Chapter 6
Biological Resources – Botanical and Wetlands

This chapter describes the affected environment for botanical and jurisdictional wetland resources, as well as potential environmental consequences and associated mitigation measures, as they pertain to implementing the alternatives. The discussion focuses on the primary study area (area of project features, Temperance Flat Reservoir Area, and Millerton Lake downstream from RM 274). It also discusses the extended study area (San Joaquin River from Friant Dam to the Merced River, the San Joaquin River from the Merced River to the Delta, the Delta, and the CVP and SWP water service areas).

Affected Environment

Biological resources addressed in this section include terrestrial plant communities, special-status plants, designated critical habitat, special-status natural communities, and wetlands and other waters of the United States. Information in this section is based on descriptions of biological resource conditions documented during biological resources studies conducted in 2007, 2008, and 2010, as discussed below, and additional documents describing historical and potential conditions for biological resources in the primary and extended study areas. The following documents were reviewed in support of preparing this section:

- *Riparian Vegetation of the San Joaquin River* (DWR 2002)
- *San Joaquin River Restoration Study Background Report* (McBain & Trush 2002)
- *Temperance Flat Reservoir Alternatives Botanical Resources Baseline Report* (Reclamation 2007)
- *Preliminary Delineation of Waters of the United States, Including Wetlands, for the Temperance Flat Reservoir* (Reclamation 2008)

- *Final Environmental Assessment/Initial Study: Water Year 2010 Interim Flows Project*. San Joaquin River Restoration Program (Reclamation 2009)
- *Mapping Standard and Land Use Categories for the Central Valley Riparian Mapping Project* (DWR 2009)
- *Supplemental Preliminary Delineation of Waters of the United States, Including Wetlands, for the Temperance Flat Reservoir Alternatives* (Reclamation 2010)
- SJRRP PEIS/R (SJRRP 2012)

With the exception of the database searches, all the sources cited in the Affected Environment section of this chapter regarding the extended study area are sources cited in the SJRRP PEIS/R (SJRRP 2012).

Vegetation Communities

For purposes of this analysis, vegetation community nomenclature follows the Holland (1986) classification system. Some modifications were made to account for local variability and communities that are not specifically described in Holland, such as willow scrub and bush lupine scrub. California Wildlife Habitat Relationships (CWHR) nomenclature (Airola 1988, Mayer and Laudenslayer 1988) was used for unvegetated cover types, such as lacustrine and riverine areas that could not be classified using Holland's terrestrial natural community types. A crosswalk analysis between the Holland vegetation community types, CWHR classification types, *A Manual of California Vegetation Second Edition* (Sawyer et al. 2009), and the plant community types for the action alternatives is provided in Table 6-1.

Sensitive habitats include those that are of special concern to resource agencies or are afforded specific consideration through CEQA, Section 1602 of the California Fish and Game Code, Section 404 of the CWA, and the State's Porter-Cologne Water Quality Control Act (Porter-Cologne Act), as discussed in Chapter 28, "Other NEPA and CEQA Considerations." Sensitive habitats may be of special concern to these agencies and conservation organizations for a variety of reasons, including their locally or regionally declining status or because they provide important habitat to common and special- status species. Many of the vegetation communities and unvegetated habitat types in the primary and extended study areas qualify as waters of the United States subject to USACE jurisdiction under

Section 404 of the CWA and/or as waters of the State. In addition, riparian communities are generally subject to regulation under Section 1602 of the California Fish and Game Code. Vegetation communities that may be subject to regulation under Section 404 of the CWA or Section 1602 of the California Fish and Game Code are so noted in the community descriptions below.

The CDFW maintains a list of terrestrial natural communities that are native to California. Within that list, CDFW identifies "special-status natural communities" (also known as sensitive natural communities), which it defines as "communities that are of limited distribution statewide or within a county or region and often vulnerable to environmental effects of projects" (CNDDB 2013a). These communities may not contain special-status species or their habitat. Special-status natural communities are tracked in the California Natural Diversity Database (CNDDB), a statewide inventory of the locations and conditions of the State's rarest plant and animal taxa and vegetation types; however, no new special-status natural community data have been added to the CNDDB since 1990 when funding was cut for this portion of the program. Several vegetation communities that occur within the primary and extended study areas are designated as special-status natural communities, as noted in the community descriptions below.

The following discussion describes the vegetation communities present in the primary study area, and in the San Joaquin River portion of the extended study area from Friant Dam downstream to the confluence with the Merced River (San Joaquin River Reaches 1–5). Greater detail is provided for these portions of the Study Area because the project would have more varied and substantially greater potential impacts on botanical and wetland resources within these areas than along the San Joaquin River from the Merced River downstream to the Delta, within the Delta, or within CVP and SWP water service areas. The extent to which the communities are present in the primary study area and the San Joaquin River between Friant Dam and Merced River portion of the extended study area is identified in Table 6-2. Their locations and extents in the primary study area are shown in Figure 6-1.

Table 6-1. Crosswalk for Different Vegetation Community Nomenclatures Used in the Upper San Joaquin River Basin Storage Investigation

A Manual of California Vegetation Nomenclature (Sawyer et al. 2009)	Global and State Rank	Wildlife Habitat Relationships Nomenclature (Airola 1988, Mayer and Laudenslayer 1988)	Holland (1986) Nomenclature	Upper San Joaquin River Basin Storage Investigation Nomenclature
Woodland Communities				
Quercus douglasii Alliance	G4 S4	Blue Oak Woodland	Blue Oak Woodland	Blue Oak Woodland
Quercus wislizeni-Quercus douglasii- Pinus sabiniana Association	G4 S4	Blue Oak Woodland	Interior Live Oak Woodland	Live Oak Woodland
Pinus sabiniana-grass Association	G4 S4	Blue Oak-Foothill Pine	Open Digger Pine Woodland	Foothill Pine Woodland
Pinus sabiniana-Quercus wislizeni/Ceanothus cuneatus Association	G4 S4	Blue Oak-Foothill Pine	Digger Pine-Oak Woodland	Foothill Pine Oak Woodland
Pinus sabiniana/Ceanothus cuneatus-Heteromeles arbutifolia Alliance *Pinus sabiniana/Ceanothus cuneatus-Rhamnus ilicifolia* Association *Pinus sabiniana-Quercus wislizeni/Ceanothus cuneatus* Association	G4 S4	Blue Oak-Foothill Pine	Nonserpentine Digger Pine-Chaparral Woodland	Foothill Pine Chaparral Woodland
Riparian Communities				
Alnus rhombifolia-Fraxinus latifolia Association	G4 S4	Valley-Foothill Riparian	White Alder Riparian Forest	White Alder Riparian
		Valley-Foothill Riparian	Great Valley Willow Scrub	Fig-Willow Riparian
		Valley-Foothill Riparian	—	Fig Riparian
Platanus racemosa Woodland Alliance	G3 S3	Valley-Foothill Riparian	Great Valley Mixed Riparian Forest	Sycamore Riparian Woodland
Populus fremontii-Acer negundo-Rubus armeniacus Association *Populus fremontii*-Salix Association	G2 S2	Valley-Foothill Riparian	—	Mixed Riparian
Populus fremontii Alliance	G2 S2	Valley-Foothill Riparian	Great Valley Cottonwood Riparian Forest	Cottonwood Riparian Forest
Quercus lobata Alliance	G3 S3	Valley-Foothill Riparian	Great Valley Valley Oak Riparian Forest	Valley Oak Riparian
Salix laevigata-Salix lasiolepis Association	G3 S3	Valley-Foothill Riparian	Great Valley Mixed Riparian Forest	Willow Riparian Forest
Salix exigua Shrubland Alliance	G5 S4	Valley-Foothill Riparian	Great Valley Willow Scrub	Willow Scrub
Salix laevigata/Salix lasiolepis/Artemisia douglasiana Association *Rubus armeniacus* Semi-Natural Stands	G3 S3 —	Valley-Foothill Riparian	Great Valley Willow Scrub	Riparian Scrub

Table 6-1. Crosswalk for Different Vegetation Community Nomenclatures Used in the Upper San Joaquin River Basin Storage Investigation (contd.)

A Manual of California Vegetation Nomenclature (Sawyer et al. 2009)	Global and State Rank	Wildlife Habitat Relationships Nomenclature (Airola 1988, Mayer and Laudenslayer 1988)	Holland (1986) Nomenclature	Upper San Joaquin River Basin Storage Investigation Nomenclature
Riparian Communities (contd.)				
Cephalanthus occidentalis Association	G5 S2	Valley-Foothill Riparian	Buttonbush Scrub	Buttonbush Scrub
Broom Semi-Natural Shrubland Alliance	—	—	Broom Scrub	Spanish Broom Scrub
Sambucus nigra Association	G3 S3	—	Elderberry Savanna	Elderberry Savanna
Arundo donax Semi-Natural Herbaceous Stands	—	Fresh Emergent Wetland	Giant Reed	Giant Reed
Upland Shrub Communities				
Ceanothus cuneatus Shrubland Alliance	G4 S4	Mixed Chaparral	Buckbrush Chaparral	Buckbrush Chaparral
Lupinus albifrons Association	G4 S4	Mixed Chaparral	Northern Mixed Chaparral	Bush Lupine Scrub
Herbaceous Upland Communities				
Avena Semi-Natural Herbaceous Stands *Bromus-Brachypodium distachyon* Semi-Natural Herbaceous Stands	—	Annual Grassland	Nonnative Grassland	Annual Grassland
Herbaceous Wetland Communities				
Eleocharis macrostachya Herbaceous Alliance	G4 S4	Freshwater Emergent Wetland	Freshwater Seep	Freshwater Seep
Carex barbarae Herbaceous Alliance *Mimulus* (*guttatus*) Herbaceous Alliance	G2 S2 G4 S3	Wet Meadow	Coastal and Valley Freshwater Marsh	Seasonal Wetland
Typha Herbaceous Alliance *Schoenoplectus acutus* Herbaceous Alliance	G5 S5 G5 S4	Freshwater Emergent Wetland	Coastal and Valley Freshwater Marsh	Emergent Wetland
Allenrolfea occidentalis Shrubland Alliance	G4 S3	Alkali Desert Scrub	Valley Sink Scrub	Alkali Sink
Lasthenia fremontii–Downingia Herbaceous Alliance *Lasthenia fremontii–Distichlis spicata* Herbaceous Alliance	G3 S3 G4 S3	—	Northern Hardpan Vernal Pool Northern Claypan Vernal Pool	Vernal Pool
Aquatic Communities				
—	—	Riverine	River	Riverine Other Waters
—	—	Lacustrine	—	Lacustrine Unconsolidated Bottom
—	—	—	—	Lacustrine Unconsolidated Shoreline

Table 6-1. Crosswalk for Different Vegetation Community Nomenclatures Used in the Upper San Joaquin River Basin Storage Investigation (contd.)

A Manual of California Vegetation Nomenclature (Sawyer et al. 2009)	Global and State Rank	Wildlife Habitat Relationships Nomenclature (Airola 1988, Mayer and Laudenslayer 1988)	Holland (1986) Nomenclature	Upper San Joaquin River Basin Storage Investigation Nomenclature
Other Habitats				
—	—	Cropland	—	Agriculture
—	—	Barren	—	Barren
—	—	—	—	Developed
—	—	Urban	—	Developed Nonnative Tree

Notes:

[1] Global and State Rank Definitions:

The global rank (G-rank) is a reflection of the overall status of an element throughout its global range.

G2: Imperiled—At high risk of extinction because of extreme rarity, very few occurrences (20 or fewer), steep declines, or other factors.

G3: Vulnerable—At moderate risk of extinction because of restricted range, relatively few occurrences (80 or fewer), recent and widespread declines, or other factors.

G4: Apparently Secure—Uncommon but not rare; some cause for long-term concern because of declines or other factors.

G5: Secure—Common; widespread, and abundant.

The state rank (S-rank) is assigned in much the same way as the global rank, but it refers to the imperilment status within California's state boundaries.

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

S3: Vulnerable—Vulnerable in the state because of restricted range, relatively few occurrences (fewer than 80), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4: Apparently Secure—Uncommon but not rare in the state; some cause for long-term concern because of declines or other factors.

S5: Secure—Common; widespread, and abundant in the state.

Table 6-2. Vegetation Communities in the Primary Study Area and San Joaquin River between Friant Dam and Merced River Portion of the Extended Study Area

Vegetation Community/Habitat	Primary Study Area		Extended Study Area – San Joaquin River Between Friant Dam and Merced River	
	Area[1] (acres)	Percent of Primary Study Area	Area[1] (acres)	Percent of Extended Study Area
Woodland Communities				
Foothill Pine Oak Woodland	5,029	42	0	0
Blue Oak Woodland	1,388	11	0	0
Live Oak Woodland	57	<1	0	0
Foothill Pine Woodland	9	<1	0	0
Foothill Pine Chaparral Woodland	5	<1	0	0
Upland Shrub Communities				
Buckbrush Chaparral	25	<1	0	0
Bush Lupine Scrub	9	<1	0	0
Herbaceous Communities				
Annual Grassland	317	2	0	0
Grassland and Pasture	0	0	8,971	41
Riparian Communities				
Cottonwood Riparian Forest	0	0	922	4
Willow Riparian Forest	4	<1	2,028	9
White Alder Riparian	25	<1	0	0
Mixed Riparian Forest	12	<1	660	3
Valley Oak Riparian Forest	0	0	391	2
Sycamore Riparian Woodland	<1	<1	0	0
Willow Scrub	0	0	1,087	5
Riparian Scrub	0	0	561	3
Elderberry Savanna	0	0	68	<1
Buttonbush Scrub	<1	<1	0	0
Fig Riparian/Fig-Willow Riparian[2]	3	<1	0	0
Spanish Broom Scrub	<1	<1	0	0
Giant Reed	0	0	13	<1

Table 6-2. Vegetation Communities in the Primary Study Area and San Joaquin River between Friant Dam and Merced River Portion of the Extended Study Area (contd.)

Vegetation Community/Habitat	Primary Study Area		Extended Study Area – San Joaquin River Between Friant Dam and Merced River	
	Area[1] (acres)	Percent of Primary Study Area	Area[1] (acres)	Percent of Extended Study Area
Herbaceous Wetland Communities				
Emergent Wetlands	0	0	1,056	5
Seasonal Wetlands[3]	268	2	0	0
Vernal Pool[4]	6	<1	0	0
Alkali Sink	0	0	2	<1
Freshwater Seep	1	<1	0	0
Aquatic Communities				
Lacustrine[5]	4,607	42	0	0
Riverine[6]	200	2	3,233	15
Riverwash	0	0	347	2
Other Waters[7]	25	<1	0	0
Other Habitats				
Nonnative Tree	0	0	81	<1
Agriculture	0	0	735	3
Disturbed Areas	0	0	455	2
Developed Areas	6	<1	1	<1
Barren Areas	31	<1	0	0
No Data[8]	0	0	1,052	5
Total	**12,030**	**100**	**21,663**	**100**

Sources: Reclamation 2007; DWR 2002, 2011

Notes:

[1] Acres rounded to the nearest whole number except where less than 0.5, which is shown as <1.

[2] Fig Riparian and Fig-Willow Riparian habitat types were mapped separately at the time of the field survey. However, because of similarities in habitat, these two habitat types were grouped for this analysis.

[3] Seasonal wetland acreage reported in this table also includes 1.4 acres of swale habitat.

[4] Vernal pools are present within the transmission line corridor in the southwestern portion of the primary study area. Potential wetted acreage reported here is overestimated because detailed analysis for this area is scheduled after release of this report.

[5] Lacustrine habitat reported above consists of Lacustrine Unconsolidated Bottom and Lacustrine Unconsolidated Shoreline.

[6] The data set for the extended study area uses the term "open water"; however, this corresponds to the open water section of the San Joaquin River.

[7] Other waters within the primary study area consist of ephemeral, intermittent, and perennial streams and instream pools and ponds.

[8] No data exist for portions of the extended study area that were not assigned a vegetation community classification by DWR (2002).

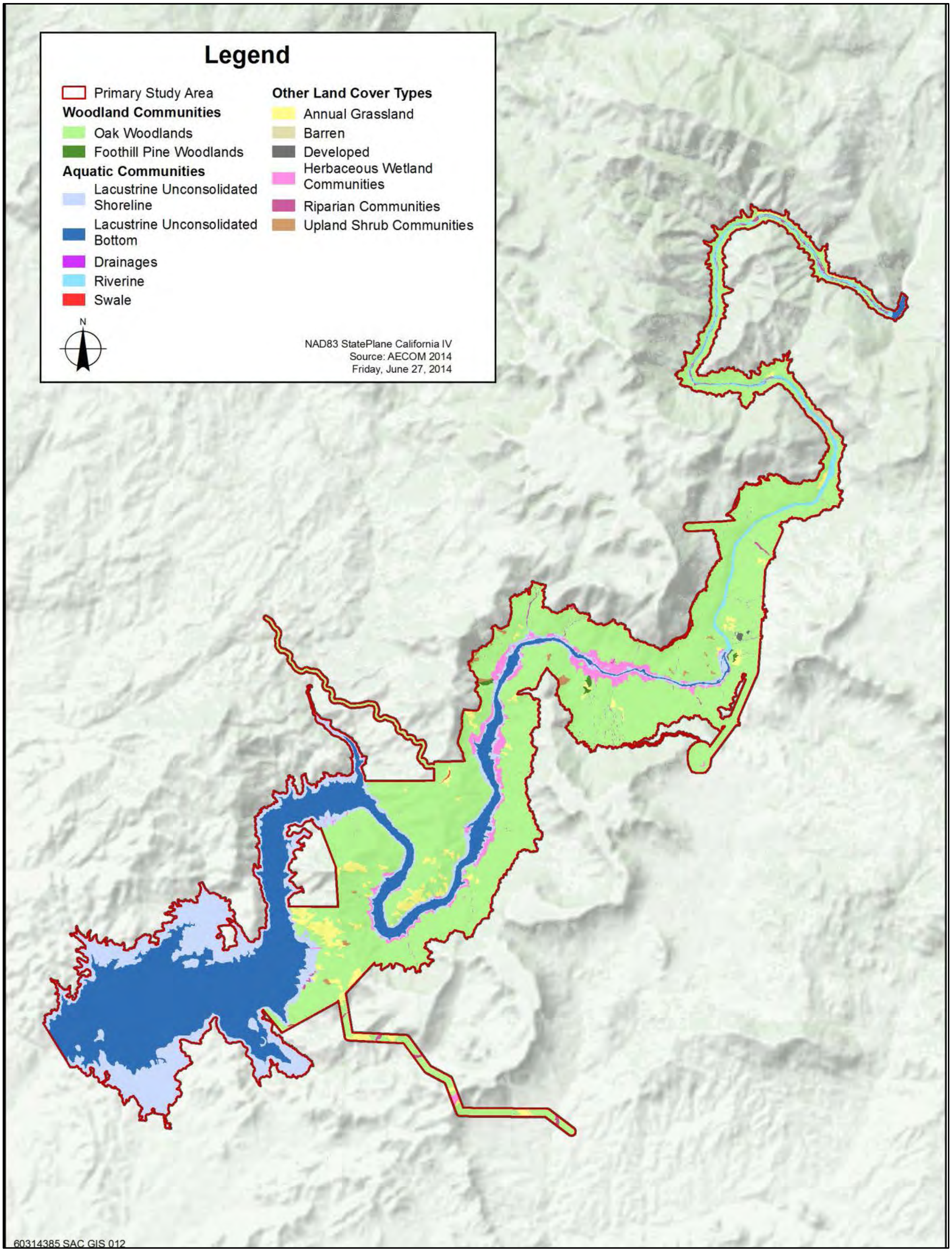


Figure 6-1. Vegetation Communities in the Primary Study Area

The following discussion presents a more detailed breakdown of vegetation community acreages in the areas that make up the primary study area and the San Joaquin River Reaches 1–5 portion of the extended study area. Greater detail is provided for these portions of the Study Area than for those portions of the extended study area beyond the San Joaquin River confluence with the Merced River because the project would have more varied and substantially greater potential impacts on botanical and wetland resources in Reaches 1–5. Plant species nomenclature used in this report follows *The Jepson Manual: Vascular Plants of California* (Baldwin et al. 2012).

Woodland Communities

Foothill Pine Oak Woodland Foothill pine (*Pinus sabiniana*) is codominant with blue oak (*Quercus douglasii*) and/or interior live oak (*Quercus wislizeni*) in this community and comprises 15 to 50 percent of the relative tree canopy cover. In some areas, interior live oak is more prevalent than blue oak and is codominant with foothill pine, particularly in shady ravines and on north-facing slopes. There are three overstory layers in this community: a shrub layer, an intermediate oak tree layer, and a taller foothill pine tree layer. Associated shrubs include California buckeye (*Aesculus californica*), poison-oak (*Toxicodendron diversilobum*), buckbrush (*Ceanothus cuneatus*), redbud (*Cercis occidentalis*), whiteleaf manzanita (*Arctostaphylos viscida*), and hollyleaf redberry (*Rhamnus ilicifolia*). California laurel (*Umbellularia californica*) is often present in this community at higher elevations.

The herbaceous layer is characterized primarily by annual grasses and forbs, with nonnative species making up most of the herbaceous cover. Characteristic species found in the herbaceous layer include fiesta flower (*Pholistoma auritum*), small baby blue eyes (*Nemophila heterophylla*), miner's lettuce (*Claytonia perfoliata*), and common chickweed (*Stellaria media*). Other common nonnative forbs include filarees (*Erodium botrys, E. cicutarium*), foothill clover (*Trifolium ciliolatum*), tocalote (*Centaurea melitensis*), dovefoot geranium (*Geranium molle*), and hedge parsley (*Torilis arvensis*). Common grasses include ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), wild oats (*Avena barbata, A. fatua*), and rattail fescue (*Festuca myuros*).

Snags with cavities are typically present, and downed pine trees in varying stages of decay are an important component of the understory. Tree canopy cover is relatively dense in the foothill pine oak woodland community. Structural diversity is high in this community because of the presence of three overstory layers, the variety of tree and shrub sizes and shapes, varying shrub distribution patterns from dense thickets to more scattered distribution, and downed woody debris and snags.

Blue Oak Woodland Blue oak makes up 85 to 100 percent of the tree canopy cover of this community. Foothill pine and interior live oak may also be present, but provide less than 15 percent of the relative tree cover. Annual grasses and forbs typically characterize the understory, but a sparse shrub layer may also be present. Associated herb species are the same as described for the foothill pine oak woodland community.

Buckbrush is the most common shrub associate. The tree canopy tends to be more open in this community than in the foothill pine oak woodland community. Snags with cavities are also typically present, although they occur less frequently in this community type than in the foothill pine oak woodland community. Structural diversity is much lower in blue oak woodland than in foothill pine oak woodland because this vegetation community tends to be primarily a two-layer community of oak trees and annual grassland with few shrubs and emergent pines and because downed trees are much less common.

Live Oak Woodland Interior live oak makes up 85 to 100 percent of the tree canopy in this vegetation community. Scattered blue oak and foothill pine trees may be present but represent less than 15 percent of the relative tree cover. A shrub layer is also typically present, and shrub species likely to be found in this community are similar to those found in the blue oak woodland community. This community is generally restricted to steep and rocky, north-facing slopes. Nonnative annual grasses typify the understory.

Foothill Pine Woodland Foothill pine is the sole dominant in the tree canopy of this vegetation community, making up 85 to 100 percent of tree cover. These communities are open, savanna-like woodlands that are generally lacking shrub layers and have only scattered oak trees. Annual grasses and forbs typical of the woodland and annual grassland communities characterize the understory. Snags may also be present.

Foothill Pine Chaparral Woodland In this vegetation community, foothill pine makes up 50 percent or more of the tree canopy, and the understory is characterized by dense cover of evergreen sclerophyllous (hard-leaved) shrubs or small trees, such as whiteleaf manzanita, toyon (*Heteromeles arbutifolia*), buckbrush, interior live oak, and hollyleaf redberry. A shrub layer and a tall foothill pine layer are characteristic in this vegetation community, but an intermediate oak tree layer is generally lacking. Oaks are typically reduced to shrubs or small trees because of the harsh growing conditions. This community is restricted to extremely dry, shallow soils.

Upland Shrub Communities

Buckbrush Chaparral This vegetation community is typically characterized by near monocultures of buckbrush, but in some cases, chaparral whitethorn (*Ceanothus leucodermis*) is also a major component. Other scattered broad-leaved sclerophyllous shrubs such as toyon and interior live oak may also be present. Shrub cover is typically dense, and the herbaceous understory is sparse. Widely scattered trees may be present but make up less than 10 percent of the total vegetative cover.

Bush Lupine Scrub Silver bush lupine (*Lupinus albifrons*) is the dominant shrub, and generally the only shrub in this community, comprising at least 10 percent of the relative cover in this community type. The understory is composed of species characteristic of the annual grassland vegetation community described below.

Herbaceous Communities

Annual Grassland This vegetation community is characterized by a dense cover of annual grasses and annual and perennial forbs, mostly nonnatives, and contains less than 10 percent cover of trees or shrubs. Grass species observed include ripgut brome, soft chess, wild oats, and rattail fescue. Common nonnative forbs include filarees, foothill clover, tocalote, dovefoot geranium, and hedge parsley. Native forbs commonly observed in annual grassland include rusty popcornflower (*Plagiobothrys nothofulvus*), miniature lupine (*Lupinus bicolor*), common fiddleneck (*Amsinckia intermedia*), elegant brodiaea (*Brodiaea elegans*), and foothill poppy (*Eschscholzia caespitosa*).

Grassland and Pasture Grassland and pasture is a forb- and grass-dominated vegetation community. Generally, sites with grassland or pasture are well drained and flood only occasionally under typical hydrologic conditions. The grassland and pasture vegetation community is composed of an assemblage of nonnative annual and perennial grasses and occasional nonnative and native forbs. The most abundant species are nonnative grasses (ripgut brome, rattail fescue, and foxtail barley [*Hordeum murinum* ssp. *leporinum*]) and forbs (red-stemmed filaree [*Erodium cicutarium*] and horseweed [*Conyza canadensis*]).

Riparian Communities

Riparian communities contain at least one dominant tree or shrub species that is typically associated with streams, such as willow (*Salix* spp.), cottonwood (*Populus* spp.), or alder (*Alnus* spp.). Riparian communities include cottonwood riparian forest, willow riparian forest, white alder riparian forest, mixed riparian forest, valley oak riparian forest, sycamore riparian woodland, willow scrub, riparian scrub, elderberry savanna, buttonbush scrub, fig riparian, fig/willow riparian, and Spanish broom scrub.

Cottonwood Riparian Forest Cottonwood riparian forest is a multilayered riparian forest. It is found on the active low floodplain of the San Joaquin River. Older and decadent stands of cottonwood riparian forest also exist in areas that were formerly active floodplains, but are now on terraces above the ordinary high-water mark (OHWM) because of the reduction in the high-flow regime following completion of Friant Dam and its associated diversion canals. Common dominant trees in the overstory include Fremont cottonwood (*Populus fremontii*) and Goodding’s black willow (*Salix gooddingii*). California wild grape (*Vitis californica*) is a conspicuous vine found growing within the canopy of this forest. The midstory is often dominated by shade-tolerant shrubs and trees, such as Oregon ash (*Fraxinus latifolia*) or California box elder (*Acer negundo* ssp. *californica*). Other shrubby species of willow may also be present within the midstory. The understory typically is dominated by native grasses and forbs, such as creeping wild rye (*Elymus triticoides*), stinging nettle (*Urtica dioica*), and Santa Barbara sedge (*Carex barbarae*). This vegetation community is designated as a special-status natural community by CDFW.

Willow Riparian Forest Willow riparian forest is dominated by willows, frequently almost exclusively by Goodding’s black willow. Red willow (*Salix laevigata*) and arroyo willow (*Salix lasiolepis*) are also common. Occasional scattered cottonwoods, ashes, or white alders (*Alnus rhombifolia*) may be present but are never an important part of the canopy cover. Cover is typically dense. California buttonbush (*Cephalanthus occidentalis* var. *californicus*) is often present and may even dominate the riverbank for stretches. This vegetation community is designated as a special-status natural community by CDFW.

White Alder Riparian White alder riparian is found primarily in the upper reaches of the San Joaquin River. It occurs as a narrow, discontinuous band of 10- to 20-foot-tall white alder trees. Associated species include Oregon ash in the tree layer and narrow-leaved willow (*Salix exigua*), arroyo willow, dusky willow (*Salix melanopsis*), and California buttonbush in the shrub layer.

Mixed Riparian Forest Mixed riparian forest is a multilayered forest generally found on intermediate terraces within the floodplains of perennial streams, such as the San Joaquin River. Species dominance in mixed riparian forest depends on site conditions, such as availability of groundwater and frequency of flooding. Typical dominant trees in the overstory and midstory include Fremont cottonwood, California box elder, Goodding's black willow, Oregon ash, and western sycamore (*Platanus racemosa*). The understory of mixed riparian forest is similar to that of cottonwood riparian forest. This vegetation community is designated as a special-status natural community by CDFW.

Valley Oak Riparian Forest Valley oak riparian forest is characterized by an open to closed canopy of valley oaks. This forest type is found on the higher elevations of the floodplain and is therefore exposed to less flood-related disturbance than other riparian vegetation communities. Valley oak (*Quercus lobata*) is the dominant tree in this vegetation type; western sycamore, Oregon ash, and Fremont cottonwood are present in small numbers. Common understory species in this vegetation type include creeping wild rye, California wild rose (*Rosa californica*), California wild grape, California blackberry (*Rubus ursinus*), and the nonnative Himalayan blackberry (*Rubus armeniacus*). This vegetation community is designated as a special-status natural community by CDFW.

Sycamore Riparian Woodland Sycamore riparian woodland is dominated by western sycamore. Associated species in the sycamore woodland include Oregon ash, spicebush (*Calycanthus occidentalis*), and white alder. This vegetation community is designated as a special-status natural community by CDFW.

Willow Scrub Willow scrub is characterized by a dense assemblage of willow shrubs and is often found within the active floodplain of the river. Sites with willow scrub are subject to more frequent scouring flows than sites supporting riparian forests. Willow scrub often occupies stable sand and gravel point bars immediately above the active channel. Dominant shrubs in willow scrub include narrow-leafed willow, arroyo willow, and red willow. Occasional emergent Fremont cottonwood may also be present in willow scrub.

Riparian Scrub Areas characterized as riparian scrub support woody shrubs and herbaceous species and are dominated by different species depending on river reach. Some areas are dominated by mugwort (*Artemisia douglasiana*), stinging nettle, and various tall weedy herbs; others are dominated either by blackberry (usually the introduced Himalayan blackberry) or by wild rose in dense thickets, with or without scattered small emergent willows. Riparian scrub may be maintained by periodic disturbance, such as flood control clearing of woody vegetation. The riparian scrub vegetation community dominated by willow and mugwort is designated as a special-status natural community by CDFW.

Elderberry Savanna Elderberry savanna is a shrub-dominated vegetation community characterized by widely spaced blue elderberry shrubs (*Sambucus nigra* ssp. *caerulea*) with a herbaceous understory typically dominated by nonnative grasses and forbs that are characteristic of the annual grassland vegetation community. Elderberry savanna is found on fine-textured, rich alluvium outside active channels but in areas that are subject to periodic flooding (Holland 1986). This vegetation community is designated as a special-status natural community by CDFW. Elderberry shrubs also provide suitable habitat for the valley elderberry longhorn beetle, a species Federally listed as threatened, although it has been proposed for delisting (see Chapter 7, "Biological Resources – Wildlife").

Buttonbush Scrub The buttonbush scrub community is characterized by a riparian shrub layer dominated by California buttonbush. Other riparian shrubs, such as Himalayan blackberry and spicebush, may also be present in this community. This vegetation community is designated as a special-status natural community by CDFW.

Fig Riparian/Fig-Willow Riparian Some intermittent and perennial drainages have heavy infestations of edible fig (*Ficus* *carica*), which have displaced the natural riparian vegetation. These stands were mapped as fig riparian (pure fig stands) or fig-willow riparian (figs mixed with willow species).

Spanish Broom Scrub Riparian scrub areas infested by Spanish broom (*Spartium junceum*) and Scotch broom (*Cytisus scoparius*) were mapped as Spanish broom scrub. Spanish and Scotch broom are invasive species that displace native species and tend to form dense single-species stands. These species are native to the Mediterranean region of Europe and were introduced to California as ornamental species. They are common in disturbed places, such as riverbanks and road cuts, but can colonize undisturbed grasslands, shrublands, and open canopy woodlands.

Giant Reed This vegetation community is characterized by dense stands of the invasive grass species giant reed (*Arundo donax*). These stands are up to 13 feet tall and consist solely of giant reed with no other plant species present. This vegetation community represents an infestation of an invasive species.

Herbaceous Wetland Communities

Emergent Wetlands Emergent wetlands within the extended study area typically occur in the river bottom immediately adjacent to the low-flow channel. Sites such as backwaters and sloughs where water is present through much of the year support emergent marsh vegetation, including common tule (*Schoenoplectus acutus* var. *occidentalis*) and cattails (*Typha* spp.). Wetlands that are more ephemeral, especially those occurring along the margins of the river and in swales adjacent to the river, support an array of native and nonnative herbaceous species, including western goldenrod (*Euthamia occidentalis*), smartweed (*Persicaria* spp.), Mexican rush (*Juncus mexicanus*), horseweed, willow herb (*Epilobium* spp.), saltgrass (*Distichlis spicata*), sunflower (*Helianthus* spp.), and nonnative curly dock (*Rumex crispus*). Emergent wetlands are considered sensitive habitats because they may be regulated under Section 404 of the CWA or under the Porter-Cologne Act.

Seasonal Wetlands Vegetation communities at Millerton Lake below the OHWM, as defined by USACE, were mapped as one of three cover types: lacustrine unconsolidated bottom, lacustrine unconsolidated shoreline, or seasonal wetland. The lacustrine vegetation communities are described under the Aquatic Communities section, below. Seasonal wetlands are considered sensitive habitats because they may be regulated under Section 404 of the CWA or under the State's Porter-Cologne Act.

The seasonal wetland community consists of three cover types that are periodically inundated to varying degrees depending on the timing and duration of inundation in Millerton Lake. The highest elevation type is dominated by Santa Barbara sedge and creeping wild rye. These two species grow together or separately in dense stands near the top of the inundation zone only in the vicinity of Big Sandy Creek.

The second seasonal wetland type is dominated by bog yellowcress (*Rorippa palustris*) and cocklebur (*Xanthium strumarium*). This seasonal wetland type occurs on low-relief shoreline areas with varying timing and duration of inundation. The low-relief areas are natural basins associated with tributary channels, former floodplain, and lower hillslope or shoreline positions. Bog yellowcress germinates in the lowest relief mudflats from fall through early spring following receding seasonal high reservoir levels. The plants achieve peak growth in late spring and complete seed production before inundation by rising reservoir levels. Bog yellowcress does not extend as far up the shoreline slope as cocklebur. Associated species for bog yellowcress-dominated seasonal wetlands include many of the early-season annual species listed below in the description of the mixed herbaceous seasonal wetland.

Cocklebur seed germinates following receding high reservoir levels in midsummer to late summer. Plant growth peaks and seed production is completed in fall. The upper elevation extent of cocklebur on the shoreline was observed to be directly related to the maximum Millerton Lake inundation level in 2007 (Reclamation 2008). Late-season associated species include green carpetweed (*Mollugo verticillata*), common purslane (*Portulaca oleracea*), Bermuda grass (*Cynodon dactylon*), and, in some locations, bog yellowcress as seedlings and resprouting plants that survived from the previous spring.

The third seasonal wetland type is a mixed herbaceous community that supports a diverse mixture of upland and hydrophytic plant species that make up 10 percent or more of the cover. Seep monkeyflower (*Mimulus guttatus*), little quakinggrass (*Briza minor*), rabbitsfoot grass (*Polypogon monspeliensis*), small fescue (*Festuca microstachys*), smooth cat's ear (*Hypochaeris glabra*), silver hairgrass (*Aira caryophyllea*), clammy clover (*Trifolium obtusiflorum*), tomcat clover (*Trifolium willdenovii*), soft chess, miniature lupine, hairy brome (*Bromus japonicus*), and red maids (*Calandrinia ciliata*) are among the more common of many annual species observed along the exposed shoreline of Millerton Lake. This mixed herb composition forms the dominant cover early in the growing season but largely disappears, leaving the perennial species, Bermuda grass, as the only dominant species remaining on these sites later in summer. Associated species of this late-season assemblage include horseweed, green carpetweed, small fescue, soft chess, ripgut brome, prickly lettuce (*Lactuca serriola*), and tomcat clover.

Vernal Pool Vernal pools are ephemeral wetlands that fill with precipitation during winter and spring months. A restrictive hardpan prevents water from percolating into deeper soil horizons. Vernal pools can be densely or sparsely vegetated depending on location, land use, and other geophysical and ecological variables. Hydrophytic species, including Great Valley button celery (*Eryngium castrense*), stalked popcornflower (*Plagiobothrys stipitatus* var. *micranthus*), marsh spikerush (*Eleocharis macrostachya*), and rabbitsfoot grass, are typically present in vernal pool wetlands in the primary study area. Vernal pools are considered sensitive habitats because they are regulated under Section 404 of the CWA or under the Porter-Cologne Act and are identified as special-status natural communities by CDFW.

Vernal pool wetlands may also provide habitat for a variety of special-status plant and wildlife species, many of which are Federally listed (see discussions of special-status plant and wildlife species below and in Chapter 7, “Biological Resources – Wildlife”).

Alkali Sink Alkali sinks are shallow, seasonally flooded areas or playas that are dominated by salt-tolerant plants. Soils in alkali playas are typically fine- textured with an impermeable caliche layer or clay pan. Salt encrustations typically form on the surface as the playa dries. Alkali sinks support valley sink scrub, which is a low-growing open-to-dense succulent shrubland vegetation community dominated by alkali-tolerant members of the goosefoot family, especially iodine bush (*Allenrolfea occidentalis*) and seablites (*Suaeda* spp.). A herbaceous understory usually is lacking, but a sparse cover of annual grasses, such as the nonnatives Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*) and red brome (*Bromus madritensis* ssp. *rubens*), may be present. Alkali sinks flood seasonally after local thunderstorms, but they may not flood every year. This vegetation community is considered a special-status natural community by CDFW and may be regulated under Section 404 of the CWA or the Porter-Cologne Act.

Freshwater Seep Freshwater seeps are inundated or saturated areas characterized by dense cover of herbaceous wetland plants, especially sedges and perennial forbs. Dominant species vary relative to the magnitude and timing of seepage flows. Freshwater seeps are found in the primary study area where the most common species assemblage is white hedge nettle (*Stachys albens*), watercress (*Nasturtium officinale*), water smartweed (*Persicaria punctata*), clustered dock (*Rumex conglomeratus*), tall flatsedge (*Cyperus eragrostis*), and seep monkeyflower. Freshwater seeps are considered sensitive habitats because they may be regulated under Section 404 of the CWA or under the Porter-Cologne Act.

Aquatic Communities

Lacustrine Water levels in Millerton Lake fluctuate seasonally in response to direct inflows and releases from Friant Dam. The open water portion of Millerton Lake is mapped as lacustrine unconsolidated bottom. The seasonally exposed inundation area of Millerton Lake below the full pool elevation was mapped as lacustrine unconsolidated shoreline. Lacustrine unconsolidated shoreline represents shoreline sections observed to support less than 10 percent plant cover; these areas are frequently steep, subject to erosion, and excessively well-drained. They often are too rocky to support significant plant cover. These habitats are considered sensitive because they are regulated under Section 404 of the CWA.

Riverine Riverine is also an aquatic community that includes the free-flowing portion of the San Joaquin River both upstream from the limits of Millerton Lake and downstream from Friant Dam that maintains flowing river channel characteristics. These habitats are considered sensitive because they are regulated under Section 404 of the CWA.

Riverwash Riverwash consists of alluvial sands and gravel associated with the active channel of perennial streams such as the San Joaquin River. Generally, riverwash areas exist as sand and gravel point bars within the floodplain of the river. Woody and herbaceous plant cover can be low, although controlled hydrologic releases from Friant Dam that prevent scour can allow denser plant growth on some point bars between high-flow releases. Numerous herbaceous species occur in riverwash areas; however, most of these plant species are relatively common. The nonnative plants rattail fescue, Bermuda grass, and red-stemmed filaree, and the native plants tall willow herb (*Epilobium brachycarpum*) and lupine species (*Lupinus* spp.) are typically the most abundant plant species on riverwash. These habitats are considered sensitive because they are generally regulated under Section 404 of the CWA.

Other Waters Other waters apply to drainage features in the primary study area that convey flowing water. Other waters in the primary study area consist of ephemeral, intermittent, and perennial streams. Some of these drainage features include small instream pools where the topography flattens and the channel is wider and deeper. One ephemeral drainage includes two natural ponds formed in natural granitic basins within the channel. Other waters are considered sensitive because they may be regulated under Section 404 of the CWA or the Porter-Cologne Act.

