Actions

Groundwater Storage and Recovery

Groundwater storage and recovery could benefit riparian and wetland habitat by reducing use of surface water during dry season months and maintaining streamflows that support riparian, wetland, and other sensitive natural habitats.

Water sources for groundwater storage and recovery include primarily surface water supply during above-average water years or treated wastewater. Potential impacts from recharging groundwater with treated wastewater that would otherwise remain instream are addressed under *Water Recycling*. Capturing significant quantities of flood flows for groundwater storage and recovery could diminish to some extent the instream ecological benefits of these high-flow events. Natural flow processes, such as sediment deposition, marsh accretion, nutrient transport, seed dispersal, and flow-related disturbance are important for wetland, riparian, and other sensitive habitats. Potential impacts on instream ecological benefits would be a potentially significant impact.

Implementation of Mitigation Measure MM-TER-a: 8 will reduce potential impacts on instream ecological benefits from the increased capture of surplus surface water, including flood flows for groundwater storage, to less-than-significant levels. Diversion of surplus surface water, including flood flows (i.e., high runoff events), will be subject to State Water Board regulation to ensure that enough flow remains instream to protect ecological benefits, including for terrestrial special-status species and wetland and riparian habitat.

Water Transfers

Water transfers have the potential to affect groundwater-dependent natural communities and some perennial wetlands. Surface water transfers based on cropland idling could affect groundwater-dependent sensitive natural communities in localized areas where these natural communities could be subject to reduced groundwater recharge from deep percolation of applied water and conveyance losses. Groundwater substitution transfers also could occur, which could exacerbate impacts related to lower groundwater levels. Conversely, some impacts could be offset by water transfers, which may result in groundwater recharge in areas adjacent to municipal and agricultural areas.

Implementation of Mitigation Measure MM-TER-a: 9 and Mitigation Measure MM-TER-b,c: 2 will avoid or reduce this impact. As discussed under Impact TER-a, *Other Water Management Actions – Water Transfers,* crop idling transfers approved by the State Water Board and/or facilitated by DWR or Reclamation are required to avoid unreasonable impacts on fish and wildlife and prevent injury to other legal users of water. To avoid or minimize these impacts when processing petitions for transfers, the State Water Board will ensure that the transfer would not result in diminished habitat for special-status terrestrial species. Additionally, MM-TER-b,c: 2 incorporates groundwater management mitigation measures to reduce lowering of groundwater levels. Groundwater impacts and associated impacts on wetlands and sensitive groundwater-dependent natural communities could be reduced by sustainable groundwater management, groundwater storage and recovery, increased use of water recycling from existing facilities, and agricultural and municipal conservation measures. The State Water Board cannot guarantee mitigation will be implemented for transfers not subject to State Water Board approval. Unless and until the mitigation is fully implemented, the impacts remain potentially significant.

Water Recycling

Increased water recycling could further reduce instream flows where wastewater is recycled instead of being discharged to streams. In some locations, reductions in flow could alter water quality in some streams, particularly in streams with low flows that are dominated by relatively high-quality WWTP effluent and have local input of poor-quality water (see Section 7.12.1, *Surface Water*). These conditions could diminish to some extent the ecological benefits of the instream flow, especially in dry seasons and in low-flow conditions where streamflow is dependent on wastewater discharges. This impact would be potentially significant.

Implementation of Mitigation Measure MM-TER-a: 7 will reduce potential impacts on special-status species from increased water recycling to less-than-significant levels. As discussed in Section 7.1, *Introduction, Project Description, and Approach to Environmental Analysis*, various regulatory requirements govern the use of recycled water. To avoid or minimize potential impacts on special-status species, the State Water Board, when processing wastewater change petitions pursuant to Water Code section 1211, will ensure that the change in wastewater discharge does not diminish ecological benefits of instream flows, especially in dry seasons and in low-flow conditions where the stream is dependent on wastewater discharges.