Other Habitats

Nonnative Tree These are areas where the dominant vegetative cover consists of tree species that are not native to California and are considered invasive by the California Invasive Plant Council (Cal-IPC). Tree species in this category include blue gum (*Eucalyptus globulus*), tree-of-heaven (*Ailanthus altissima*), and red sesbania (*Sesbania punicea*).

Agriculture Agricultural lands consist primarily of annual crops, orchards, and vineyards. Annual crops include field crops, such as cotton, sweet corn, and safflower; truck, nursery, and berry crops, such as lettuce, bell peppers, strawberries, melons, and tomatoes; and rice. Orchards consist of citrus and subtropical crops, including lemons, nectarines, olives, and oranges, and deciduous fruit and nut crops, including almonds, apples, peaches, pistachios, plums, and walnuts. Vineyards produce raisin, table, and wine grapes.

Disturbed Areas Disturbed areas include existing roads, canals, levees, and aggregate pits. Also included are areas used by off-highway vehicles and sites where rubble or fill has been deposited. Active and former aggregate mines are included if they are dry or unvegetated. As with agricultural communities, these areas have low vegetative cover and species diversity.

Developed Areas Developed areas within the primary study area are limited to areas of development, including low-density residential housing and recreational facilities. Low-density housing in a rural environment typically includes patches of surrounding woodland. Developed areas in the extended study area also include urban development. Urban areas are areas of moderate- to high-density development and impervious surfaces. These areas have low vegetative cover and species diversity and are dominated by horticultural plantings, lawns, landscaping, and weed species.

Barren Areas Barren areas were mapped in the primary study area and consist of areas of exposed bedrock, escarpments, and vertical rock faces that do not support vegetative cover.

Primary Study Area

Area of Project Features Vegetation communities located within the dam site, haul roads, borrow areas, and transmission line alignments are depicted in Figure 6-1, and their acreage is presented in Table 6-3.

Table 6-3. Vegetation Communities in the Area of Project Features Within the Primary Study Area

Vegetation Community/Habitat	Area (acres) of Habitat Within Area of Project Features[1]
Woodland Communities	
Foothill Pine Oak Woodland	1,215
Blue Oak Woodland	298
Live Oak Woodland	6
Subtotal	1,519
Upland Shrub Communities	
Bush Lupine Scrub	5
Subtotal	5
Herbaceous Communities	
Annual Grassland	165
Subtotal	165
Riparian Communities	
Mixed Riparian Forest	9
Subtotal	9
Herbaceous Wetland Communities	
Seasonal Wetlands	1
Swale	1
Vernal Pool[2]	6
Subtotal	8
Aquatic Communities	
Lacustrine Unconsolidated Shoreline[3]	6
Other Waters[4]	2
Subtotal	8
Total	1,714

Table 6-3. Vegetation Communities in the Area of Project Features Within the Primary Study Area (contd.)

Source: Reclamation 2007

Notes:
[1] Acres have been rounded to the nearest whole number except where less than 0.5 acre, which is shown as <1.
[2] Acreage of vernal pool likely overestimated because detailed analysis for this area is scheduled after release of this report. Area mapped as vernal pool grassland within transmission route.
[3] Lacustrine Unconsolidated Shoreline is below the OHWM of Millerton Lake.
[4] Other waters are composed of 0.59 acre of intermittent drainage and 1.04 acre of ephemeral drainage, and 0.15 acre of natural instream ponds.

Temperance Flat Reservoir Area Vegetation communities within the Temperance Flat Reservoir Area are depicted in Figure 6-1, and their acreages are presented in Table 6-4.

Table 6-4. Vegetation Communities in the Temperance Flat Reservoir Area

Vegetation Community/Habitat	Area (acres) of Habitat Within Temperance Flat Reservoir Area[1]
Woodland Communities	
Foothill Pine Oak Woodland	3,802
Blue Oak Woodland	1,088
Live Oak Woodland	51
Foothill Pine Woodland	9
Foothill Pine Chaparral Woodland	5
Subtotal	4,955
Upland Shrub Communities	
Buckbrush Chaparral	25
Bush Lupine Scrub	4
Subtotal	29
Herbaceous Communities	
Annual Grassland	152
Subtotal	152
Riparian Communities	
White Alder Riparian	25
Mixed Riparian Forest	3
Sycamore Riparian Woodland	<1
Willow Riparian Forest	2
Fig Riparian/Fig-Willow Riparian	3
Spanish Broom Scrub	<1
Subtotal	33
Herbaceous Wetland Communities	
Seasonal Wetlands	264
Swale	0
Vernal Pool	0
Freshwater Seep	1
Subtotal	265

Table 6-4. Vegetation Communities in the Temperance Flat Reservoir Area (contd.)

Vegetation Community/Habitat	Area (acres) of Habitat Within Temperance Flat Reservoir Area[1]
Aquatic Communities	
Lacustrine Unconsolidated Bottom	425
Lacustrine Unconsolidated Shoreline[2]	282
Other Waters[3]	23
Riverine	200
Subtotal	930
Other Habitats	
Barren Areas	31
Developed Areas	6
Subtotal	37
Total	**6,401**

Notes:
[1] Acres have been rounded to the nearest whole number except where less than 0.5 acre, which is shown as <1.
[2] Lacustrine Unconsolidated Shoreline is below the OHWM of Millerton Lake.
[3] Other waters are composed of 8.07 acres of ephemeral drainage, 15.25 acres of intermittent drainage, and 0.02 acre of perennial drainage.

Millerton Lake Below RM 274 Vegetation communities within Millerton Lake downstream from RM 274 are restricted to lacustrine aquatic habitats and seasonal wetland and riparian communities growing below the maximum inundation level of Millerton Lake. Acreages of Lacustrine Unconsolidated Bottom, Lacustrine Unconsolidated Shoreline, and vegetation growing below the high water level are presented in Table 6-5 and depicted in Figure 6-1.

Table 6-5. Vegetation Communities in the Millerton Lake Area Downstream from RM 274

Vegetation Community	Area (acres) of Habitat[1]
Aquatic Communities	
Lacustrine Unconsolidated Bottom	2,425
Lacustrine Unconsolidated Shoreline	1,469
Seasonal Wetland	3
Mixed Riparian	<1
Willow Woodland	3
Total	**3,900**

Note:
[1] Acres have been rounded to the nearest whole number
Key:
RM = River Mile

Extended Study Area

San Joaquin River from Friant Dam Downstream to Merced River Sections describing the biological resources within the specific reaches of this portion of the extended study area are based on McBain & Trush (2002), DWR (2002), and Reclamation (1998a, 1998b). In these prior analyses, study areas were used that encompassed 1,000 feet from the edge of levees (e.g., the upper portion of Reach 1 and most of Reaches 3 and 4) or the extent of riparian vegetation (e.g., portions of Reaches 1 and 2) if those features were present. When no levee, escarpment, or clear, discrete outer boundary of riparian vegetation was present but riparian vegetation extended more or less continuously from the mainstem to adjacent sloughs or side channels, the boundary was set at 2,000 feet from the centerline of the main channel of the San Joaquin River (e.g., portions of Reach 5) (McBain & Trush 2002, DWR 2002).

Because the extended study area varies somewhat from this definition, land cover in some areas of the San Joaquin River from Friant Dam to Merced River portion of the extended study area was not mapped in the previous studies. Descriptions of reach-specific vegetation communities are based on the above-listed studies for the San Joaquin River Restoration Area and the CNDDB.

Vegetation communities found in the San Joaquin River from Friant Dam to Merced River portion of the extended study area, including the bypass system, were mapped by DWR in 2002 and 2011 (DWR 2002, 2011) using a modified Holland classification system (Holland 1986). Table 6-6 provides acreages for the vegetation communities and habitats in the various reaches and bypass systems of this portion of the extended study area.

San Joaquin River from Merced River to the Delta
Sections describing the biological resources within the specific reaches of this portion of the extended study area are based on the SJRRP PEIS/R (SJRRP 2012). The San Joaquin River downstream from the Merced River confluence is similar to the river upstream from the confluence. The upstream portion of the reach below the Merced River is more incised than the downstream area, with generally drier conditions in the riparian zone and a less developed understory.

Table 6-6. Vegetation Communities and Habitats in the San Joaquin River from Friant Dam to Merced River Portion of the Extended Study Area

Vegetation Community/ Habitat	Reaches (acres)									Bypasses (acres)
	Reach 1A	Reach 1B	Reach 2A	Reach 2B	Reach 3	Reach 4A	Reach 4B1	Reach 4B2	Reach 5	
Cottonwood Riparian Forest	138	193	61	48	410	16	12	16	28	0
Willow Riparian Forest	194	119	43	111	94	78	242	404	743	0
Mixed Riparian Forest	359	274	2	0	0	6	0	0	1	20
Valley Oak Riparian Forest	207	<1	1	0	0	48	16	8	35	78
Willow Scrub	263	144	200	50	220	0	100	31	80	0
Riparian Scrub	25	46	193	63	46	60	55	3	71	0
Elderberry Savanna	2	0	3	63	0	0	0	0	0	0
Giant Reed	3	4	6	0	<1	0	0	0	<1	0
Grassland and Pasture	156	66	281	88	71	194	200	768	2,320	4,828
Emergent Wetlands	90	5	11	59	3	39	79	47	185	539
Alkali Sink	0	0	0	0	0	0	0	0	2	0
Riverine	659	219	327	279	299	110	139	96	434	670
Riverwash[1]	30	47	170	4	20	67	3	<1	6	0
Nonnative Tree	49	20	1	0	0	0	0	0	12	0
Agriculture	7	<1	33	74	271	28	0	0	310	11
Disturbed Areas	113	0	51	39	65	51	31	48	57	0
Developed Areas	1	0	0	0	1	0	0	0	0	0
No Data[2]	5	<1	6	346	101	0	7	0	587	0
Total[3]	2,300	1,140	1,387	1,223	1,601	696	883	1,421	4,871	6,146

Source: DWR 2002, DWR 2011

Notes:

[1] Riverwash partially depends on flow at the time of the survey/photograph, and values should not be presumed to be precise.

[2] No data exist for areas within the extended study area that were not mapped by DWR (2002).

[3] Columns do not all sum exactly to total acreage because of round-off error. Acres have been rounded to the nearest whole number except where less than 0.5 acre, which is shown as <1.

Agricultural land use has encroached on the riparian habitat along most of the river. Along much of the river, only a narrow ribbon of riparian habitat is supported. However, riparian habitat is more extensive locally, especially near the confluence with tributary rivers, within cutoff oxbows, and in the 6,500-acre San Joaquin River NWR between the confluences with the Tuolumne and Stanislaus Rivers. Remnant common tule- and cattail-dominated marshes may occur in these areas.

Habitats found in the San Joaquin River from the Merced River to the Delta were identified using the California Fire and Resource Assessment Program (FRAP) (CAL FIRE 2005). The FRAP provides a single information source for habitat types that encompasses the entire extended study area. However, because of the methodology used, FRAP mapping does not capture all community types present or the full extent of each type. FRAP is a compilation of the best available land cover data as of 2005 (CAL FIRE 2005). The land cover data, provided as a 100-meter grid, were compiled into the CWHR classification system. The CWHR system does not include categories for plant communities associated with vernal pools and seasonal wetlands and has only two categories for riparian communities (montane riparian and valley and foothill riparian). Seasonal wetlands are ephemeral and not easily identified without on-the-ground investigations and are therefore not typically included in regional-scale land cover data. Because project impacts on botanical and wetland resources in the San Joaquin River beyond the Merced River confluence are expected to be negligible to none, detailed habitat descriptions for this area are not provided in this chapter, but Table 6-7 summarizes the habitats in this portion of the extended study area.

Delta The Delta is divided into numerous islands by hundreds of miles of waterways. Historically, the Delta had extensive areas of wetlands. Nearly all of the Delta’s wetlands have been reclaimed for agricultural and other land uses. However, some small islands remain in a quasi-natural state. (These quasi-natural islands include “flooded islands” that were once reclaimed land but that were abandoned after levee failures.) The portion of the Delta under consideration within the extended study area is limited to open waterways because the impacts of the upstream project would be limited to the conveyance of water that would be contained within the bed, bank, and channels of the existing waterways within the Delta.

Table 6-7. Habitats Mapped in the San Joaquin River from Merced River to the Delta and Delta Portions of the Extended Study Area

Habitat and Description	San Joaquin River from Merced River to the Delta	Delta
Riparian and Open-Water Habitats		
Valley Foothill Riparian:[1] A wide variety of forest, woodland, and scrub communities dominated by broadleaved, deciduous trees and shrubs. The climax valley foothill riparian type is a dense, multilayered forest with a tree canopy dominated by any combination of cottonwood, sycamore, and valley oak; a subcanopy of shorter, shade-tolerant tree species such as box elder and Oregon ash; and an understory of shrubs such as willow, wild rose, and buttonbush.	Yes	Yes
Open Water[1] Aquatic habitats that include both riverine and lacustrine communities. Riverine communities are in sloped stream channels with intermittent or continually flowing water. Lacustrine habitats are in inland depressions or dammed river channels containing standing water. Submerged aquatic vegetation may be sparse to dense in shallower depths (generally less than 10 feet).	Yes	Yes
Perennial Wetland Habitats		
Freshwater Emergent Wetland[1] Dense, tall herbaceous community dominated by perennial hydrophytic plant species (plants that grow in water or saturated soil), typically monocots up to 7 feet tall. Occurs throughout the Sacramento and San Joaquin Valleys and foothills in permanently flooded or saturated soils in depressions or at the edges of streams, rivers, ponds, and lakes. Distinct vegetation zones often form, as rings, strips, or patches, in response to varying water depths and hydroperiods.	Yes	Yes
Saline Emergent Wetland[1] Dense herbaceous community dominated by perennial hydrophytic species adapted to saline or brackish conditions. Found in the Delta–Suisun Marsh within the intertidal zone or on lands that historically were subject to tidal exchange (i.e., diked wetlands). This type category includes both saltwater and brackish marshes.	No	Yes
Other Sensitive Habitats		
Seasonal Wetlands[1] Herbaceous wetlands that are subject to inundation during the winter months; these features generally occur in topographically low areas. Seasonal wetlands are generally dominated by hydrophytes during the winter and spring months. The vegetation of these features may transition to species that are characteristic of surrounding nonwetland habitat as the drying down process occurs. Evidence of hydrology including algal matting, flow patterns, or presence of decedent hydrophytes, is usually evident in the dry season upon close inspection.	Yes	Yes
Alkali Seasonal Wetlands[1] Herbaceous communities on alkaline soils that remain inundated or saturated for prolonged periods during the growing season; these seasonal wetlands are in a surrounding matrix of grassland. At low elevations, found at seasonal drainages, historical lake beds, and basin rims.	No	Yes

Source: CAL FIRE 2005

Notes:

Acreages are not provided. The lateral extent of the San Joaquin River to Delta and Delta portions of the extended study area is limited to the top of existing channels because water releases from Friant Dam would not exceed existing channel capacity. Because the project is not expected to affect aquatic botanical resources within the San Joaquin River from the confluence with the Merced River to the Delta and the Delta portions of the extended study area, these resources are not discussed in detail.

[1] Sensitive habitat.

Because project impacts on botanical and wetland resources in the Delta are expected to be negligible to none, detailed habitat descriptions for this area are not provided in this chapter but are summarized in Table 6-7.

CVP and SWP Water Service Areas The project is not expected to affect terrestrial botanical resources within the CVP and SWP SOD service areas; therefore, these resources are not discussed in detail.

The CVP and SWP SOD service areas cover a vast area spread across portions of 10 biogeographic regions: the northern, central, and southern coast; the central Coast Ranges; the southern mountains and valleys; the Central Valley; the Sierra Nevada and foothills; and the Mojave and Sonoran Deserts. These areas range in elevation from sea level to more than 10,000 feet and vary from very wet coastal areas receiving up to 60 inches of annual rainfall to the dry deserts where annual precipitation is 3 to 6 inches. The high-mountain areas can receive up to 50 inches of precipitation a year, mostly in the form of snow. The coastal areas experience a cool climate with a long growing season, whereas the high-mountain areas have a cold climate and a short growing season. The deserts have a hot climate and a long growing season. Therefore, this portion of the Study Area has even greater topographic, climatic, edaphic, and geologic variation than the Sacramento and San Joaquin Valleys and foothills and the Sacramento and San Joaquin Valley watersheds; even greater diversity of habitat types (Table 6-8); and structure and species compositions that vary widely.

Table 6-8. Habitats Mapped in the CVP and SWP South-of-Delta Service Areas

Habitat	Acreage[1]
Riparian Habitats	
Valley Foothill Riparian[2]	41,200
Desert Riparian[2]	7,400
Montane Riparian[2]	37,600
Palm Oasis[2]	100
Perennial Wetland Habitats	
Freshwater Emergent Wetland[2]	24,900
Saline Emergent Wetland[2]	32,000
Wet Meadow	4,800
Grassland Habitats	
Annual Grassland	3,978,600
Perennial Grassland[2]	34,500

Table 6-8. Habitats Mapped in the CVP and SWP South-of-Delta Service Areas (contd.)

Habitat	Acreage[1]
Anthropogenic (Human-Made) Habitats	
Agriculture	4,050,800
Pasture	1,400
Urban	3,321,600
Barren	178,200
Chaparral and Scrub Habitats	
Bitterbrush Scrub	3,000
Sagebrush Scrub	122,000
Chamise Chaparral	468,800
Coastal Scrub	1,109,000
Desert Succulent Shrub	80,400
Desert Wash[2]	51,000
Desert Scrub	4,171,800
Mixed Chaparral	1,644,000
Montane Chaparral	37,700
Alkali Desert Scrub	750,700
Woodland and Hardwood Forest Habitats	
Blue Oak Woodland[2]	576,200
Blue Oak-Foothill Pine Woodland[2]	244,400
Coastal Oak Woodland[2]	654,000
Juniper	96,900
Pinyon-Juniper	396,400
Montane Hardwood	281,700
Montane Hardwood-Conifer	88,000
Valley Oak Woodland[2]	89,100
Joshua Tree[2]	39,800
Coniferous Forest Habitats	
Sierran Mixed Conifer Forest	87,000
Closed-Cone Pine-Cypress[2]	6,000
Eastside Pine[2]	500
Redwood	14,500
Subalpine Conifer	100
Jeffrey Pine	118,200
Lodgepole Pine	<100
White Fir	1,000
Red Fir	600
Douglas Fir Forest	7,800
Ponderosa Pine Forest	15,900

Source: CAL FIRE 2005
Notes:
[1] Acreages are rounded to the nearest 100 acres.
[2] Sensitive habitat.
Key:
CVP = Central Valley Project
SWP = State Water Project

The CVP and SWP water service areas contain a large diversity of both lowland and upland habitats and species, although agricultural and urban growth has reduced the area and connectivity of important habitats that are critical to sustaining a wide variety of unique plants and animals. The agricultural land and urban development that dominate the CVP and SWP water service areas, respectively, are dominated by nonnative and ornamental plant species.

Special-Status Plants

Special-status plants are defined as plants that are legally protected or that are otherwise considered sensitive by Federal, State, or local resource conservation agencies and organizations. Special-status plant taxa are species, subspecies, or varieties that fall into one or more of the following categories, regardless of their legal or protection status:

- Officially listed by California or the Federal government as endangered, threatened, or rare
- A candidate for State or Federal listing as endangered or threatened
- Taxa that meet the criteria for listing, even if not currently included on any list, as described in Section 15380 of the State CEQA Guidelines
- Taxa designated as a special-status, sensitive, or declining species by other State or Federal agencies or nongovernmental organizations (including species classified as sensitive by BLM)
- Taxa considered by CDFW to be “rare, threatened, or endangered in California” and assigned a California Rare Plant Rank (CRPR). The CDFW system uses the following five rarity and endangerment ranks to categorize plant species of concern:
    - **CRPR 1A –** Plants presumed extinct in California
    - **CRPR 1B –** Plants rare, threatened, or endangered in California and elsewhere
    - **CRPR 2A –** Plants presumed to be extinct in California
    - **CRPR 2B –** Plants rare, threatened, or endangered in California but more common elsewhere
    - **CRPR 3 –** Plants about which more information is needed—a review list

- **CRPR 4** – Plants of limited distribution—a watch list

All plants with a CRPR are considered “special plants” by CDFW. The term “special plants” is a broad term used by CDFW to refer to all of the plant taxa inventoried in the CNDDB, regardless of their legal or protection status. Plants ranked as CRPR 1A, 1B, 2A, or 2B may qualify as endangered, rare, or threatened species within the definition of State CEQA Guidelines Section 15380. CDFW recommends, and local governments may require, that CRPR 1 and 2 species be addressed in CEQA documents. Species ranked as CRPR 1B meet the definitions of Sections 2062 and 2067 of the California Fish and Game Code and are eligible for State listing. In general, CRPR 3 and 4 species do not meet the definition of endangered, rare, or threatened under State CEQA Guidelines Section 15380; however, these species may be evaluated by the lead agency on a case-by-case basis to determine significance criteria under CEQA.

The following sources were reviewed to support compilation of information on special-status plant species:

- *Inventory of Rare and Endangered Plants of California* (CNPS 2001, 2010)
- CNDDB (2013b, 2013c)
- Special Vascular Plants, Bryophytes, and Lichens List (CNDDB 2013a)
- USFWS’s Federal endangered and threatened species list (USFWS 2012)
- SJRRP PEIS/R (SJRRP 2012)
- *Temperance Flat Alternatives Botanical Resources Baseline Report* (Reclamation 2007)

Primary Study Area

Area of Project Features Most of the area of project features within the primary study area was surveyed in 2007 and 2010 for rare plants. Rare plant surveys have not been conducted within the new and relocated transmission line corridors, construction staging area 2, the Wellbarn Road haul route outside of the Temperance Flat Reservoir Area, the Road 216 haul route, and portions of the relocated trails. Figure 6-2 shows the areas that have been surveyed at a protocol level for special-status plants and areas that have not.

Temperance Flat Reservoir Area The *Temperance Flat Reservoir Alternatives Botanical Resources Baseline Report* (Reclamation 2007) describes focused plant studies and rare plant surveys that were conducted from February through July 2007 for the investigation within the area inundated by the Temperance Flat RM 274 Reservoir and the buffer area. A supplemental focused survey was conducted in April 2010 to survey haul routes, potential quarry sites, other project features, and areas associated with dam construction outside of the Temperance Flat Reservoir Area. Table 6-9 provides information on special-status plants that are known to occur or have the potential to occur within the primary study area. Figure 6-3 shows the locations of CNDDB special-status plant occurrence records within 1 mile of the primary study area.

Millerton Lake Below RM 274 This portion of the primary study area is limited to the elevation below the high-water inundation line, corresponding to approximately 580 feet above msl. The habitats present within this portion of the primary study area are limited to lacustrine unconsolidated shoreline and lacustrine unconsolidated bottom. The sandy granitic soils associated with the lacustrine unconsolidated shoreline provide marginal suitable habitat for two special-status plant species: slender-flowered monkeyflower (*Mimulus gracilipes*) and Farnsworth’s jewelflower (*Streptanthus farnsworthianus*). Farnsworth’s jewelflower was documented below the high-water mark of Millerton Lake in 2007. The CNDDB was searched to obtain additional information on documented rare plants within this portion of the primary study area (Figure 6-3). No occurrences of rare plants were identified below the high-water mark of Millerton Lake (CNDDB 2013b).

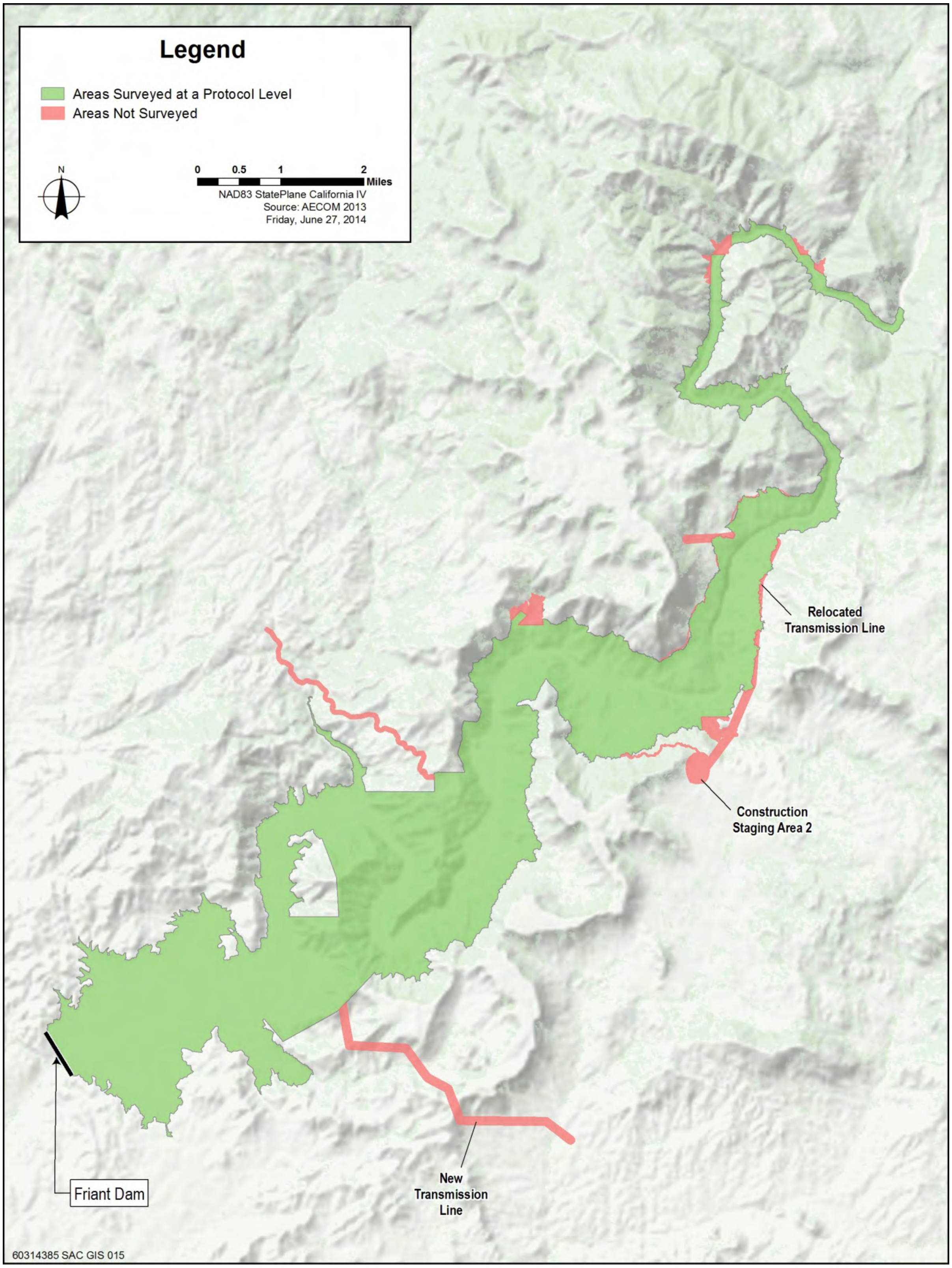


Figure 6-2. Areas Surveyed at a Protocol Level and Areas Not Surveyed (Mapped and Evaluated from Aerial Imagery)

Table 6-9. Special-Status Plant Species Known to Occur or with Potential to Occur in the Primary Study Area

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Likelihood of Presence
Mariposa pussypaws *Calyptridium pulchellum*	T	—	CRPR 1B.1	Known from bare sandy, gravelly granitic substrates at elevations between 1,300 to 4,000 feet in chaparral and woodland Flowering: April to August	Unlikely • Known to occur at higher elevations near but outside the Study Area • Suitable habitat is limited in the primary study area • Species was not documented during 2007 and 2010 surveys
Tree anemone *Carpenteria californica*	—	T	CRPR 1B.2	Species generally occurs at elevations between 1,500 to 3,000 feet; occurs on granitic soils in chaparral or forests with shrub layer Flowering: May to July	Present • One known occurrence in primary study area and two occurrences very near inundation line at higher elevations • Known occurrence was relocated during 2007 surveys
Succulent owl’s clover *Castilleja campestris* ssp. *succulenta*	T	E	CRPR 1B.2	Known from northern basalt flow vernal pools on table tops in the region and northern hardpan vernal pools downstream from Friant Dam Flowering: April to May	Possible • Documented on top of tables above Millerton Lake and below Friant Dam • Soil and terrain conditions conducive to vernal pool formation do not appear to be present in the Temperance Flat Reservoir Area, but suitable habitat is present within the transmission line corridor • Neither the species nor its habitat was documented during 2007 and 2010 surveys, but the survey area did not include the transmission line corridor
Ewan’s larkspur *Delphinium hansenii* ssp. *ewanianum*	—	—	CRPR 4.2	Rocky soils, bluffs, often acidic soils associated with woodland and grassland at elevations ranging from 200 to 2,000 feet. Flowering: March to May	Present • Abundant potential habitat in the Study Area • Increasing discoveries of this taxon in the Sierra Nevada foothills • Species was documented in the Study Area during 2007 surveys
Dwarf downingia *Downingia pusilla*	—	—	CRPR 2B.2	Northern basalt flow vernal pools on top of tables tops in the region and northern hardpan vernal pools downstream from Friant Dam Flowering: March to May	Possible • Documented on top of tables above Millerton Lake and below Friant Dam • Soil and terrain conditions conducive to vernal pool formation do not appear to be present in the Temperance Flat Reservoir Area, but suitable habitat is present within the transmission line corridor • Species was not documented during 2007 and 2010 surveys, but the survey area did not include the transmission line corridor

Table 6-9. Special-Status Plant Species Known to Occur or with Potential to Occur in the Primary Study Area (contd.)

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Likelihood of Presence
Spiny-sepaled button-celery *Eryngium spinosepalum*	—	—	CRPR 1B.2	Vernal pools, wet swales below 1,000 feet, Tulare County to San Joaquin County Flowering: April to May	Possible • Documented on top of tables above Millerton Lake and below Friant Dam • Soil and terrain conditions conducive to vernal pool formation do not appear to be present in the Temperance Flat Reservoir Area, but suitable habitat is present within the transmission line corridor • Species was not documented during 2007 and 2010 surveys, but the survey area did not include the transmission line corridor
Boggs Lake hedge-hyssop *Gratiola heterosepala*	—	E	CRPR 1B.2	Found in shallow water margins of vernal pools, also margins of small lakes and ponds, wet meadows Flowering: April to August	Unlikely • Not known in Study Area but occurs in nearby vernal pools on top of tables • Vernal pools not recorded in Study Area, but possible for species to occur in the transmission line corridor • Neither the species nor its habitat was documented during 2007 and 2010 surveys, but the survey area did not include the transmission line corridor
Madera leptosiphon *Leptosiphon serrulatus*	—	—	CRPR 1B.2 BLM Sensitive	Cismontane woodland, lower montane coniferous forest Flowering: April to May	Present • Previously documented occurrence in the Study Area was not relocated during 2007 surveys, but two new occurrences were found in the Study Area, and another occurrence has been documented near the inundation line in the vicinity of Kerckhoff Dam
Congdon's lewisia *Lewisia congdonii*	—	R	CRPR 1B.3	Occurs in mesic rocky/outcrop habitats in chaparral, woodland, and coniferous forest at elevations between 1,500 and 8,400 feet Flowering: April to June	Unlikely • Many potential habitats in the Study Area, but species was not found during 2007 surveys, and Study Area is below typical elevation range • Occurs in Merced River and Kings River canyons to north and south, respectively
Orange lupine *Lupinus citrinus* var. *citrinus*	—	—	CRPR 1B.2 BLM Sensitive	Often occurs on decomposed granite in chaparral, cismontane woodland, or lower montane coniferous forest Flowering: April to June	Unlikely • Known to occur at higher elevations near but outside the Study Area • A limited amount of suitable habitat occurs in Study Area, but this species was not found during 2007 and 2010 surveys

Table 6-9. Special-Status Plant Species Known to Occur or with Potential to Occur in the Primary Study Area (contd.)

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Likelihood of Presence
Slender-stalked monkeyflower *Mimulus gracilipes*	—	—	CRPR 1B.2	Decomposed granite, disturbed sites often following fire in chaparral, woodland, and coniferous forest at elevations between 1,500 and 3,900 feet Flowering: April to July	Possible • Known to occur in the vicinity of the Study Area • Loose, bare granitic sands provide at least marginal habitat in the Study Area, but this species was not found during surveys. However, 2007 was a poor year for this species due to below-average precipitation, which could have resulted in false negative survey results
Small-flowered monkeyflower *Mimulus inconspicuus* (includes *M. acutidens* and *M. grayi*)	—	—	CRPR 4.3	Mesic sites in chaparral, cismontane woodland, lower montane coniferous forest above 1,300 feet elevation Flowering: May to June	Present • Twelve occurrences were documented in the Study Area during 2007 surveys • One occurrence documented in 2010 near the Temperance Flat RM 274 Dam site
San Joaquin Orcutt grass *Orcuttia inaequalis*	T	E	CRPR 1B.1	Known from northern basalt flow vernal pools on table tops in the region and northern hardpan vernal pools downstream from Friant Dam Flowering: April to September	Possible • Documented on top of tables above Millerton Lake and below Friant Dam • Soil and terrain conditions conducive to vernal pool formation do not appear to be present in the Temperance Flat Reservoir Area, but potentially suitable habitat is present in the transmission line corridor • Neither the species nor its habitat was found during 2007 and 2010 surveys, but the survey area did not include the transmission line corridor
Michael’s piperia *Piperia michaelii*	—	—	CRPR 4.2	Coastal bluff scrub, closed-cone coniferous forest, chaparral, cismontane woodland, coastal scrub, lower montane coniferous forest between 10 and 3,000 feet in elevation Flowering: April to August	Present • Two occurrences of this species were documented in the Study Area during 2007 surveys
Hartweg’s golden sunburst *Pseudobahia bahiifolia*	E	E	CRPR 1B.1	Species is limited to grasslands and open woodlands on fine- to medium-textured sandy loam soils; typically on north to northeast-facing mima mounds Flowering: March to April	Possible • Suitable soils do not occur in the Temperance Flat Reservoir Area, but potentially suitable habitat is present in the transmission line corridor • This species was not found during surveys conducted in 2007 and 2010, but the survey area did not include the transmission line corridor

Table 6-9. Special-Status Plant Species Known to Occur or with Potential to Occur in the Primary Study Area (contd.)

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Likelihood of Presence
Sanford's arrowhead *Sagittaria sanfordii*	—	—	CRPR 1B.2 BLM Sensitive	Shallow freshwater marshes habitats on margins of small lakes and ponds, sluggish waters of sloughs, creeks, rivers, canals, and ditches between 0 and 2,000 feet in elevation Flowering: May to October	Unlikely • Streams in the area support periodic high velocity flows making them unsuitable for this species. No suitable habitat was observed in stock ponds • This species was not found during surveys conducted in 2007 and 2010
Farnsworth's jewelflower *Streptanthus farnsworthianus*	—	—	CRPR 4.3	Cismontane woodland at elevations between 1,300 and 4,600 feet in elevation Flowering: May to June	Present • Three occurrences of this species were found in the Study Area during 2007 surveys
Oval-leaved viburnum *Viburnum ellipticum*	—	—	CRPR 2B.3	Chaparral, cismontane woodland, and lower montane coniferous forest Flowering: May to June	Possible • Known to occur in vicinity of the Study Area • Reported on Squaw Leap Trail uphill from the primary Study Area • Suitable habitat occurs in Study Area, but this species was not found during surveys
Hall's wyethia *Wyethia elata*	—	—	CRPR 4.3	Cismontane woodland and lower montane coniferous forest between 1,500 to 4,600 feet in elevation Flowering: May to August	Present • Four occurrences of this species were found in the Study Area during 2007 surveys at 800-1,500 feet in elevation, which is below the elevation range report in the literature for this species.

Key:
BLM = U.S. Bureau of Land Management
CRPR = California Rare Plant Rank

Status:
[1] Federal Status:
E = Endangered
T = Threatened

[2] State Status:
E = Endangered
T = Threatened
R = Rare

[3] Other Status:
CDFW California Rare Plant Ranks (CRPR):
CRPR 1B: Rare, threatened, or endangered in California and elsewhere
CRPR 2B: Rare, threatened, or endangered in California, but more common elsewhere
CRPR 4.: Limited distribution (Watch List)
CRPR Extensions:
.1: Seriously endangered in California (>80 percent of occurrences are threatened and/or high degree and immediacy of threat)
.2: Fairly endangered in California (20–80 percent of occurrences are threatened)
.3: Not very endangered in California (<20 percent of occurrences are threatened or no current threats are known)
BLM Sensitive = BLM Sensitive Species

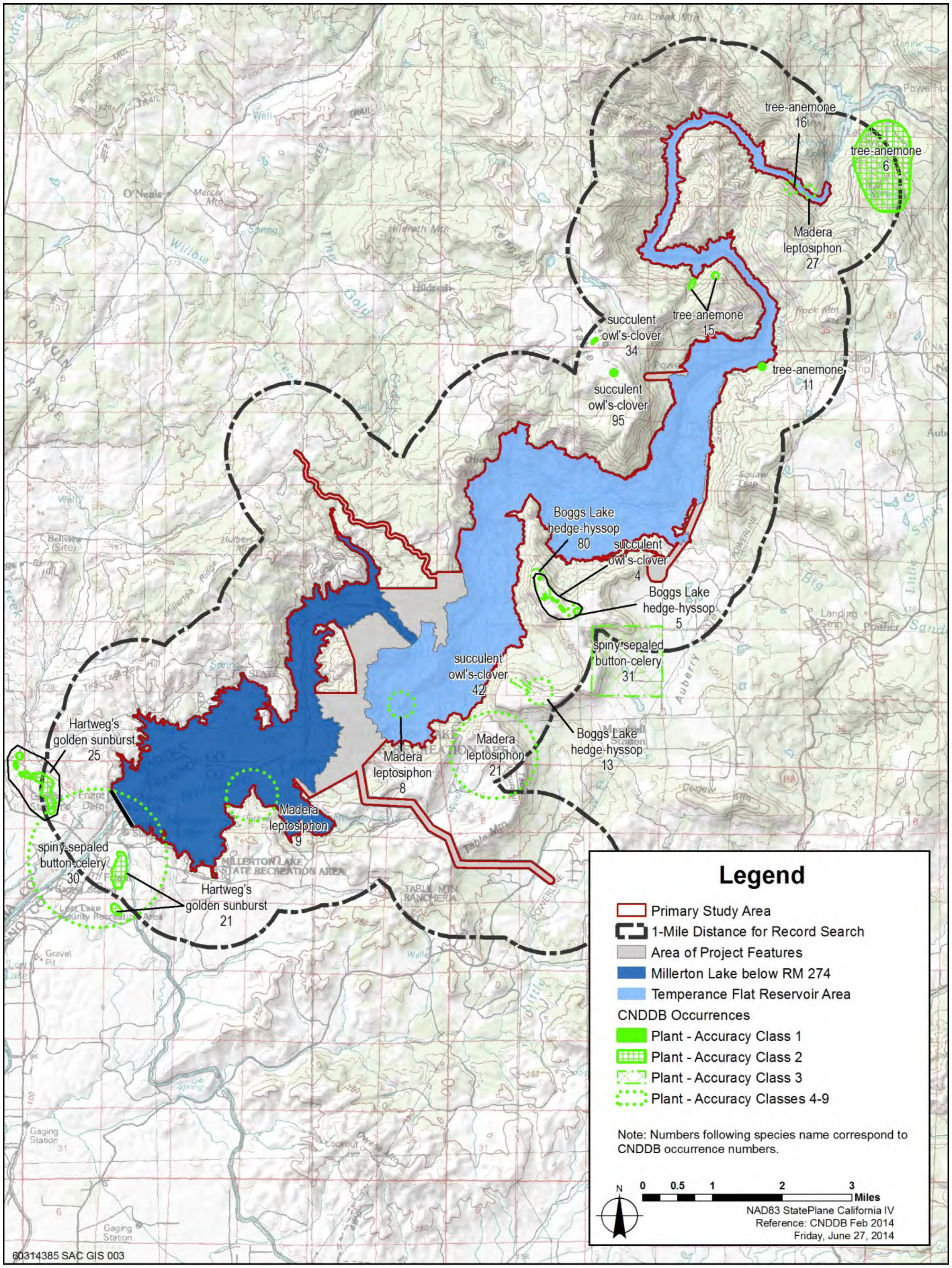


Figure 6-3. CNDDB Plant Occurrences in Vicinity of Primary Study Area

Results by Species

Tree Anemone (Carpenteria californica) One occurrence of tree anemone consisting of five mature shrubs and one young shrub was found in the primary study area within the BLM San Joaquin River Gorge during spring 2007 surveys. These six shrubs are contained within a 1,500-square-foot area on the left bank (Fresno County side) of the San Joaquin River, on a northeast-facing slope 1.14 miles northwest of Kerckhoff Dam at RM 291.25 (Figure 6-4). This occurrence corresponds to CNDDB occurrence number 16.

Two other tree anemone occurrences have been documented just outside the primary study area: one at the 1,148-foot elevation located approximately 0.3 mile east-southeast of RM 285 on the Fresno County side and another consisting of two polygons in close proximity at an elevation of 1,400 feet and located approximately 1.5 miles north of Kerckhoff Powerhouse on the Madera County side. A third occurrence has been documented within 1 mile of the primary study area upstream from Kerckhoff Reservoir and south of the river on both sides of Powerhouse Road.

Madera Leptosiphon (Leptosiphon serrulatus) Two occurrences of Madera leptosiphon were mapped in the primary study area during the 2007 surveys (Figure 6-4). One occurrence is approximately 0.5 mile upslope to the northwest of RM 277 at 990 feet and occupies an approximately 500-square-foot area. The other occurrence is approximately 1 mile northeast of the Kerckhoff Powerhouse upslope of RM 285 at an elevation of approximately 900 feet and occupies an approximately 3,000-square-foot area. These represent two separate occurrences because they are more than 0.25 mile apart. The two occurrences consisted of approximately 500 and 5,000 individuals, respectively.

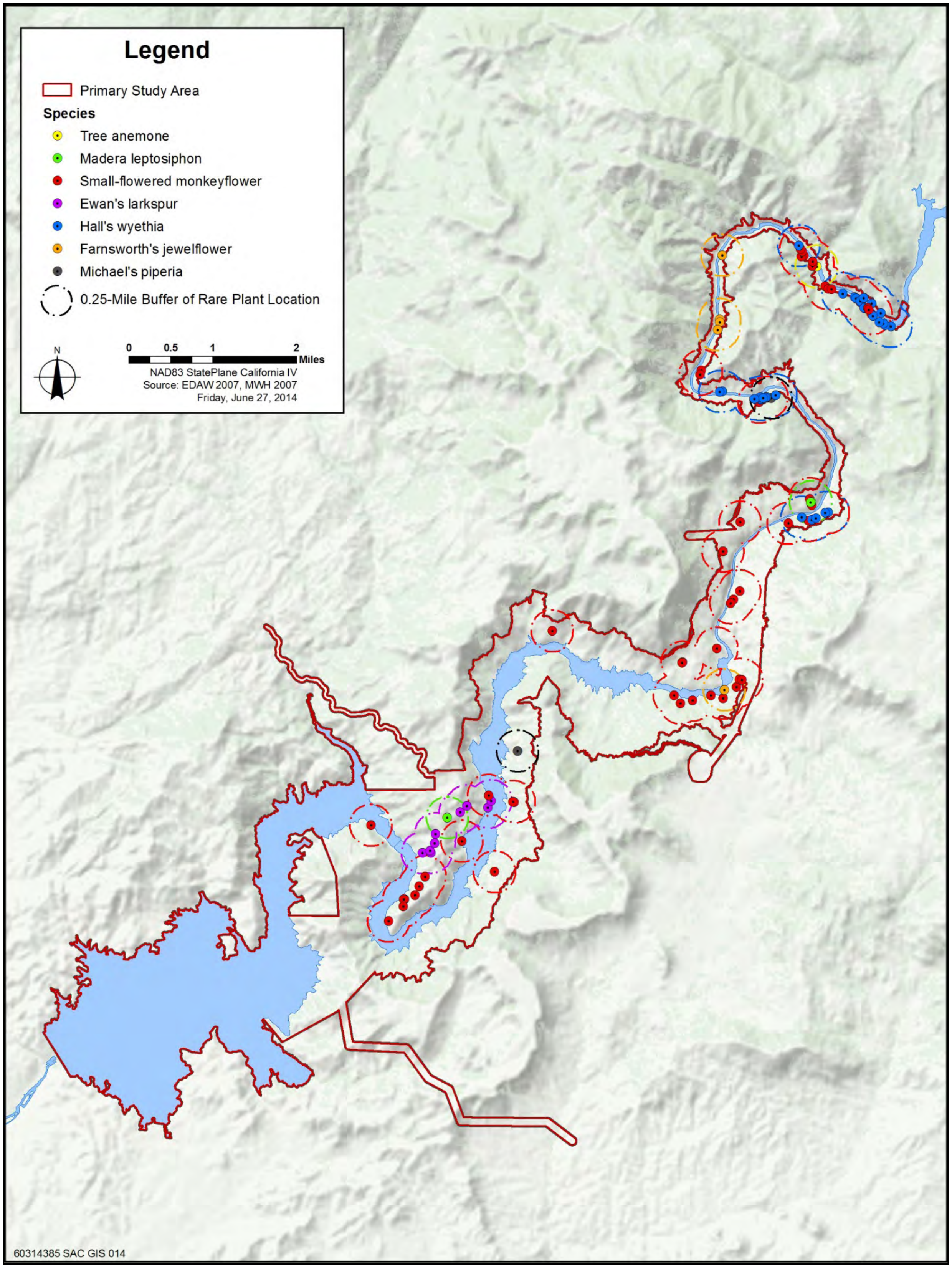


Figure 6-4. Special-Status Plant Occurrences in the Primary Study Area

It should be noted that population sizes of annual plant species are cyclical and fluctuate greatly from year to year because of environmental variation. Therefore, these occurrences could be much larger or much smaller in any given year depending on a variety of factors, including precipitation amount and timing, temperature, and grazing intensity and timing. Precipitation was below average for the winter preceding the spring 2007 surveys, making it a relatively poor year for annual wildflowers in general. Therefore, it is possible that Madera leptosiphon would be more abundant in the primary study area in a more favorable year. Reference populations of Madera leptosiphon were visited in 2007 before surveys and were observed to support similar population numbers as previously reported and were flowering vigorously.

The CNDDB contains a historical record of Madera leptosiphon that was reportedly found in the lower portion of Millerton Lake, upslope and north of RM 275.5 on the Madera County side of the lake. The area where this occurrence was reported was thoroughly searched during the 2007 surveys and Madera leptosiphon was not found. There are three additional records of Madera leptosiphon within 1 mile of the primary study area: one on big Table Mountain, which is isolated from the proposed Temperance Flat Reservoir Area and other project features; one on the south shore of Millerton Lake along an existing trail; and one record near Kerckhoff Dam on the Madera side of the San Joaquin River. The Kerckhoff Dam occurrence may fall partially within the Temperance Flat Reservoir Area, but the location information for this occurrence is not exact (accurate within one-tenth of a mile). The occurrence record is from a 2005 observation, but was not included in the CNDDB when the database was searched in 2007. This occurrence was also not observed within the Temperance Flat Reservoir Area during the 2007 surveys.

Ewan's Larkspur (Delphinium hansenii var. *ewanianum)*
Nine distinct locations of Ewan's larkspur, each containing between one and five individuals, were mapped on the Madera County side of the lower portion of Millerton Lake during the 2007 surveys. These locations are within 0.25 mile of each other, so they are considered a single occurrence. All of these plants were found growing in rocky outcrops in blue oak woodland or foothill pine oak woodland habitat.

Michael's Piperia (Piperia michaelii) Two occurrences of Michael's piperia, each consisting of a single individual, were found in the primary study area during the spring 2007 surveys.

One occurrence is located immediately south of RM 275 on the Madera County side of the river, along the Study Area boundary at approximately the 1,000-foot elevation level. The other occurrence was mapped east of RM 278.33 on the Fresno County side of the river, approximately 0.25 mile above the current high-water mark of Millerton Lake at the 700-foot elevation level. Both were found in foothill pine oak woodland habitat.

Farnsworth's Jewelflower Farnsworth's jewelflower was mapped at six locations classified as three distinct occurrences within the primary study area. All of the plants were found in open rocky sites along the San Joaquin River between Kerckhoff Dam and the Millerton Lake area, with the exception of a single plant that was found in the upper portion of Millerton Lake downstream from Kerckhoff No. 2 Powerhouse in a cocklebur-dominated community below the Millerton Lake high-water mark. The other five colonies contained between 100 and 1,000 individuals each. Below-average precipitation made 2007 a relatively poor year for annual wildflowers, but Farnsworth's jewelflower could be more abundant in the Study Area in a more favorable year.

Hall's Wyethia (*Wyethia elata*) Four occurrences of Hall's wyethia, containing a total of 31 clumps of plants, were identified in the primary study area along the San Joaquin River between Kerckhoff Dam and Millerton Lake. All of the occurrences were found in areas between 800 and 1,100 feet in elevation in somewhat open foothill pine oak woodland habitat.

Small-Flowered Monkeyflower (*Mimulus inconspicuus*) Small-flowered monkeyflower is widespread throughout the primary study area. Fifty-three clumps of small-flowered monkeyflower were mapped in 12 occurrences within the Study Area during the spring 2007 surveys (Figure 6-4). One additional population was identified during the spring 2010 surveys near the southwest side of the proposed Temperance Flat RM 274 Dam. This species could be even more abundant in the primary study area in years with normal precipitation. Small-flowered monkeyflower is endemic and rare in California, but it is locally abundant.

Extended Study Area

San Joaquin River from Friant Dam to Merced River

Sections describing the biological resources within the specific reaches of this portion of the extended study area are based on the prior analysis of biological resources in these reaches prepared in McBain & Trush (2002), DWR (2002 and 2011), Reclamation (1998a and 1998b), and SJRRP (2012). In these analyses, study areas were used that encompassed 1,000 feet from the edge of levees (e.g., the upper portion of Reach 1 and most of Reaches 3 and 4) or extent of riparian vegetation (e.g., portions of Reaches 1 and 2) if those features were present. When no levee, escarpment, or clear, discrete outer boundary of riparian vegetation was present, but riparian vegetation extended more or less continuously from the mainstem to adjacent sloughs or side channels, the boundary was set at 2,000 feet from the centerline of the main channel of the San Joaquin River (e.g., portions of Reach 5) (McBain & Trush 2002; DWR 2002, 2011; and SJRRP2012).

Because the extended study area varies somewhat from this definition, land cover in some portions of the extended study area was not mapped in the previous studies. Descriptions of reach-specific physical conditions, plant communities, and sensitive resources by reach are based on the SJRRP PEIS/R (SJRRP 2012), and the CNDDB (2013c).

Reach 1A Special-status plant species have been documented high above the alluvial plain of the river corridor in Reach 1A, just outside the extended study area. No special-status plant species have previously been documented in Reach 1A (CNDDB 2013c).

Reach 1B No special-status plant species have previously been documented in Reach 1B (CNDDB 2013c). This is likely largely because of the minimal amount of remnant native habitats along this stretch of the river.

Reach 2A One occurrence of heartscale (*Atriplex cordulata*) has previously been documented in the grasslands on the terraces above the alluvial plain, which is outside the identified extended study area in this reach. Heartscale is associated with grassland habitats. Elderberry shrubs have been documented along the river within this reach of the extended study area (DWR 2002).

Reach 2B In the marshy backwater area of the Mendota Pool that extends into Reach 2B, there is a 1948 record of Sanford’s arrowhead (*Sagittaria sanfordii*) (CNDDB 2013c). One other special-status plant species has been documented at Mendota Wildlife Area, outside the extended study area: Lost Hills crownscale (*Atriplex vallicola*) (CNDDB 2013c).

Reach 3 Lesser saltscale (*Atriplex minuscula*) and Munz' tidy-tips (*Layia munzii*), both associated with alkaline scrub and grassland habitats, have previously been documented on the higher terraces above the alluvial plain and just outside the extended study area along this reach (CNDDB 2013c). Palmate-bracted bird's beak (*Chloropyron palmatum*), a species that is Federally and State listed as endangered, is known to occur in the vicinity of the extended study area near Reach 3. This species grows in saline-alkaline soils in alkaline scrub and alkali meadow communities (USFWS 1998). This species primarily occurs along drainage channels (USFWS 1998).

Reach 4 The San Luis NWR and Grasslands Wildlife Management Area (WMA) in Reach 4B support marsh and emergent wetland, native grassland, alkali sink, riparian forest, and vernal pool vegetation communities; the Grasslands WMA supports the largest remaining block of contiguous wetlands in the Central Valley. Numerous documented occurrences of special-status plant species affiliated with these habitats have been documented throughout Reach 4B2; however, only one special-status plant, Delta button-celery (*Eryngium racemosum*), has previously been documented in Reach 4B1. Critical habitat for Hoover's spurge (*Chamaesyce hooveri*) and Colusa grass (*Neostapfia colusana*) has been designated within and adjacent to Reach 4B2 of the extended study area. No special-status plant species have been documented in the vicinity of the extended study area near Reach 4A.

Reach 5 Just north of its confluence with Bear Creek, Reach 5 of the San Joaquin River flows through Great Valley Grasslands State Park and then traverses the San Luis NWR. The State Park and San Luis NWR support the following vegetation communities: marsh and emergent wetlands, alkali sacaton (*Sporobolus airoides*) grasslands, alkali sinks, riparian forest, and vernal pools. Delta button-celery has previously been documented within Reach 5 (CNDDB 2013c). The State Park and NWR support occurrences of rare and endangered species, although these are not documented in this reach of the extended study area itself. These species include alkali milk-vetch (*Astragalus tener* var. *tener*), brittlescale (*Atriplex depressa*), heartscale, Hispid bird's-beak (*Cordylanthus mollis* ssp. *hispidus*), lesser saltscale, prostrate navarretia (*Navarretia prostrata*), vernal pool smallscale (*Atriplex persistens*), and Wright's trichocoronis (*Trichocoronis wrightii*).

Bypasses There are several documented occurrences of special-status species at the Eastside Bypass intersection with the Grasslands WMA, San Luis NWR, and Merced NWR. Marsh and perched wetlands, sand dunes, riparian forests, native grasslands, and vernal pools in these areas provide habitat for special-status plant species, including Delta button-celery, Wright's trichocoronis, and subtle orache (*Atriplex subtilis*). The Merced NWR also supports habitat for Colusa grass. Other special-status species, including brittlescale, heartscale, Sanford's arrowhead, and vernal pool smallscale, are documented in the vicinity but outside the extended study area. Critical habitat for Hoover's spurge and Colusa grass has been designated within and adjacent to the extended study area along the Eastside Bypass.

Palmate-bracted bird's beak is known to occur in the vicinity of the extended study area near Reach 3 and the Chowchilla Bypass.

The Mariposa Bypass supports several occurrences of Delta button-celery. Critical habitat for Hoover's spurge and Colusa grass has been designated within and adjacent to the extended study area along the Mariposa Bypass.

San Joaquin River from Merced River to the Delta
Special-status plant species in the San Joaquin River downstream from the confluence with the Merced River to the Delta include species that occur in the river floodplains, such as Delta button-celery, a State-listed endangered species, and marsh plants, such as Sanford's arrowhead, a CRPR List 1B species.

Delta Many special-status species are known or are likely to occur in the Delta because of the presence of unique wetland habitats. Tidal marshes, wet banks, and instream emergent wetlands support several special-status plant species, including rose mallow (*Hibiscus lasiocarpus*) (CRPR List 2), bristly sedge (*Carex comosa*) (CRPR List 2), slough thistle (*Cirsium crassicaule*) (CRPR List 1B), and Sanford's arrowhead (CRPR List1B). Riparian scrub provides habitat for Delta button-celery (State listed as endangered, CRPR List 1B), and riparian woodland provides habitat for fox sedge (*Carex vulpinoidea*) (CRPR List 2).

CVP and SWP Water Service Areas The CVP and SWP water service areas are subject to heavy anthropogenic influence and modification. As such, many native plant species have been displaced by nonnative species or plants of horticultural or agricultural value. The potential for special-status plant species is generally considered low in areas subject to substantial human modification. However, Sanford’s arrowhead, a CRPR List 1B species, is known to occur in drainages and canals and could be present within the water distribution systems within the CVP and SWP water service areas, particularly in areas that lack regular routine maintenance.

Waters of the United States, Including Wetlands, in Millerton Lake, the San Joaquin River, and Vicinity

Primary Study Area

A wetland delineation of the primary study area was performed in 2007 and supplemented in 2010 to determine the extent of waters of the United States within the primary study area.

Table 6-10 summarizes the findings of the respective wetland delineations. Also shown in Table 6-10 is the lacustrine habitat of Millerton Lake downstream from RM 274, which is part of the primary study area. Millerton Lake, which was formed by damming the San Joaquin River, a Traditional Navigable Water (TNW) of the United States, is subject to USACE jurisdiction under Section 404 of the CWA. A wetland delineation has not been conducted for the new or relocated transmission line corridors and therefore any wetlands present within these areas are not reflected in Table 6-10. Wetlands and waters of the United States within the primary study area are depicted in Figure 6-5.

Extended Study Area

A wetland delineation is under preparation for the San Joaquin River from Friant Dam to the Merced River portion of the extended study area; acreage of jurisdictional waters in this area is not yet available.

The San Joaquin River from Friant Dam to the confluence with the Merced River would be considered a navigable water and thus a jurisdictional feature subject to USACE regulation pursuant to Section 404 of the CWA and Section 10 of the Rivers and Harbors Act. The river channel likely contains other wetland habitats, including riparian habitats as described above.

Table 6-10. Acreages of Waters and Wetlands within the Primary Study Area

	Acres
Traditionally navigable waters	
Lacustrine (Millerton Lake)	4,607
Wetland habitats below OHWM of Millerton Lake	
Seasonal Wetlands[1]	71
Nonwetland habitats below OHWM of Millerton Lake	
Willow Riparian	3
Seasonal Wetlands (non-criteria)[2]	196
Riverine (San Joaquin River)	200
Riparian habitat below OHWM of San Joaquin River	
White Alder Riparian Woodland	25
Spanish Broom Scrub	<1
Relatively permanent waters (RPW)	
Perennial drainage	<1
Intermittent drainage	16
Wetlands abutting/adjacent to relatively permanent waters and nonrelatively permanent waters	
Swale	1
Freshwater seep	1
Nonrelatively permanent waters	
Ephemeral drainage	9
Total	5,129

Sources: Reclamation 2007, 2010

Notes:

California Wildlife Habitat Relationships (CWHR) nomenclature (Airola 1988; Mayer and Laudenslayer 1988) and the Cowardin classification system (Cowardin et al. 1979) were used for unvegetated cover types, such as lacustrine and riverine areas that could not be classified using Holland's terrestrial natural communities. Additional nomenclature, such as traditional navigable waters and relatively permanent waters, are from the *U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook* (USACE 2007).

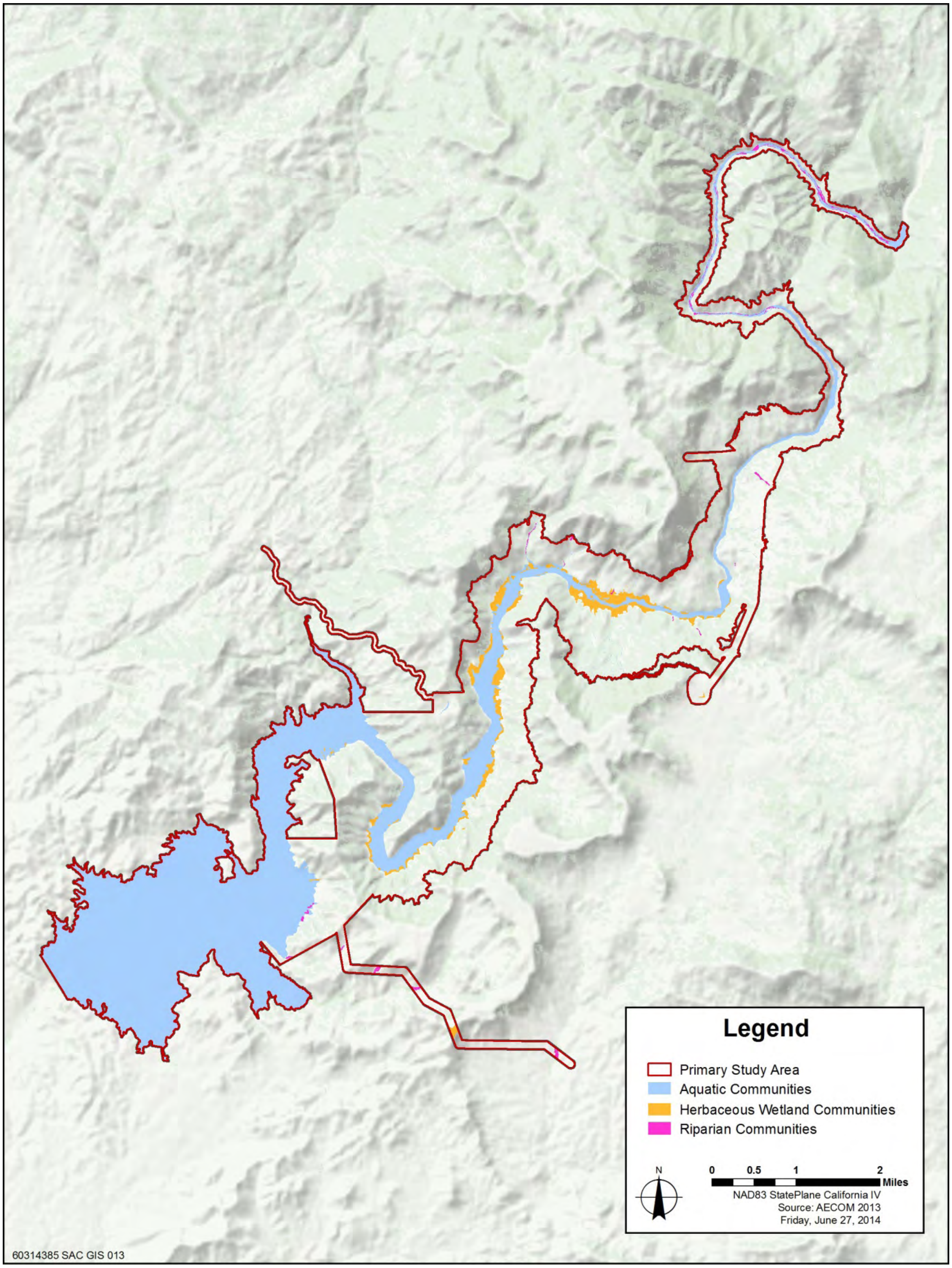
Acres are rounded to the nearest whole number.

[1] This acreage consists of 70 acres of bog yellowcress-cocklebur wetland and 1.4 acres of wet meadow. Both of these met the three criteria to qualify as wetlands under the CWA.

[2] This represents mixed herbaceous seasonal wetlands along the shoreline of Millerton Lake that did not meet the three criteria to qualify as wetlands under the CWA. These areas are considered waters of the United States, however, because they are within the OHWM of a Traditionally Navigable Water.

Key:

OHWM = ordinary high-water mark



Note: A wetland delineation has not been conducted for the transmission line corridors; wetlands identified in this portion of the primary study area are based on habitat types only.

Figure 6-5. Wetland Location Map for the Primary Study Area

The introduction of interim flows has resulted in surface water flows in several dry portions of the channel and has also contributed to near-river groundwater.

Sensitive aquatic habitats, including waters of the United States and wetland habitats present within the San Joaquin to Delta and the Delta portions of the extended study area, are present as shown in Table 6-7. Aquatic habitats found in the CVP and SWP water service areas, all of which are considered sensitive habitats and some of which may be waters of the United States, are listed in Table 6-8.

Invasive Plant Species

Invasive plants are species that are not native to the region, persist without human assistance, and have serious impacts on the native environment (Davis and Thompson 2000). The term “invasive plant” differs from the classification terms “nonnative,” “exotic,” or “introduced plant” because it is (when applied correctly) used only to describe those nonnative plant species that displace native species on a large enough scale to alter habitat functions and values. The Cal-IPC maintains a list of species that have been designated as invasive in California. The term “noxious weed” is used by government agencies for nonnative plants that have been defined as pests by law or regulation (CDFA 2009). Many invasive noxious trees and shrubs that have the ability to occupy channel and floodplain surfaces are a constant threat to river floodway capacity, and substantial cost and resources are required to remove and control large stands. Unlike the native riparian flora, many invasive riparian species do not attract populations of invertebrate life or produce edible seeds and fruit that support the food web for fish and aquatic and terrestrial wildlife.

Primary Study Area

Botanical surveys were conducted in the Temperance Flat Reservoir Area from February through July 2007. Within this area, stands of edible fig and Himalayan blackberry have been identified along intermittent and perennial drainages. Additionally, Spanish broom scrub habitat has been mapped in the primary study area. These vegetation communities are comprised of invasive species that typically occur in riparian habitats. Tocalote is an herbaceous invasive species typical of woodland and grassland vegetation communities, and localized infestations are present throughout the primary study area. Prevalent species and their associated Cal-IPC category and

California Department of Food and Agriculture (CDFA) rating are identified in Table 6-11.

Table 6-11. Prevalent Invasive Species in the Primary Study Area

Species	California Invasive Plant Council Inventory Category[1]	California Department of Food and Agriculture Rating[2]
Terrestrial Riparian Species		
Edible fig (*Ficus carica*)	Moderate	—
Scotch broom (*Cytisus scoparius*)	High	C
Spanish broom (*Sparticum junceum*)	High	C
Himalayan blackberry (*Rubus armeniacus*)	High	—
Terrestrial Woodland and Grassland Species		
Tocalote (*Centaurea melitensis*)	Moderate	—

Sources: California Invasive Plant Council 2006, CDFA 2009

Notes: Only plants with a Cal-IPC rating of Moderate, High, or Red Alert, or noxious weeds with a CDFA rating were included for consideration.

[1] California Invasive Plant Council Inventory Categories:

High – Have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Ecological amplitude and distribution is widespread.

Moderate – Have substantial and apparent, but generally not severe, ecological impacts on physical processes, plant and animal communities, and vegetation structure. Reproductive biology and other attributes are conducive to moderate to high rates of dispersal, but establishment generally depends on ecological disturbance. Ecological amplitude and distribution range from limited to widespread.

[2] California Department of Food and Agriculture Rating:

C – State-endorsed holding action and eradication only when found in a nursery; action to retard spread outside of nurseries at the discretion of the commissioner.

Key:
— = Not applicable
Cal-IPC = California Invasive Plant Council.

Extended Study Area

San Joaquin River from Friant Dam to Merced River

Prevalent riparian and aquatic species and their associated Cal-IPC category and CDFA rating are identified in Table 6-12. Invasive species known to occur within this portion of the extended study area include salt cedar (*Tamarix* sp.), red sesbania, giant reed, pampas grass (*Cortaderia* sp.), and Himalayan blackberry (DWR 2002).

Table 6-12. Prevalent Invasive Species in the Extended Study Area

Species	California Invasive Plant Council Inventory Category[1]	California Department of Food and Agriculture Rating[2]
Terrestrial Riparian Species		
Pampas grass (*Cortaderia jubata*)	High	—
Red sesbania (*Sesbania punicea*)	High, Red Alert	B
Salt cedar (*Tamarix* spp.)	High	B
Giant reed (*Arundo donax*)	High	B
Chinese tallow (*Sapium sebiferum*)	Moderate	—
Tree-of-heaven (*Ailanthus altissima*)	Moderate	C
Blue gum (*Eucalyptus globulus*)	Moderate	—
Perennial pepperweed (*Lepidium latifolium*)	High	B
Aquatic Species		
Water hyacinth (*Eichornia crassipes*)	High	C
Water primrose (*Ludwigia hexapetala*)	High	—
Water milfoil (*Myriophyllum spicatum*)	High	C
Parrot's feather (*Myriophyllum aquaticum*)	High, Red Alert	—
Curly-leaf pondweed (*Potamogeton crispus*)	Moderate	—
Sponge plant (*Limnobium spongia*)	—	Q

Sources: California Invasive Plant Council 2006, CDFA 2009, SJRRP 2012

Notes: Only plants with a Cal-IPC rating of Moderate, High, or Red Alert, or noxious weeds with a CDFA rating, were included for consideration.

[1] California Invasive Plant Council Inventory Categories:

High – Have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

Moderate – Have substantial and apparent, but generally not severe, ecological impacts on physical processes, plant and animal communities, and vegetation structure. Reproductive biology and other attributes are conducive to moderate to high rates of dispersal, but establishment generally depends on ecological disturbance. Ecological amplitude and distribution range from limited to widespread.

Limited – Invasive but ecological impacts are minor on a Statewide level, or not enough information was available to justify higher rating. Reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are limited, but these species may be locally persistent and problematic.

Red Alert – plants with the potential to spread explosively; infestations currently small and localized.

[2] California Department of Food and Agriculture Rating:

B – Eradication, containment, control or other holding action at the discretion of the commissioner.

Table 6-12. Prevalent Invasive Species in the Extended Study Area (contd.)

C – State-endorsed holding action and eradication only when found in a nursery; action to retard spread outside of nurseries at the discretion of the commissioner.
Q – Temporary rating for eradication, containment, rejection, or other holding action at the State-county level, outside of nurseries pending determination of a permanent rating.

Key:
— = Not applicable
Cal-IPC = California Invasive Plant Council

Additional invasive plants that are potentially present include emergent and submergent aquatic plants, including sponge plant (*Limnobium spongia*), water hyacinth (*Eichornia crassipes*), curly leaf pond weed (*Potamogeton crispus*), parrot feather (*Myriophyllum aquaticum*), water milfoil (*Myriophyllum spicatum*), and water primrose (*Ludwigia hexapetala*).

Giant reed is widespread and mapped in all reaches except Reach 4 (SJRRP 2012). Himalayan blackberry is also frequently encountered, especially in riparian scrub communities, where it is observed over long channelized portions of the river. Red sesbania is a relatively recent introduction to the San Joaquin River, but it is spreading aggressively. It occurs extensively through Reaches 1A and upper Reach 1B, but as of 2008, it was more sparsely distributed in lower Reach 1B and Reach 2A (SJRRP 2012).

Invasive species information collected in 2008 was also included in the baseline description here because invasive species such as red sesbania can rapidly colonize a river corridor and substantially change vegetation composition identified during surveys conducted in 2000. The recent and rapid spread of red sesbania is of particular concern because it has successfully colonized both disturbed bar soil and substrate (banks of aggregate mining pits, sand and gravel bars, other exposed surfaces), as well as encroached into the occupied understory of existing dense riparian vegetation and formed monocultures along the low-flow shoreline.

Also, based on recent information from stakeholders, water hyacinth is present in Reaches 2, 3, and 4, and a small population of Chinese tallow (*Sapium sebiferum*) is present in Reach 1 (SJRRP 2012). In 2008, Chinese tallow was also observed in Reach 3 (SJRRP 2012). Perennial pepperweed (*Lepidium latifolium*), a herbaceous invasive not mapped by DWR in 2000, was documented in four occurrences in Fresno Slough and was widely distributed and abundant in patches in

Reach 5 and adjoining Salt and Mud Sloughs within the extended study area in 2008 (SJRRP 2012). Low-flow channels choked with a mix of floating and submerged aquatic weeds severely decrease flow capacity, lower dissolved oxygen (due to higher biochemical oxygen demand), and benefit habitat for nonnative fish species (e.g., centrarchids) that prey on native juvenile fish. Dense surface mats of aquatic weeds also cause greater adult mosquito production and diminish the effectiveness of biological mosquito control measures (e.g., bacterial toxin dispersal, mosquitofish).

Invasive species are likely to spread throughout this portion of the extended study area due to increased flows in the San Joaquin River and Bypass system resulting from implementation of the interim flow schedule. Seeds of native and invasive species are transported by the river and deposited at downstream locations, where germination occurs if conditions are favorable. As the water surface elevation of the San Joaquin River increases due to the interim flow schedule, seeds of invasive species growing along the active channel are transported downstream and onto the active floodplain, and are then reconnected to the San Joaquin River by the interim flows. Invasive species associated with riparian and riverine habitats, are adapted to aquatic transport and long distance seed dispersal.

San Joaquin River from Merced River to the Delta
Invasive plant species identified in Table 6-12 are anticipated to be present within the San Joaquin River from the Merced River to the Delta portion of the extended study area.

Delta Invasive plant species identified in Table 6-12 are anticipated to be present within the Delta portion of the extended study area.

CVP and SWP Water Service Areas Invasive plant species identified in Table 6-12 are anticipated to be present throughout the CVP and SWP water service areas.

Environmental Consequences and Mitigation Measures

This section describes the methods of environmental evaluation, assumptions, and specific criteria that were used to determine the significance of impacts on botanical resources and wetlands. It then discusses the impacts of the alternatives and proposes mitigation where appropriate. The potential impacts on botanical resources and wetlands and associated mitigation measures are summarized in Table 6-13.

Methods and Assumptions

This analysis is based on information obtained from the CNDDB and California Native Plant Society databases; biological resource conditions as documented in biological resources studies conducted in 2007, 2008, and 2010, as discussed in the Affected Environment section; and additional documents describing historical and potential conditions for biological resources in the primary and extended study areas. A list of the main documents reviewed in support of preparing this analysis is presented in the Affected Environment section of this chapter (the complete list is provided in Chapter 30, "References").

This analysis assumes that existing habitat and botanical resources located between 580 and 985 feet above msl within the Temperance Flat Reservoir Area would be eliminated either as a result of inundation or from vegetation removal before inundation. It is further assumed that existing habitat and botanical resources within the footprints of the project features located higher than the 985-foot full pool elevation would be removed or converted to other habitat types as a result of construction activities. The area encompassing all of the quarry, batch plant, and haul road options was included in the impact calculations for project features even though only one quarry site, supporting dam batch plant, and connecting haul road would ultimately be constructed under the action alternatives. This approach overestimates the area that would experience habitat removal or conversion, and provides a conservative analysis of the potential impacts of the action alternatives.

As discussed in Chapter 2, "Alternatives," the environmental commitments for the project include revegetation of temporary construction areas. Because the action alternatives would have the same physical footprint and affected area, impacts on botanical and wetland resources would be the same for each of the action alternatives.

Table 6-13. Summary of Impacts and Mitigation Measures for Botanical and Wetland Resources

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
BOT-1: Loss of Special-Status Plants and Loss or Degradation of Special-Status Plant Habitat	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	BOT-1: Relocate Special-Status Plant Populations	LTS
		Alternative Plan 2	S		LTS
		Alternative Plan 3	S		LTS
		Alternative Plan 4	S		LTS
		Alternative Plan 5	S		LTS
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	LTS		LTS
		Alternative Plan 2	LTS		LTS
		Alternative Plan 3	LTS		LTS
		Alternative Plan 4	LTS		LTS
		Alternative Plan 5	LTS		LTS
BOT-2: Loss of Riparian Habitat and Other Sensitive Communities	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	BOT-2: Compensate for Loss of Specific Habitats	SU
		Alternative Plan 2	S		SU
		Alternative Plan 3	S		SU
		Alternative Plan 4	S		SU
		Alternative Plan 5	S		SU
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	LTS		LTS
		Alternative Plan 2	LTS		LTS
		Alternative Plan 3	LTS		LTS
		Alternative Plan 4	LTS		LTS
		Alternative Plan 5	LTS		LTS

Table 6-13. Summary of Impacts and Mitigation Measures for Botanical and Wetland Resources (contd.)

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
BOT-3: Loss or Degradation of Waters of the United States, Including Wetlands, and Waters of the State	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	BOT-3: Ensure No Net Loss of Wetlands	LTS
		Alternative Plan 2	S		LTS
		Alternative Plan 3	S		LTS
		Alternative Plan 4	S		LTS
		Alternative Plan 5	S		LTS
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
BOT-4: Introduction and Spread of Invasive Plants	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	PS	BOT-4: Implement a Weed Management Plan	LTS
		Alternative Plan 2	PS		LTS
		Alternative Plan 3	PS		LTS
		Alternative Plan 4	PS		LTS
		Alternative Plan 5	PS		LTS
	Extended Study Area	No Action Alternative	LTS	None Required	LTS
		Alternative Plan 1	LTS		LTS
		Alternative Plan 2	LTS		LTS
		Alternative Plan 3	LTS		LTS
		Alternative Plan 4	LTS		LTS
		Alternative Plan 5	LTS		LTS

Table 6-13. Summary of Impacts and Mitigation Measures for Botanical and Wetland Resources (contd.)

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
BOT-5: Elimination of a Plant Community or Substantial Reduction in the Number or Restriction of the Range of an Endangered, Rare, or Threatened Plant Species	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	LTS		LTS
		Alternative Plan 2	LTS		LTS
		Alternative Plan 3	LTS		LTS
		Alternative Plan 4	LTS		LTS
		Alternative Plan 5	LTS		LTS
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
BOT-6: Conflict with Local or Regional Policies and Plans Protecting Wetland or Botanical Resources	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	BOT-6: Implement Mitigation Measures BOT-1, BOT-2, and BOT-3	LTS
		Alternative Plan 2	S		LTS
		Alternative Plan 3	S		LTS
		Alternative Plan 4	S		LTS
		Alternative Plan 5	S		LTS
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI

Table 6-13. Summary of Impacts and Mitigation Measures for Botanical and Wetland Resources (contd.)

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
BOT-7: Conflict with Provisions of an Adopted Habitat Conservation Plan Protecting Wetland or Botanical Resources	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 4	NI		NI
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI

Key:
LTS = less than significant
NI = no impact
PS = potentially significant
S = significant
SU = significant and unavoidable

Each action alternative would deliver some portion of the new water supply to the Friant Division via the Friant-Kern Canal and Madera Canals. Alternative Plans 2, 3, 4 and 5 would also deliver new supply to other CVP SOD contractors via the San Joaquin River through exchange at Mendota Pool and the California Aqueduct. Alternative Plans 1, 2, and 4 would also deliver new supply to SWP SOD M&I contractors via the San Joaquin River through exchange at Mendota Pool and the California Aqueduct. Alternative 3 would also deliver new supply to SWP SOD M&I contractors via existing cross-valley conveyance and the California Aqueduct.

The conveyance of water supplies via the San Joaquin River through exchange at Mendota Pool would not exceed channel capacity of the San Joaquin River, bypass systems, or Delta waterways. The delivery of this additional water, when combined with other existing CVP and SWP supplies, would not exceed the historical maximum CVP and SWP water deliveries, exceed existing contracted water volumes, result in placing new land into agricultural production, change cropping patterns, or result in other physical changes to the environment.

Construction of Temperance Flat RM 274 Reservoir would create incidental flood storage space, reducing the volume of winter and spring releases to the San Joaquin River that would be required to maintain the conservation space for rain flood and conditional space for forecasted snowmelt inflows by the Friant Dam and Millerton Lake Flood Control Manual. The largest reduction in releases is simulated to occur in February when releases from Friant Dam are reduced by a long-term average of 46 percent under the action alternatives. Under the action alternatives, some of the additional water supply captured in the Temperance Flat RM 274 Reservoir is released to the San Joaquin River. Because agricultural demand is highest in the summer months, this results in a long-term average increase in releases from Friant Dam during the month of August. For example, long-term average simulated flows in Reach 2B in August increase by 135 percent compared to the No Action Alternative.

Changes in stream flow volumes would remain within typical historical volumes and within the range of flows modeled for the No Action Alternative, as described in Chapter 14, "Hydrology – Surface Water Supplies and Facilities Operations," of this Draft EIS. Therefore, delivery of new water supplies to CVP and SWP water contractors and changes in stream flow within the extended study area would not have a substantial impact on botanical and wetland resources in the extended study area.

As described in Chapter 14, “Hydrology – Surface Water Supplies and Facilities Operations,” of this Draft EIS, before the release of Interim and Restoration flows began, Reach 2 of the San Joaquin River was typically dry and flows only reached Mendota Pool from Reach 2B or from the Fresno Slough during periods of flood management releases. Channel capacity limitations downstream from Mendota Pool have required recapture of most of the Interim and Restoration flows at Mendota Pool. As the capacity of the San Joaquin River downstream from Mendota Pool is gradually increased, Restoration Flows will increase downstream from Mendota Pool, and recapture at Mendota Pool would only occur as needed (e.g., during scheduled construction activities downstream from Mendota Dam, such as in Reach 4B). Flows in Reach 3 currently consist primarily of water conveyed from the Delta to Mendota Pool via the Delta-Mendota Canal. Flows in Reach 4 are predominantly agricultural return flows and current operations divert all flow from Reach 4B1 to the Eastside Bypass. Because Reaches 2B, 3, and 4 currently receive very little flow from Friant Dam as a result of channel limitations and water diversions, construction of the Temperance Flat RM 274 Reservoir has very little potential to substantially alter conditions, as a result of flow changes, in these reaches. San Joaquin River flows from Friant Dam reenter the river in Reach 5.

Although construction of the Temperance Flat RM 274 Reservoir could reduce the frequency of flood management releases from Friant Dam, it would not reduce flows reaching the lower San Joaquin River below the levels mandated by the Settlement, which would be an increase from the current condition in the lower San Joaquin River.

Criteria for Determining Significance of Impacts

An environmental document prepared to comply with NEPA must consider the context and intensity of the environmental impacts that would be caused by, or result from, implementing the No Action Alternative and other alternatives. Under NEPA, the severity and context of an impact must be characterized. An environmental document prepared to comply with CEQA must identify the potentially significant environmental impacts of a proposed project. A “[s]ignificant effect on the environment” means “a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project" (State CEQA Guidelines, Section 15382). CEQA also requires that the environmental document propose feasible measures to avoid or substantially reduce significant environmental impacts (State CEQA Guidelines, Section 15126.4[a]).