Potential effects associated with increased water recycling and water conservation also are discussed and mitigation identified under Impact TER-a, *Changes in Water Supply – Reduced Sacramento/Delta Supply to Municipal Use*.

Impact TER-d: Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites

As discussed under Impact TER-a, changes in hydrology are expected to provide a more natural flow regime that generally would benefit riverine and associated wetland and riparian habitat and natural communities in the Sacramento/Delta. Native resident and migratory wildlife that use these habitats as migratory corridors or nursery sites, such as migratory waterfowl and shorebirds, also would benefit from the proposed Plan amendments. In addition, changes in hydrology would improve the movement of native fish through the Sacramento River watershed, Delta, and Delta eastside tributaries regions, as discussed in Section 7.6.2, *Aquatic Biological Resources*.

Changes in reservoir levels could affect the amount of resident waterfowl breeding habitat that occurs along the edges of reservoirs; however, reservoir levels already fluctuate from season to season and between wet and dry years. Migratory waterfowl that use the Pacific Flyway migrate through California primarily during winter. For large reservoirs in the Sacramento/Delta, changes in reservoir levels could occur primarily during spring and summer and would be expected to be closer to baseline conditions during winter. Even for reservoirs such as Lake Berryessa that may exhibit lower elevations relative to baseline conditions across all months, the relative difference from baseline conditions is not expected to be substantial enough to significantly affect the amount of available shoreline or open water habitat such that it would significantly reduce resident or migratory waterfowl populations. Similarly, for export reservoirs, the impact of changes in reservoir water levels would be expected to be within historical levels of fluctuation or would not likely decrease substantially enough to significantly affect the amount of available shoreline or open water habitat such that it would significantly reduce resident or migratory waterfowl populations. Overall, the effect of changes in reservoir levels on wildlife corridors and native nursery sites for resident and migratory waterfowl would be less than significant.

Changes in refuge water supplies could affect resident and migratory waterfowl and shorebirds. Reductions in refuge water supplies would result in decreased amounts of wetland habitat flooded for migratory waterfowl and shorebirds as well as reduced breeding habitat for resident waterfowl and shorebirds over time. The average reduction in Sacramento/Delta water supplies under the proposed Plan amendments could result in a potentially significant impact on migratory waterfowl and shorebirds and over time could reduce the availability of breeding habitat for resident waterfowl and shorebirds. In addition, changes in agricultural land use patterns from reduced Sacramento/Delta water supplies to agriculture could affect the movement of migratory waterfowl and shorebirds during migration through the Pacific Flyway. Changes in water supply could result in a decrease in the acreage of agricultural crops that provide foraging habitat for waterfowl, particularly if it is assumed that no replacement groundwater pumping would occur to replace reduced surface water supplies (see Impact TER-a for further discussion of SWAP model results). Changes in water supply also could result in decreased acreage of post-harvest flooding of rice fields, which provide wetland habitat for migratory waterfowl and shorebirds. Because these diversions can occur under lower priority water rights during fall compared to water supplied under higher priority water rights and contracts during spring and summer, the proposed Plan amendments could result in reduced water supplies for fall rice straw decomposition unless these diversions occur during the settlement contract season or other water supplies are used. These impacts would be potentially significant.

Implementation of Mitigation Measures MM-TER-a: 2 and 3 will minimize the effects on terrestrial species resulting from habitat loss from reduced water supply to refuges and agriculture. The proposed Plan amendments are intended to be implemented in an integrated fashion with habitat restoration and other non-flow measures that would provide benefits for both aquatic and terrestrial species, including actions identified in the program of implementation. Specifically, the proposed program of implementation identifies habitat restoration actions through EcoRestore and other efforts, as well as other non-flow actions that others should take to protect fish and wildlife. The proposed Plan amendments also allow for and encourage voluntary implementation plans that would facilitate a combination of flow and non-flow actions to promote habitat restoration to amplify the ecological benefit of new and existing flows. Voluntary implementation plans with proven effective habitat restoration may may allow flow requirements lower in the range, reducing the potential impacts associated with reduced Sacramento/Delta water supply such as impacts on agriculture and associated impacts on terrestrial species. Voluntary implementation plans are required to include measures to avoid or minimize impacts on terrestrial species of concern. The proposed program of implementation includes specific provisions related to water supplies provided to refuges, including refuge supplies provided pursuant to the CVPIA. The proposed program of implementation would prioritize refuge water supplies and would direct State Water Board staff to take measures to implement that prioritization. Specific measures include potentially reducing fees and expediting processing for water transfers to refuges, funding mechanisms, and water right or other regulatory requirements to ensure adequate water supply to refuges, including measures to ensure the delivery of Level 2 water supply at the times needed to support refuges and to provide for full delivery of Level 4 supply. Unless and until the mitigation is fully implemented, impacts remain potentially significant.