The thresholds of significance for impacts used for this analysis are based on Appendix G of the State CEQA Guidelines, as amended, and Federal Executive Order (EO) 11312 regarding invasive species. These thresholds also encompass the factors taken into account to characterize the context and the intensity of an impact. Impacts on botanical resources would be significant if project implementation would do any of the following:

- Have a substantial adverse impact, either directly or through habitat modifications, on any plant species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by USFWS or CDFW.

- Have a substantial adverse impact on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by USFWS or CDFW.

- Have a substantial adverse impact on Federally protected wetlands, as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool), through direct removal, filling, hydrological interruption, or other means.

- Introduce or substantially spread a nonnative invasive plant species.

- Threaten to eliminate a plant community, or substantially reduce the number or restrict the range of an endangered, rare, or threatened plant species.

- Conflict with local policies or ordinances protecting wetland or botanical resources, such as an oak tree or woodland preservation policy or ordinance.

- Conflict with the provisions of an adopted habitat conservation plan (HCP), natural community conservation plan, or other approved local, regional, or State HCP relating to the protection of plant resources.

Topics Eliminated from Further Consideration

No topics related to botanical resources and wetlands that are included in the significance criteria listed above were eliminated from further consideration. All relevant topics are analyzed in the following discussion.

Direct and Indirect Impacts

This section identifies how specific vegetation and wetland types could be affected by implementing any of the alternatives. Implementing any of the alternative plans could affect botanical resources and wetlands by doing any of the following:

- Grading land, removing vegetation, or otherwise disturbing ground for the construction of features including haul roads, transmission lines, and recreational facilities
- Clearing vegetation from the Temperance Flat Reservoir Area to facilitate safe operation of the Temperance Flat RM 274 Reservoir, ancillary facilities, and surrounding recreational areas; and the continued safe operation of Millerton Lake recreational areas
- Inundating habitats located between 580 and 985 feet above msl within the Temperance Flat Reservoir Area between the Temperance Flat RM 274 Dam site and Kerckhoff Dam
- Increasing water discharges from Millerton Lake into the San Joaquin River for conveyance to SOD CVP and SWP water contractors by 28 TAF to 37 TAF

Impact BOT-1: Loss of Special-Status Plants and Loss or Degradation of Special-Status Plant Habitat

Primary Study Area

No Action Alternative Under the No Action Alternative, the proposed Temperance Flat RM 274 Dam would not be constructed and no change would occur to the operation of Friant Dam or the full pool elevation of Millerton Lake. Continuation of existing land uses would not result in changes to the quality or types of habitats present within the primary study area. No change in vegetation community composition or conversion of habitat types would occur.

There would be **no impact** under the No Action Alternative.

Action Alternatives Creation of the Temperance Flat RM 274 Reservoir would result in inundation of several special-status plant occurrences that have been documented within the Temperance Flat Reservoir Area. Inundation of this area would result in mortality of known special-status plant populations and permanent loss of known occupied and potential habitat. Additional special-status plant species, including State-listed and Federally listed vernal pool plant species, could be adversely affected by development of project features outside of the Temperance Flat Reservoir Area that have not yet been surveyed.

Known plant occurrences that would be lost in the primary study area as a result of project implementation consist of one occurrence of tree anemone (State listed as threatened), two occurrences of Madera leptosiphon (CRPR 1B.2 and BLM Sensitive), and the following CRPR 4 (watch list) species: one occurrence of Ewan’s larkspur, 12 occurrences of small-flowered monkeyflower, two occurrences of Michael’s piperia, three occurrences of Farnsworth’s jewelflower, and four occurrences of Hall’s wyethia (Table 6-9). Each of these plant occurrences are located within the Temperance Flat Reservoir Area between the Temperance Flat RM 274 Dam site and Kerckhoff Dam and would be inundated as a result of dam construction and operation (Figure 6-4).

The known occurrence of tree anemone in the primary study area is small, consisting of only six plants observed at the time of the 2007 survey; however, there are only 11 known natural occurrences in existence so loss of this one occurrence would represent a substantial decrease in the number of occurrences. The overall wild population size for all known occurrences combined is close to 5,000 individuals (DFG 2005). Therefore, the 6 plants present in the primary study area represent 0.12 percent of the existing wild population. This occurrence is unique because it is the lowest elevation at which this species has been found, and if left undisturbed, it would likely increase in size over time. This population consisted of five mature shrubs and one young shrub in 2007 indicating that it is regenerating at this location.

Madera leptosiphon, designated as a CRPR 1B plant, is eligible for State listing because it is rare throughout its range and subject to a moderate degree and immediacy of threat. There are only three other documented occurrences of this plant species within the nine quadrangles surrounding the primary study area, so loss of two occurrences represents a loss of 40 percent of the known occurrences in the area. There are only 20 total records of this species covering Fresno and Madera counties so the two occurrences in the Temperance Flat Reservoir Area represent 10 percent of the known occurrences in these two counties. Many of the recorded occurrences have not been seen in more than 50 years and may no longer be extant. Loss of the two occurrences in the Temperance Flat Reservoir Area and loss and degradation of substantial acreage of suitable habitat within this species' limited range could further jeopardize it and warrant State or Federal listing of this species.

Watch-list species (designated CRPR 4) documented in the primary study area are all either widely distributed across the state (e.g., Michael's piperia) or are locally common (e.g., small-flowered monkeyflower, Hall's wyethia). None of these species are seriously threatened in the state at this time and they are found in common habitat types. Therefore, these species do not meet the definition of endangered, rare, or threatened pursuant to State CEQA Guidelines Section 15380. Loss of these watch list plant occurrences would not substantially reduce the number or restrict the range of any of these species or be likely to result in a trend toward State or Federal listing as threatened or endangered.

Additional special-status plant occurrences could be present in portions of the primary study area that have not yet been surveyed either because they are located on private property that could not be accessed or are associated with recent modifications in the location of project features, such as trails, campgrounds, and transmission lines. No Federally listed plant species are known or expected to occur in the Temperance Flat Reservoir Area because no suitable habitat is present.

The proposed new transmission line would traverse vernal pool habitat that has the potential to support vernal pool plant species such as succulent owl's clover and San Joaquin Orcutt grass, which are State listed as endangered and Federally listed as threatened, and Boggs Lake hedge-hyssop, which is State listed as endangered. The transmission line also traverses grasslands and open woodlands that may provide suitable habitat for Hartweg's golden sunburst, which is State and Federally listed as endangered. Construction of the transmission line could result in destruction of State-listed or Federally listed plant species or loss or degradation of their habitat. Dwarf downingia (CRPR 2B.2) and spiny-sepaled button celery (CRPR 1B.2) could also be adversely affected by construction of the new transmission line if they are present.

Project implementation would result in loss and degradation of habitat that could support other special-status plant species or populations (refer to Table 6-9 for list of potentially occurring species) in areas that were not surveyed at a protocol level due to lack of access (Figure 6-2). Inundation, vegetation removal, grading, and other construction disturbances in suitable habitat for special-status plants could result in loss of special-status plants that may be present.

In addition to direct mortality of special-status plant populations and direct loss of habitat, project implementation could result in indirect impacts on populations adjacent to the Temperance Flat RM 274 Reservoir or other project features. Potential indirect impacts include changes in vegetation management around project features, introduction or spread of invasive species that compete with special-status plants, and degradation of habitat in adjacent areas due to increased access and use resulting from the new Temperance Flat RM 274 Reservoir, recreational trails and other recreation facilities, and new project roads. In particular, two populations of tree anemone and one population of Madera leptosiphon documented within 500 feet of the primary study area boundary may be subject to indirect impacts from increased access and recreational use in areas that currently receive very little human visitation. Indirect impacts on special-status plant occurrences that are near but outside the primary study area or that may be retained within project features that do not require complete removal of existing vegetation could result in eventual mortality of individuals or populations and loss of occupied habitat.

Loss and disturbance of known occurrences of tree anemone and Madera leptosiphon in the primary study area constitutes a substantial adverse impact on special-status plant species. Loss and degradation of habitat that could support other special-status plant species or populations could have a substantial adverse impact on special-status plant species if they are present.

This impact would be **significant** under the action alternatives. Mitigation for this impact is proposed below in the Mitigation Measures section.

Extended Study Area

No Action Alternative Under the No Action Alternative, the proposed Temperance Flat RM 274 Dam and Reservoir would not be constructed, and no change would occur to the operation of Friant Dam. No change in vegetation community composition or conversion of habitat types would take place.

There would be **no impact** under the No Action Alternative.

Action Alternatives Implementation of any of the action alternatives would increase water delivery reliability from Millerton Lake. On average for all but Wet years, 46 TAF to 110 TAF of the added water supply provided by the new Temperance Flat RM 274 Reservoir would be discharged to the San Joaquin River for conveyance to SOD CVP and/or SWP water contractors. In wet years with large runoff events, stream flow downstream from Friant Dam would be reduced from current conditions during the wettest part of the year, generally winter and spring, and increased during dry months or years. However, these additional water supplies would not exceed current channel capacity of the San Joaquin River or bypass systems and changes in stream flows during wet and dry years would be within typical historical volumes. Therefore, the additional water supply would not substantially alter special-status plant habitats.

The majority of special-status plant species that are known to occur in the vicinity of the extended study area between Friant Dam and the Merced River, as discussed in the Affected Environment section, are found in habitats that occur above the alluvial plain, such as grassland, vernal pool, and alkaline scrub habitats. Special-status plant species associated with these habitat types would not be affected by water releases within the current channel capacity of the San Joaquin River and other conveyance channels.

Delta button-celery, a species that is State listed as endangered, has been documented at 36 locations within Reaches 4B and 5 and the Eastside and Mariposa bypasses of the extended study area. These occurrences represent approximately three-quarters of all known extant occurrences of Delta button-celery. This species inhabits seasonally inundated floodplain depressions in riparian scrub habitat. The action alternatives would not increase flows in these reaches, therefore, Delta button-celery would not be substantially affected by the additional water supply.

Three special-status species that are not Federally or State listed, but have a CRPR of 1 or 2, are species that could occur in riverine, marsh, or riparian habitats in the extended study area: California satintail (*Imperata brevifolia*), Sanford's arrowhead, and Wright's trichocoronis. Marsh and riparian habitats potentially supporting these species within the current San Joaquin River and other conveyance channels could experience occasional flooding from additional water deliveries from Millerton Lake in dry months or dry years, but water deliveries would not substantially alter the current hydrologic regime and the overall flow patterns, water depth, and frequency and duration of flooding in these waterways would be within the current range of variation to which these species are adapted. Therefore, these species would not be substantially affected by the additional water supply.

The additional water storage in the Temperance Flat RM 274 Reservoir would provide a more reliable water supply making water available for delivery during periods when it might not otherwise be available. This means that in most years, more water would be released into the San Joaquin River and bypass channels than under current conditions. However, the overall maximum water deliveries, contracted water volumes, and existing water uses and adjacent land uses would not substantially change because water flows from Friant Dam would not deviate from the range of operating conditions that define existing conditions.

Additional water supply from the Temperance Flat RM 274 Reservoir could result in a minimal increase in flow duration in the existing San Joaquin River channel between Friant Dam and Mendota Pool in some years, but the increased water supply would not be enough to result in prolonged submergence of established vegetation that would lead to plant mortality or conversion of habitat.

Changes in delivery of the new water supply would have even less impact on San Joaquin River flows downstream from the Merced River as the contribution from Friant Dam becomes a smaller proportion of the total flow because of contributions from other major tributaries (e.g., the Merced, Tuolumne, and Stanislaus rivers). The action alternatives would not result in substantial changes in water levels, flood frequency or magnitude, or other conditions or events that could affect vegetation in the San Joaquin River from the Merced River to the Delta or in the Delta. Thus, any changes downstream from the Merced River confluence or in the Delta would not be sufficient to affect special-status plant species.

Implementing any of the action alternatives is not expected to substantially alter potential habitat for special-status plant species or result in loss of any special-status plant occurrences in the extended study area.

This impact would be **less than significant** under the action alternatives. Mitigation for this impact is not needed and thus not proposed.

Impact BOT-2: Loss of Riparian Habitat and Other Sensitive Communities

Primary Study Area

No Action Alternative Under the No Action Alternative, the proposed Temperance Flat RM 274 Dam and Reservoir would not be constructed, and no change would occur to the operation of Friant Dam. No change in vegetation community composition or conversion of habitat types would take place.

There would be **no impact** under the No Action Alternative.

Action Alternatives Creation of the Temperance Flat RM 274 Dam and Reservoir would result in inundation of riparian habitat and oak woodland natural communities resulting in converting these terrestrial natural communities to lacustrine (open water) habitats. Constructing project features could also result in ground disturbance, stream or wetland alteration, and vegetation removal in riparian and oak woodland natural communities resulting in loss or degradation of these sensitive habitats.

Implementing any of the action alternatives would result in loss and degradation of substantial acreage of riparian and oak woodland natural communities considered sensitive by State and local resource agencies, protected under Section 1602 of the California Fish and Game Code, and/or requiring consideration under CEQA. Table 6-14 lists the acreage of each type of riparian and oak woodland community that would be inundated as a result of project implementation. Table 6-15 identifies the acreage that would be affected as a result of constructing other project features.

Aquatic habitats found in the primary study area qualify as wetlands or waters of the United States under Section 404 of the CWA and waters of the State and are addressed in the discussion of Impact BOT-3.

Riparian and oak woodland communities would be directly affected as a result of constructing project features, vegetation removal within the Temperance Flat Reservoir Area, and from the Temperance Flat RM 274 Reservoir. All riparian and oak woodland habitats located between 580 and 985 feet above msl within the Temperance Flat Reservoir Area between the Temperance Flat RM 274 Dam site and Kerckhoff Dam would be converted to lacustrine habitat.

Table 6-14. Summary of Riparian and Oak Woodland Habitat Impacts in the Temperance Flat Reservoir Area under the Action Alternatives

Habitat	Acres Affected (Direct Impact)
Oak Woodland[1]	**4,238**
Foothill Pine Oak Woodland	3,289
Blue Oak Woodland	920
Live Oak Woodland	29
Riparian	**33**
White Alder Riparian	25
Mixed Riparian	2
Willow Riparian	2
Sycamore Woodland	<1
Buttonbush Scrub	<1
Fig Riparian	1
Fig - Willow Riparian	2
Total Oak Woodland and Riparian	4,271

Note:
[1] A total of 251.3 acres of oak woodland habitat would be directly affected on Sierra Foothill Conservancy lands and 82.8 acres of oak woodland would be impacted within the CDFW Big Table Reserve.

Table 6-15. Summary of Riparian and Oak Woodland Habitat Impacts in the Area of Project Features under the Action Alternatives

Habitat	Acres Affected (Direct Impact)
Oak Woodland	**1,519**
Foothill Pine Oak Woodland	1,215
Blue Oak Woodland	298
Live Oak Woodland	6
Riparian	**9**
Mixed Riparian	9
Total Oak Woodland and Riparian	1,528

Two ecological preserves, McKenzie Table Mountain Preserve and the Austin & Mary Ewell Memorial Preserve on Fine Gold

Creek, owned and managed by the Sierra Foothill Conservancy, would be directly affected as a result of inundation by the Temperance Flat RM 274 Dam or by construction of project features within the primary study area, such as haul routes or transmission corridors. Approximately 251 acres of oak woodland habitats within the McKenzie Table Mountain Preserve are located below the inundation line of the Temperance Flat Reservoir Area. In addition, a total of 74 acres of oak woodland and 3 acres of riparian habitat within the McKenzie Table Mountain Preserve are present within the new transmission line corridor. Approximately 8 acres of oak woodland habitat within the Austin & Mary Ewell Memorial Preserve would be directly affected as a result of the construction of the haul route to the aggregate quarry. In addition, approximately 83 acres of oak woodlands would be directly affected due to inundation on the Big Table Ecological Reserve, managed by CDFW.

Most of the riparian and oak woodland habitat within the footprint of other project features would be converted to developed or disturbed habitat types, although riparian habitat may be avoided during development of some of the project features. For example, the proposed Temperance Flat transmission line corridor intersects four intermittent streams supporting riparian habitat, but transmission towers could be located to avoid riparian features along these stream channels. In other instances, sensitive habitats may be more difficult to avoid during construction of project features. Some acreage of oak woodland vegetation within some project features, such as the new or relocated transmission line corridors, would likely be converted to annual grassland following project implementation.

Although not officially recognized as special-status natural communities by CDFW, the oak woodland communities within the primary study area are designated under the Oak Woodlands Conservation Act, California Public Resources Code 21083.4, and the Fresno County and Madera County general plans.

Oak woodlands provide important habitat to numerous common and special-status wildlife species. As such, oak woodland communities are considered sensitive habitats by wildlife resource agencies, including USFWS and CDFW. There is a great deal of concern about oak and other hardwood communities in California (Harris and Kocher 2002) because the rapid rate of urban and agricultural development in the foothills is fragmenting and altering these communities. Studies suggest that oak and other hardwood habitats are at risk throughout California (California Oak Foundation 2006, Saving and Greenwood 2002, Giusti and Merenlender 2002, Light and Pedroni 2002). In the San Joaquin region, it is estimated that about 250,000 acres of oak woodland are at risk for loss by the year 2040 (California Oak Foundation 2006). The loss of approximately 5,757 acres of oak woodland habitat from project implementation is considered a substantial loss of this habitat.

Additional indirect impacts on sensitive natural communities could result from introduction of invasive species, vegetation management practices (e.g., clearing for fire control, maintaining recreational facilities), and intrusion by humans and domestic animals that could disturb sensitive natural communities and reduce habitat values.

The loss and degradation of riparian and oak woodland habitat that would occur in the primary study area with project implementation constitutes substantial adverse impact on sensitive natural communities regulated by CDFW under Section 1602 of the California Fish and Game Code and California Public Resources Code.

This impact would be **significant** under the action alternatives. Mitigation for this impact is proposed below in the Mitigation Measures section.

Extended Study Area

No Action Alternative Under the No Action Alternative, the proposed Temperance Flat RM 274 Dam would not be constructed, and no change would occur to the regular operation of Friant Dam or water conveyance within the San Joaquin River and bypass systems. No new water supply would be discharged down the San Joaquin River to the Delta and no change in vegetation community composition or conversion of habitat types would occur.

There would be **no impact** under the No Action Alternative.

Action Alternatives Under Alternative Plans 1 through 5, the construction of the Temperance Flat RM 274 Dam would increase water delivery reliability from Millerton Lake. During wet years, average stream flow would be reduced downstream from Friant Dam in winter and spring months when Temperance Flat RM 274 Reservoir would store large runoff events that otherwise would be released from Millerton Lake as flood flows.

This stored water would be released during drier months and years thereby increasing average flows downstream from Friant Dam during these periods. Changes in stream flows during wet and dry years would be within typical historical volumes. Delivery of the new water supply would not exceed historical maximum CVP and SWP water deliveries, exceed existing contracted water volumes, result in placing new land into agricultural production, or change crop patterns.

All action alternatives described in this Draft EIS would enhance riparian habitat restoration along the San Joaquin River under the SJRRP, by providing the following effects:

- The reduced frequency, magnitude, and duration of Friant Dam releases greater than Restoration Flows would:
    - Reduce the risk of damage to SJRRP instream and floodplain investments
    - Increase flexibility for managing riparian recruitment flows and flexible flow periods
    - Reduce the potential for riparian zone/bank erosion
- Reduce frequency, magnitude, duration of floodplain habitat inundation
- Improve flexibility in management of Restoration Flows with no effect on water deliveries, including increased operational flexibility for providing buffer flows and pulse flows for gravel mobilization

The San Joaquin River downstream from Friant Dam would not experience a change in vegetation community composition or conversion of habitat types because water flows from Friant Dam would not deviate from the range of operating conditions that define existing conditions. Because the new water supply delivery would not exceed the current channel capacity of the San Joaquin River and would not substantially alter the overall hydrological regime, no substantial change in vegetation communities is anticipated. Therefore, the additional water supply would not substantially alter riparian habitats or other sensitive natural communities that occur within the San

Joaquin River channel or bypass systems within the extended study area downstream from Friant Dam to the confluence with the Merced River.

Changes in delivery of the new water supply would have even less influence on San Joaquin River flows downstream from the Merced River as the contribution from Friant Dam becomes a smaller proportion of the total flow because of contributions from other major tributaries (e.g., the Merced, Tuolumne, and Stanislaus Rivers). The action alternatives would not result in substantial changes in water levels, flood frequency or magnitude, or other conditions or events that could affect vegetation in the San Joaquin River from the Merced River to the Delta or in the Bay-Delta estuary.

The additional water storage in the Temperance Flat RM 274 Reservoir would provide a more reliable water supply, making water available for delivery during periods when it might not otherwise be available. This means that in most years, more water (about 46 TAF to 110 TAF) would be discharged into the San Joaquin River and bypass channels than under current conditions. However, the overall maximum water deliveries, contracted water volumes, and existing water uses and adjacent land uses would not change and flow would not exceed the current channel capacity.

Additional water supply from the Temperance Flat RM 274 Reservoir could result in a minimal increase in flow duration in existing channels in some years, but water deliveries would remain within the current range of variation and would not result in prolonged submergence of established vegetation that could lead to plant mortality or conversion of habitat. Therefore, project implementation is not expected to substantially alter riparian habitat or other sensitive natural communities.

This impact would be **less than significant** under the action alternatives. Mitigation for this impact is not needed and thus not proposed.

Impact BOT-3: Loss or Degradation of Waters of the United States, Including Wetlands, and Waters of the State

Primary Study Area

No Action Alternative Under the No Action Alternative, the proposed Temperance Flat RM 274 Dam would not be constructed, and no change would occur to the regular operation of Friant Dam. The primary study area would continue to be used for water storage, recreation, and cattle grazing. Continued operation of Friant Dam would not result in discharge of fill or dredged materials into waters of the United States or loss of wetlands. No change in vegetation community composition or conversion of habitat types would occur.

There would be **no impact** under the No Action Alternative.

Action Alternatives Implementation of any of the action alternatives would result in direct impacts from the loss of waters of the United States resulting from the placement of fill material into Federally jurisdictional waters of the United States within the primary study area, including wetlands, or the conversion of wetland types. This impact would be **significant**.

Waters of the United States and wetlands would be converted to a deeper water lacustrine habitat type as a direct result of constructing the dam at Temperance Flat RM 274 and inundation to the full-pool height of 985 msl. Waters of the United States that would be converted consist of riverine, ephemeral and intermittent drainages, swales, seasonal wetlands, vernal pools, and seeps. Table 6-16 lists the acreage of each type of wetland and other waters that would be inundated and converted to lacustrine habitat as a result of construction of the Temperance Flat RM 274 Dam, or filled as a result of project construction.

Table 6-16. Summary of Wetland Impacts in the Primary Study Area under the Action Alternatives

Habitat Type	Acreage within Area of Project Features	Acreage within Temperance Flat Inundation Area
Lacustrine	27[1]	5
Riverine	—	185
Perennial Drainage	—	0.02
Intermittent Drainage	1	13
Ephemeral Drainage	1	7
Freshwater Seep	—	1
Seasonal Wetland	4	6
Swale	1	—
Vernal Pool Grassland	6[2]	—
Total Area	**40**	**217**
Total for all Impacts within the Primary Study Area		**245**

Notes:

[1] Area of habitat identified here for the area of project features consists of the 5.5-acre area below the Millerton Lake maximum inundation level that would be permanently filled by the Temperance Flat RM 274 dam structure and 21.5 acres of existing Millerton Lake Reservoir downstream from RM 274 that would be filled with waste disposal rock from the diversion tunnel. An additional 16.6 acres of lacustrine unconsolidated bottom and 4 acres of lacustrine unconsolidated shoreline within the existing Millerton Lake Reservoir would be temporarily filled by coffer dams.

[2] Acreage of vernal pool likely overestimated because detailed analysis for this area is scheduled after release of this report. Area mapped as vernal pool grassland within transmission route.

Implementing the action alternatives would result in converting all habitat types located between 580 and 985 feet above msl within the Temperance Flat Reservoir Area to lacustrine habitat. The conversion of riverine, ephemeral and intermittent drainages, swales, seasonal wetlands, vernal pools, and seeps to lacustrine habitat would be a significant impact because there would be some loss or change in ecological functions provided by these wetland resource types. However, the change of riverine habitat to a deeper water habitat would not represent an overall loss of waters of the United States and the functions currently provided by the riverine habitat (185 acres) in the upper San Joaquin River, would continue to be provided following construction of the Temperance Flat RM 274 Dam. Loss of waters of the United of the States would occur in the area of project features (Table 6-16), except where these waters could be avoided through project design. Dam construction would require the construction of temporary coffer dams and dewatering of approximately 64 acres of existing lacustrine habitat in Millerton Lake upstream and downstream from RM 274. The permanent dam footprint would occupy 15.3 acres within these 64 acres, and approximately 5.5 acres of that would be within the existing maximum inundation level of Millerton Lake and therefore represents a permanent loss of lacustrine waters of the United States. In addition, wetland habitats (freshwater seep and seasonal wetland) within the inundation area would be lost because these habitats would become lacustrine habitats and would no longer function as wetlands.

In addition to direct impacts, lacustrine habitat created by the Temperance Flat RM 274 Dam would be indirectly affected as a result of increased recreation use upstream from the proposed Temperance Flat RM 274 Dam. A potential indirect impact on lacustrine habitat includes reduction in water quality caused by erosion and siltation; intrusion of humans and domestic animals; and introduction of aquatic invasive plant or fauna species that could result in habitat degradation.

Construction of the Temperance Flat RM 274 Dam would result in the need to dispose of waste rock from the diversion tunnel and powerhouse excavation. Waste rock disposal would require approximately 21.5 acres and would occur below the existing top-of-active-storage inundation level of Millerton Lake, located downstream from the Temperance Flat RM 274 Dam. Waste rock disposal below the top-of-active storage of Millerton Lake would constitute a direct impact on waters of the United States resulting from the placement of fill material into jurisdictional waters of the United States within the Millerton Lake downstream from the RM 274 portion of the primary study area, including wetlands. The bottom elevation of Millerton Lake would be altered as a result of waste rock disposal, and would change the substrate from unconsolidated lakeshore sediments to fragmented bedrock materials. The waste rock would occupy approximately 21.5 acres of existing lacustrine habitat in Millerton Lake.

In addition to the direct impact of altering the bottom elevation of Millerton Lake, waste rock disposal also has the potential to directly affect water quality within Millerton Lake. Sediment may cling to waste rock materials, and lubricants or other industrial chemicals may come into contact with rock as a result of the extraction process. These pollutants would wash these into the lake once the material is deposited below the top-of-active-storage level of Millerton Lake.

Potential indirect impacts on water quality also include erosion and siltation as a result of the new road required to access the waste rock disposal site, and intrusion of humans and heavy construction equipment below the top-of-active-storage level of Millerton Lake. Construction equipment depositing the waste rock would cause soil disturbance that could result in the establishment of invasive plant species. The colonization of nonnative species in areas disturbed as a result of construction activities would result in decreased species richness and habitat degradation.

The placement of waste rock below the top-of-active-storage level of Millerton Lake would be considered fill material and would result in the change in the bottom elevation of waters of the United States. This action would result in the loss and degradation of USACE jurisdictional waters of the United States and constitutes a substantial adverse impact on jurisdictional waters of the United States, as defined by CWA Section 404. Loss of waters of the United States would also occur in the footprint of the Temperance Flat Dam where the dam itself would result in fill of water of the United States.

The loss and degradation of USACE jurisdictional waters of the United States and wetland habitats that would occur with project implementation constitutes a substantial adverse impact on jurisdictional waters of the United States, including wetlands, as defined by CWA Section 404. Construction of project features in upland habitats has the potential to directly and indirectly affect water quality and alter hydrology.

This impact would be **significant** under the action alternatives. Mitigation for this impact is proposed below in the Mitigation Measures section.

Extended Study Area

No Action Alternative Under the No Action Alternative, the proposed Temperance Flat RM 274 Dam would not be constructed, no additional water supply would be created, and no changes would occur to the operation of Friant Dam. Continued operation of Friant Dam would not result in discharge of fill or dredged materials into waters of the United States or loss of wetlands within the San Joaquin River downstream from Friant Dam or Delta waterways. No filling or conversion of wetlands and waters of the United States from one type to another (e.g., seasonal stream or wetland to perennial stream or emergent marsh) would occur.

There would be **no impact** under the No Action Alternative.

Action Alternatives Under any of the action alternatives, the proposed Temperance Flat RM 274 Dam would be constructed allowing large runoff events in wet years to be stored in the Temperance Flat RM 274 Reservoir, then released in dry months and years when water is scarce. These changes in stream flows would be within typical historical volumes.

Continued operations of Friant Dam would not result in discharge of fill or dredged materials into waters of the United States or loss of wetlands within the San Joaquin River downstream from Friant Dam. Additional water supply from the Temperance Flat RM 274 Reservoir would result in a minimal increase in flow duration in existing channels in drier months of some years, but water deliveries would remain within the current normal range of variation and would not result in a conversion of wetlands and waters of the United States from one type to another (e.g., seasonal stream or wetland to perennial stream or emergent marsh) in the San Joaquin River from Friant Dam to the Delta or in Delta waterways. There would be no loss of wetland acreage or function in the extended study area.

There would be **no impact** under the action alternatives. Mitigation for this impact is not needed and thus not proposed.

Impact BOT-4: Introduction and Spread of Invasive Plants

Primary Study Area

No Action Alternative Under the No Action Alternative, the proposed Temperance Flat RM 274 Dam would not be constructed, no vegetation removal would occur, and existing recreation trails would remain in use. Invasive species have been documented within the primary study area. Under the No Action Alternative, invasive species may continue to spread. However, the rate of spread would not be increased above the current rate because this alternative would not result in expansion of human recreation into currently inaccessible areas, and new dispersal corridors would not be created as part of constructing project features. The No Action Alternative would not cause any change in the rate of spread of invasive species.

There would be **no impact** under the No Action Alternative.

Action Alternatives Ground disturbance and vegetation removal associated with construction of the dam and other project features have the potential to introduce and spread invasive plant species. Ground-disturbing construction activities can create gaps in native vegetation that provide optimal sites for establishment of invasive plants. Erosion-control materials, seed mixes, and unwashed construction equipment often transport propagules of invasive plants to construction sites where disturbed areas can provide ideal conditions for their establishment and aid their spread into adjacent native plant communities. Construction of project features would result in a temporary increase in weed vectors in the primary study area.

Establishment of new access roads, trails, and recreation areas would provide permanent new dispersal corridors and increase human use in areas that currently get little human visitation. Recreationists and their pets using new or relocated campgrounds, trails, and the Temperance Flat RM 274 Reservoir represent new or increased vectors for the introduction and spread of invasive plants. Rising water in the Temperance Flat 274 Reservoir would provide a new weed vector for invasion of habitats adjacent to the new inundation zone.

As shown in Table 6-11, five invasive plant species that have a moderate to high Cal-IPC rating have been documented in the primary study area. These species could be spread to new sites during project construction activities, and new invasive species could be introduced to the area via construction equipment and materials or by recreational users when construction and inundation are completed.

Establishment of invasive plant species results in general habitat degradation by eliminating native plants that provide habitat for native fish and wildlife species. Infestations by aggressive invaders can degrade sensitive habitats such as riparian and wetland habitats and eventually alter hydrological or other functions of these habitats. Competition from invasive plant species can exclude special-status plant species and generally lower species diversity.

This impact would be **potentially significant** under the action alternatives. Mitigation for this impact is proposed below in the Mitigation Measures section.

Extended Study Area

No Action Alternative Under the No Action Alternative, the proposed Temperance Flat RM 274 Dam would not be constructed, and no change would occur to the current operation of Friant Dam, or water conveyance within the San Joaquin River and bypass systems. Existing infestations of invasive species may continue to spread within the San Joaquin River corridor and Delta waterways, but no new water supply would be discharged down the San Joaquin River to the Delta to facilitate spread of invasive species.

Continuation of existing land uses and current water delivery would not result in changes to the quality or types of habitats present within the extended study area or in the dispersal mechanisms for invasive plants. No change in vegetation community composition or conversion of habitat types would occur and no new weed vectors would be established.

Increased instream flow releases from the SJRRP could increase dispersal of invasive plants over time even though mitigation is included in the SJRRP to minimize expansion and establishment of invasive plants.

This impact would be **less than significant** under the No Action Alternative.

Action Alternatives Under any of the action alternatives, the proposed Temperance Flat RM 274 Dam would be constructed and water supply reliability would be increased, making additional water available during dry months and years when it might not otherwise be available. Invasive species have been documented downstream from Friant Dam down to and including the Delta. Under any of the action alternatives, invasive species may continue to spread within the San Joaquin River corridor and Delta waterways. However, the rate of spread would not be increased above the current rate because the rate of water released into the San Joaquin River would be within the range of flow releases from the SJRRP, except during flood events where some peak flood flows would be reduced under the action alternatives. All water released is anticipated to remain within the existing river channel, and new dispersal corridors would not be created as part of implementation of any of the action alternatives.

This impact would be **less than significant** under the action alternatives. Mitigation for this impact is not needed and thus not proposed.

Impact BOT-5: Elimination of a Plant Community or Substantial Reduction in the Number or Restriction of the Range of an Endangered, Rare, or Threatened Plant Species

Primary Study Area

No Action Alternative Under the No Action Alternative, the proposed Temperance Flat RM 274 Dam and project features would not be constructed in the primary study area, and project actions that would remove plant communities, special-status plants, and their habitats would not be carried out. Existing plant communities and special-status plant occurrences in the primary study area would remain comparable to existing conditions.

No habitat or special-status plants would be removed or taken as a result of project activities under the No Action Alternative. Implementing the No Action Alternative would not substantially reduce habitat for special-status plants or plant communities or reduce the number or restrict the range of an endangered, rare, or threatened plant species.

There would be **no impact** under the No Action Alternative.

Action Alternatives Plant communities within the primary study area are widely distributed across the Sierra Nevada foothills and would continue to be well represented within the region following project completion. Although project implementation would result in habitat loss and loss of special-status plant occurrences, these species would continue to exist at a number of locations outside of the Study Area (note that the project also includes Mitigation Measure BOT-1 to compensate for the loss of tree anemone and Madera leptosiphon occurrences by creating new occurrences and preserving existing occurrences outside of the Study Area in perpetuity; see the Mitigation Measures section). The project would not eliminate any habitat important to the long-term survival of any species or community.

The only plant species officially listed as threatened or endangered that is known to occur in the primary study area is tree anemone. This species is an extremely localized endemic found only in eastern Fresno and Madera counties, but elimination of one occurrence would not further restrict the range of this species. There are four additional occurrences of tree anemone within 10 miles of the primary study area and most of the known occurrences of this species are on USFS or

Sierra Foothill Conservancy lands and receive some level of protection that would enable them to persist into the future.

Therefore, project implementation would not eliminate a plant community, or substantially reduce the number or restrict the range of an endangered, rare, or threatened plant species.

This impact would be **less than significant** under the action alternatives. Mitigation for this impact is not needed and thus not proposed.

Extended Study Area

No Action Alternative Under the No Action Alternative, the proposed Temperance Flat RM 274 Dam would not be constructed, and no additional water supply would be discharged into the San Joaquin River, bypass systems, or Delta waterways. Existing plant communities and special-status plant occurrences in the extended study area would remain comparable to existing conditions. No habitat or special-status plants would be altered or taken as a result of project activities under the No Action Alternative. Implementing the No Action Alternative would not substantially reduce habitat for special-status plants or plant communities or reduce the number or restrict the range of an endangered, rare, or threatened plant species.

There would be **no impact** under the No Action Alternative.

Action Alternatives Implementing any of the action alternatives would not result in substantial changes in existing plant communities or potential habitat for special-status plants within the San Joaquin River from Friant Dam to the Delta or in Delta waterways, because water flows from Friant Dam would not deviate from the range of operating conditions that define existing conditions. Additional water supply from the Temperance Flat RM 274 Reservoir could result in a minimal increase in flow duration in existing channels in some years, but this additional flow duration would not result in prolonged submergence of established vegetation that could lead to plant mortality or conversion of habitat. No change in vegetation community composition or conversion of habitat types would occur. Therefore, implementing any of the action alternatives would not eliminate a plant community or reduce the number or restrict the range of any special-status plant species.

There would be **no impact** under the action alternatives. Mitigation for this impact is not needed and thus not proposed.

Impact BOT-6: Conflict with Local or Regional Policies and Plans Protecting Wetland or Botanical Resources

Primary Study Area

No Action Alternative Under the No Action Alternative, the proposed Temperance Flat RM 274 Dam and project features would not be constructed in the primary study area, and project actions that could affect botanical and wetland resources protected under local or regional plans and policies would not occur. Therefore, there would be no conflict with these plans and policies.

There would be **no impact** under the No Action Alternative.

Action Alternatives The action alternatives would result in removal of special-status plants and sensitive habitats addressed in Madera County and Fresno County general plan policies and the BLM RMP. This would result in a conflict with the goals of these plans and policies.

Implementing any of the action alternatives would result in loss of wetland, riparian, and oak woodland habitats and special-status plant species as described under Impact BOT-1, Impact BOT-2, and Impact BOT-3. The Fresno County and Madera County general plan documents and BLM RMP include goals and policies aimed at conserving these resources to the extent feasible within their jurisdictions.

The majority of the primary study area is located on lands owned by the Federal government and not subject to county policies, but some portions of the Temperance Flat Reservoir Area and some of the project features, including most of the new transmission line, are on private property within either Fresno County or Madera County jurisdiction.

Much of the Temperance Flat Reservoir Area and some of the project features are situated within the SJRG SRMA and are therefore subject to the BLM RMP. Project implementation would result in direct conflicts with the goals and policies of these plans. Specifically, project implementation would result in the loss of Madera leptosiphon occurrences, a BLM sensitive plant species. Project implementation would also conflict with a number of Fresno County and Madera County policies requiring protection of endangered species and their habitat, wetlands, streams, riparian areas, and oak woodlands.

This impact would be **significant** under the action alternatives. Mitigation for this impact is proposed below in the Mitigation Measures section.

Extended Study Area

No Action Alternative Under the No Action Alternative, the proposed Temperance Flat RM 274 Dam would not be constructed and no additional water supply would be discharged into the San Joaquin River, bypass systems, or Delta waterways. Project actions that could affect botanical and wetland resources protected under local or regional plans and policies would not occur. Therefore, there would be no conflict with these plans and policies.

There would be **no impact** under the No Action Alternative.

Action Alternatives Within the extended study area, project impacts would be restricted to the current channel capacity of the San Joaquin River and bypass systems. No change in existing use of adjacent lands would occur, and no change in vegetation community composition or conversion of habitat types would occur that could substantially adversely affect botanical or wetland resources protected under local and regional policies and plans. Implementing any of the action alternatives therefore would not conflict with local land use policies such as county and city general plan policies.

There would be **no impact** under the action alternatives. Mitigation for this impact is not needed and thus not proposed.

Impact BOT-7: Conflict with Provisions of an Adopted Habitat Conservation Plan Protecting Wetland or Botanical Resources

Primary Study Area

No Action Alternative PG&E has an adopted HCP that covers routine operations and maintenance activities throughout 276,350 acres within the San Joaquin Valley. The primary study area is included within the PG&E HCP plan area. It is expected that all covered activities carried out by PG&E within the primary study area would be implemented in compliance with the adopted HCP, as it is mandatory for PG&E's operations. There are no other adopted conservation plans covering the primary study area, so implementing the No Action Alternative would not conflict with the provisions of an adopted conservation plan.

There would be **no impact** under the No Action Alternative.

Action Alternatives The PG&E HCP plan area is narrowly defined to include all gas and electrical transmission lines and distribution facilities, private access routes to infrastructure associated with operations and maintenance activities, minor facility expansion areas, and mitigation areas for impacts resulting from activities specifically covered by the HCP (PG&E 2006). This HCP provides coverage for routine operations and maintenance activities conducted by PG&E, which are not part of any of the action alternatives. Therefore, the PG&E HCP is not applicable to the action alternatives, nor are there other adopted conservation plans that cover the primary study area.

There would be **no impact** under the action alternatives. Mitigation for this impact is not needed and thus not proposed.

Extended Study Area

No Action Alternative Under the No Action Alternative, the proposed Temperance Flat RM 274 Dam would not be constructed and no additional water supply would be discharged into the San Joaquin River, bypass systems, or Delta waterways. Project actions that could affect botanical and wetland resources protected under adopted HCPs would not occur. Therefore, there would be no conflict with the goals and policies of adopted HCPs.

There would be **no impact** under the No Action Alternative.

Action Alternatives The CALFED Bay-Delta Program sponsors the San Joaquin River Riparian Habitat Restoration Program Pilot Project to establish riparian habitat along the river where little or none existed before using releases from Friant Dam to disperse and germinate native tree seed. The National Wildlife Refuge comprehensive conservation plans (CCP) for Merced NWR and San Luis NWR include goals to restore and manage upland, riparian, and wetland habitats on refuge lands for the purpose of conserving natural diversity.