Lower groundwater levels have the potential to affect groundwater-dependent ecosystems in localized areas, such as certain riparian and wetland habitats, that may provide habitat for migratory and resident waterfowl and shorebirds. Many waterfowl and shorebirds use wetland habitat at wildlife refuges and other managed wetlands that would not be significantly affected by changes in groundwater levels. The impact of reduced groundwater levels would not significantly affect waterfowl and shorebirds. Increased groundwater pumping, reduced groundwater recharge, conjunctive uses, increased use of recycled water from existing facilities, and agricultural and municipal conservation would not likely directly affect migratory waterfowl and shorebirds. Thus, there would be no impact.

Water transfers could exacerbate impacts on migratory waterfowl associated with changes in crop acreage. Surface water transfers based on cropland idling could affect foraging habitat for waterfowl and shorebirds. Groundwater substitution transfers also could occur. The magnitude and severity of the effects of water transfers on migratory waterfowl and shorebirds that utilize agricultural lands would depend on the duration of the transfer and the location and extent of cropland idling. As described in Section 7.4, *Agriculture and Forest Resources*, the magnitude and effect of water transfers on agricultural land conversion are unknown, but some conversion could occur. These impacts would be potentially significant.

Implementation of Mitigation Measure MM-TER-a: 9 and Mitigation Measure MM-TER-b,c: 2 will avoid or reduce this impact. As discussed under Impact TER-a, *Other Water Management Actions – Water Transfers,* crop idling transfers approved by the State Water Board and/or facilitated by DWR or Reclamation are required to avoid unreasonable impacts on fish and wildlife and prevent injury to other legal users of water. To avoid or minimize these impacts when processing petitions for transfers, the State Water Board will ensure that the transfer would not result in diminished habitat for special-status terrestrial species, including migratory waterfowl. The State Water Board cannot guarantee mitigation will be implemented for transfers not subject to State Water Board approval. Unless and until the mitigation is fully implemented, the impacts remain potentially significant.

Impact TER-e: Conflict with any local policies or ordinances protecting biological resources such as a tree preservation policy or ordinance

Actions associated with changes in hydrology and water supply would not conflict with any local policies or ordinances protecting terrestrial biological resources. Most local ordinances focus on the removal of a biological resource, such as oak trees or other sensitive habitats, as part of a construction project. The proposed Plan amendments and possible responses would not result in the direct removal of or damage to sensitive habitats. Many general plans within the study area contain policies that call for the conservation of biological resources within the respective general plan areas. The proposed Plan amendments would not conflict with these policies because they would not result in a change in land use or zoning or result in the direct removal of biological resources. There would be no impact.

Impact TER-f: Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan

HCPs and NCCPs (or conservation plans) are plans adopted under the federal ESA and the California Natural Communities Conservation Plan Act that require conservation actions, such as the purchase or protection of specific habitat land, in connection with certain “covered actions,” such as approval and construction of residential development. Public agencies generally are the permittees under such plans. In exchange for the conservation actions, the permittees are given authority for their covered actions to “take” the special-status species listed in the conservation plans; the state and federal endangered species acts would otherwise bar any activity causing such take.

Table 7.6.1-4 lists the HCPs and NCCPs in the plan area. An activity could impede a conservation plan if it substantially reduces the effectiveness of the plan’s conservation strategies or otherwise prevent attainment of the plan’s goals and objectives. This could result from reducing the viability of populations that are targets of the plan’s goals, objectives, and conservation strategies. Other actions could impede implementing conservation plans and reduce the habitat value of conserved lands (e.g., by creating adjacent, incompatible land uses), interfere with the management of conserved lands (e.g., by eliminating access or water supplies), or eliminate opportunities for conservation activities (e.g., by developing land identified for preservation in the plan). Many such inconsistencies, however, would not lead to a formal conflict between the action and the plan because once the conservation plan is approved, both the state and federal endangered species acts protect the permittee from changes in circumstances: the permittee maintains its take authority and is not required to take further action, including the acquisition of land or water, not contemplated under the conservation plan, in order to respond to unforeseen circumstances.

The proposed Plan amendments would not create adjacent incompatible land uses, develop land, or otherwise result in actions incompatible with conservation plans or activities as the proposed Plan amendments do not require or result in those types of activities. However, the proposed Plan amendments could impede a conservation plan if they would impair a permittee's ability to undertake the required conservation actions.

If the required conservation actions under a conservation plan rely on Sacramento/Delta water supplies, reduced diversions required under the proposed Plan amendments could impair those actions. Some conservation plans direct the creation, maintenance, or enhancement of wetland habitat; some of these require or assume that the habitat includes water supplied by diversions that may rely on Sacramento/Delta supply. For example, the final Natomas Basin HCP includes rice cultivation and marsh management using water that the Natomas Central Mutual Water Company diverts from the Sacramento River. These diversions may be reduced during summer if required to provide flows under the proposed Plan amendments (City of Sacramento et al. 2003) The Natomas Basin HCP provides for the possibility of reduced diversions by identifying back-up water sources such as groundwater and acquisition of other users' tailwater. Where a conservation plan provides for alternative sources, reducing surface diversions would not impair the permittees' ability to meet the plan's requirements and would cause no conflict.

Other conservation plans that similarly rely on Sacramento/Delta water supplies, however, may not include such alternative sources. For example, the Butte Regional HCP, presently in draft, requires acquisition of land with water rights or of conservation easements on habitat or irrigated lands (Butte County Association of Governments 2015). Its conservation actions assume that sufficient water would be available to, for example, "[m]aintain] water in canals and ditches during the activity period (early spring through mid-fall) for the giant gartersnake, western pond turtle, and other native wildlife species" (Butte County Association of Governments 2015). The HCP characterizes frequent extended drought and the inability of a water district to continue service as "unforeseen circumstances" (Butte County Association of Governments 2015). It further provides for some responses to reduced water supply, although it includes that "it may not be feasible to replace the loss of giant gartersnake rice habitat with natural wetlands under drought conditions" (Butte County Association of Governments 2015). Such a failure to provide replacement habitat could contribute to the type of habitat loss discussed under Impact TER-a. As described previously, however, under the statutes authorizing the HCP, any failure to perform conservation actions because of unforeseen water-supply reductions would not violate the permittee's duties and would not cause a formal conflict with the HCP.