Implementing any of the action alternatives would provide a more reliable water supply, making water available for delivery during periods when it might not otherwise be available. The additional water supply would not result in changes to the overall maximum water deliveries, contracted water volumes, and existing land uses would not change. Therefore, implementing any of the action alternatives would not conflict with the goals of adopted conservation plans to establish or restore riparian habitat and maintain natural diversity.

Implementing action alternatives would not alter hydrology in the refuges and would not interfere with restoration or management of habitats in the refuges; therefore, there would be no conflict with the NWR conservation goals or strategies.

Implementing any of the action alternatives would not conflict with the CALFED Bay-Delta Program objectives for enhancing or conserving native biotic communities in the Bay-Delta estuary and its watersheds. Communities targeted for conservation and enhancement under the program include estuarine and freshwater marsh, riparian, seasonal wetland, vernal pool, and aquatic plant communities.

Operations under the action alternatives would not result in substantial changes in water levels, flood frequency or magnitude, or other conditions or events that could affect vegetation in the San Joaquin River from the Merced River to the Delta or in the Bay-Delta estuary.

There would be no conflict with the goals of any adopted conservation plans covering any portion of the extended study area.

There would be **no impact** under the action alternatives. Mitigation for this impact is not needed and thus not proposed.

Mitigation Measures

This section discusses mitigation measures for each significant impact described in the Direct and Indirect Impacts section, as presented in Table 6-13.

No mitigation is required for Impacts BOT-5 and BOT-7 within the primary study area or for Impacts BOT-1 through BOT-7 within the extended study area, because there would be no impact or the impact would be less than significant for all action alternatives.

Impacts BOT-1, BOT-3, BOT-4, and BOT-6 within the primary study area would be significant or potentially significant. Implementing Mitigation Measures BOT-1, BOT-3, BOT-4, and BOT-6 would reduce these impacts to a **less-than-significant** level.

Impact BOT-2 within the primary study area would be significant. Implementing Mitigation Measure BOT-2 would reduce this impact, but not to a less-than-significant level.

Therefore, Impact BOT-2 (within the primary study area) would be **significant and unavoidable**.

Mitigation Measure BOT-1: Relocate Special-Status Plant Populations

To mitigate direct and indirect impacts on tree anemone and Madera leptosiphon within the primary study area, outside the areas that would be directly affected by project implementation, Reclamation will implement the following measures:

- Preserve the other single known occurrence of tree anemone located on BLM lands at the 1,148-foot elevation located approximately 0.3 mile east-southeast of RM 285 on Fresno County side (CNDDB occurrence number 11) with a conservation easement (Figure 6-3).

- Acquire land, if possible, associated with the known occurrence of tree anemone consisting of two polygons in close proximity in the vicinity of the primary study area approximately 1.5 miles north of Kerckhoff Powerhouse on the Madera County side (CNDDB occurrence number 15). Place the acquired occupied habitat under a perpetual conservation easement (Figure 6-3).

- Preserve the known occurrence of Madera leptosiphon present within the Millerton Lake SRA portion of the primary study area (CNDDB occurrence number 9) with protective fencing to deter recreational users from trampling occupied habitat (Figure 6-3).

To compensate for the direct loss of tree anemone and Madera leptosiphon populations, new self-reproducing populations of tree anemone and Madera leptosiphon shall be established at a ratio of not less than 1:1 (one new population established for each population lost):

- Compensatory populations shall be preserved in perpetuity with a conservation easement and incompatible land uses shall be prohibited in habitat conservation areas.

- New populations shall be established from seed or cuttings, as appropriate for the individual species, of plants that would be lost as a result of project implementation. Seed and topsoil shall be salvaged from the occupied habitat that would be removed by project implementation. Seed shall be collected from affected populations for at least three seasons before loss, but no more than 10 percent of the seed produced shall be removed from the overall population in a given growing season. Before the first seed collection, population density and extent of occupied habitat shall be determined. Collection seasons do not have to be consecutive. All of the seed from plants in occupied habitat to be removed shall be harvested in the final harvest season. Collected seeds shall be stored at two different seed repositories, including the National Center for Genetic Resources Preservation in Fort Collins, Colorado, and a repository certified by the Center for Plant Conservation, such as the Rancho Santa Ana Botanic Garden, until reestablishment habitat is ready for planting.

- Before planting, tree anemone shall be propagated at a qualified plant nursery and installed by a qualified firm with restoration expertise.

- The extent of occupied area and the flower density in compensatory reestablished populations shall be equal to or greater than the affected occupied habitat.

- Reestablished populations shall be monitored for a minimum of 5 years. Monitoring will continue beyond 5 years until reestablished populations are self-reproducing.

- Reestablished populations shall be considered self-reproducing when:

    - Plants reestablish annually for a minimum of 5 years with no human intervention such as supplemental seeding

    - Reestablished habitats contain an occupied area and flower density comparable to existing affected occupied habitat areas at the time of impact

- Reclamation will provide bonds or other financial assurances to ensure implementation of the mitigation measures.

Reclamation will develop and implement a mitigation and monitoring plan (MMP) for tree anemone and Madera leptosiphon in consultation with CDFW. The MMP shall include detailed plans to compensate for the direct loss of occupied habitat at a ratio agreeable to CDFW and Reclamation. At a minimum, the MMP shall include all of the measures listed above and shall include monitoring of preserved and compensatory reestablished populations annually for a minimum of 5 years to ensure plants are regenerating on a yearly basis without human intervention. If plants are not regenerating, reseeding and other measures (e.g., weed management), will be implemented as appropriate based on assessment by a qualified ecologist, and monitoring will continue until populations are self-sustaining.

Special-status plant surveys shall be conducted in areas that have not previously been surveyed during the time of year that target species are readily identifiable (i.e., in bloom or fruit). Surveys shall be floristic in nature and shall follow the protocol outlined by CDFW for special-status plant surveys (DFG 2009). If special-status species are not identified, no further action is required. However, if special-status species are identified, then the special-status plant populations shall be avoided to the maximum extent possible (i.e., trail realignment, relocating transmission towers to avoid direct impacts).

Federally listed and State-listed species, including Hartweg’s sunburst, succulent owl’s clover, and San Joaquin Orcutt grass, and the State-listed Boggs Lake hedge-hyssop, have the potential to occur within the new transmission corridor. Direct impacts on species afforded protection under Federal ESA and/or CESA would require an incidental take permit from USFWS and/or CDFW 2081 permit. Final mitigation for Federally protected or State-protected species would be determined through consultation; however, mitigation for impacts on Federally listed or State-listed species would be mitigated through a combination of preserving and enhancing existing populations, creation of off-site populations on project mitigation sites through seed or inoculum collection or transplantation, and/or purchase of preservation credits at a conservation or mitigation bank in sufficient quantities to achieve no net loss of occupied habitat.

Implementing Mitigation Measure BOT-1 would reduce potentially significant impacts from the loss of special-status plant populations to a **less-than-significant** level.

Mitigation Measure BOT-2: Compensate for Loss of Specific Habitats

To compensate for the loss of riparian habitat within the Temperance Flat Reservoir Area and avoid, minimize, or compensate for riparian habitat impacts within the area of project features, Reclamation will implement the following measures.

Project features including but not limited to haul roads, access roads, staging areas, powerhouse, transmission facilities, and hydroelectric facilities shall be located outside of riparian areas and shall avoid impacts on riparian habitat to the maximum extent possible. If avoidance is not possible, impacts on riparian habitats shall be compensated for by planting appropriate riparian trees within the primary study area at a ratio of not less than 1:1 and purchasing credits at a ratio of not less than 1:1 at a mitigation bank to compensate for temporal loss.

Reclamation will establish and/or restore riparian habitat along existing stream corridors located above the Temperance Flat inundation area. If suitable riparian habitat establishment and restoration areas are not available in sufficient quantities to satisfy the 1:1 compensation ratio on site, additional off-site riparian habitat restoration and/or establishment shall be implemented as needed to achieve a minimum compensation ratio of not less than 1:1 to offset the loss of riparian habitat functions and services at the project site. Reclamation will hire a qualified restoration ecologist to prepare a MMP describing specific method(s) to be implemented to compensate for impacts on the stream channels supporting riparian habitats within the Temperance Flat Reservoir Area that would be inundated as a result of constructing the Temperance Flat RM 274 Dam or would be removed during construction of project features.

The compensation habitat planted above the level of inundation shall be similar in composition and structure to the habitat to be removed and shall be at a ratio of not less than 1:1 to offset the loss of riparian habitat functions and services at the project site. To compensate for the temporal loss of riparian habitats and any additional acreage of riparian habitat loss that cannot be replaced on site, credits shall be purchased at a conservation bank at a ratio of not less than 1:1. The riparian habitat compensation section of the habitat MMP shall include the following:

- Compensatory mitigation sites and criteria for selecting these mitigation sites
- Complete assessment of the existing biological resources in both the on-site and off-site preservation and restoration areas
- Site-specific management procedures to benefit establishment and maintenance of native riparian plant species, including California sycamore, black willow, arroyo willow, white alder, and Fremont cottonwood
- A planting and irrigation program if needed for establishment of native riparian trees and shrubs at strategic locations within each mitigation site (planting and irrigation may not be necessary if preservation of functioning riparian habitat is chosen as mitigation or if restoration can be accomplished without irrigation or planting)
- In-kind reference habitats for comparison with compensatory riparian habitats (using performance and success criteria) to document success
- Monitoring protocol, including schedule and annual report requirements (compensatory riparian habitats shall be monitored for a minimum period of 5 years)
- Ecological performance standards, based on the best available science and including specifications for native riparian plant densities, species composition, amount of dead woody vegetation gaps and bare ground, and survivorship; at a minimum, compensatory mitigation planting sites must achieve 80 percent survival of planted riparian trees and shrubs by the end of the 5-year maintenance and monitoring period, or dead and dying trees shall be replaced and monitoring continued until 80 percent survivorship is achieved
- Corrective measures if performance standards are not met
- Responsible parties for monitoring and preparing reports

- Responsible parties for receiving and reviewing reports and for verifying success or prescribing implementation or corrective actions

Before the start of any ground-disturbing activities that would affect riparian habitats, streams, or alter Millerton Lake or any habitats subject to CDFW jurisdiction under Section 1602 of the California Fish and Game Code, a Lake and Streambed Alteration Agreement shall be obtained. The agreement shall be executed by Reclamation and CDFW before the approval of any grading or improvement plans or any construction activities in any project phase that could potentially affect the bed and bank of streams and associated riparian habitats present within the Study Area. Any conditions of issuance of the Streambed Alteration Agreement shall be implemented as part of project construction activities.

To compensate for the loss of oak woodland habitat within the Temperance Flat Reservoir Area and project features, Reclamation will preserve and protect existing oak woodland habitat in Madera and Fresno Counties in the vicinity of the primary study area. Lands with oak woodland habitat shall be acquired and placed under conservation easement to be protected in perpetuity. The mitigation lands shall be purchased within the upper San Joaquin watershed, to the maximum extent possible to mitigate for loss of oak woodland habitat within the watershed.

Woodland habitat selected for conservation shall be similar in species composition, age, and canopy cover, to the maximum extent possible, with the emphasis on the acquisition and protection of mitigation lands with opportunities to restore, establish, enhance, and preserve habitats with high conservation values and that connect and/or provide protection for wildlife migration corridors. Lands acquired to compensate for loss of oak woodland habitat shall be at a ratio of not less than 1:1 for each affected acre within the primary study area. If land acquisition cannot be completed at a 1:1 ratio within the watershed of impact, funds shall be contributed to CDFW's Oak Woodlands Conservation Fund at a ratio of not less than 1.5:1 for each acre of oak woodland impacted by project implementation and not compensated through acquisition of conservation lands within the affected watershed.

Implementing Mitigation Measure BOT-2 would reduce potentially significant impacts on riparian habitats to a less-than-significant level because a MMP ensuring adequate compensation for the loss of riparian habitat would be developed and implemented establishing riparian areas along existing streams within the primary study area.

Implementing Mitigation Measure BOT-2 would reduce potentially significant impacts on oak woodland habitats, but not to a less-than-significant level, because the loss of oak woodland acreage and function would be substantial and would contribute substantially to the regional loss of this resource. It is unknown at this time if oak woodland habitat acreage having similar tree sizes and densities, species composition, site condition, and landscape context to the oak woodland to be removed would be available for purchase, and preservation in perpetuity of existing oak woodland habitat would still result in a net loss of oak woodland habitat. Therefore, impacts on oak woodland habitat would remain **significant and unavoidable**.

Mitigation Measure BOT-3: Ensure No Net Loss of Wetlands

A wetland delineation shall be conducted for any areas not previously surveyed for wetlands and waters of the United States. The wetland delineation shall be submitted to the Sacramento District USACE for review and verification before the preparation of permit applications required pursuant to Sections 404 and 401 of the CWA. To the maximum extent feasible, project features located above the Temperance Flat RM 274 Reservoir inundation line shall be located to avoid wetlands and other waters of the United States to the maximum extent possible.

Reclamation shall develop a draft wetland MMP for the project. Before any ground-disturbing activities that would adversely affect wetlands, Reclamation will submit the draft wetland MMP to USACE and the Central Valley Water Board for review and approval of those portions of the plan over which they have jurisdiction. The MMP would be required to be finalized before issuance of a Section 404 permit. Once the final MMP is approved and implemented, mitigation monitoring shall continue for a minimum of 5 years from completion of mitigation, or until the performance standards identified in the approved MMP have been met, whichever is longer.

As part of the MMP, Reclamation will prepare and submit plans for the creation of aquatic habitat to adequately offset and replace the aquatic functions and services that would be lost within the primary study area, account for the temporal loss of habitat, and contain an adequate margin of safety to reflect anticipated success. Restoration of previously altered and degraded wetlands shall be a priority of the MMP for offsetting losses of aquatic functions on the project site because it is typically easier to achieve functional success in restored wetlands than in those created from uplands. The MMP must demonstrate how the aquatic functions and values that would be lost through project implementation will be replaced.

Mitigation for jurisdictional wetland features shall be consistent with USACE's and EPA's April 10, 2008 *Final Rule for Compensatory Mitigation for Losses of Aquatic Resources* (33 CFR Parts 325 and 332 and 40 CFR Part 230). According to the *Final Rule*, mitigation banks should be given preference over other types of mitigation because much of the risk and uncertainty regarding mitigation success is alleviated by the fact that mitigation bank wetlands must be established and demonstrating functionality before credits can be sold. This also alleviates temporal losses of wetland function while compensatory wetlands are being established.

The *Final Rule* also establishes a preference for compensating losses of aquatic resources within the same watershed as the impact site. The primary study area is located entirely within the upper San Joaquin watershed. Mitigation credits may be available within the watershed. To compensate for the conversion of terrestrial wetlands to a deeper water lacustrine habitat type, additional wetland habitat may need to be restored or created within the primary study area or on off-site lands within the affected watershed, to successfully replace lost functions.

Compensatory mitigation for losses of stream and intermittent drainage channels shall be achieved through in-kind preservation, restoration, or enhancement, as specified in the *Final Rule* guidelines. The wetland MMP shall address how to mitigate impacts on vernal pool, seasonal swale, seasonal wetland, seep, and ephemeral, intermittent, and perennial stream habitat, and shall describe specific method(s) to be implemented to avoid and/or mitigate any off-site project-related impacts.

An operations and management plan (OMP) for all on- and off-site wetland preservation and mitigation areas shall be prepared and submitted to USACE and USFWS for review and approval before the issuance of any permits under Section 404 of the CWA. The plan shall include detailed information on the habitats present within the preservation and mitigation areas, the long-term management and monitoring of these habitats, legal protection for the preservation and mitigation areas (e.g., conservation easement, declaration of restrictions), and funding mechanism information (e.g., endowment).

Before the start of any ground-disturbing activity associated with the construction of any project feature that would affect waters of the United States, including wetlands, or waters of the State, Reclamation will obtain all necessary permits under Sections 404 and 401 of the CWA or the State's Porter-Cologne Act for the project.

All permits, regulatory approvals, and permit conditions for impacts on wetland habitats shall be secured before implementation of any grading activities within waters of the United States or wetland habitats, including waters of the State. Reclamation will commit to replace, restore, or enhance on a "no net loss" basis (in accordance with USACE and the Central Valley Water Board) the acreage of all wetlands and other waters of the United States that would be removed, lost, and/or degraded with implementation of project plans.

Wetland habitat shall be restored, enhanced, and/or replaced at an acreage and location and by methods agreeable to USACE and the Central Valley Water Board, as determined during the Section 404 and Section 401 permitting processes. Final mitigation ratios will be determined during the permitting process.

USACE has determined that the project will require an individual permit. In its final stage and once approved by USACE, the MMP for the project is expected to detail proposed wetland restoration, enhancement, and/or replacement activities that would ensure no net loss of aquatic functions in the project vicinity. Approval and implementation of the wetland MMP shall aim to fully mitigate all unavoidable impacts on jurisdictional waters of the United States, including jurisdictional wetlands.

All mitigation requirements determined through this process shall be implemented before grading plans are approved. The MMP shall be submitted to USACE and approved before the issuance of any permits under Section 404 of the CWA.

Water quality certification pursuant to Section 401 of the CWA will be required before issuance of the record of decision and before issuance of a Section 404 permit. Before construction in any areas containing wetland features, Reclamation will obtain water quality certification for the project. Any measures required as part of the issuance of water quality certification shall be implemented.

Implementing Mitigation Measure BOT-3 would reduce potentially significant impacts from the loss of waters of the United States, and State to a **less-than-significant level**.

Mitigation Measure BOT-4: Implement a Weed Management Plan

A weed management plan shall be prepared in advance of any ground-disturbing activity. The weed management plan shall include annual weed monitoring of construction areas and shall extend for three seasons after construction is complete. The weed management plan shall include measures to monitor, control, and eradicate, where possible, invasive plant infestations within and adjacent to construction areas. Construction contractors shall use only weed-free fill, gravel, mulches, and seed sources.

Before commencement of ground-disturbing activities, a qualified botanist shall conduct comprehensive surveys to identify, map, and quantify invasive plant infestations at all construction areas within the primary study area. Mapping will be done using a Global Positioning System (GPS) unit. The resultant Geographic Information System (GIS) layer will be used to identify new and expanded infestations. This procedure will be repeated annually during construction and for 3 years following construction.

The weed management plan will establish and implement control and eradication methods specific to each invasive plant species. The plan will establish thresholds and specific management responses should those thresholds be exceeded. Management responses will be species-specific and will also depend on the size of the plants and of the infestation. Management responses may include mechanical and chemical treatment of infestations.

The weed management plan will include monitoring procedures, success criteria, and adaptive management measures for controlling invasive plant species.

Reclamation will implement the following measures at all construction sites within the primary study area to prevent the introduction and spread of invasive plant species:

- Use only certified weed-free straw or rice straw mulch
- Use native, noninvasive species or nonpersistent hybrids in erosion-control plantings to stabilize site conditions and prevent invasive species from colonizing
- Minimize surface disturbance to the greatest extent possible
- Clean construction equipment before transport to and from construction sites to remove debris that could contain invasive species or their seeds
- Limit washing of construction vehicles and equipment to approved maintenance facilities or staging areas

Implementing Mitigation Measure BOT-4 would reduce potentially significant impacts from the spread of invasive plants to a **less-than-significant** level.

Mitigation Measure BOT-6: Implement Mitigation Measures BOT-1, BOT-2, and BOT-3

Implementing Mitigation Measure BOT-6 would reduce the significant impact related to a conflict with local or regional policies and plans protecting wetland or botanical resources to a **less-than-significant** level because it would require the implementation of a combination of related mitigation measures (BOT-1, BOT-2, and BOT-3) to avoid, minimize, or compensate for impacts on special-status plants, riparian and oak woodland habitats, and wetlands and other waters of the United States consistent with Madera County and Fresno County general plan policies and the BLM RMP protecting these resources.

This page left blank intentionally.

Chapter 7
Biological Resources – Wildlife

This chapter describes the affected environment for wildlife species, as well as potential environmental consequences and associated mitigation measures, as they pertain to implementing the alternatives. The discussion focuses on the primary study area (area of project features, Temperance Flat Reservoir Area, and Millerton Lake below RM 274). It also discusses the extended study area (the San Joaquin River from Friant Dam to the Merced River, the San Joaquin River from the Merced River to the Delta, the Delta, and the CVP and SWP water service areas).

Affected Environment

This section describes the affected environment of the primary and extended study areas for the Investigation. Vegetation communities and their coverage in the Study Area is discussed in detail in Chapter 6, "Biological Resources – Botanical and Wetlands." The habitat types corresponding to the vegetation communities that occur in the primary study area are addressed in the Wildlife Habitats section below. The special-status and general wildlife species that could potentially inhabit these communities are described in the Special-Status Species section below.

Wildlife Habitats

Primary Study Area

The primary study area is located in Madera and Fresno counties in the eastern foothills of the Sierra Nevada, along the San Joaquin River from Friant Dam to Kerckhoff Dam. Elevation ranges from approximately 310 feet msl at Friant Dam to approximately 1,035 feet msl, which includes the buffer area surrounding the high-water surface elevation of the proposed Temperance Flat RM 274 Reservoir.

Area of Project Features Chapter 6, "Biological Resources – Botanical and Wetlands," presents the vegetation communities identified in the area of project features. The project features impact area has been defined to encompass all project features and their footprints.

Dam and Appurtenant Structures Construction of the proposed Temperance Flat RM 274 Dam and the upstream and downstream coffer dams would take place entirely within lacustrine unconsolidated bottom and lacustrine unconsolidated shoreline habitats. Dam embankments would be located in the foothill pine oak woodland atop the cliffs along both sides of the river channel.

Power-Generation Features Power-generation features include a new powerhouse, a Kerckhoff tunnel extension, a right-of-way/diversion tunnel, and an intake structure. Connecting these features and supporting construction is a network of access roads and haul routes. The primary habitat type in this area is foothill pine oak woodland, but annual grassland, blue oak woodland, and a small amount of bush lupine scrub are interspersed through the area where the features, access roads, and haul routes would be constructed. A ventilation shaft for the Kerckhoff tunnel extension would be constructed within an area that is a mix of foothill pine oak woodland, blue oak woodland, and annual grassland. Scattered through the area of project features are a few intermittent and ephemeral drainages. The features described above are all located south of Millerton Lake.

Transmission Line Corridors One new transmission line corridor and one relocated transmission line corridor would be constructed within the primary study area. The new transmission line would be located on the south bank of Millerton Lake and would follow a course that passes through foothill pine oak woodland and annual grassland habitats. Four small and disjunct patches of blue oak woodland are scattered through the general transmission line corridor, and one small patch of bush lupine scrub occurs in the northern portion of the corridor.

The second transmission line would replace an existing PG&E transmission line located near the existing Kerckhoff Powerhouse and cross over the Temperance Flat RM 274 Reservoir. The transmission line course would pass through foothill pine oak woodland and blue oak woodland.

Other Construction Areas Additional construction areas would include a soils waste area and a mobilization or staging area, and batch plants for making concrete and an aggregate quarry for excavating rock. The waste area would be used for waste rock and tunnel muck from various excavations and would be sited in a small embayment on Millerton Lake composed entirely of lacustrine habitats. The area encompassing all of the quarry, batch plant, and haul road options was included in the impact calculations for project features even though only one quarry site, supporting dam batch plant, and connecting haul road would ultimately be constructed under the action alternatives. This approach overestimates the impacted area, and provides a conservative analysis of the potential impacts of the action alternatives.

A total of up to four potential boat-in campsites would be located within the primary study area. They would all be located on the edge of the new Temperance Flat RM 274 Reservoir, and the estimated impact on habitat associated with these features is included within the impact calculated for the area of inundation.

Existing hiking trails would also be relocated to areas along the edge of the Temperance Flat RM 274 Reservoir shoreline.

Temperance Flat Reservoir Area The Temperance Flat RM 274 Reservoir Area includes Millerton Lake above the proposed Temperance Flat RM 274 Dam, the San Joaquin River between the top of Millerton Lake and Kerckhoff Dam, the area that would be inundated by a 985-foot dam, and a buffer area outside of the inundation zone that is the lesser of 50 vertical feet or 0.25 mile. Nearly 78 percent of this area is composed of upland woodland habitats (see Chapter 6, "Biological Resources – Vegetation and Wetlands"), and most of those habitats consist of foothill pine oak woodland and blue oak woodland. Lacustrine and riverine habitats comprise the next largest component, covering 44 percent of the Temperance Flat Reservoir Area. Herbaceous wetland habitats in the form of seasonal wetland and freshwater seep make up 2 percent, annual grassland makes up 2 percent, and three cover types each make up less than 1 percent, including riparian communities covering approximately 33 acres.

Millerton Lake Below RM 274 Millerton Lake between Friant Dam and RM 274 consists solely of lacustrine unconsolidated bottom (open water [i.e., the lake]) and lacustrine unconsolidated shoreline (the shoreline exposed at lower lake levels) habitats. No other habitats were considered in this part of the primary study area.

Extended Study Area

San Joaquin River from Friant Dam to Merced River The portion of the extended study area encompassing the San

Joaquin River from Friant Dam to the Merced River was divided into eight reaches. Habitat types vary widely in each reach and are summarized below.

Reach 1A As a result of stabilized active-channel conditions below Friant Dam (due to reduced magnitude, frequency, and duration of flood flows), the extent of gravel bars and herbaceous riparian and marsh vegetation has declined from historical conditions. In addition, riparian forest has shifted from cottonwood dominance to mixed riparian forest, with dominance by willows and alders, which are particularly effective colonizers following upstream diversions (Reclamation 1998a). Reach 1A presently supports continuous riparian vegetation, except where the channel has been disrupted by instream aggregate removal or off-channel aggregate pits that have been captured by the river. This reach has the greatest diversity of vegetation types and has the highest overall diversity of plant species. Based on the 2000 vegetation surveys by DWR (DWR 2002), eight identified riparian communities (cottonwood, willow, mixed, and oak riparian forest; willow and riparian scrub and elderberry savanna; and emergent wetlands) are present in this reach.

Reach 1B Woody riparian vegetation is prevalent and occurs mainly in narrow strips immediately adjacent to the river channel. Mature vegetation on the back side of many point bars and on low floodplains is scarce. Remnant valley oaks are present on some of the higher terraces. Previously cleared terraces and the understory of the cottonwood and oak stands are dominated by nonnative annual grasses (McBain & Trush 2002).

Reach 2A Riparian vegetation in the upper 10 miles of this reach is sparse or absent because the river is usually dry and the shallow groundwater is overdrafted (McBain & Trush 2002). Grassland/pasture is relatively abundant in Reach 2A, contributing almost 50 percent to the total natural land cover (excluding urban and agricultural land cover types). The most abundant riparian communities present are riparian and willow scrub habitats. The only significant stand of elderberry savanna mapped in the extended study area occurs on the left bank of this reach.

Reach 2B The lower few miles of this reach support narrow, patchy, but nearly continuous vegetation, because this area is continuously watered by the backwater of the Mendota Pool affecting both surface and groundwater elevation. The riparian zone is narrowly confined to a thin strip 10 to 30 feet wide bordering the channel. The herbaceous understory is rich in native species, and a high portion of the total vegetative cover is native plants. The margins of Mendota Pool support some areas of emergent vegetation dominated by cattails and tules; a few cottonwoods and willows grow above the waterline.

Reach 3 Nearly continuous riparian vegetation of various widths and cover types occurs on at least one side of the channel in this reach (McBain & Trush 2002); however, the narrow width of the riparian corridor results in a low ratio of native vegetation per river mile (DWR 2002). In this reach, cottonwood riparian forest is the most abundant native vegetation type, followed by willow scrub, willow riparian forest, and riparian scrub. The narrow riparian corridor is likely a result of development of the upper and middle floodplain elevations for agricultural and urban uses. A reduction in the frequency of flood events also likely resulted in less-frequent scouring events, decreasing the abundance of early successional riparian vegetation (i.e., scrub) and riverwash (Reclamation 1998b), while allowing the riparian forest to establish.

Reach 4A Reach 4A is sparsely vegetated, with a thin band of vegetation along the channel margin (or none at all). Willow scrub and willow riparian forest occur in small to large stands, and in-channel pools rimmed by small areas of marsh vegetation are present in the channel; however, this reach has the fewest habitat types and lowest ratio of natural vegetation per river mile in the extended study area.

Reach 4B Reach 4B is divided into Reaches 4B1 and 4B2. Reach 4B1 supports a nearly unbroken, dense, but narrow corridor of willow scrub or young mixed riparian vegetation on most of the reach, with occasional large gaps in the canopy. It no longer conveys flows because the Sand Slough Control Structure diverts all flows into the bypass system. As a result, the channel in Reach 4B1 is poorly defined and filled with dense vegetation, and, in some cases, it is plugged with fill material. Because of the wider floodplain and available groundwater, as well as management of the land as part of the San Luis NWR, Reach 4B2 contains vast areas of natural vegetation compared to the upstream reaches. Grasslands and pasture are the most common vegetation type, but willow riparian forest and emergent wetlands are also relatively abundant (DWR 2002).

Reach 5 In Reach 5, the San Joaquin River is surrounded by large expanses of upland grassland with numerous inclusions of woody riparian vegetation in the floodplain. Remnant riparian tree groves are concentrated on the margins of mostly dry secondary channels and depressions, or in old oxbows. Along the mainstem San Joaquin River, a relatively uniform pattern of patchy riparian canopy hugs the channel banks as large individual trees or clumps (primarily valley oaks or black willow) with a mostly grassland or brush understory (McBain & Trush 2002). The most abundant plant community is grassland and pasture, followed by willow riparian forest, emergent wetland, willow and riparian scrub, and willow, oak, and cottonwood riparian forests. Alkali scrub is also present in this reach (DWR 2002).

San Joaquin River from Merced River to the Delta From the confluence with the Merced River to the Delta, the San Joaquin River is bordered extensively by agricultural fields. Agricultural land use has also reduced much of the riparian habitat. In most areas, only a narrow ribbon of riparian habitat is supported. However, riparian habitat is more extensive locally, especially near the confluence with tributary rivers, within cutoff oxbows, and in the 6,500-acre San Joaquin River NWR between the confluences with the Tuolumne and Stanislaus Rivers (DWR 2012).

Delta The Delta is divided into numerous islands and hundreds of miles of waterways. Historically, the Delta had extensive areas of wetlands. Nearly all of the Delta’s wetlands have been reclaimed for agriculture and other land uses. These islands include “flooded islands” that were once reclaimed land, but were abandoned after levee failures. The portion of the Delta under consideration for the extended study area is limited to open waterways because the impacts of the project in the Delta would be limited to the conveyance of water that would be contained within the bed, bank, and channels of the existing waterways. Chapter 6, “Biological Resources – Vegetation and Wetlands,” provides a list of land cover types in this portion of the extended study area.

CVP and SWP Water Service Areas The CVP and SWP water service areas contain a large diversity of both lowland and upland habitats and associated species, although agricultural and urban development has reduced the area and connectivity of important habitats that are critical to sustaining a wide variety of unique plants and animals (DFG 2007). The agricultural land and urban development that dominate the

CVP and SWP water service areas, respectively, are dominated by nonnative and ornamental plant species. Examples of habitat features within these areas include shelter belts characterized by disked agricultural fields and urban parks with landscaped vegetation.

Special-Status Species

Primary Study Area

As defined in this document, special-status taxa are species or subspecies that fall into one or more of the following categories, regardless of their legal or protection status:

- Officially listed or proposed for listing by California or the Federal government as endangered, threatened, or rare
- Taxa that meet the criteria for listing, even if not currently included on any list, as described in Section 15380 of the State CEQA Guidelines
- Taxa designated as a special-status, sensitive, or declining species by other State or Federal agencies or nongovernmental organizations, including species classified as sensitive by BLM
- Species identified by the CDFW as California Species of Special Concern
- Animals fully protected in California under the California Fish and Game Code

Each special-status species known to be present or potentially present in the primary study area is presented in Table 7-1.

Temperance Flat Reservoir Area Based on the results of database searches and review of existing environmental documentation, 39 special-status animal species were identified as either known to occur or having potential to occur in the primary study area (Table 7-1). See Figures 7-1 and 7-2 for special-status wildlife species that have been documented in the vicinity of the primary study area. The same species are either known to occur or have potential to occur in the Temperance Flat Reservoir Area. Species descriptions are derived primarily from information in the CNDDB records (CDFW 2013); existing species accounts available from CDFW, the USFWS, and others; recovery plans for special-status species with potential to occur in the extended study area; and relevant scientific literature.

Table 7-1. Special-Status Wildlife Species Known or with Potential to Occur in the Primary Study Area

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Potential to Occur
Invertebrates					
Dutchman's pipe / Pipevine swallowtail *Battus philenor*	—	—	BLM	Plants from the pipevine family are hosts (e.g., Dutchman's pipe, California pipevine); found in mesic habitat in forest understory or with shrubs	Present • Multiple pipevine swallowtails were observed in the primary study area during surveys (Figure 3-2 of wildlife technical report-Bureau of Reclamation 2007). Eleven populations of host-plant locations were also detected throughout the primary study area (U.S. Department of the Interior, Bureau of Reclamation 2007). • Suitable habitat occurs in riparian habitat throughout primary study area
Vernal pool fairy shrimp *Branchinecta lynchi*	T	—	—	Inhabits primarily vernal pools, but also occurs in other seasonal wetlands such as alkaline rain pools, ephemeral drainages, rock outcrop pools, ditches, stream oxbows, stock ponds, and vernal swales	Possible • A number of CNDDB records northeast, north, west, south, southwest, and southeast of Friant Dam • May use vernal pools on tops of tables
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T	—	—	Elderberry shrubs are host; generally found in riparian areas and floodplains, also open hillsides and rocky outcrops	Possible • Species not documented in primary study area but known to occur in region • Many elderberry shrubs present; some older live and dead shrubs with potential exit holes
Vernal pool tadpole shrimp *Lepidurus packardi*	E	—	—	Occurs in a variety of seasonal habitats: vernal pools, ponded clay flats, alkaline pools, ephemeral stock tanks, and roadside ditches	Possible • A number of CNDDB records northeast of Friant Dam at Big Table Mountain • May use vernal pools on tops of tables

Table 7-1. Special-Status Wildlife Species Known or with Potential to Occur in the Primary Study Area (contd.)

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Potential to Occur
Amphibians					
California tiger salamander *Ambystoma californiense*	T	T	—	Breeds in vernal pools or other temporary pools; spends most of life cycle in upland burrows	Possible • One undocumented report near Indian Village site within primary study area • A number of CNDDB records northeast, north, west, south, and southeast of Friant Dam; also documented in Auberry • May use vernal pools on tops of tables • Potential movement corridors exist from tops of tables to Millerton Lake, but movements into and out of the San Joaquin River Gorge are unlikely • No California tiger salamander detected during aquatic larval surveys in 2008 and 2011
California red-legged frog *Rana draytonii*	T	CSC	—	Aquatic habitat such as ponds, backwaters, sloughs, stock ponds, especially with emergent and submersed aquatic vegetation	Unlikely • Primary study area in current known range, and suitable habitat is present; however, nearest known occurrence 65 miles away
Foothill yellow-legged frog *Rana boylii*	—	CSC	BLM-S	Partly shaded shallow streams and riffles with rocky substrate that is at least cobble sized, in various habitats; may breed near confluence of smaller tributaries with larger rivers	Possible • Potential habitat is present in primary study area • None found during 2007 focused surveys in the San Joaquin River Gorge or tributaries
Western spadefoot *Spea hammondii*	—	CSC	BLM-S	Preferred habitat is grasslands with temporary water pools, but will breed in permanent pools	Possible • Known occurrences near primary study area • Suitable habitat available
Birds					
Cooper's hawk *Accipiter cooperii* (nesting)	—	WL	—	Inhabits oak savanna, woodlands, and open grassland habitats, especially near water	Present • Present throughout primary study area
Sharp-shinned hawk *Accipiter striatus* (nesting)	—	WL	—	Nests in woodlands, but may occur in the more open savanna type habitats, especially near water	Present • Present in portions of primary study area with relatively higher-quality nesting habitat

Table 7-1. Special-Status Wildlife Species Known or with Potential to Occur in the Primary Study Area (contd.)

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Potential to Occur
Birds (contd.)					
Grasshopper sparrow *Ammodramus savannarum* (nesting)	—	CSC	—	Inhabits moderately open grasslands, grassland-shrub areas, and ruderal areas with patchy bare ground	Possible • No recent records of occurrence near primary study area • Limited suitable nesting habitat is present in the table top grasslands to the southeast of the Temperance Flat RM 274 Dam site.
Golden eagle *Aquila chrysaetos*	—	FP, WL	BGEPA	Forages over open shrub and grasslands; nests in large trees and on cliffs or large rock outcrops	Present • Known to occur in primary study area; nests in cliffs above Millerton Lake
Long-eared owl *Asio otus* (nesting)	—	CSC	—	Wide distribution but uncommon; found in riparian and areas of dense trees and shrubs near water	Unlikely • Habitat in primary study area is marginal
Western burrowing owl *Athene cunicularia* (burrow sites and some wintering sites)	—	CSC	BLM-S	Open dry grasslands and desert habitat; nests and dens in underground burrows, especially those of ground squirrels	Unlikely • Habitat in primary study area is marginal
Northern harrier Circus cyaneus (nesting)	—	CSC	—	Prefers annual and perennial grasslands, open meadows	Unlikely • Predominantly forested habitats in the primary study area are not optimal
White-tailed kite Elanus leucurus	—	FP	—	Prefers coastal and lowland valleys; often associated with farmlands, meadows with emergent vegetation, grasslands	Unlikely • Not commonly known in the primary study area; may be occasional migrant • Preferred habitat not present
Little willow flycatcher *Empidonax trailii brewsteri*	—	E	—	Requires contiguous patches of multilayered dense willows or riparian habitat with moist soils and/or standing water for nesting; riparian habitats and large wet meadows with abundant willows during migration	Unlikely • No confirmed recent sightings in primary study area but incidental occurrence as migrant is possible • Riparian habitat too limited in size, distribution, and structure for nesting
California horned lark *Eremophila alpestris actia*	—	WL	—	Open grasslands and pasture with short vegetation	Possible • Limited suitable nesting habitat is present in the table top grasslands to the southeast of the proposed Temperance Flat RM 274 Dam site

Table 7-1. Special-Status Wildlife Species Known or with Potential to Occur in the Primary Study Area (contd.)

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Potential to Occur
Merlin *Falco columbarius* (wintering)	—	WL	—	Prefers open grasslands, savannas and woodlands below elevation 4,000 feet	Possible • Uncommon winter migrant • Suitable habitat is limited in primary study area
Prairie falcon *Falco mexicanus* (nesting)	—	WL	—	Forages over large areas of open habitats; nests in cliffs	Present • Known to nest in San Joaquin River Gorge and in cliffs above Millerton Lake
American peregrine falcon *Falco peregrinus anatum* (nesting)	—	FP	—	Forages in open fields, especially near water and over forest and woodland habitats; nests on cliffs, tall buildings, or bridges	Present • Reported as occasional over the San Joaquin River east of Friant Dam • Suitable nesting and foraging habitat is available but nesting has not been documented
Bald eagle *Haliaeetus leucocephalus*	—	E, FP	BGEPA	Forages over open water, roosts in adjacent trees, nests in tall, sturdy trees	Present • Pair nesting at southwestern edge of primary study area near Millerton Lake and known to use other parts of primary study area
Yellow-breasted chat *Icteria virens* (nesting)	—	CSC	—	Dense riparian thickets of willows, vine tangles, and dense brush associated with streams, swampy ground, and the borders of small ponds	Unlikely • Suitable riparian habitat is limited in primary study area
Loggerhead shrike *Lanius ludovicianus* (nesting)	—	CSC	—	Common resident in open habitats with scattered trees and shrubs; prefers habitats with abundant perches	Possible • Known to occur in primary study area as winter migrant • Suitable habitat is available for nesting
Osprey *Pandion haliaetus* (nesting)	—	WL	—	Forages over large bodies of water and rivers that have abundant fish with large trees or other platforms for nesting	Present • Observed around Millerton Lake; nests north of primary study area • Nesting within primary study area possible
Yellow warbler *Setophaga petechia* (nesting)	—	CSC	—	Breeds in mesic, deciduous thickets, especially riparian; preferred habitat includes moist areas with dense insect prey populations	Present • Detected in primary study area at Big Sandy Creek but nesting not documented • Habitat is limited in size and has marginal structure for nesting

Table 7-1. Special-Status Wildlife Species Known or with Potential to Occur in the Primary Study Area (contd.)