In the Sacramento/Delta, changes in tributary flows, Delta inflows, and Delta outflows would likely complement the actions identified in the conservation/habitat management plans that preserve and restore riverine and estuarine habitat and associated special-status species. For example, the primary conservation actions of the Solano Multispecies Habitat Conservation Plan include maintenance of water quality and natural hydrologic, geomorphic, and ecological processes supporting the conservation and recovery needs of the covered species (e.g., soft bird's beak, Suisun thistle, Mason's lilaeopsis, California black rail, California Ridgway's rail, saltmarsh harvest mouse) (^Solano County Water Agency 2012). The proposed Plan amendments, by promoting a more natural flow regime consistent with these needs, supports the Solano Multispecies Habitat Conservation Plan. Likewise, the proposed Plan amendments would support the objectives of the Suisun Marsh Habitat Management, Preservation, and Restoration Plan, which focuses on restoration of tidal wetlands, management, and function of managed wetlands (Reclamation et al. 2011). Changes in Delta inflow and Delta outflow, as proposed under the Plan amendments, would support the Suisun Marsh Habitat Management, Preservation, and Restoration Plan's steps to restore the ecological value of historical tidal wetland habitat and improve water quality issues. Changes in tributary flows also would benefit Delta eastside tributaries, such as the Cosumnes River and the conservation actions identified in the Cosumnes River Preserve Management Plan (Kleinschmidt Associates 2008). The preserve's conservation actions include maintaining natural hydrological processes that sustain habitat and native species, restoring riparian and floodplain communities, implementing flow releases and other measures to recharge local groundwater levels and enhance surface flows for salmon migration, and maintaining and restoring freshwater wetland habitats within an ecologically functional landscape (Kleinschmidt Associates 2008).

In general, conservation plans would provide for reduced diversions, either by providing for alternative water supplies or through the unforeseen circumstances provisions of the state. Therefore, reduced diversions likely would not conflict with these conservation plans, and the impact would be less than significant.

7.6.1.5 Mitigation Measures

MM-TER-a: Mitigate impacts on special-status species

1. **Minimize Impacts on Sutter and Yolo Bypass Agricultural Lands:** Implement Mitigation Measure MM-AG-a,e: 4 and Mitigation Measure MM-AG-a,e: 8 (see Section 7.4, *Agriculture and Forest Resources*) to reduce potential effects on Sutter and Yolo Bypass agricultural habitat from changes in hydrology.
2. **Habitat Protection and Restoration Actions:**
   i. **Habitat Restoration Actions:** The proposed Plan amendments include actions that other entities should take to restore habitat, including as part of EcoRestore and other efforts. Habitat restoration in the Sacramento/Delta and areas that receive Sacramento/Delta water supplies will reduce potential impacts on terrestrial species associated with reduced Sacramento/Delta water supplies to wildlife refuges and wildlife areas.

   ii. **Refuge Management Activities:** Managed wetlands provide habitat for numerous waterfowl and shorebirds and for several special-status wildlife species. Refuge managing agencies can and should continue to enhance and maintain habitat at wildlife refuges for special-status terrestrial species, including giant gartersnake, Swainson's hawk, greater sandhill crane, and tricolored blackbird.

   iii. **Prioritize Refuge Water Supplies:** The proposed Plan amendments include provisions that prioritize water supplies to refuges. Specific measures include potentially reducing fees and expediting processing for water transfers to refuges, funding mechanisms, and minor modifications to the strict rule of priority to ensure adequate water supplies to refuges, including full delivery of CVPIA Level 2 water supplies at the times needed to support refuges and to provide for delivery of CVPIA Level 4 supplies.

   iv. **Species Recovery Plans:** State and federal resource agencies and other appropriate entities should continue and expand management efforts for special-status aquatic and terrestrial species. State and federal resource agencies should continue to develop, refine, and implement species recovery plans to protect special-status terrestrial species, including giant gartersnake, Swainson's hawk, greater sandhill crane, tricolored blackbird, and California black rail.

v. **Funding:** The State Water Board will consult and coordinate with state and federal resource agencies and other appropriate entities to secure and distribute funding to support habitat restoration activities that would benefit terrestrial biological resources, including but not limited to, giant gartersnake, Swainson's hawk, greater sandhill crane, tricolored blackbird, California black rail, and other special-status terrestrial species.

3. **Voluntary Implementation Plans:** The proposed program of implementation promotes habitat restoration as a potential component in voluntary implementation plans that could amplify the ecological benefit of new and existing flows. Habitat restoration could reduce potential impacts on terrestrial species associated with reduced Sacramento/Delta water supplies to wildlife refuges and wildlife areas. Voluntary implementation plans also may reduce the volume of water that needs to be dedicated for instream purposes, resulting in less supply reductions to agricultural use and associated impacts on terrestrial species.

   i. Voluntary implementation plans are required to include measures to avoid or minimize impacts on terrestrial species of concern.

   ii. Voluntary implementation plans involving CVP contractors should include a plan to fully supply water to applicable Refuge Water Supply Program refuges.