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Potential to Occur
California spotted owl *Strix occidentalis occidentalis*	—	CSC	BLM-S	In the Sierra Nevada foothills, nests in oak woodlands located in or near riparian areas in steep-sided canyons	Possible • Detected immediately southeast of Kerckhoff Dam • Suitable habitat is available in primary study area
Least Bell's vireo *Vireo bellii pusillus* (nesting)	E	E	—	Cottonwood-willow forest, oak woodland, shrubby thickets, and dry washes with willow thickets	Unlikely • Riparian habitat too limited in size, distribution, and structure • Not known to nest in or near primary study area
Mammals					
Pallid bat *Antrozous pallidus*	—	CSC	BLM-S	Forages over wide range of habitats, including grasslands, scrub, woodlands, and forests; most common in open, dry habitat with rocky areas for roosting; also roosts in large oaks and buildings	Present • Known to breed in cliffs above Millerton Lake
Ringtail *Bassariscus astutus*	—	FP	—	Prefers riparian, brush habitats and most forest habitats, areas with talus or rocky elements or snags for cover; occurs at low elevations to middle elevations	Possible • Species is known to occur near primary study area and likely to occur within it • Suitable habitat available
Townsend's big-eared bat *Corynorhinus townsendii*	—	CSC	BLM-S	Found throughout California in many habitats; roosts in colonies in caves, mines, or buildings; extremely sensitive to human disturbance	Present • Detected in rock outcrop near Millerton Bottoms • Suitable roosting and foraging habitat is available in primary study area
Spotted bat *Euderma maculatum*	—	CSC	BLM-S	Species biology not well known; distribution limited to approximately 40 small areas in California; may forage in foothills, desert; breeds and roosts in rock crevices	Possible • Not known to occur in primary study area • Suitable habitat occurs in primary study area
Western mastiff bat Eumops perotis californicus	—	CSC	BLM-S	Found throughout California in many habitats; nests in cliffs; intolerant of human activity	Possible • Known to nest in cliffs above Millerton Lake. Likely uses portions of primary study area for foraging.
Western small-footed myotis *Myotis ciliolabrum*	—	—	BLM-S	Occurs in wide range of dry upland habitats in the Sierra Nevada; prefers scrub and woodlands near open water where it feeds; ranges from sea level to elevation 9,000 feet	Possible • Occurrence in primary study area unknown • Suitable habitat exists

Table 7-1. Special-Status Wildlife Species Known or with Potential to Occur in the Primary Study Area (contd.)

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Potential to Occur
Long-eared myotis *Myotis evotis*	—	—	BLM-S	Widespread but uncommon; prefers brushy, woodland, and forest habitats; roosts in buildings, caves, under tree bark, snags and rock crevices	Possible • Occurrence in primary study area unknown • Suitable habitat present
Fringed myotis *Myotis thysanodes*	—	—	BLM-S	Distribution is widespread, but abundance is irregular; optimal habitat is pinyon–juniper, valley foothill hardwood and hardwood-conifer between elevation 4,000 and 7,000 feet	Possible • Occurrence in primary study area unknown • Suitable habitat is limited in the primary study area; elevation is below general distribution
Yuma myotis *Myotis yumanensis*	—	—	BLM-S	Common and widespread in California; wide range of habitats used; roosts in caves, mines, buildings; optimal habitat is open woodlands and forests near open water	Present • Known to occur in region • Suitable habitat occurs in primary study area
San Joaquin pocket mouse *Perognathus inornatus inornatus*	—	—	BLM-S	Occurs in dry, open grasslands with fine-textured soils in the Central and Salinas Valleys from elevation 1,000 to 2,000 feet	Possible • Presence in primary study area unknown • Suitable habitat is limited
American badger *Taxidea taxus*	—	CSC	—	Drier open grassland, shrub, and forest habitats with friable soils	Possible • Known to occur near primary study area • Suitable habitat present and species is likely to occur

Key:
CNDDB = California Natural Diversity Database
[1] Federal Status:
E: Endangered
T: Threatened
[2] State Status:
CSC: California Species of Special Concern
E: Endangered
FP: Fully Protected
T: Threatened
WL: Watch list

[3] Other Status:
BGEPA: Federal Bald and Golden Eagle Protection Act
BLM-S: BLM Sensitive Species
BLM: Species of management concern to BLM

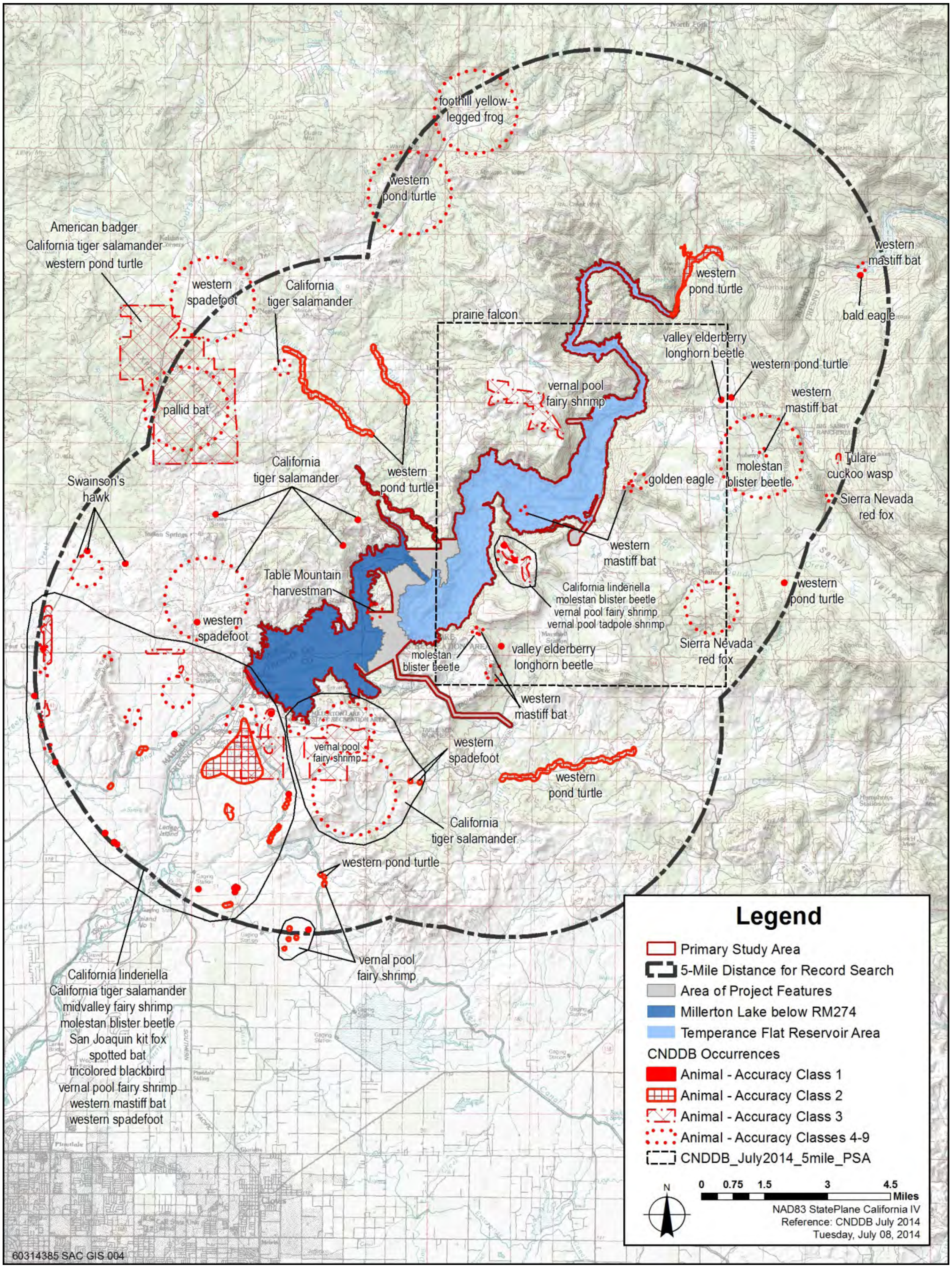


Figure 7-1. Wildlife Occurrences in Vicinity of Primary Study Area

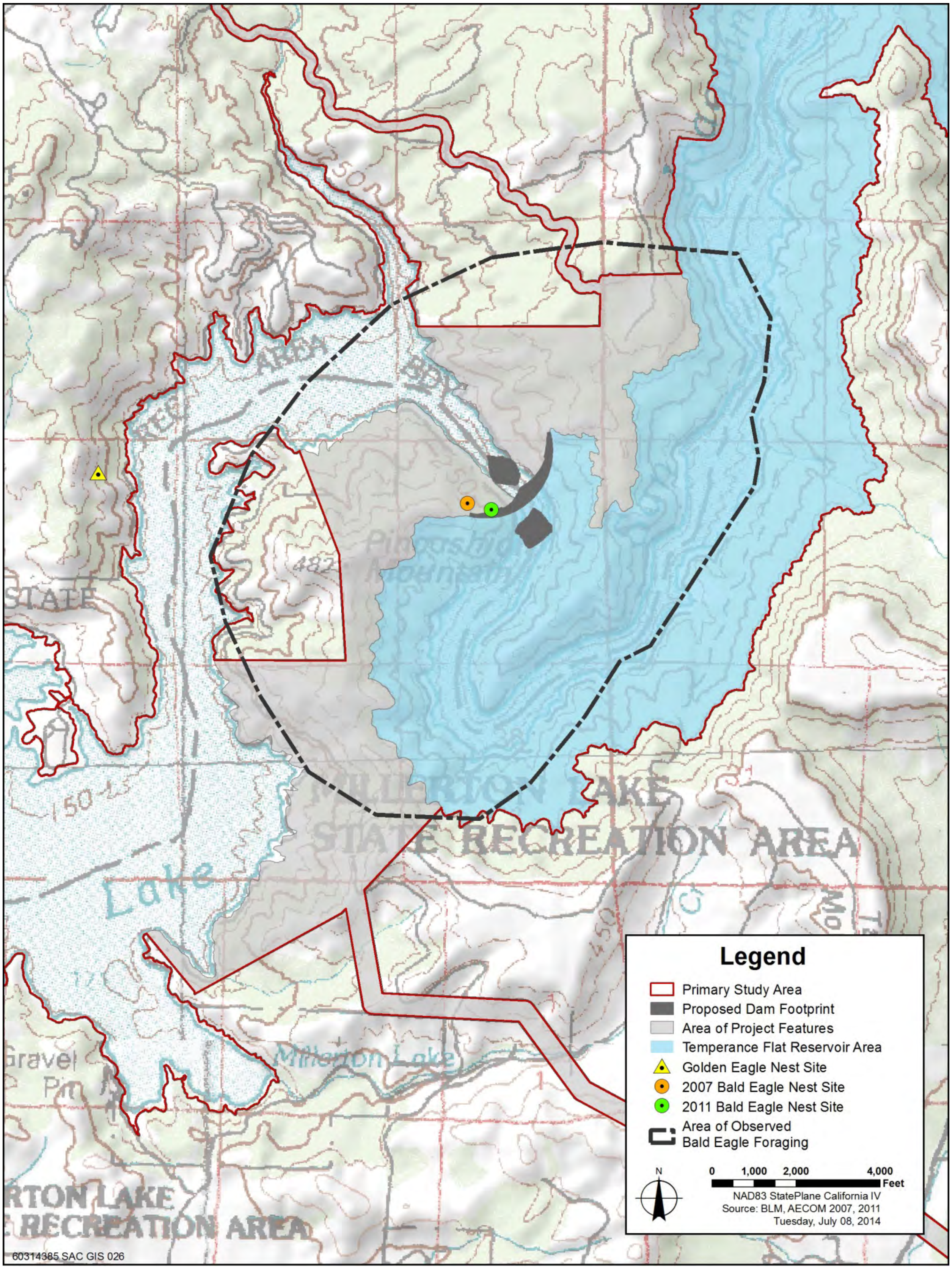


Figure 7-2. Eagle Nest Location Map

Invertebrates

Pipevine Swallowtail (*Battus philenor*) Eleven California pipevine (*Aristolochia californica*) plant populations were identified in the Temperance Flat Reservoir Area. All were located on streambanks or in mesic woodland sites between Big Sandy Creek and just upstream from Kerckhoff Powerhouse. Pipevine swallowtail butterflies were observed in the Temperance Flat Reservoir Area, primarily in the vicinity of the BLM facilities and Kerckhoff Powerhouse. Each of the five of the largest pipevine populations observed in the primary study area supported hundreds of pipevine swallowtail caterpillars during surveys conducted in April and May. The pipevine swallowtail is of management concern to BLM because it is reportedly one of only two known resident populations (Reclamation 2007); however, it has not been designated as a sensitive species by BLM.

Vernal Pool Fairy Shrimp (*Branchinecta lynchi*) The entire primary study area is located within the known range of the vernal pool fairy shrimp. Suitable habitat for this species within the primary study area is generally limited to possible vernal pool grassland in the new transmission line corridor. No vernal pool fairy shrimp have been detected within the primary study area, but there are various CNDDB occurrences within 3 to 5 miles of the primary study area, with the closest occurrences at Big Table Mountain approximately 0.4 miles to the southeast of the primary study area (CNDDB 2014). Two critical habitat units have been designated in the vicinity of the primary study area: Units 25 and 24b (USFWS 2006a). These critical habitat units are located outside of the primary study area, one in Madera County at Kennedy Table (Unit 25), and one in Fresno County southwest of Friant Dam (Unit 24b). Upland habitats used by vernal pool fairy shrimp are grassland uplands interspersed with vernal pools. No vernal pool branchiopod surveys have been performed within the primary study area.

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*) Elderberry shrubs, host plant for the valley elderberry longhorn beetle, were found throughout the Temperance Flat Reservoir Area, primarily in foothill pine oak woodland, often near intermittent or ephemeral drainages or in rock outcrops. A total of 375 elderberry shrubs were mapped within the Temperance Flat Reservoir Area, and all were of appropriate size for this beetle. Exit holes were frequently observed in dead wood but were observed in the live wood of only five shrubs. There are six documented valley elderberry longhorn beetle occurrences in the CNDDB within 10 miles of the primary study area (CDFW 2013). The nearest CNDDB occurrence is located just east of Big Table Mountain, approximately 1 mile from the primary study area. Another occurrence is reported for Little Sandy Creek, approximately 3 miles from the primary study area. Other occurrences are reported in the San Joaquin River Gorge by Stebbins (2003).

Vernal Pool Tadpole Shrimp (*Lepidurus packardi*) The primary study area is located partially within the known range of the vernal pool tadpole shrimp. Suitable habitat for this species within the primary study area is generally limited to possible vernal pool grassland in the new transmission line corridor. No vernal pool tadpole shrimp have been detected within the primary study area, but there are three CNDDB occurrences within 1 mile of the primary study area, all at Big Table Mountain approximately 0.4 miles to the southeast of the primary study area (CNDDB 2014). One critical habitat unit has been designated in the vicinity of the primary study area: Unit 17 (USFWS 2006a). This critical habitat unit is located outside of the primary study area at Big Mountain Table approximately 0.4 miles to the southeast of the Temperance Flat Reservoir Area. Upland habitats used by vernal pool tadpole shrimp are grassland uplands interspersed with vernal pools. No vernal pool branchiopod surveys have been performed within the primary study area.

Amphibians and Reptiles

California Red-Legged Frog (*Rana draytonii*) The primary study area is located within the historic range of the California red-legged frog, but not the current known range (USFWS 1999a, 2002; CDFW 2013). The nearest known occurrence is approximately 65 miles west of the primary study area (CDFW 2013). Five stream segments and four pools in the Temperance Flat Reservoir Area provide habitat with suitable physical characteristics, but they are located a substantial distance from known occupied habitats. This species is considered unlikely to occur in the primary study area.

California Tiger Salamander (*Ambystoma californiense*) The entire primary study area is located within the known range of the California tiger salamander. There are two reported California tiger salamander occurrences within 3 miles of the primary study area and one reported sighting of California tiger salamander within the primary study area (CDFW 2013). Three California tiger salamander critical habitat units have been designated in the vicinity of the primary study area: Units 1a, 1b, and 2 (USFWS 2005). These critical habitat units are located outside of the primary study area, two in Madera County north (Unit 1a) and west (Unit 1b) of Friant Dam, and one in Fresno County south of Friant Dam and mostly south of Auberry Road (Unit 2). Upland habitats used by California tiger salamander are grasslands and woodlands with active small-mammal burrows. Larval surveys were conducted in 2008 and 2011 within the primary study area, at which time no California tiger salamanders were found.

Foothill Yellow-Legged Frog (*Rana boylii*) Habitat for foothill yellow-legged frog is limited within the primary study area by lack of perennial water and by management of water releases from Kerckhoff Dam. Based on general habitat requirements, three locations were identified as potentially suitable, and five, including the San Joaquin River, as marginal. The entire primary study area is located within the known range of the foothill yellow-legged frog, and there are three known occurrences of foothill yellow-legged frog located within 10 miles of the primary study area; however, there are no known occurrences located within 3 miles (CDFW 2013). These frogs were not detected during visual-encounter surveys in 2007.

Western Spadefoot (*Spea hammondii*) Western spadefoot occurs in grassland with temporary pools and is likely to occur in the primary study area based on habitat presence and known occurrence in the vicinity. The species was not observed during field surveys in 2007, 2010, and 2011. There are more than 30 recorded spadefoot occurrences located within 10 miles.

Western Pond Turtle (*Emys marmorata*) Western pond turtle is known to occur in the primary study area and in the general vicinity in stock ponds, streams, and reservoirs. There are a number of western pond turtle occurrences identified in the vicinity of the primary study area, including Kerckhoff Lake (CDFW 2013). During surveys, three adult western pond turtles were observed in Big Sandy Creek, and one adult western pond turtle was observed in the San Joaquin River. Sixteen CNDDB records of western pond turtle are reported within 10 miles of the primary study area.

Coast Horned Lizard (*Phrynosoma blainvillii*) Coast horned lizard is found on gravelly, sandy soils in a variety of habitats. Suitable habitat occurs at a number of locations in the primary study area. This species was not observed during field surveys but has the potential to be present.

Birds

Cooper's Hawk (*Accipiter cooperi*) Cooper's hawk breeds in deciduous, mixed, and evergreen forests with forest-edge habitat for hunting (Curtis et al. 2006). Occurrences of Cooper's hawks within and surrounding the primary study area include the San Joaquin River Gorge (Stebbins 2003), the San Joaquin Experimental Range as uncommon permanent residents (Purcell et al. 2005), and observations during point-count surveys between 1999 and 2004 along transects in Big Sandy Creek, on Wellbarn Road, and in Sky Harbor Channel (Millerton Lake, downstream from Fine Gold Creek) (Smith, pers. comm., 2007). Suitable habitat is present, and a Cooper's hawk was detected in the primary study area during the May 2007 survey.

Sharp-Shinned Hawk (*Accipiter striatus*) Sharp-shinned hawk breeds in dense woodlands that contain conifers and are cool, moist, well shaded, and near water (Bildstein and Meyer 2000). Occurrences of sharp-shinned hawks within and surrounding the primary study area are from the San Joaquin Experimental Range as a rare fall migrant and winter resident and as an occasional spring migrant (Purcell et al. 2005); they have typically been recorded from September to April. This species has also been detected during point-count surveys between 1999 and 2004 along Winchell Cove and Sky Harbor Channel transects (Smith, pers. comm., 2007). Suitable nesting habitat is present in the primary study area and a sharp-shinned hawk was detected during a May 2007 survey near Kerckhoff Dam.

Grasshopper Sparrow (*Ammodramus savannarum*) Grasshopper sparrow generally prefers moderately open grasslands and prairies with patchy bare ground (Vickery 1996). There are no records of grasshopper sparrow occurrence in the San Joaquin River Gorge or San Joaquin Experimental Range. It is unlikely to occur in the primary study area because grassland habitats are small and patchy.

Golden Eagle (*Aquila chrysaetos*) Golden eagle occurs in open and forested habitats, nesting in large trees or on ledges, cliffs, or rock outcrops (Kochert et al. 2002) and foraging primarily for small mammals in open areas. It has been detected in the vicinity of the primary study area in the San Joaquin River Gorge (Stebbins 2003) and in the San

Joaquin Experimental Range as an occasional permanent resident (Purcell et al. 2005), has been observed on or above cliffs along the Sky Harbor Channel and during point-count surveys between 1999 and 2006 (Smith, pers. comm., 2007), and was seen flying over in the primary study area during 2010 surveys. Suitable breeding habitat and foraging habitat is found throughout the primary study area. Therefore, it is assumed to be present within the primary study area.

Long-Eared Owl (*Asio otus*) Long-eared owl prefers riparian habitats or other areas with dense trees and shrubs near water. There are no CNDDB or other local records for this species; however, it is a secretive owl that is difficult to detect. Available habitat is considered only marginal for this species, but occurrence is possible. There are no CNDDB records indicating the presence of this species within 10 miles of the primary study area.

Western Burrowing Owl (*Athene cunicularia*) Western burrowing owl inhabits dry, open, short-grass, mostly treeless plains, usually associated with burrowing mammals (Haug et al. 1993). There are no CNNDB records (CDFW 2013) or other recorded observations in San Joaquin River Gorge or San Joaquin Experimental Range. With the exception of the transmission line area, suitable habitat was not found within the primary study area, and this species is not expected to nest or winter there. There are three CNDDB records of occurrence for this species within 10 miles, but no records of occurrence within 1 mile of the primary study area.

Northern Harrier (*Circus cyaneus*) Northern harrier breeds in open wetlands, including meadows, lightly grazed pastures, fallow croplands, upland prairies, and marshes (MacWhirter and Bildstein 1996). Harriers were observed adjacent to the primary study area during spring point-count surveys in 2000 near Sky Harbor Channel (Smith, pers. comm., 2007) and as a casual species from fall through spring. Harriers were not detected within the primary study area during 2007 surveys and are unlikely to be present based on existing habitat conditions. Grassland and open-marsh habitats in the primary study area are marginal, and this species is unlikely to nest there.

White-Tailed Kite (*Elanus leucurus*) White-tailed kite prefers low-elevation grassland, agricultural, wetland, oak-woodland, or savanna habitats (Dunk 1995). Although it may be an occasional migrant in the primary study area, suitable nesting habitat is not present and foraging habitat is marginal. Occurrences near the primary study area include observations in the San Joaquin Experimental Range, located northwest of the primary study area (Purcell et al. 2005), and infrequent observations of individuals at other times. This species is considered unlikely to occur.

Little Willow Flycatcher (*Empidonax trailii brewsteri*) Little willow flycatcher inhabits moist, shrubby areas, often with standing or running water (Sedgwick 2000). It is typically restricted to thickets of willows, whether along streams, in canyon bottoms, in seepages, or at the margins of ponds and lakes (Grinnell and Miller 1944). There are eight records of occurrence from the San Joaquin Experimental Range (upstream from the Temperance Flat Reservoir Area) of accidental migrants in spring/summer and fall (Purcell et al. 2005). Suitable habitat for breeding little willow flycatchers was not detected in the Temperance Flat Reservoir Area, and flycatchers were not observed during surveys in May and June 2007 in the highest-quality habitats available. It is unlikely to occur within the primary study area and there are no CNDDB records of occurrence within 10 miles.

California Horned Lark (*Eremophila alpestris actia*) California horned lark prefers open grasslands and grazed fields with short and often sparse vegetation (Beason 1995). There are no known occurrences of California horned lark within the primary study area but they are known to occur nearby. Suitable habitat is limited, so this species is unlikely to be present.

Merlin (*Falco columbarius*) Merlin occurs in open grassland, savanna and woodland habitats. Merlin could occur in the primary study area during winter; however, it does not nest in California. There are no recorded occurrences of this species within the primary study area.

Prairie Falcon (*Falco mexicanus*) Prairie falcon nests on ledges, crevices, or potholes on volcanic buttes, sandstone canyons, bluffs, and isolated rock outcrops. Vertical cracks and horizontal shelves provide the most typical nest sites, and open grass and shrub land provide foraging habitat (Steenhof 1998). Prairie falcons have been detected in the San Joaquin River Gorge (Stebbins 2003) and in the San Joaquin Experimental Range (Purcell et al. 2005) where they have been rare in fall and winter and occasional in spring. Prairie falcons were detected during spring point-count surveys in 2004 and 2006 along Wellbarn Road and Sky Harbor Channel (Smith, pers. comm., 2007). No prairie falcons were detected during spring surveys in 2007, but this species is expected to nest in the area based on presence in the area and abundance of high-quality nesting habitat.

American Peregrine Falcon (*Falco peregrinus anatum*) American peregrine falcon nests on cliff ledges, buildings, and bridges, usually adjacent to rivers, lakes, and marshes supporting abundant waterfowl and other water birds for prey (White et al. 2002). This species has not been recorded in the San Joaquin River Gorge or San Joaquin Experimental Range (Purcell et al. 2005), but occurrence is considered likely. Although it was not observed during the spring surveys in 2007, high-quality breeding habitat, such as table-top mountain cliffs within the San Joaquin River Gorge, is present, as is suitable foraging habitat. Therefore, the species is assumed to be present in the primary study because of existing high-quality nesting habitat and suitable foraging habitat.

Bald Eagle (*Haliaeetus leucocephalus*) Bald eagle forages in rivers and lakes and nests in many parts of California and is known to occur in the primary study area. Nesting habitat typically includes large trees with open branches, usually within 1 mile of large bodies of open water (Buehler 2000). There are several documented occurrences of bald eagles in the San Joaquin River Gorge (Stebbins 2003). They are common winter residents, and some remain to nest at Millerton Lake, the Fine Gold Creek area, and Bass Lake (Smith, pers. comm., 2007). They have also been detected during spring point-count surveys along Sky Harbor Channel in 2000, 2003, and 2007 (Smith, pers. comm., 2007). Nests were found in 2010 and 2011 within the proposed Temperance Flat Reservoir Area.

Yellow-Breasted Chat (*Icteria virens*) Yellow-breasted chat inhabits riparian and shrubby habitat and is a relative generalist in its use of available habitat (Eckerle and Thompson 2001). In California, chats use dense riparian thickets of willows, vine tangles, and dense brush associated with streams and the borders of small ponds (Small 1994). There are no CNDDB or other local records of occurrence for this species in the primary study area or in the region, it was not detected on 2007 surveys, and little suitable habitat is found in the primary study area. It is considered unlikely to occur.

Loggerhead Shrike (*Lanius ludovicianus*) Loggerhead shrike is typically found in open country with short vegetation, such as pastures, mowed roadsides, and open woodlands with isolated trees or shrubs for nesting (Yosef 1996). There are no CNDDB records of occurrence (CDFW 2013), reports in local accounts, or point-count data for this bird in the region during the breeding season. Habitat is considered marginal for nesting, but nesting in the primary study area is possible.

Osprey (*Pandion haliaetus*) Osprey forages and nests in a variety of habitats where an adequate supply of accessible fish and shallow waters exists within 12 miles of elevated and open nest sites (Poole et al. 2002). Occurrences include an individual observed in 2006 at Millerton Lake and multiple observations during early spring point-count surveys in 1999 and 2000 near Sky Harbor Road, Wellbarn Road, and Winchell Cove (Smith, pers. comm., 2007). Suitable nesting habitat is sparse but nesting cannot be precluded. Ospreys are likely to forage in the primary study area whether they nest there or not.

Yellow Warbler (*Setophaga petechia*) Yellow warbler breeds most commonly in wet, deciduous thickets, especially those dominated by willows, and in disturbed and early successional riparian habitats (Lowther et al. 1999). It has been observed in the San Joaquin Experimental Range as an occasional spring and fall migrant and as an incidental visitor in late summer (Purcell et al. 2005). Yellow warbler was also detected multiple times during spring point-count surveys between 2000 and 2004 along transects in Big Sandy Creek and Sky Harbor Channel (Smith, pers. comm., 2007). Nesting habitat within the primary study area is considered marginal, but yellow warblers have been detected in the primary study area and may nest there.

California Spotted Owl (*Strix occidentalis occidentalis*) Known nest sites for California spotted owl range in elevation from approximately 1,000 to 7,700 feet; approximately 86 percent occur between 3,000 and 7,000 feet (Verner et al. 1992). In the Sierra Nevada, approximately 3 percent of spotted owls occur in foothill riparian/hardwood forest and eastside pine (USFS 2001). Nesting habitat is generally characterized by dense canopy closure with medium to large trees in stands with multiple canopy levels. The primary study area itself contains limited suitable nesting and foraging habitat for this species. However, a single individual spotted owl responded to calls on each of two separate nocturnal surveys near Kerckhoff Dam; therefore, it is possible that this species occurs in the primary study area.

Least Bell's Vireo (*Vireo bellii pusillus*) Least Bell's vireo inhabits dense, low, shrubby vegetation in riparian areas or near water in arid regions (Brown 1993). In California, it is found in dense shrub layers 2 to 10 feet above ground (Kus 2002, Franzreb 1989), usually in early- to mid-successional stages of riparian habitat with structurally diverse canopies for foraging (Kus 2002). There are no CNDDB or other local records of occurrence for least Bell's vireo in the primary study area. Suitable habitat for breeding Bell's vireos was not found in the primary study area, and it was not detected during surveys in May and June 2007. This species is unlikely to occur in the primary study area.

Mammals

Pallid Bat (*Antrozous pallidus*) Pallid bat is known to roost in a number of habitats found in the primary study area, including abandoned buildings, adits, crevices, caves, mines, and cliff overhangs. It forages over oak savanna, grassland, and woodlands. The nearest CNDDB pallid bat roosts are 6 and 9 miles away, at Millerton Lake and Musick Mountain respectively (CNDDB 2014). This species is expected to occur in the primary study area.

Ringtail (*Bassariscus astutus*) Ringtail inhabits riparian, brush, and most forest habitats; it is particularly associated with talus or rocky elements (Whitaker 1996). Rodney Olsen (Reclamation 2007) reports that ringtails are likely to be found within the primary study area, especially near Big Sandy Creek (Stebbins 2003, Reclamation 2007). They were not detected during 2007 surveys, but they are shy and nocturnal and difficult to detect.

Townsend's Big-Eared Bat (*Corynorhinus townsendii*) Townsend's big-eared bat is primarily a cave-dwelling species, with most known roost sites located in caves and mines (Fellers and Pierson 2002). In California, more than 40 percent of known roosts are located in abandoned mines and buildings (Pierson pers. comm. as cited in Sherwin et al. 2000), with recent studies showing that caves are more frequently inhabited than mines and have larger and more spatially stable populations (Sherwin et al. 2000, 2003). Both caves and mines are found in the primary study area as is suitable foraging habitat. A single big-eared bat was detected in April 2007 in the primary study area; four Townsend's big-eared bats were found within the Millerton Lake Cave System in 2012 (Graening 2013).

Spotted Bat (*Euderma maculatum*) Spotted bat has a wide geographic range but a patchy distribution (Pierson and Rainey 1998a). It appears to specialize on butterflies and moths as prey items, and distribution may be limited by availability of suitable roost sites. It is considered a nearly obligate cliff-roosting species (Pierson and Rainey 1998b). The nearest known roost was found in 1970 approximately 4 miles southwest of the primary study area. In 2002, spotted bats were documented at two locations approximately 11 and 12 miles away. No spotted bats were detected during 2007 surveys, although focused surveys for bats were not conducted. Suitable roosting habitat is found within the primary study area and presence of this bat is possible. There is one CNDDB record of occurrence for this bat within 10 miles of the primary study area.

Western Mastiff Bat (*Eumops perotis californicus*) Western mastiff bat was recorded in the primary study area in 1994 and 1995 at the San Joaquin River and adjacent to the primary study area at McKenzie Table Mountain Preserve (Pierson and Rainey 1998a; CDFW 2013). They have also been reported at Kennedy Table Mountain (Stebbins 2003). Although no western mastiff bats were detected during 2007 surveys, the basaltic tables, cliff margins, crevices, and abandoned structures of the primary study area offer potential roosting habitat (Pierson and Rainey 1998a, Reclamation 2007), and its presence is possible. There are three CNDDB records of occurrence for this bat within 1 mile of the primary study area.

Other Bat Species Several BLM-sensitive bat species are known or likely to occur in the primary study area: the Yuma myotis (*Myotis yumanensis*) is known to occur, western small-footed myotis (*Myotis ciliolabrum*) could occur, and long-eared myotis (*Myotis evotis*) could occur. It is also possible that the fringed myotis (*Myotis thysanodes*) occurs in the primary study area, although it is generally found at higher elevations. There are several CNDDB-recorded locations for these species within 10 miles of the primary study area. Western red bat (*Lasiurus blossevillii*) is a species of special concern that may occur within the primary study area, although no CNDDB-recorded locations for this species are within 10 miles of the primary study area.

San Joaquin Pocket Mouse (*Perognathus inornatus inornatus*) San Joaquin pocket mouse prefers weedy or grassy areas with fine soils (Whitaker 1996). The nearest recorded location of a pocket mouse is 13 miles away from 1933 (CNDDB 2014). Suitable habitat is limited and patchily distributed in the primary study area, but presence of this species is possible.

American Badger (*Taxidea taxus*) American badger occurs in drier grasslands, shrublands, and forests with friable soils. It has been documented in the San Joaquin Experimental Range (DFG 1986) and reported at the McKenzie Preserve (Big Table Mountain) and Kennedy Table southwest of the primary study area (Reclamation 2007). Olsen (Reclamation 2007) suggested that badgers are highly likely to occur in the primary study area. No badgers were seen during surveys although night surveys were not conducted as part of the survey of the primary study area. This species would be expected to be most active at night.

Area of Project Features The Temperance Flat Reservoir Area section above provides detail on all the special-status wildlife species that could occur in the Temperance Flat Reservoir Area. This list of species also applies to the area of project features. Of the 29 habitat types found in the primary study area, 12 are present in the area of project features: foothill pine oak woodland, blue oak woodland, bush lupine scrub, annual grassland, mixed riparian, willow riparian, seasonal wetland, lacustrine (unconsolidated bottom and unconsolidated shoreline), ephemeral drainage, intermittent drainage, in-channel pools, and developed. Foothill pine oak woodland is the most prevalent habitat type and comprises approximately 71 percent of the total area of project features. Blue oak woodland comprises 17 percent of the total area of project features. Grassland habitats comprise 10 percent of the total area of project features. Each of the others makes up less than 1 percent of the remaining area. Special-status wildlife species that could use this area are listed briefly below:

- Pipevine swallowtail was observed in this area during 2010 surveys.

- Blue elderberry was observed in the area of project features; valley elderberry longhorn beetle is potentially present where there are elderberry plants.

- California tiger salamander is not known or likely to occur but could potentially use pools found along intermittent or ephemeral drainages. Larval surveys were conducted in 2011 in the area of project features. No California tiger salamander larvae were found.
- Western spadefoot could breed in ponds.
- Coast horned lizard could occur in more open habitats with sandy soils.
- Bald eagle is known to nest near the Temperance Flat RM 274 Dam site and to winter in the general area.
- American peregrine falcon, golden eagle, and prairie falcon could nest on cliffs or ledges.
- Cooper’s hawk could nest in woodlands in the area, especially near riparian areas.
- Sharp-shinned hawk could nest in woodlands in the area, especially near riparian areas.
- Loggerhead shrike could nest in woodland areas that are relatively open.
- Osprey could nest in large trees or snags in the woodlands.
- Merlin, a winter visitor, could forage in open woodlands or over open waters in or near the area.
- Ringtail is likely to occur in the woodlands.
- American badger is likely to occur in most of the area.
- Pallid bat, spotted bat, western mastiff bat, and other bat species could roost and/or breed in the cliffs and rock crevices.
- Townsend’s big-eared bat could roost in rock outcrops in this area and forage over woodlands and riparian habitats.

Millerton Lake Below RM 274 Millerton Lake between Friant Dam and the proposed Temperance Flat RM 274 Dam provides open-water, or lacustrine, habitat surrounded primarily by relatively open foothill pine oak woodland. Millerton Lake is known to support basking and foraging western pond turtle and foraging bald eagles and osprey. Lacustrine habitats also provide foraging habitat for at least four of the special-status bats known to occur nearby: western mastiff bat, pallid bat, spotted bat, and Townsend's big-eared bat. These species are all discussed above. These and other bat species, as well as a number of special-status raptors such as golden eagles and falcons, could nest in the cliffs around Millerton Lake and forage on waterfowl and other birds using the lake and its adjacent habitats.

Extended Study Area

San Joaquin River from Friant Dam to Merced River

Based on the results of database searches and review of existing environmental documentation, 23 special-status animal species were identified as having potential to occur in habitats associated with the active channel of the extended study area or the Mariposa and Eastside bypasses. They are presented in Table 7-2 below. Species descriptions are derived primarily from information in CNDDB records (CDFW 2013); existing species accounts available from CDFW, USFWS, and others; recovery plans for special-status species with potential to occur in the extended study area; relevant scientific literature; other environmental assessments for the San Joaquin River Restoration Program (SJRRP 2009, 2011); and information contained in the San Joaquin River Restoration Study Background Report (McBain & Trush 2002).

Invertebrates

Valley Elderberry Longhorn Beetle Valley elderberry longhorn beetle is known to occur in elderberry shrubs present within the riparian woodland in Reach 1A. The species is also expected to occur in suitable habitat in other locations in the extended study area.

Amphibians and Reptiles

California Red-Legged Frog California red-legged frog is unlikely to occur within the extended study area because it is not generally known to occur on the valley floor. However, there is one 1993 CNDDB record of occurrence within 10 miles of the extended study area in a farm pond 4.5 miles southwest of Newman (CDFW 2013).

Table 7-2. Special-Status Wildlife Species Known or with Potential to Occur in the Extended Study Area

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Potential to Occur
Invertebrates					
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T	—	—	Elderberry shrubs are host; generally found in riparian areas and floodplains, also open hillsides and rocky outcrops	Present • Known to occur in elderberry shrubs present in the riparian woodland in Reach 1A • Expected to occur in suitable habitat in other locations in the extended study area
Amphibians					
California red-legged frog *Rana draytonii*	T	CSC	—	Aquatic habitat such as ponds, backwaters, sloughs, and stock ponds, especially with emergent and submersed aquatic vegetation	Unlikely • Not generally known to occur on the floor of the Central Valley
California tiger salamander *Ambystoma californiense*	T	T	—	Breeds in seasonal wetlands, such as vernal pools and other ephemeral features. Adults spend most of life in upland burrows up to 1.5 miles from suitable breeding habitat.	Present • Widespread in suitable habitat within the extended study area. • Would not be expected to be found within the channel of the San Joaquin River because this is not suitable habitat.
Reptiles					
Western pond turtle *Emys marmorata*	—	CSC	—	Ponds, lakes, streams, rivers, and backwaters with abundant basking habitat and escape cover (e.g., deep or turbid water, submerged root wads, or shoreline vegetation)	Present • Known to occur in suitable habitat on the San Luis NWR complex, in the Mendota Wildlife Area, and at Mendota Pool in Reach 2B • Expected to occur in suitable habitat in other locations in the extended study area
Blunt-nosed leopard lizard *Gambelia sila*	—	FP	—	Alkali scrub habitat, sparsely vegetated habitat with sandy soil; uses burrows for shelter, predator avoidance, and thermoregulation	Possible • Known to occur on the Merced NWR, adjacent to the Eastside Bypass • Upland habitat adjacent to the Eastside and Mariposa bypasses could provide suitable habitat • Surveys adjacent to these bypasses in 2009 and 2010 did not locate any individuals

Table 7-2. Special-Status Wildlife Species Known or with Potential to Occur in the Extended Study Area (contd.)

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Potential to Occur
Giant garter snake *Thamnophis gigas*	T	T	—	Streams, sloughs, ponds, and irrigation/drainage ditches; requires upland refugia not subject to flooding during inactive season (winter)	Present • Known to occur in suitable habitat on the San Luis NWR complex and in the Mendota Wildlife Area; reported from Mendota Pool in Reach 2B; expected to occur in suitable habitat in other locations in the extended study area
Birds					
Tricolored blackbird *Agelaius tricolor* (nesting colony)	—	CSC	—	Nests in large colonies near open water in dense emergent, riparian scrub, and herbaceous vegetation with open grassland/agricultural foraging habitat nearby	Present • Known to occur in suitable habitat on the San Luis NWR complex and other sites in the extended study area
Long-eared owl *Asio otus* (nesting)	—	CSC	—	Wide distribution, but uncommon; found in riparian and areas of dense trees and shrubs near water	Possible • Suitable habitat present in extended study area; nesting possible
Redhead *Aythya americana* (nesting)	—	CSC	—	Nests in freshwater emergent wetlands with dense patches of tules or cattails interspersed with areas of deep, open water	Present • Uncommon but regular breeder in Central Valley; known to nest at Mendota Pool in Reach 2B and also occurs at the San Luis NWR and Mendota Wildlife Area; expected in the extended study area
Black tern *Chlidonias niger* (nesting colony)	—	CSC	—	Nests semi-colonially in protected marshes and rice fields; forages on fish and insects	Present • Uncommon visitor in extended study area, including San Luis NWR • Suitable habitat present; nesting possible
Western yellow-billed cuckoo *Coccyzus americanus occidentalis* (nesting)	C	E	—	Inhabits wide, dense riparian forests with thick understory of willows for nesting; prefers sites with a dominant cottonwood overstory for foraging	Possible (nesting) • No recent nesting records, but potential nesting habitat present

Table 7-2. Special-Status Wildlife Species Known or with Potential to Occur in the Extended Study Area (contd.)

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Potential to Occur
Little willow flycatcher *Empidonax trailii*	E (*E.t. extimus*)	E	—	Riparian habitats and large wet meadows with abundant willows during migration	Present • Known as rare spring and uncommon fall migrants in riparian habitats of the San Luis and West Bear Creek units of the San Luis NWR • Nesting unlikely in extended study area
Lesser sandhill crane *Grus canadensis canadensis* (wintering)	—	CSC	—	Forages in winter in grasslands, pastures, and agricultural fields; roosts in a variety of wetlands with shallow water depths	Present • Known to winter at the Merced NWR; expected to occur in suitable habitat in extended study area
Greater sandhill crane *Grus canadensis tabida* (nesting and wintering)	—	T	FP	Nests near shallow lakes and freshwater marshes in northeastern California; foraging habitat in winter similar to lesser sandhill crane above	Present • Known to occur during winter on San Luis NWR complex and along the San Joaquin River • extended study area not within nesting range
Yellow-breasted chat *Icteria virens* (nesting)	—	CSC	—	Dense riparian thickets of willows, vine tangles, and dense brush associated with streams, swampy ground and the borders of small ponds	Present • Known to occur during migration in the San Joaquin Valley • Suitable nesting habitat present in extended study area; nesting possible
Double-crested cormorant *Phalacrocorax auritus* (rookery)	—	WL	—	Forages in inland ponds and lakes; nests on rock ledges, rugged slopes, and in live or dead trees	Present • Known to occur in suitable habitat on the San Luis NWR complex • Known along Reach 1A at CDFW's Milburn Ecological Reserve • Nesting unlikely; not generally known to nest in Central Valley
White-faced ibis *Plegadis chihi* (nesting colony)	—	WL	—	Nests in dense, fresh emergent wetlands; forages in wetlands, meadows, flooded pastures, and croplands	Present • Known to occur on the San Luis NWR complex and other sites in the extended study area • Not currently known as a regular breeder anywhere in California

Table 7-2. Special-Status Wildlife Species Known or with Potential to Occur in the Extended Study Area (contd.)

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Potential to Occur
Least bittern *Ixobrychus exilis* (nesting)	—	CSC	—	Nests in dense emergent vegetation in fresh and brackish marsh	Possible • Uncommon but regular breeder in suitable habitat in the San Joaquin Valley • Expected in the extended study area
Bank swallow *Riparia riparia* (nesting)	—	T	—	Forages in various habitats; nests in banks or bluffs, typically adjacent to water	Possible • No recent nesting records, but potential nesting habitat present
Yellow warbler *Setophaga petechia* (nesting)	—	CSC	—	Breeds in mesic, deciduous thickets, especially riparian; preferred habitat includes moist areas with dense insect prey populations	Present • No recent nesting records, but potential nesting habitat present • Known to occur during migration on the San Luis NWR complex and other sites in the extended study area
Least Bell's vireo *Vireo bellii pusillus*	E	E	—	Cottonwood-willow forest, oak woodland, shrubby thickets, and dry washes with willow thickets	Present • Known to nest in suitable habitat on the San Joaquin River NWR and in the San Luis NWR complex
Yellow-headed blackbird *Xanthocephalus xanthocephalus* (nesting)	—	CSC	—	Nests in freshwater emergent wetlands with dense vegetation and deep water, often along borders of lakes or ponds	Present • Known to occur throughout San Joaquin Valley, including the San Luis NWR complex • Potential nesting habitat present in extended study area
Swainson's hawk *Buteo swainsonii*	—	T	—	Nests in riparian woodlands or suitable large trees. Forages in grasslands, row crops, and other open habitat types.	Present • Known to occur throughout San Joaquin Valley • Potential nesting habitat present in extended study area

Table 7-2. Special-Status Wildlife Species Known or with Potential to Occur in the Extended Study Area (contd.)

Species	Federal Status[1]	State Status[2]	Other Status[3]	Habitat	Potential to Occur
Mammals					
San Joaquin (riparian) woodrat *Neotoma fuscipes riparia*	E	CSC	—	Riparian forests	Unlikely • No recorded locations known from the extended study area in the immediate vicinity of the channel • Unlikely, but could occur in suitable habitat
Riparian brush rabbit *Sylvilagus bachmani riparius*	E	E	—	Dense thickets of brush associated with riparian or chaparral habitats	Unlikely • No records known from the extended study area in the immediate vicinity of the channel • Reintroduced on private land adjacent to San Joaquin River NWR • Unlikely, but could occur in suitable habitat

Key:
NWR = National Wildlife Refuge
[1] Federal Status:
E: Endangered
C: Candidate
T: Threatened
[2] State Status:
CSC: California Species of Special Concern
E: Endangered
FP: Fully Protected
T: Threatened
WL: Watch list
[3] Other Status:
BGEPA::Federal Bald and Golden Eagle Protection Act

Western Pond Turtle Western pond turtle is known to occur in suitable habitat in the San Luis NWR complex, in the Mendota Wildlife Area, and at Mendota Pool in Reach 2B. It is expected to occur in suitable habitat in other locations in the extended study area. The CNDDB provides many records for western pond turtle occurrences within 10 miles of the extended study area (CDFW 2013).

Blunt-Nosed Leopard Lizard (*Gambelia sila*) The blunt-nosed leopard lizard has been observed at the Merced NWR, and habitats adjacent to the Mariposa and Eastside bypasses could provide potentially suitable habitat for this species. Recent surveys in 2009 and 2010 did not locate any individuals in accessible areas near the bypasses (SJRRP 2011). The inundation of potentially suitable habitat in the bypass reaches by either flood releases or interim flow releases would decrease the suitability of this habitat and make it less likely to be occupied.

Giant Garter Snake (*Thamnophis gigas*) The giant garter snake (GGS) has been observed at the San Luis, Kesterson, and West Bear Creek units of the San Luis NWR and documented in the Mendota Wildlife Area (Dickert 2005) and south of the San Joaquin River in Fresno Slough (USFWS 2006b). The southernmost populations at the Mendota Wildlife Area (Fresno County) and the Grassland Wetlands (Merced County) are small, fragmented, unstable, and probably decreasing (USFWS 2006b). There are eight CNDDB records of occurrence within 1 mile of the extended study area, including one at the San Luis NWR and one in the Mendota Pool area (Reach 2B) of the San Joaquin River (CDFW 2013).

Birds

Tricolored Blackbird (*Agelaius tricolor*) Tricolored blackbird is known to nest in suitable habitat in the San Luis NWR complex and other sites in the extended study area. There are no CNDDB records of occurrence within 1 mile, but approximately 40 records of occurrence within 10 miles of the extended study area (CDFW 2013).

Long-Eared Owl Long-eared owl prefers riparian habitats or other areas with dense trees and shrubs near water. There are no CNDDB or other local records for this species; however, it is a secretive owl that is difficult to detect. There are no CNDDB records of occurrence for this species within 10 miles of the extended study area.

Redhead (*Aythya americana*) Redhead is known to nest in the extended study area at Mendota Pool, and nesting also occurs at the San Luis NWR and Mendota Wildlife Area (Beedy and Deuel 2008). There are no CNDDB records of occurrence for this species within 10 miles of the extended study area (CDFW 2013).

Black Tern (*Chlidonias niger*) Although there are no CNDDB records of black tern occurrence within 10 miles of the extended study area (CDFW 2013), it has been documented as an occasional visitor at the San Luis NWR complex (USFWS 1996a, 2006a). It is likely to use wetland habitats in the extended study area for foraging during the nonbreeding season and may also nest there.

Western Yellow-Billed Cuckoo (*Coccyzus americanus occidentalis*) In the late 1960s, a few western yellow-billed cuckoos were observed regularly near the confluence of the Tuolumne and San Joaquin rivers, but this area was subsequently intensively logged and no cuckoos have been observed in recent years (McBain & Trush 2002). The yellow-billed cuckoo has been considered a rare migratory species during spring in Stanislaus County (McBain & Trush 2002). The CNDDB contains one July 1977 record in the extended study area at Mendota Pool on the San Joaquin River (CDFW 2013). Suitable nesting habitat for this species is present in the extended study area.

Little willow Flycatcher Within the San Joaquin River floodplain, little willow flycatchers are rare spring and uncommon fall migrants in riparian habitats of the San Luis and West Bear Creek units of the San Luis NWR. There are no CNDDB records of this species, and no recent breeding has been documented in the San Joaquin Valley (RHJV 2004, McBain & Trush 2002, CDFW 2013).

Lesser Sandhill Crane (*Grus canadensis canadensis*) The lesser sandhill crane is known to winter at Merced NWR (Littlefield 2008); most lesser sandhill cranes wintering in California concentrate near the Merced NWR in autumn, and later disperse to the northwest and southwest. Sandhill crane records are not normally provided in the CNDDB.

Greater Sandhill Crane (*Grus canadensis tabida*) The greater sandhill crane nests in Siskiyou, Modoc, and Lassen counties, and in Sierra Valley in Plumas County (Remsen 1978; Zeiner et al. 1990), but is only a winter visitor in the extended study area. It occurs along the San Joaquin River and at the San Luis NWR complex during winter (McBain & Trush 2002). Sandhill crane records are not normally provided in the CNDDB.

Yellow-Breasted Chat Historically, the yellow-breasted chat bred in areas throughout California below 5,000 feet and in almost all areas of the Central Valley (Comrack 2008). Currently, it breeds in only a small portion of the Sacramento Valley and is not known to nest in the San Joaquin Valley. Potential nesting habitat is present in the extended study area, and this bird is known to occur during migration in the San Joaquin Valley. There are no CNDDB records of occurrence within 10 miles of the extended study area.

Double-Crested Cormorant (*Phalacrocorax auritus*) Nesting habitat for the double-crested cormorant includes steep slopes, cliff faces, tall trees (such as those found in riparian forests), and tall human-made structures such as transmission towers beside water, but it is not generally known to nest in the Central Valley (DFG 2005b). It is known to occur in the San Luis NWR complex and along Reach 1A at the CDFW Milburn Ecological Reserve, but is not recorded as nesting at these locations.

White-Faced Ibis (*Plegadis chihi*) White-faced ibis is known to occur in the San Luis NWR complex and at other sites in the extended study area. Nesting colonies have been documented in the past at the Mendota Wildlife Area south of the extended study area; however, it is not currently known to be a regular breeder anywhere in California (DFG 2005b).

Least Bittern (*Ixobrychus exilis*) The historic distribution of least bittern included most of the Central Valley (Sterling 2008). The present distribution includes isolated marsh areas in the Central Valley and other parts of the state. Although there are no CNDDB records of occurrence within 10 miles of the extended study area (CDFW 2013), it is a regular, though uncommon, breeder in San Joaquin Valley marshes, including the Mendota area (Sterling 2008). Recent breeding records from the San Luis NWR are lacking. The species is likely to nest in suitable marsh habitat in the extended study area.

Bank Swallow (*Riparia riparia*) Bank swallow historically occurred along the larger lowland rivers throughout

California (Garrison 1998). The current breeding range (about 50 percent of the historical range) is primarily confined to parts of the Sacramento Valley and northeastern California, including the banks of the Sacramento and Feather Rivers (DFG 2005a). There is one 1980 record of a colony at Mendota Pool in Reach 2B on San Joaquin River, and it could occur elsewhere in the extended study area.

Yellow Warbler The historical breeding range of the yellow warbler included the entire Central Valley, but it has been largely extirpated from the Central Valley as a breeder. It nests and forages in dense riparian woodlands. There are no nesting records for this species within 10 miles of the extended study area (CDFW 2013), but potential nesting habitat is present. It is known to occur during migration in the San Luis NWR complex and other sites in the extended study area.

Least Bell's Vireo Least Bell's vireo historically nested in riparian areas throughout the Central Valley (RHJV 2004). The species was characterized as abundant at one time, but by 1980 it was extirpated from the entire Central Valley, and it is now absent from most of its historical range (RHJV 2004). Recent observations indicate that the species' range is expanding northward and individuals are currently recolonizing areas that have been unoccupied for decades (RHJV 2004). Least Bell's vireos successfully nested at the San Joaquin River NWR in 2005 and 2006 (USFWS 2006c).

Yellow-Headed Blackbird (*Xanthocephalus xanthocephalus*) The yellow-headed blackbird is recorded in the CNDDB at Dos Palos, in the vicinity of the extended study area. Potential nesting habitat is present in emergent wetland habitats.

Mammals

San Joaquin Valley (Riparian) Woodrat (*Neotoma fuscipes riparia*) Historically found along the San Joaquin, Stanislaus, and Tuolumne Rivers, this species likely occurred throughout the riparian forests of the northern San Joaquin Valley (USFWS 1998). Its range has become much more restricted, and the only verified extant population is confined to about 250 acres of riparian forest in Caswell Memorial State Park on the Stanislaus River at its confluence with the San Joaquin River, and within the San Joaquin NWR (USFWS 1998). There are no documented CNDDB occurrences of San Joaquin Valley woodrat within or near the river channel within the extended study area, although it could occur in suitable habitat.

Riparian Brush Rabbit (*Sylvilagus bachmani riparius*) Because the riparian brush rabbit subspecies was not described until after it is believed to have been extirpated from most of its historical range, definitive information on its former distribution is lacking, but it has been extirpated from most of the lower San Joaquin River and its tributaries (Williams 1986). It is currently restricted to several populations at Caswell Memorial State Park: along the Stanislaus River, along Paradise Cut, a channel of the San Joaquin River in the southern part of the Delta, and a reintroduction on the San Joaquin River NWR (Williams 1993; Williams and Basey 1986).

San Joaquin River from Merced River to the Delta
Special-status animals that may occur in this section of the San Joaquin River include valley elderberry longhorn beetle; Swainson's hawk; and a number of riparian-dependent songbirds, such as least Bell's vireo and yellow warbler. The riparian brush rabbit and riparian woodrat are known to occur in specific locations along the lower San Joaquin River including the San Joaquin NWR (DWR 2012).

Delta Several special-status wildlife species are known or are likely to occur in the Delta because of the presence of unique wetland habitats. Tidal marshes, wet banks, and instream emergent wetlands support several special-status wildlife species, including salt marsh harvest mouse (*Reithrodontomys raviventris*) (Federally and State listed as endangered), Suisun song sparrow (*Melospiza melodia maxillarus*) (California Species of Special Concern), and salt marsh common yellowthroat (*Geothylpis trichas sinuosa*) (California Species of Special Concern). Riparian scrub and woodland provides habitat for western yellow-billed cuckoo (State listed as endangered).

CVP and SWP Water Service Areas The CVP and SWP water service areas are subject to substantial human influence and modification. For this reason, much of the native wildlife has been displaced by nonnative species that have adapted well to human-influenced land cover, including urban and agricultural land uses. Although a variety of special-status species could occur in habitats within and adjacent to the CVP and SWP water service areas, special-status species under consideration in this document are limited to those that could occur in the ditches and canals that constitute the CVP and SWP delivery systems, because other habitats are not expected to be influenced. The potential for special-status wildlife species to occur within these water delivery systems is generally considered low because of the developed nature of the canals and frequency of maintenance. However, western pond turtle (California Species of Special Concern) is known to forage in drainages and canals and could be present within the water distribution systems within the CVP and SWP water service areas, particularly in areas that lack regular routine maintenance.

Other Wildlife Resources

Primary Study Area

Temperance Flat Reservoir Area Approximately 50 percent of the new Temperance Flat Reservoir Area supports upland woodland, dominated by foothill pine oak woodland, blue oak woodland, and live oak woodland. These habitat types, which are described in detail in Chapter 6, “Biological Resources – Botanical and Wetlands,” support a diversity of upland wildlife species. In contrast, less than 1 percent of the primary study area supports riparian habitat, mostly in small fragmented patches. For that reason, wildlife species that depend on riparian habitats are not common. Wetland and aquatic habitats above the inundation zone of Millerton Lake are also uncommon in the primary study area. Only 1 acre of freshwater seep was mapped. These habitats are frequently invaded by bullfrogs, compromising their suitability for native amphibians. Millerton Lake supports seasonal wetlands; however, the habitat value of this area is compromised by erratic changes in water level. Numerous rock faces, crevices, caves, and abandoned mines in the primary study area provide extensive habitat for bats and other cave-dwelling species.

Foothill pine oak woodland, which supports a moderately diverse wildlife community, is the dominant terrestrial habitat in the primary study area. It provides foraging habitat and cover for such species as white-breasted nuthatch (*Sitta carolinensis*), turkey vulture (*Cathartes aura*), lesser goldfinch (*Spinus psaltria*), common gray fox (*Urocyon cinereoargenteus*), bobcat (*Lynx rufus*), and western gray squirrel (*Sciurus griseus*). California voles (*Microtus californicus*), Botta’s pocket gopher (*Thomomys bottae*), and mule deer (*Odocoileus hemionus*) all forage on the leaves, twigs, and acorns of many oak species, especially young seedlings (Griffin 1971). This habitat provides nesting features, such as large limbs of pines and oaks, and snags and cavities for species such as American kestrel (*Falco sparverius*), acorn woodpecker (*Melanerpes formicivorus*), red-tailed hawk (*Buteo jamaicensis*), and oak titmouse (*Baeolophus inornatus*). Raccoons (*Procyon lotor*) may use hollow oaks and snags as den sites or escape cover. Deer mice (*Peromyscus maniculatus*) (Quinn and Baldwin 2012) and striped skunks (*Mephitis mephitis*) (Salmon et al. 2004) will seek cover under fallen oaks and bark (Ingles 1965). Wildlife such as pacific slender salamander (*Batrachoseps pacificus*), California quail (*Callipepla californica*), Gilbert's skink (*Eumeces gilberti*), and western rattlesnake (*Crotalus viridis*) may use undersides of logs or the interior of brush piles for shelter. Bats likely forage at the edges of foothill pine oak woodlands, and several bat species, such as long-eared myotis, may roost under tree bark or in big snags and large oaks.

Blue oak, live oak, and foothill pine woodland types are the most common habitat types after foothill pine oak woodland. These habitats generally support an assemblage of wildlife similar to that found in foothill pine oak woodland. Some blue oak woodland is more open and savanna-like and may provide habitat for grassland-associated species. Blue oak woodland has a less complex structure than other woodland types, and its overstory cover is generally more open. Thus, its groundcover is more exposed, making it more xeric than communities with a closed canopy. These factors affect the wildlife species associated with this habitat type resulting in a generally less-diverse wildlife community. It is nevertheless an important habitat type, being similar to the other woodland types and providing important food and structure for local wildlife.

Annual grassland is the next most common vegetation community in the primary study area. Annual grassland is dominated by nonnative plant species. These grasslands may provide habitat for species such as western rattlesnake, western fence lizard (*Sceloporus occidentalis*), California ground squirrel (*Spermophilus beecheyi*), black-tailed hare (*Lepus californicus*), and grassland birds such as meadowlark (*Sturnella neglecta*), as well as foraging habitat for red-tailed hawk, turkey vulture, and coyote (*Canis latrans*). Grasslands provide prey and forage, and dens and cover. For many species dependent on extensive grassland habitat, the annual grasslands within the Temperance Flat Reservoir Area are of generally poor quality because they are relatively small and patchily distributed, and have steep topography.

Riparian communities mapped in the Temperance Flat Reservoir Area include white alder riparian, willow woodland, sycamore alluvial woodland, mixed riparian woodland, fig-willow riparian, Spanish broom scrub, sycamore woodland, and button bush scrub. Along the San Joaquin River, there are also a number of ephemeral and intermittent drainages running through foothill pine oak woodland habitat, many with riparian vegetation.

No flowing water and few pools were observed in any of the tributaries to the San Joaquin River, including larger ones such as Big Sandy Creek. Riparian areas provide foraging, nesting, and roosting habitat for bats such as small-footed myotis and Yuma myotis and for riparian-associated birds such as black phoebe (*Sayornis nigricans*), Bewick's wren (*Thryomanes bewickii*), and lazuli bunting (*Passerina amoena*). Moist soils covered with loose leaf litter offer hiding places for amphibians and reptiles, including California newt (*Taricha torosa*), Sierran treefrog (*Pseudacris sierra*), and common kingsnake (*Lampropeltis getulus*).

Dampness creates good habitat for insect larvae that are prey for vertebrate species, such as raccoon and striped skunk. Riparian habitats also provide travel corridors for larger mammals, including mule deer, coyote, bobcat, and mountain lion (*Felis concolor*). For species with more restricted riparian habitat requirements, such as warbling vireo (*Vireo gilvus*) and special-status passerines (discussed previously), riparian habitat in the primary study area is generally of poor quality, primarily because the existing habitat is fairly limited in size, has a patchy, fragmented configuration and distribution, and has little structural diversity.

Seasonal wetlands are located at the upper extent of Millerton Lake and interface with areas of unconsolidated shoreline. Most of this area is fairly dry and on a steep incline and is therefore of limited value for most species. Seasonal wetland in the upper part of the seasonally inundated zone has a more dense vegetation cover (mostly nonnative plants) than unconsolidated shoreline and provides foraging habitat for some wildlife species. There are a few sparsely distributed areas of seasonal wetland habitat that would potentially be suitable for amphibian and reptile species, including American bullfrog (*Rana catesbeiana*), Sierran tree frog, western pond turtle, and western toad (*Bufo boreas*). These areas include small in-channel pools and riffle areas in drainages surrounded by annual grassland or foothill pine oak woodland. The combination of lack of perennial streams, erratic hydrology, and steep topography within San Joaquin River Gorge results in only marginally suitable habitat for most amphibians and the western pond turtle.

Riverine habitat within the new Temperance Flat Reservoir Area includes the San Joaquin River upstream from Millerton Lake which is located near the PG&E Powerhouse to Kerckhoff Dam. Riverine habitat differs from lacustrine habitat in the rate of water circulation. Aside from fish species described in Chapter 5, “Biological Resources – Fisheries and Aquatic Ecosystems,” riverine habitats in the Temperance Flat Reservoir Area could support western pond turtle, river otter (*Lontra canadensis*), and aquatic garter snake (*Thamnophis couchii*), and birds such as American dipper (*Cinclus mexicanus*), belted kingfisher (*Ceryle alcyon*), and common merganser (*Mergus merganser*).

Millerton Lake upstream from RM 274 is composed of lacustrine habitat in the forms of lacustrine unconsolidated bottom (e.g., open water, or the lake) and lacustrine unconsolidated shoreline (or the shoreline exposed at lower lake levels). The lacustrine unconsolidated bottom open-water habitat supports fish species that are prey for such special-status wildlife as bald eagle and osprey and for other birds such as common merganser and belted kingfisher. In winter, open water often supports rafts of waterfowl such as mallards (*Anas platyrhynchos*), Canada goose (*Branta canadensis*), America coot (*Fulica americana*), and western grebe (*Aechmophorus occidentalis*). Lacustrine unconsolidated shoreline could support basking western pond turtles, and wading birds and shorebirds such as great blue heron (*Ardea herodias*), great egret (*Ardea alba*), and killdeer (*Charadrius vociferus*). Waterfowl often come ashore to rest in the sun on exposed shorelines.

There are 31 acres of natural barren areas such as rock outcrops, cliffs, caves, and crevices in the Temperance Flat Reservoir Area, which are suitable and in some cases essential for bat roosting (Whitaker 1996). The tall cliffs of the table-top mountains bordering much of the primary study area are also of value as perches for foraging raptors and for nesting red-tailed hawk, turkey vulture, and common raven (*Corvus corax*). Several reptile species, such as western rattlesnake and western fence lizard, also use barren habitats for basking and foraging.

The primary study area, once the site of historic towns and gold-mining districts (Springer 2005), contains a number of abandoned mines, prospects, and adits that are frequently the sites of bat roosts. Sullivan Mine is reported to have multiple adits and mill sites; limited surveys in this area found a deep (approximately 145 feet), abandoned mine shaft that contains a number of wall crevices suitable for bat roosting. San Joaquin and Diana (Patterson) mines, along with more southern prospects, have numerous tunnels. Most of the prospects and mine tunnels have suitable features for bats such as crevices, proximity to water, and little apparent human disturbance, and were found in foothill pine oak woodland habitat with rock outcrops.

Abandoned homesteads near mining operations appeared to have been disturbed by humans following abandonment but showed signs of wildlife use such as woodrat nests, presence of juvenile owls, and bird droppings. Mourning doves (*Zenaida macroura*) and barn owls (*Tyto alba*) will nest in abandoned buildings. The San Joaquin Mine site was more disturbed than the other mine sites; an abandoned structure on the property had recently been occupied by humans; however, the home near Sullivan Mine had an attic and a basement that were considered suitable bat-roosting locations.

The primary study area has a mixture of resident and migratory mule deer (black-tailed deer subpopulation) herds. CDFW reported the presence of at least three herds in the primary study area (Reclamation 2007). The Piedra herd is a resident herd in the area, inhabiting the Sierra Nevada foothills year-round at an elevation of 50 to 3,000 feet. It is unknown how many deer are in this herd. The deer population increases in winter when two migratory herds come down to the foothills and join the resident population. It is believed that the San Joaquin migratory deer herd winters in Madera County and then migrates up into the Sierra Nevada in summer. This herd's range is more southern than the North King's herd, a second migratory herd using the area. The North King's deer herd is reported to migrate to the Auberry and Squaw Leap areas in winter.

Because most deer studies have been conducted outside the primary study area, little is known about the migratory routes and specific herd locations within the primary study area. Cotter indicated that the San Joaquin River can act as a dividing line between the two migratory deer herds. Bart Toppings (Reclamation 2007) reported that the majority of deer are observed during the summer, but they are also seen year-round on Kennedy Table. Toppings does not believe that Kennedy Table is located within a migratory route for deer; rather, he suggests that the migratory route lies on the North Fork of the San Joaquin River, approximately 20 miles northeast of Kerckhoff Lake, at an elevation of approximately 3,000 feet.

Although the precise location is unknown, it has been reported that critical deer winter range is located near the primary study area (Reclamation 2007). Important deer winter ranges exist in the vicinity of the new Temperance Flat Reservoir Area. San Joaquin mule deer are year-round residents of the area and mix with migratory herds from higher elevations (USFS 2004). Some critical features of deer habitat include oaks, acorn masts, a shrub layer composed of Ceanothus, and open grassland for fawn use (e.g., foraging on forbs).

Deer, and more frequently deer sign, were detected during 2007 surveys. Patterson Bend Reach was reported by a local resident to be a fawning ground; however, no fawns were detected during any surveys. Four major river crossings used by mule deer during migration in the Mammoth reach of the San Joaquin River include near Chawanakee at Dam 6, below the confluence of Rock Creek and the San Joaquin River, the confluence of Shake Flat Creek and the San Joaquin River, and the Mammoth Pool area. Additionally, mule deer cross the San Joaquin River at its confluence with Jackass Creek (SCE 2003).

Area of Project Features The wildlife habitats observed in the area of project features are upland woodland, scrub, riparian, seasonal wetland, in-channel pools, and lacustrine habitats, similar to those identified in the new Temperance Flat Reservoir Area and addressed in the previous section. The multilayered woodlands and grasslands provide excellent habitat for a number of mammal, bird, and other wildlife species such as those described in the previous section.

Pools in the otherwise dry grasslands and woodlands of the primary study area would support aquatic species such as crayfish (*Pacifastacus* spp.), bullfrog, and Sierran treefrog, and an array of local animals that would both drink from the pool and forage there, such as raccoon, bobcat, mountain lion, great blue heron, gopher snake, and aquatic and terrestrial garter snakes.

Millerton Lake below RM 274 Millerton Lake below the proposed Temperance Flat RM 274 Dam is entirely composed of lacustrine unconsolidated bottom and lacustrine unconsolidated shoreline habitat. General wildlife species using these habitats are described in the Temperance Flat Reservoir Area section above, and include mallard, Canada goose, common merganser, great blue heron, and western pond turtle.

Extended Study Area

San Joaquin River from Friant Dam to Merced River Vegetation communities found in the extended study area are described in detail in Chapter 6, "Biological Resources – Botanical and Wetlands." Below, this section describes the general wildlife species commonly associated with these communities that are present within the extended study area. The San Joaquin River from Friant Dam to Merced River section above identifies which of these habitats is found in each of the reaches.

Riparian forest has been classified into four major types based on the dominant species: cottonwood riparian forest, willow riparian forest, mixed riparian forest, and valley oak riparian forest. Large, mature riparian forest stands support the most dense and diverse breeding bird communities in California (Gaines 1974). Tall riparian trees provide high-quality nesting habitat for raptors, such as red-tailed hawk and red-shouldered hawk (*Buteo lineatus*). They also provide nesting habitat for cavity-nesting species such as downy woodpecker (*Picoides pubescens*), wood duck (*Aix sponsa*), northern flicker (*Colaptes auratus*), ash-throated flycatcher (*Myiarchus cinerascens*), and tree swallow (*Tachycineta bicolor*).

Riparian forests and associated wetlands produce populations of insects that feed on foliage and stems during the growing season and are in turn prey for migratory and resident birds, including Pacific-slope flycatcher (*Empidonax difficilis*), western wood-pewee (*Contopus sordidulus*), olive-sided flycatcher (*Contopus cooperi*), warbling vireo, orange-crowned warbler (*Vermivora celata*), and Bullock's oriole (*Icterus bullockii*). Mammal species using riparian forests include coyote, beaver (*Castor canadensis*), river otter, raccoon, desert cottontail (*Sylvilagus audubonii*), and striped skunk.

Three types of scrub habitat—willow scrub, riparian scrub, and elderberry savanna—are found in the extended study area.

Typical bird species found in scrub habitats include western wood-pewee, black phoebe, yellow-billed magpie (*Pica nuttalli*), bushtit (*Psaltriparus minimus*), Bewick's wren, and blue grosbeak (*Passerina caerulea*). Mammals using scrub habitats are similar to those described for riparian forest habitats above.

Emergent wetlands typically occur in the river bottom immediately adjacent to the low-flow channel. Sites such as backwaters and sloughs where water is present through much of the year support emergent marsh vegetation. Many wildlife species are known to use emergent wetlands, including song sparrow (*Melospiza melodia*), common yellowthroat (*Geothlypis trichas*), marsh wren (*Cistothorus palustris*), and red-winged blackbird (*Agelaius phoeniceus*). Mammal species that use this habitat include California vole, common muskrat (*Ondatra zibethicus*), and the nonnative Norway rat (*Rattus norvegicus*). Sierran treefrog and western terrestrial garter snake (*Thamnophis elegans*) are commonly present in this habitat.

The nonnative giant reed plant community is characterized by dense stands of the invasive grass species giant reed—nonnative plants are discussed further in Chapter 6, "Biological Resources – Botanical and Wetlands," and are mentioned in more detail below. These stands are up to 13 feet tall and consist solely of giant reed with no other plant species present. Giant reed stands provide very little habitat value for wildlife.

Grassland and pasture habitats are forb- and grass-dominated plant communities. Typical bird species associated with grasslands include northern harrier, mourning dove, savannah sparrow (*Passerculus sandwichensis*), and the nonnative ring-necked pheasant (*Phasianus colchicus*). Mammal species that use grasslands include deer mouse, California vole, California ground squirrel, Botta's pocket gopher, and coyote. Common amphibians and reptiles associated with grasslands in the San Joaquin Valley include western toad, western fence lizard, western racer (*Coluber constrictor mormon*), and gopher snake (*Pituophis catenifer*).

Alkali sinks are shallow, seasonally flooded areas or playas that are dominated by salt-tolerant plants. Wildlife species typically associated with alkali sink habitats include species of common kangaroo rats (*Dipodomys* spp.), coyote, and side-blotched lizard (*Uta stansiburiana*).

Agricultural lands in the extended study area consist primarily of annual crops, orchards, and vineyards. Cropland agricultural habitats can provide food and cover for wildlife, but the value of the habitat varies greatly among crop type and agricultural practice. Grain crops provide forage for songbirds, small rodents, and waterfowl at certain times of year. Pastures, alfalfa, and row crops, such as beets and tomatoes, provide foraging opportunities for raptors because of the frequent flooding, mowing, or harvesting of fields, which make prey readily available. Orchards and vineyards have relatively low value for wildlife because understory vegetation growth that would provide food and cover typically are removed. Species that use orchards and vineyards, such as ground squirrel, American crow (*Corvus brachyrhynchos*), Brewer's blackbird (*Euphagus cyanocephalus*), and the nonnative European starling (*Sturnus vulgaris*), often are considered agricultural pests.

Open water is characterized by permanent or semi-permanent ponded or flowing water. Open-water areas provide habitat for waterfowl, western pond turtle, Sierran treefrog, and the nonnative American bullfrog. Both submerged and floating aquatic vegetation are used as basking or foraging habitat and provide cover for aquatic wildlife. Deeper open-water areas without vegetation provide habitat for species that forage for fish, crayfish, or other aquatic organisms, such as river otter and waterfowl.

Riverwash consists of alluvial sands and gravel associated with the active channel of the San Joaquin River. Generally, riverwash areas exist as sand and gravel point bars within the floodplain of the river. Riverwash provides nesting habitat for shorebirds, such as killdeer. Other species, such as mallard and western pond turtle, may use riverwash habitats for roosting or resting.

Disturbed areas include roads, canals, levees, and aggregate pits. Also included are areas used by off-highway vehicles and sites where rubble or fill has been deposited. Active and former aggregate mines are included if they are dry or unvegetated. As with agricultural habitats, low vegetation cover and species diversity in disturbed habitats limit their value to wildlife. However, these habitats are expected to support some common mammals, such as California ground squirrel, deer mouse, and desert cottontail.

Within each of the habitat types above, a variety of invasive plants is found. Plant communities within the extended study area that are dominated by invasive plant species are often less suitable for native wildlife, and often support a higher number and higher densities of nonnative wildlife species. Nonnative eucalyptus trees within the extended study area may provide roosting and nesting habitat for native birds (e.g., hawks and waterbirds) and insects (i.e., monarch butterflies); however, studies have found the diversity and abundance of wildlife to be lower in eucalyptus groves than in native scrub and oak woodland habitats (Hanson et al. 1979). While native habitats often support nonnative wildlife species such as American bullfrog, crayfish, and red-eared slider (*Trachemys scripta elegans*), habitats with nonnative vegetation often support higher densities than native habitats of nonnative wildlife species such as Norway rat, house mouse (*Mus musculus*), house sparrow (*Passer domesticus*), European starling, and rock pigeon (*Columba livia*).

San Joaquin River from Merced River to the Delta The San Joaquin River between the Merced River and the Delta supports a variety of nonnative species, including American bullfrog, crayfish, Norway rat, and house sparrow. Common wildlife species such as raccoon, striped skunk, opossum (*Didelphimorphia* spp.), and other wildlife generalists that are adaptable to a variety of habitat types likely occur along this section of the San Joaquin River (DWR 2012).

Delta The Delta supports a variety of wildlife as a result of the mixture of various types of wetland and marsh habitats along with riparian and upland habitats. For example, riparian trees are an important feature of the Delta landscape, providing nesting opportunities for numerous wading birds, raptors, and cavity-nesting birds, and roosting habitat for some bat species, including the Mexican free-tailed bat (*Tadarida brasiliensis*) and California myotis (*Myotis californicus*). Tidal marshes and associated mudflats are exposed at low tides and support a variety of foraging shorebirds and dabbling ducks, such as least sandpiper (*Calidris minutilla*) and mallard. Adjacent upland habitats are also required for seasonal hibernation and reproduction in some species; they serve as important resting, cover, and nesting sites for many birds and mammals that move into uplands during high tide, including northern-rough winged swallow (*Stelgidopteryx serripennis*). Canals, side channels, and backflow pools of the Delta that contain emergent vegetation provide forage and cover habitat for species such as beaver, American mink (*Mustela vison*), and green heron (*Butorides striatus*). They also are dispersal corridors that link habitat areas for terrestrial and semiaquatic species, including river otter, as well as many bird species.

CVP and SWP Water Service Areas The service areas cover a vast area spread across portions of 10 biogeographic regions: the northern, central, and southern coast; the central Coast Ranges; the southern mountains and valleys; the Central Valley; the Sierra Nevada and foothills; and the Mojave and Sonoran Deserts. Therefore, this portion of the extended study area has a great diversity of habitat types (see Chapter 6, “Biological Resources – Vegetation and Wetlands”), and structure and species composition vary widely. Because of intense human-induced habitat loss and change of land cover, much of the common wildlife consists of introduced species, including European starlings that nest in cavities in wooden telephone poles, house sparrows that nest in eaves in suburban homes, and Norway rats that forage in urban areas including parking lots or landfills.

Environmental Consequences and Mitigation Measures

This section describes the methods of environmental evaluation, assumptions, and specific criteria used to determine the significance of impacts on wildlife resources. It then discusses the impacts of the Investigation and proposes mitigation where appropriate. The potential impacts on wildlife resources and associated mitigation measures are summarized in Table 7-3.

Table 7-3. Summary of Impacts and Mitigation Measures for Wildlife Resources

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
WLD-1: Substantial Impact on Special-Status Invertebrates	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	WLD-1a: Mitigate Impacts on VELB, WLD-1b: Mitigate Impacts on Pipevine Swallowtail, WLD-1c: Mitigate Impacts on Listed Vernal Pool Branchiopods	LTS
		Alternative Plan 2	S		LTS
		Alternative Plan 3	S		LTS
		Alternative Plan 4	S		LTS
		Alternative Plan 5	S		LTS
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
WLD-2: Substantial Impact on Special-Status Amphibians and Reptiles	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	WLD-2a: Mitigate Impacts on California Tiger Salamander and Western Spadefoot, WLD-2b: Mitigate Impacts on Foothill Yellow-Legged Frog and California Red-Legged Frog, WLD-2c: Mitigate Impacts on Western Pond Turtle, WLD-2d: Mitigate Impacts on Coast Horned Lizard	LTS
		Alternative Plan 2	S		LTS
		Alternative Plan 3	S		LTS
		Alternative Plan 4	S		LTS
		Alternative Plan 5	S		LTS
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI

Table 7-3. Summary of Impacts and Mitigation Measures for Wildlife Resources (contd.)

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
WLD-3: Substantial Impact on Special-Status Raptors	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	WLD-3a: Mitigate Impacts on Bald Eagle and Golden Eagle, WLD-3b: Mitigate Impacts on California Spotted Owl, WLD-3c: Mitigate Impacts on Burrowing Owl WLD-3d: Mitigate Impacts on American Peregrine Falcon and Prairie Falcon, WLD-3e: Mitigate Impacts on Cooper's Hawk and Sharp-Shinned Hawk, WLD-3f Mitigate Impacts on Osprey, WLD-3g: Mitigate Impacts on Northern Harrier	SU
		Alternative Plan 2	S		SU
		Alternative Plan 3	S		SU
		Alternative Plan 4	S		SU
		Alternative Plan 5	S		SU
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
WLD-4: Substantial Impact on Special-Status Passerines or Birds Protected by the Migratory Bird Treaty Act	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	WLD-4a: Mitigate Impacts on Yellow Warbler, WLD-4b: Mitigate Impacts on Grasshopper Sparrow and California Horned Lark, WLD-4c: Mitigate Impacts on Loggerhead Shrike, WLD-4d: Mitigate Impacts on Bird Species Protected by the Migratory Bird Treaty Act	LTS
		Alternative Plan 2	S		LTS
		Alternative Plan 3	S		LTS
		Alternative Plan 4	S		LTS
		Alternative Plan 5	S		LTS
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI

Table 7-3. Summary of Impacts and Mitigation Measures for Wildlife Resources (contd.)

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
WLD-5: Substantial Impact on Ringtail	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	WLD-5: Mitigate Impacts on Ringtail	LTS
		Alternative Plan 2	S		LTS
		Alternative Plan 3	S		LTS
		Alternative Plan 4	S		LTS
		Alternative Plan 5	S		LTS
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
WLD-6: Substantial Impact on American Badger	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	WLD-6: Mitigate Impacts on American Badger	LTS
		Alternative Plan 2	S		LTS
		Alternative Plan 3	S		LTS
		Alternative Plan 4	S		LTS
		Alternative Plan 5	S		LTS
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI

Table 7-3. Summary of Impacts and Mitigation Measures for Wildlife Resources (contd.)

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
WLD-7: Substantial Impact on San Joaquin Pocket Mouse	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	WLD-7: Mitigate Impacts on San Joaquin Pocket Mouse	LTS
		Alternative Plan 2	S		LTS
		Alternative Plan 3	S		LTS
		Alternative Plan 4	S		LTS
		Alternative Plan 5	S		LTS
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
WLD-8: Substantial Impact on Special-Status Bat Species	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	WLD-8: Mitigate Impacts on Special-Status Bat Species	LTS
		Alternative Plan 2	S		LTS
		Alternative Plan 3	S		LTS
		Alternative Plan 4	S		LTS
		Alternative Plan 5	S		LTS
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI

Table 7-3. Summary of Impacts and Mitigation Measures for Wildlife Resources (contd.)

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
WLD-9: Substantial Impact on Migratory and Wintering Deer Herds	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	WLD-9: Mitigate Impacts on Migratory and Wintering Deer Herds	LTS
		Alternative Plan 2	S		LTS
		Alternative Plan 3	S		LTS
		Alternative Plan 4	S		LTS
		Alternative Plan 5	S		LTS
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
WLD-10: Potential Conflict with Fresno County and Madera County General Plan Objectives and Guidelines	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	None Available	NI
		Alternative Plan 2	S		SU
		Alternative Plan 3	S		SU
		Alternative Plan 4	S		SU
		Alternative Plan 5	S		SU
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI

Table 7-3. Summary of Impacts and Mitigation Measures for Wildlife Resources (contd.)