4. **Special-Status Species Management Measures:** Agricultural water providers and users and land managers should develop and implement management actions (e.g., best management practices) to minimize, and where possible, avoid impacts on special-status species on or near agricultural lands.

   i. To protect giant gartersnake, agricultural water users and suppliers and land managers should develop and implement appropriate management measures such as the following.

      - Avoiding or minimizing crop idling or conversion of rice fields to other uses near areas likely to support giant gartersnake populations.
      - When fallowing rice fields, using an alternating "checkerboard" pattern to minimize impacts on giant gartersnakes (USFWS 2010).
      - Maintaining adequate water in major irrigation and drainage canals that can serve as movement corridors for giant gartersnake and other wildlife; and in smaller drains and conveyance infrastructure that can support giant gartersnake, maintaining habitat attributes such as emergent vegetation for escape cover and foraging habitat (USFWS 2010).
      - Incorporating measures into agricultural management plans that minimize impacts on giant gartersnake.

   ii. To protect Swainson's hawk, agricultural water users and suppliers and land managers should develop and implement appropriate management measures such as the following.

      - Incorporating measures into agricultural management plans that minimize impacts on Swainson's hawks.
      - Avoiding or minimizing crop idling or conversion of agricultural lands used by Swainson's hawk to other uses near areas likely to support Swainson's hawk populations.
      - Minimize the conversion of suitable crops for Swainson's hawk foraging (e.g., alfalfa) to unsuitable crops (e.g., vineyards).

iii. To protect greater sandhill crane, agricultural water users and suppliers and land managers should develop and implement appropriate management measures such as the following.

- Minimizing conversion of grasslands and cereal grain fields to other uses near areas likely to support greater sandhill cranes.
- Incorporating measures into agricultural management plans that minimize impacts on greater sandhill cranes.

iv. To protect tricolored blackbird, agricultural water users and suppliers and land managers should develop and implement appropriate management measures such as the following.

- Delaying harvesting fields that support or are located near tricolored blackbird breeding colonies until the end of the tricolored blackbird breeding season (CDFW 2015a; Meese et al. 2015).
- Avoiding intensive disturbances (e.g., heavy equipment operation associated with crop harvesting) near tricolored blackbird breeding colonies (CDFW 2015b).
- Developing and implementing long-term solutions to manage tricolored blackbird colonies located on or near agricultural lands.

v. To protect California black rails, agricultural water users and suppliers and land managers should take appropriate management measures such as the following.

- Minimizing disturbances to Sierra Nevada wetland vegetation associated with clearing, burning, or overgrazing (Richmond et al. 2010).
- Incorporating measures into agricultural management plans that minimize impacts on California black rails.

5. **Diversify Water Portfolios**: Water users can and should diversify their water supply portfolios to the extent possible, in an environmentally responsible manner and in accordance with the law, to mitigate potential impacts on terrestrial resources from reduced water supplies for agricultural uses. This includes sustainable conjunctive use of groundwater and surface water, water transfers, water conservation and efficiency upgrades, and increased use of recycled water.
6. **Regulation of Waste Discharges to Streams**: Implement Mitigation Measure MM-SW-a,f: 1 (see Section 7.12.1, *Surface Water*) to reduce potential effects on streamflow and water quality from changes in municipal supply, water recycling, and indoor water conservation that affect WWTP effluent discharge.
7. **Support and Approval of Water Recycling:** The State Water Board will continue efforts to encourage and promote water recycling projects, including projects that involve use of recycled water for groundwater recharge, through expediting permit processes and funding efforts. When processing wastewater change petitions pursuant to Water Code section 1211, the State Water Board will ensure that the change in wastewater discharge does not diminish ecological benefits of instream flows, especially in dry seasons and in low-flow conditions where the stream is dependent on wastewater discharges.
8. **Support and Approval of Groundwater Storage and Recovery:** The State Water Board will continue efforts to encourage and promote environmentally sound recharge projects that use surplus surface water, including prioritizing the processing of temporary and long-term water right permits for projects that enhance the ability of a local or state agency to capture high

runoff events for local storage or recharge (Governor's Exec. Order No. B-39-17 [April 6, 2017]). In processing water right applications that involve groundwater storage, the State Water Board will consider the need to preserve ecological functions of high-flow events and other relevant factors in accordance with the Water Code to ensure that enough flow remains instream to protect ecological benefits, including for terrestrial species and wetland and riparian habitat.

9. **Oversight and Approval of Water Transfers:**
   i. When processing petitions for transfers based on cropland idling, specifically crop types that are important to giant gartersnake, Swainson's hawk, greater sandhill crane, and tricolored blackbird, the State Water Board will ensure that the transfer would not result in diminished habitat for these special-status terrestrial species.
   ii. When processing transfers based on cropland idling, specifically crop types that are important to giant gartersnake, Swainson's hawk, greater sandhill crane, and tricolored blackbird, DWR, Reclamation, and other agencies involved in approving transfers should require transferors to show that the transfer would not result in diminished habitat for these special-status terrestrial species.

MM-TER-b,c: Mitigate impacts on riparian habitats or other sensitive natural communities, including wetlands

1. **Reservoir Management:** Implement Mitigation Measure MM-AQUA-a,d: 1 (Section 7.6.2, *Aquatic Biological Resources*) to reduce impacts of changes in reservoir levels and related impacts on terrestrial biological resources. Specifically, the long-term strategy and annual operation plans for Sacramento/Delta reservoirs (MM-AQUA-a,d: 1.i) will consider impacts on riparian and wetland habitat and any associated special-status species, and will include measures to avoid or minimize impacts on riparian habitat and wetlands and any associated special-status species to the extent possible. In addition, all reservoir owners and operators are subject to existing regulatory requirements that protect water quality in reservoirs and streams below reservoirs, including export reservoirs (MM-AQUA-a,d: 1.ii). In exercising its regulatory authorities, the State Water Board will consider terrestrial biological resources and ensure that any impacts on riparian habitat and wetlands and associated special-status species are avoided or minimized.
2. **Reduce Impacts on Groundwater-Dependent Ecosystems:** Implementation of Mitigation Measures MM-GW-b: 1 through 7 will reduce impacts of lowered groundwater levels on riparian habitat and sensitive natural communities, including wetlands.
3. **Agricultural Drainage Control:** Implementation of Mitigation Measure MM-SW-a,f: 7 will reduce impacts associated with poor-quality agricultural discharges on riparian habitat and sensitive natural communities, including wetlands.
4. Implement the following Mitigation Measure MM-TER-a elements to mitigate impacts of other water management actions on riparian habitats or other sensitive natural communities, including wetlands.
   - Habitat Protection and Restoration Actions (MM-TER-a: 2)
   - Regulation of Waste Discharges to Streams (MM-TER-a: 6)
   - Support and Approval of Water Recycling (MM-TER-a: 7)
   - Support and Approval of Groundwater Storage and Recovery (MM-TER-a: 8)

  - Oversight and Approval of Water Transfers (MM-TER-a: 9)

MM-TER-d: Mitigate impacts on wildlife movement or wildlife nurseries

Implement Mitigation Measure MM-TER-a and Mitigation Measure MM-TER-b,c elements to mitigate impacts on the movement of native resident or migratory fish or wildlife species, migratory wildlife corridors, and native wildlife nursery sites.

- Habitat Protection and Restoration Actions (MM-TER-a: 2)
- Voluntary Implementation Plans (MM-TER-a: 3)
- Oversight and Approval of Water Transfers (MM-TER-a: 9)
- Reduce Impacts on Groundwater-Dependent Ecosystems (MM-TER-b,c: 2)

7.6.1.6 References Cited

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