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
WLD-11: Potential Reduction in Habitat or Populations of Special-Status Invertebrates	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	LTS		LTS
		Alternative Plan 2	LTS		LTS
		Alternative Plan 3	LTS		LTS
		Alternative Plan 4	LTS		LTS
		Alternative Plan 5	LTS		LTS
WLD-12: Potential Reduction in Habitat or Populations of Special-Status Amphibians and Reptiles	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	LTS		LTS
		Alternative Plan 2	LTS		LTS
		Alternative Plan 3	LTS		LTS
		Alternative Plan 4	LTS		LTS
		Alternative Plan 5	LTS		LTS

Table 7-3. Summary of Impacts and Mitigation Measures for Wildlife Resources (contd.)

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
WLD-13: Potential Reduction in Habitat or Populations of Special-Status Bird Species	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	LTS		LTS
		Alternative Plan 2	LTS		LTS
		Alternative Plan 3	LTS		LTS
		Alternative Plan 4	LTS		LTS
		Alternative Plan 5	LTS		LTS
WLD-14: Potential Reduction in Habitat or Populations of Special-Status Mammal Species	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	LTS		LTS
		Alternative Plan 2	LTS		LTS
		Alternative Plan 3	LTS		LTS
		Alternative Plan 4	LTS		LTS
		Alternative Plan 5	LTS		LTS

Table 7-3. Summary of Impacts and Mitigation Measures for Wildlife Resources (contd.)

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
WLD-15: Potential Interference with Migratory Corridors or Nursery Sites	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	LTS		LTS
		Alternative Plan 2	LTS		LTS
		Alternative Plan 3	LTS		LTS
		Alternative Plan 4	LTS		LTS
		Alternative Plan 5	LTS		LTS
WLD-16: Potential Impact on Riparian Habitat for Special-Status Bird Species	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	PS	WLD-16: Monitor and Manage Riparian Vegetation Structure Within Extended Study Area	LTS
		Alternative Plan 2	PS		LTS
		Alternative Plan 3	PS		LTS
		Alternative Plan 4	PS		LTS
		Alternative Plan 5	PS		LTS

Table 7-3. Summary of Impacts and Mitigation Measures for Wildlife Resources (contd.)

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
WLD-17: Conflict with Local or Regional Policies Protecting Wildlife Resources	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
WLD-18: Potential Conflict with Adopted Conservation Plans	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI

Key:
LTS = less than significant
NI = no impact
S = significant
SU = significant and unavoidable

Methods and Assumptions

This analysis of impacts on wildlife resources resulting from implementing any of the alternatives under consideration is based on review of existing documentation that addresses biological resources in or near the primary and extended study areas and on GIS analysis. Where specific suitable habitat data for individual species with the potential to occur within the primary study area were not available, suitable habitat data as defined by California Wildlife Habitat Relationships (CWHR) was used to determine impacts.

The following assumptions about activity within the primary study area and vicinity have been made for the purposes of the impact analysis:

- Proposed facilities sites (dam construction areas, transmission lines, power houses, valve houses, access/haul roads, recreation facilities) would be completely cleared of all vegetation and would have marginal habitat value for wildlife after project construction.

- Complete or overstory vegetation removal would occur in vegetated areas below the Temperance Flat RM 274 Reservoir maximum surface water elevation during construction, except in special habitat areas.

Criteria for Determining Significance of Impacts

An environmental document prepared to comply with NEPA must consider the context and intensity of the environmental impacts that would be caused by, or result from, implementing the No Action Alternative and other alternatives. Under NEPA, the severity and context of an impact must be characterized. An environmental document prepared to comply with CEQA must identify the potentially significant environmental impacts of a proposed project. A "[s]ignificant effect on the environment" means "a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project" (State CEQA Guidelines, Section 15382). CEQA also requires that the environmental document propose feasible measures to avoid or substantially reduce significant environmental impacts (State CEQA Guidelines, Section 15126.4[a]).

Significance criteria used to analyze the potential impacts of the project on wildlife resources include factual and scientific information and regulatory standards of county, State, and Federal agencies, including the State CEQA Guidelines. These criteria have been developed to establish thresholds to determine the significance of impacts pursuant to CEQA (Section 15064.7) and should not be confused with a "take" or adverse impact under the ESA. Impacts on wildlife resources would be significant if project implementation would do any of the following:

- Result in mortality of State-listed or Federally listed wildlife species, or species that are candidates for listing or proposed for listing
- Have the potential to substantially reduce the habitat of any wildlife species, including those that are listed as endangered or threatened or are candidates or proposed for endangered or threatened status
- Have the potential to cause a wildlife population to drop below self-sustaining levels
- Have a substantial adverse impact, either directly or through habitat modifications, on any non-special-status wildlife species
- Substantially adversely affect, either directly or through habitat modifications, any wildlife species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by CDFW or USFWS
- Interfere substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites
- Conflict with or violate the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved Federal, State, regional, or local habitat conservation plan relating to the protection of wildlife species
- Conflict with any State or local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance

Significance statements are relative to both existing conditions and future conditions unless stated otherwise. Impact conclusions are made using the significance criteria described above and include consideration of the “context” of the action and the “intensity” (severity) of its impacts in accordance with NEPA guidance (40 CFR 1508.27).

Topics Eliminated from Further Consideration

No topics related to wildlife resources that are included in the significance criteria listed above were eliminated from further consideration. All relevant topics are analyzed below.

Implementing any of the action alternatives would increase the amount of water available for delivery from Millerton Lake. Portions of this water would be conveyed directly to Friant Division water contractors or down the San Joaquin River and rediverted or exchanged for delivery to SOD CVP and SWP water contractors. The conveyance of these water supplies would not exceed channel capacity of the San Joaquin River or Delta waterways. No change in existing use of adjacent lands would occur.

The direct and indirect impact assessment in the extended study area is limited to riverine, riparian, and wetland habitats within the existing channel of the San Joaquin River. Because implementing any of the action alternatives would not result in San Joaquin River or Delta instream flows that would exceed channel capacity or result in changes to land uses or habitats outside of the river channel, their implementation would not result in an impact on associated wildlife resources. Therefore, none of the five action alternatives would have an impact on biological resources in the San Joaquin River or Delta located outside of the river channel. Therefore, these portions of the extended study area are not discussed further in this analysis.

As described in Chapter 14, “Hydrology – Surface Water Supplies and Facilities Operations,” of this Draft EIS, implementing any of the action alternatives would increase water reliability for the Friant Division and SOD CVP and SWP water contractors during most water-year types. The delivery of this additional water would not exceed historic maximum deliveries or existing contracted water volumes, result in placing new land into agricultural production, change cropping patterns, or result in other physical changes to the environment.

Because implementing any of the action alternatives would not result in land use changes or other physical consequences in the CVP and SWP water service areas that would affect existing habitat for biological resources, their implementation would not create an impact on biological resources within these service areas. This portion of the extended study area is not discussed further in this analysis.

Impacts on biological resources within the primary study area are addressed in the discussions for Impact WLD-1 through Impact WLD-10. These discussions address impacts on biological resources that are expected to be restricted to the primary study area. The discussions for Impact WLD-11 through Impact WLD-18 address impacts on biological resources that could occur within the extended study area only. These impact discussions address potential impacts associated with changes in water delivery volumes and flooding frequency that could occur within the San Joaquin River and Delta channels within the extended study area.

Direct and Indirect Impacts

This section describes the environmental consequences of implementing any of the alternatives. It describes how various wildlife species could be affected by the following types of impacts:

- Direct impacts from construction-related activities at the Temperance Flat RM 274 Dam and project facilities, including a new powerhouse, a water intake structure, campsites, and temporary construction facilities, including staging areas, and quarry, batch plant, and haul road options

- Direct impacts associated with habitat loss from construction and operation of the Temperance Flat RM 274 Dam and associated project facilities

- Direct impacts from habitat loss associated with inundation upstream from the Temperance Flat RM 274 Dam related to the Temperance Flat RM 274 Reservoir

- Indirect impacts from an increase in the level of human disturbance associated with increased recreation activities or recreation activities in a new location

- Indirect impacts from an increase in erosion and decrease in water quality in aquatic habitat

Impact WLD-1: Substantial Impact on Special-Status Invertebrates

Primary Study Area

No Action Alternative Implementing the No Action Alternative would not result in any impacts associated with the development of the Temperance Flat RM 274 Dam and Reservoir on natural habitats that support wildlife species or result in changes to existing management activities. Future development in Fresno and Madera counties would continue in accordance with these counties' respective general plans. Limited rural residential development is expected to occur, resulting in loss of open space and degradation of wildlife habitat from increased noise, increased light and glare, and other disturbances associated with developed land uses. No impact of future development would occur in the primary study area.

There would be **no impact** under the No Action Alternative.

Action Alternatives Ground-disturbing activities and vegetation removal associated with the construction of the new Temperance Flat RM 274 Dam, as well as activities associated with construction of project facilities sites, could result in direct take of pipevine swallowtail, a BLM species of management concern, and valley elderberry longhorn beetle, a species Federally listed as threatened and CALFED Multi-Species Conservation Strategy Recovery species. The goal for species with a recover status is to "Recover species populations within the MSCS focus area to levels that ensure the species long-term survival in nature." The potential for direct take of these species through vegetation removal and inundation associated with construction of the project would be substantial.

In addition, the construction of the new Temperance Flat RM 274 Dam and Reservoir would result in inundation of suitable habitat, and the ground-disturbing activities would also remove suitable valley elderberry longhorn beetle habitat throughout the primary study area, and in the Temperance Flat Reservoir Area up to the Kerckhoff Powerhouse for the pipevine swallowtail. The permanent loss of habitat through vegetation removal and inundation for these special-status species associated with construction of the project would be substantial.

Vernal pool branchiopods, vernal pool fairy shrimp, and vernal pool tadpole shrimp are Federally listed under the ESA. These species are not expected to occur within the zone of inundation associated with Temperance Flat RM 274 Reservoir because of the absence of vernal pool or seasonal wetland habitat. However, suitable vernal pool habitat exists on table top grasslands found along the proposed transmission line to the south of the Temperance Flat RM 274 Dam, as described above in the Special-Status Species section under Invertebrates.

Direct mortality of listed vernal pool branchiopods or loss of dormant cysts could occur where vegetation clearing implemented for the construction of the transmission lines intersects potential habitat for listed vernal pool branchiopods. The potential for direct take of listed vernal pool branchiopods associated with construction of the transmission lines would be substantial.

The construction of the transmission lines would also potentially result in loss of suitable habitat in the primary study area for vernal pool branchiopods (Table 7-4). The permanent loss of habitat through vegetation removal for these special-status species associated with construction of the project would be substantial.

This impact would be **significant**. Mitigation for this impact is proposed below in the Mitigation Measures section.

Table 7-4. Impacts on Suitable Habitat for Vernal Pool Branchiopods in the Primary Study Area

Suitable Habitat	Area (acres)
Vernal Pool and Swale	6.37
Total	**6.37**

Impact WLD-2: Substantial Impact on Special-Status Amphibians and Reptiles

Primary Study Area

No-Action Alternative Implementing the No-Action Alternative would not result in any impacts associated with the development of the Temperance Flat RM 274 Dam and Reservoir on natural habitats that support wildlife species or result in changes to existing management activities. Future development in Fresno and Madera counties would continue in accordance with these counties' respective general plans. Limited rural residential development is expected to occur, resulting in loss of open space and degradation of wildlife habitat from increased noise, increased light and glare, and other disturbances associated with developed land uses. No impact of future development would occur in the primary study area.

There would be **no impact** under the No Action Alternative.

Action Alternatives California tiger salamander is Federally and State listed as threatened. Western spadefoot is a California Species of Special Concern. These species have not been observed within the primary study area. However, suitable seasonal wetland habitat could exist within seasonal ponds along ephemeral drainages within the primary study area, as described above in the Special-Status Species section under Amphibians and Reptiles. If California tiger salamander or western spadefoot were present in seasonal wetland habitats in the primary study area, construction of the Temperance Flat RM 274 Dam and resulting inundation could lead to direct take of individuals and loss of breeding habitat.

Direct mortality of California tiger salamander and western spadefoot could occur in areas of suitable upland habitat where vegetation clearing is implemented if these activities occur during the breeding (i.e., wet) season when these species are on the surface. The potential for direct take of these special-status species with construction of the project would be substantial.

California tiger salamander and western spadefoot may use grasslands for dispersal and aestivation habitat. Construction activities in suitable upland habitat would result in a loss of upland dispersal and aestivation habitat for these species. Impacts on suitable California tiger salamander and western spadefoot habitat by CWHR type in the primary study area is summarized in Table 7-5. The permanent loss of suitable aestivation and movement habitat for these special-status species associated with construction of the project would be substantial.

Regularly or permanently inundating these habitats could make remaining suitable seasonal pools unsuitable for California tiger salamander and western spadefoot by altering their hydrology or by increasing predation from nonnative fish or bullfrogs, which require more permanent water. The potential change in hydrology for these special-status species associated with construction of the project would be substantial.

Table 7-5. Impacts on Suitable Habitat for Special-Status Amphibians and Reptiles in the Primary Study Area

Suitable Habitat	Area (acres)
California Tiger Salamander and Western Spadefoot	
Annual Grassland	317
Vernal Pool and Swales	6
Total	**323**
Foothill Yellow-Legged Frog	
Riverine	200
Willow Riparian Forest	4
White Alder Riparian Forest	25
Mixed Riparian Forest	12
Sycamore Riparian Forest	0.4
Buttonbush Scrub	0.3
Fig Riparian/Fig-Willow Riparian	3
Total	**245**
Western Pond Turtle	
Riverine	200
Seasonal Wetlands	269
Willow Riparian Forest	4
White Alder Riparian Forest	25
Mixed Riparian Forest	12
Sycamore Riparian Forest	0.4
Buttonbush Scrub	0.3
Fig Riparian/Fig-Willow Riparian	3
Total	**512**
Coast Horned Lizard	
Annual Grassland	317
Foothill Pine Chaparral Woodland	5
Total	**322**

Implementing any of the action alternatives could also result in the degradation of suitable aquatic habitat because of increased erosion, increased sedimentation, or accidental fuel leaks and spills. The potential decrease in water quality for California tiger salamander and western spadefoot habitat associated with construction of the Project would be substantial.

California red-legged frog is Federally listed as threatened, a California Species of Special Concern, and a CALFED Multi-Species Conservation Strategy Goal – Maintain species. The goal for species with a “maintain” status is to “Ensure that any adverse effects on the species that could be associated with implementation of CALFED actions will be fully offset through implementation of actions beneficial to the species.” Although suitable breeding and upland habitat is present and the primary study area falls within its range, the nearest known occurrence of California red-legged frog is more than 65 miles away, and the species has not been observed during surveys of the primary study area. Given this information, it is unlikely for construction and operation of the project to result in direct take of California red-legged frog or indirect take through changes in hydrology or water quality. However, until such time as its absence in the primary study area is confirmed, there is some potential for the project to affect this species. Loss of suitable habitat within the primary study area as a result of implementing the action alternatives may result in a potentially significant impact on the future recovery of the species. If California red-legged frog were present in the primary study area, the impact on California red-legged frog within the primary study area would be substantial.

Foothill yellow-legged frog is a California Species of Special Concern and a BLM-sensitive species. No foothill yellow-legged frogs have been observed within the primary study area. However, limited potentially suitable breeding habitat occurs within the primary study area at the confluence of small tributaries with the San Joaquin River (see the Special-Status Species section under Amphibians and Reptiles). Ground-disturbing activities and vegetation removal associated with Temperance Flat RM 274 Dam construction activities could result in direct take of foothill yellow-legged frog. Although frogs could move away from disturbance, impacts on foothill yellow-legged frog could also occur as a result of ground-disturbing construction activities in or near suitable aquatic habitat. The potential for direct or indirect take of foothill yellow-legged frog associated with construction of the action alternatives would be substantial.

In addition, inundation caused by the construction of the new Temperance Flat RM 274 Dam would result in converting suitable riverine and riparian habitat to unsuitable lacustrine habitat. Impacts on suitable foothill yellow-legged frog habitat by CWHR type in the primary study area is summarized in Table 7-5. Loss of suitable habitat for foothill yellow-legged frog would be substantial.

Project implementation could also result in the degradation of remaining suitable aquatic habitat because of increased erosion, sedimentation, or accidental fuel leaks and spills. The potential decrease in water quality in aquatic habitat for foothill yellow-legged frog associated with construction of the project would be substantial.

Western pond turtle is a California Species of Special Concern and a BLM-sensitive species that is known to occur within the primary study area. Ground-disturbing activities and vegetation removal associated with Temperance Flat RM 274 Dam and project facilities construction could lead to direct take of western pond turtle as a result of project-associated construction activities in or near suitable aquatic and upland habitat. Potential construction impacts include direct mortality of western pond turtle individuals from strikes by construction equipment and through increased vehicle traffic. The potential for direct take of western pond turtle associated with construction of the project would be substantial.

Although lacustrine habitat that would be created by implementing the action alternatives is suitable habitat for western pond turtle, annual fluctuations in water levels may result in an adverse impact on western pond turtle individuals in the primary study area. In addition to using aquatic habitats, western pond turtle uses upland habitats for nesting and overwintering. Nests are generally located on south-facing slopes of less than 60 degrees averaging about 660 feet from an aquatic site (DFG 1994). Thus, loss of existing upland habitat adjacent to suitable aquatic habitat (within approximately 660 feet) could adversely affect western pond turtle. Direct take of western pond turtle eggs or juveniles could occur during initial inundation of habitat. Western pond turtles could lay eggs in suitable habitat that subsequently becomes inundated, resulting in the death of the eggs or overwintering juveniles. In addition, inundation would convert suitable upland habitat to lacustrine habitat that is not suitable for nesting and overwintering.

Construction of the new Temperance Flat RM 274 Dam and Reservoir would also result in conversion of riverine habitat to lacustrine habitat. Impacts on suitable western pond turtle habitat by CWHR type in the primary study area is summarized in Table 7-5. Western pond turtles use both riverine and lacustrine habitat. However, lacustrine habitat would occur only during times of high water levels in the Temperance Flat RM 274 Reservoir. Thus, the conversion of suitable riverine habitats to suitable lacustrine habitat would result in a net loss of suitable western pond turtle habitat. These impacts would be moderate in intensity.

An increase in human activity in suitable habitat for hibernating and nesting western pond turtle could occur in association with Temperance Flat RM 274 Dam construction. The creation and future use of the Temperance Flat boat-in campground upstream from Millerton Lake would result in more human activity close to potential upland burrows. The increase in noise and human disturbance could lead to abandonment and the incidental loss of fertile eggs or young.

In addition, project implementation could result in the degradation of suitable aquatic habitat from increased erosion, sedimentation, or accidental fuel leaks and spills associated with human activity. The potential decrease in water quality and increased human activity associated with construction of the project would be a substantial risk of indirect impacts on western pond turtle.

The coast horned lizard is a California Species of Special Concern and BLM-sensitive species. Although this species has not been observed within the primary study area, potentially suitable grassland and scrub habitat occurs within the primary study area (see the Special-Status Species section under Amphibians and Reptiles). Ground-disturbing activities and vegetation removal associated with Temperance Flat RM 274 Dam construction activities could result in direct take of coast horned lizard. Potential construction impacts include mortality of individuals through crushing by construction equipment or vehicle traffic within suitable breeding and hibernation habitat.

Inundation of suitable habitat could also lead to direct take of coast horned lizard eggs or juveniles during the initial Temperance Flat RM 274 Reservoir inundation. The lizards use small-mammal burrows for refuge and for hibernating during winter and could lay eggs in suitable habitat that subsequently becomes inundated, resulting in the death of the eggs or overwintering juveniles. The potential for direct take resulting from ground-disturbing construction and inundation associated with construction of the project would be substantial.

In addition, ground-disturbing activities and vegetation removal associated with the construction of the Temperance Flat RM 274 Dam, as well as construction activities in the project facilities sites, could result in loss of suitable habitat for the coast horned lizard. Impacts on suitable coast horned lizard habitat by CWHR type in the primary study area is summarized in Table 7-5.

In addition, the construction of the new Temperance Flat RM 274 Dam would result in the inundation of additional suitable grassland and scrub habitat within the primary study area. The permanent loss of habitat through vegetation removal and inundation for coast horned lizard associated with construction of the project would be substantial.

Human activity in suitable habitat for hibernating and nesting coast horned lizards could increase. The creation and future use of the boat-in campground upstream from Millerton Lake would result in more human activity close to potential upland burrows for coast horned lizard. The increase in noise and human disturbance could lead to abandonment or incidental loss of fertile eggs or young. The increase in human activity associated with construction of the project would substantially increase the risk of indirect take of coast horned lizard.

This impact would be **significant** under the action alternatives. Mitigation for this impact is proposed below in the Mitigation Measures section.

Impact WLD-3: Substantial Impact on Special-Status Raptors

Primary Study Area

No Action Alternative Implementing the No Action Alternative would not result in any impacts associated with the development of the Temperance Flat RM 274 Dam and Reservoir on natural habitats that support wildlife species or result in changes to existing management activities. Future development in Fresno and Madera counties would continue in accordance with these counties' respective general plans. Limited rural residential development is expected to occur, resulting in loss of open space and degradation of wildlife habitat from increased noise, increased light and glare, and other disturbances associated with developed land uses.

There would be **no impact** under the No Action Alternative.

Action Alternatives Special-status raptors, including bald eagle, golden eagle, California spotted owl, burrowing owl, American peregrine falcon, prairie falcon, merlin, osprey, northern harrier, Cooper's hawk, and sharp-shinned hawk, are known to occur or have the potential to occur within the primary study area.

Bald eagle (State listed as endangered, State fully protected species, covered by Federal Bald and Golden Eagle Protection Act), golden eagle (covered by Federal Bald and Golden Eagle Protection Act), osprey (watch list), Cooper's hawk (watch list), sharp-shinned hawk (watch list), merlin (watch list), and California spotted owl (California Species of Special Concern, BLM-Sensitive) are known to occur in woodland habitats within the primary study area.

Suitable habitat features that serve as nesting sites such as snags and large trees would be removed with construction of the new Temperance Flat RM 274 Dam, construction of the project facilities, and inundation associated with the new Temperance Flat RM 274 Reservoir. Inundation could also increase erosion and decrease bank stability, which could affect nest trees that are close to the inundation zone.

A known bald eagle nest tree in the vicinity of the proposed Temperance Flat RM 274 Dam site would be lost by vegetation removal associated with the action alternatives. Because bald eagles generally use the same nest for multiple years, construction of the dam would likely result in the loss of a bald eagle nest site. This impact would be substantial.

Inundation from the Temperance Flat RM 274 Dam in the primary study area within suitable foraging habitat could also affect cliff-nesting raptors such as golden eagle (fully protected species, covered by the Bald and Golden Eagle Protection Act, watch list species), American peregrine falcon (fully protected species), and prairie falcon (watch list species) by inundating suitable cliff nesting sites or resulting in a loss of suitable foraging habitat for these species, potentially resulting in a loss of an existing territory.

Western burrowing owl (California Species of Special Concern, BLM-Sensitive) and northern harrier (California Species of Special Concern) nest in open grasslands. Vegetation removal and construction activities along the transmission line in these habitats would result in loss of potential nesting habitat for these species.

Ground-disturbing activities associated with project construction and resulting inundation from the Temperance Flat RM 274 Dam would also result in significant loss of foraging habitat for woodland-foraging species such as Cooper’s hawk, sharp-shinned hawk, California spotted owl, and merlin. The permanent loss of nesting and foraging habitat for these special-status raptors associated with construction of the project and inundation would be substantial.

White-tailed kite and long-eared owl are not expected to nest in the primary study area, but could use grasslands and meadows, and dense shrubs in riparian woodlands, respectively, for foraging in winter or during migration. Similarly, western burrowing owl and northern harrier use foraging habitat that is widespread outside of the primary study area. Impacts on suitable raptor habitat by CWHR type in the primary study area is summarized in Table 7-6. For these species, given the prevalence of surrounding suitable habitat, this impact would not be substantial.

Table 7-6. Impacts on Suitable Habitat for Special-Status Raptors in the Primary Study Area

Suitable Habitat	Area (acres)
Bald Eagle, Osprey, Cooper's Hawk, Sharp-Shinned Hawk, Merlin	
Foothill Pine Oak Woodland	5,029
Blue Oak Woodland	1,388
Live Oak Woodland	57
Foothill Pine Woodland	9
Foothill Pine Chaparral Woodland	5
Mixed Riparian Forest	12
Sycamore Riparian Woodland	0.4
Total	**6,500.4**
California Spotted Owl	
Mixed Riparian Forest	12
Sycamore Riparian Woodland	0.4
Total	**12.4**
Western Burrowing Owl, Northern Harrier	
Annual Grassland	317
Vernal Pool and Swales	6
Total	**323**

In addition, vegetation removal during the nesting season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to the abandonment of active raptor nests. Noise generated by vegetation removal, such as noise caused by helicopter use, excavators, and chainsaws that occurs during the breeding season, could also lead to nest abandonment, resulting in the incidental loss of fertile eggs or nestlings. The potential for direct take for these special-status raptors associated with construction of the project would be substantial.

An increase in human activity close to remaining suitable nesting habitat for bald eagles, osprey, and cliff-nesting raptors such as golden eagle, prairie falcon, and peregrine falcon could occur during operation of the project. The increased elevation in the Temperance Flat RM 274 Reservoir could increase access to these species' nests by recreational boaters. In addition, the creation and future use of the Temperance Flat boat-in campground upstream from Millerton Lake would result in more human activity close to potential nest trees.

The increase in noise and human disturbance could lead to nest abandonment and the incidental loss of fertile eggs or young. These indirect impacts would be moderate in intensity.

This impact would be **significant**. Mitigation for this impact is proposed below in the Mitigation Measures section.

Impact WLD-4: Substantial Impact on Special-Status Passerines or Birds Protected by the Migratory Bird Treaty Act

Primary Study Area

No Action Alternative Implementing the No Action Alternative would not result in any impacts associated with the development of the Temperance Flat RM 274 Dam and Reservoir on natural habitats that support wildlife species or result in changes to existing management activities. Future development in Fresno and Madera counties would continue in accordance with these counties' respective general plans. Limited rural residential development is expected to occur, resulting in loss of open space and degradation of wildlife habitat from increased noise, increased light and glare, and other disturbances associated with developed land uses. No impact of future development would occur in the primary study area.

There would be **no impact** under the No Action Alternative.

Action Alternatives Yellow warbler (California Species of Special Concern) is known to occur within the primary study area along Big Sandy Creek (see the Special-Status Species section under Birds). Although nesting habitat within the primary study area is marginal, there is the potential for this species to nest within the primary study area, and loss of riparian habitat for this species would be substantial.

Little willow flycatcher, yellow-breasted chat, and least Bell's vireo are riparian-dependent species and are unlikely to occur within the primary study area due to lack of suitable riparian habitat. Therefore, ground-disturbing activities related to construction of the new Temperance Flat RM 274 Dam and resulting in loss or inundation of riparian habitat would be unlikely to result in impacts on little willow flycatcher, yellow-breasted chat, or least Bell's vireo. Because they are not likely to be present, these riparian-dependent bird species would not be substantially affected by construction and operation within the primary study area.

Grasshopper sparrow, a California Species of Special Concern, and California horned lark, a watch list species, are not known to occur in the primary study area. However, suitable breeding and foraging habitat is present in the table top grasslands along the proposed southeastern transmission line. If ground-disturbing activities and vegetation removal related to the transmission line occurs during the nesting season, this could result in the incidental loss of fertile eggs or nestlings or otherwise lead to the abandonment of nests. Noise generated by vegetation removal, such as noise caused by helicopter use, excavators, and chainsaws, could also lead to nest abandonment, resulting in the incidental loss of fertile eggs or nestlings. The potential for direct take resulting from ground-disturbing construction associated with construction of the project would be substantial.

Grasshopper sparrow and California horned lark use grasslands or extensive, dense riparian woodlands for foraging in winter or during migration, and these habitats are widespread in the areas outside of the primary study area. For these species, given the prevalence of suitable habitat in the immediate vicinity of the primary study area, the loss of suitable habitat associated with construction and operation of the project would not be substantial.

Loggerhead shrike, a California Species of Special Concern, is a known migrant within the primary study area and suitable breeding and foraging habitat occurs in open habitats with scattered perches (see the Special-Status Species section under Birds). If ground-disturbing activities related to construction of project facilities occur during the nesting season, there is a potential for loss of loggerhead shrike individuals. Vegetation removal during the nesting season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to the abandonment of nests.

Noise generated by machinery used in vegetation removal, including helicopters, excavators, and chainsaws, could also lead to nest abandonment, resulting in the incidental loss of fertile eggs or nestlings. The potential for mortality of loggerhead shrike individuals associated with construction of the project would be substantial.

Vegetation removal and other construction activities as well as inundation from construction of the Temperance Flat RM 274 Dam within or near suitable habitat for loggerhead shrike would result in a loss of suitable nesting and foraging habitat. Impacts on suitable loggerhead shrike habitat by CWHR type in the primary study area is summarized in Table 7-7. The permanent loss of habitat through vegetation removal and inundation associated with construction of the project would be substantial.

Table 7-7. Impacts on Suitable Habitat for Loggerhead Shrike in the Primary Study Area

Suitable Habitat	Area (acres)
Annual Grassland	317
Foothill Pine Chaparral Woodland	5
Total	**322**

The Migratory Bird Treaty Act (MBTA) also covers a variety of common bird species known to occur within the primary study area. As with special-status bird species, construction and operation of the Temperance Flat RM 274 Dam could result in loss of bird species protected by the MBTA through incidental loss of fertile eggs or nestlings due to direct removal of nests or through nest abandonment.

Vegetation removal and Temperance Flat RM 274 Reservoir inundation that occurs during the nesting season would result in the permanent loss of habitat for nesting bird species protected by the MBTA. The permanent loss of nesting habitat through vegetation removal and inundation associated with construction of the project for bird species covered by the MBTA would be substantial.

This impact would be **significant**. Mitigation for this impact is proposed below in the Mitigation Measures section.

Impact WLD-5: Substantial Impact on Ringtail

Primary Study Area

No Action Alternative Implementing the No Action Alternative would not result in any impacts associated with the development of the Temperance Flat RM 274 Dam and Reservoir on natural habitats that support wildlife species or result in changes to existing management activities. Future development in Fresno and Madera counties would continue in accordance with these counties' respective general plans. Limited rural residential development is expected to occur, resulting in loss of open space and degradation of wildlife habitat from noise, increased light and glare, and other disturbances associated with developed land uses.

There would be **no impact** under the No Action Alternative.

Action Alternatives Ringtails are a State fully protected species that could occur within riparian and forest habitats within the primary study area. Ground-disturbing activities and vegetation removal during project construction would result in the loss of suitable habitat for ringtail within the primary study area. Suitable habitat for ringtail within the zone of inundation of the Temperance Flat RM 274 Reservoir would also be lost. It is assumed that all vegetation would be removed within the zone of inundation; therefore, no habitat value would remain for upland wildlife species even during periods of Temperance Flat RM 274 Reservoir drawdown. Estimated loss of suitable habitat for ringtail within the primary study area is presented in Table 7-8. The permanent loss of suitable habitat for ringtail would be substantial.

Table 7-8. Impacts on Suitable Habitat for Special-Status Mammals in the Primary Study Area

Species	Habitat Affected	Estimated Impact Acreage
Pallid bat[1] *Antrozous pallidus*	All woodland, shrub, riparian herbaceous wetland, aquatic, and herbaceous upland habitat types are suitable foraging habitat.	7,418
	Roosting caves, mines, and rock faces.	31[2]
Townsend's big-eared bat[1] *Corynorhinus townsendii*	All woodland, shrub, riparian herbaceous wetland, aquatic, and herbaceous upland habitat types are suitable foraging habitat.	7,418
	Roosting caves, mines, and rock faces.	31[2]
Spotted bat[1] *Euderma maculatum*	All woodland, shrub, riparian herbaceous wetland, aquatic, and herbaceous upland habitat types are suitable foraging habitat.	7,418
	Roosting caves, mines, and rock faces.	31[2]
Western mastiff bat[1] *Eumops perotis californicus*	All woodland, shrub, riparian herbaceous wetland, aquatic, and herbaceous upland habitat types are suitable foraging habitat.	7,418
	Roosting caves, mines, and rock faces.	31[2]

Table 7-8. Impacts on Suitable Habitat for Special-Status Mammals in the Primary Study Area (contd.)

Species	Habitat Affected	Estimated Impact Acreage
Western small-footed myotis[1] *Myotis ciliolabrum*	All woodland, shrub, riparian herbaceous wetland, aquatic, and herbaceous upland habitat types are suitable foraging habitat.	7,418
	Roosting caves, mines, and rock faces.	31[2]
Long-eared myotis[1] *Myotis evotis*	All woodland, shrub, riparian herbaceous wetland, aquatic, and herbaceous upland habitat types are suitable foraging habitat.	7,418
	Roosting caves, mines, and rock faces.	31[2]
Fringed myotis[1] *Myotis thysanodes*	All woodland, shrub, riparian herbaceous wetland, aquatic, and herbaceous upland habitat types are suitable foraging habitat.	7,418
	Roosting caves, mines, and rock faces.	31[2]
Yuma myotis[1] *Myotis yumanensis*	All woodland, shrub, riparian herbaceous wetland, aquatic, and herbaceous upland habitat types are suitable foraging habitat.	7,418
	Roosting caves, mines, and rock faces.	31[2]
Ringtail *Bassariscus astutus*	The species is found in oak and foothill pine woodlands, riverine, seasonal wetland, sycamore woodland, willow woodland, riparian woodland, button bush scrub, bush lupine scrub, and buckbrush scrub.	7,036
San Joaquin pocket mouse *Perognathus inornatus inornatus*	The species could potentially occur in annual grassland, bush lupine scrub, and buckbrush scrub.	351
American badger *Taxidea taxus*	The species could potentially occur in annual grassland, bush lupine scrub, and buckbrush scrub.	351

Notes:

[1] Lacustrine shoreline and lacustrine unconsolidated bottom can also serve as foraging habitat for bats. However, because these habitats would continue at the same or greater acreage after construction, they are not included in the impact acreage for bat species.

[2] There are approximately 31 acres of barren habitat within the primary study area that would be affected by Temperance Flat RM 274 Reservoir inundation. This habitat includes rock faces. The exact acreage of caves or mines that would be affected by inundation cannot be determined. Under the maximum inundation level of 985 feet, the Millerton Lake Cave System would be inundated. At lower water levels, some of the cave system would be available to roosting bat species.

The use of construction equipment and increased roadway traffic during project construction could result in ringtails being struck and injured or killed. Removal of trees could also result in the loss of occupied ringtail dens. These impacts would be moderate in intensity.

Increased noise and lighting within the primary study area during construction could result in displacing ringtails from the construction area. These impacts would be moderate in intensity.

The creation of additional recreational facilities within the primary study area could result in indirect impacts on remaining suitable habitat during project operation. These new facilities, including campgrounds, boat launches, trails, and access roads, could increase human activity near ringtails or ringtail dens, resulting in indirect impacts and reduction in habitat suitability for ringtail within the primary study area. These indirect impacts would be moderate in intensity.

This impact would be **significant** under the action alternatives. Mitigation for this impact is proposed below in the Mitigation Measures section.

Impact WLD-6: Substantial Impact on American Badger

Primary Study Area

No Action Alternative Implementing the No Action Alternative would not result in any impacts associated with the development of the Temperance Flat RM 274 Dam and Reservoir on natural habitats that support wildlife species or result in changes to existing management activities. Future development in Fresno and Madera counties would continue in accordance with these counties' respective general plans. Limited rural residential development is expected to occur, resulting in loss of open space and degradation of wildlife habitat from increased noise, increased light and glare, and other disturbances associated with developed land uses No impact of future development would occur in the primary study area.

There would be **no impact** under the No Action Alternative.

Action Alternatives American badger is a State Species of Special Concern. Ground-disturbing activities and vegetation removal would occur with Temperance Flat RM 274 Dam construction activities and associated structures that would permanently remove suitable habitat for American badger within the primary study area. Suitable habitat for badgers within the zone of inundation of the Temperance Flat RM 274

Reservoir would also be lost. It is assumed that all vegetation would be removed within the zone of inundation and therefore, no habitat value would remain for upland wildlife species even during periods of Temperance Flat RM 274 Reservoir drawdown. Estimated loss of suitable habitat for American badger within the primary study area is provided in Table 7-8. The permanent loss of suitable habitat for American badger would be substantial.

The use of construction equipment and increased roadway traffic during project construction could result in American badgers being struck and injured or killed. Construction activity and subsequent inundation could result in the loss of active badger dens within the primary study area. These impacts would be moderate in intensity.

Increased noise and lighting within the primary study area during construction could result in displacing badgers from the construction area. These impacts would be moderate in intensity.

The creation of additional recreational facilities within the primary study area could result in increased human presence within the primary study area after project construction. These new facilities would include campgrounds, boat launches, trails, and access roads. The indirect impacts on remaining suitable habitat for badgers could result in avoidance of suitable habitat with human presence or increased interaction of badgers with humans and associated species such as dogs that could result in injury to or death of badgers. These indirect impacts would be moderate in intensity.

This impact would be **significant** under the action alternatives. Mitigation for this impact is proposed below in the Mitigation Measures section.

Impact WLD-7: Substantial Impact on San Joaquin Pocket Mouse

Primary Study Area

No Action Alternative   Implementing the No Action Alternative would not result in any impacts associated with the development of the Temperance Flat RM 274 Dam and Reservoir on natural habitats that support wildlife species or result in changes to existing management activities. Future development in Fresno and Madera counties would continue in accordance with these counties’ respective general plans.

Limited rural residential development is expected to occur, resulting in loss of open space and degradation of wildlife habitat from increased noise, increased light and glare, and other disturbances associated with developed land uses.

There would be **no impact** under the No Action Alternative.

Action Alternatives San Joaquin pocket mouse is a BLM sensitive species. It is not known to occur within the primary study area, but suitable grassland habitat does occur within the primary study area. This habitat type is limited within the primary study area and therefore, this species is not expected to occur extensively within the primary study area. However, ground disturbance and vegetation removal would occur associated with construction of the Temperance Flat RM 274 Dam and associated facilities that would permanently remove suitable habitat for the San Joaquin pocket mouse. Suitable habitat within the zone of inundation of the Temperance Flat RM 274 Reservoir would also be lost. It is assumed that all vegetation would be removed within the zone of inundation and therefore, no habitat value would remain for upland wildlife species even during periods of Temperance Flat RM 274 Reservoir drawdown. The permanent loss of suitable habitat for San Joaquin pocket mouse would be of moderate intensity.

The use of construction equipment and increased roadway traffic during project construction could result in San Joaquin pocket mice being struck and injured or killed. Construction activity and subsequent inundation could result in the loss of active burrows within the primary study area. These impacts would be moderate in intensity.

Increased noise and lighting within the primary study area during construction could result in displacing the San Joaquin pocket mouse from the construction area. These impacts would be moderate in intensity.

The creation of additional recreational facilities within the primary study area could result in increased human presence within the primary study area after project construction. These facilities include campgrounds, boat launches, trails, and access roads. These indirect impacts on remaining suitable habitat for San Joaquin pocket mice could result in the species avoiding suitable habitat with human presence, or could cause increased interaction of mice with humans and associated species such as dogs that could result in injury to or death of individuals. These indirect impacts would be moderate in intensity.

This impact would be **significant** under the action alternatives. Mitigation for this impact is proposed below in the Mitigation Measures section.

Impact WLD-8: Substantial Impact on Special-Status Bat Species

Primary Study Area
No Action Alternative Implementing the No Action Alternative would not result in any impacts associated with the development of the Temperance Flat RM 274 Dam and Reservoir on natural habitats that support wildlife species or result in changes to existing management activities. Future development in Fresno and Madera counties would continue in accordance with these counties' respective general plans. Limited rural residential development is expected to occur, resulting in loss of open space and degradation of wildlife habitat from increased noise, increased light and glare, and other disturbances associated with developed land uses.

There would be **no impact** under the No Action Alternative.

Action Alternatives The primary study area is known to support several special-status bat species, including Townsend's big-eared bat and western mastiff bat. Ground disturbance and vegetation removal associated with construction of the Temperance Flat RM 274 Dam and associated facilities would result in the loss of suitable foraging and roosting habitat for a variety of bat species. The new Temperance Flat RM 274 Reservoir area would likely support foraging habitat for some bat species that currently use Millerton Lake and the San Joaquin River for foraging. However, some foraging habitats within upland areas would be permanently lost or altered, and potential roosting habitat would be permanently lost. This loss of foraging and roosting habitat would be substantial.

The primary study area also contains several mines and the Millerton Lake Cave System, which provide potential roosting habitat for bat species. Several mines and portions of the Millerton Lake Cave System would be inundated by the Temperance Flat RM 274 Reservoir. The Millerton Lake Cave System is located at a range of 540 to 980 feet in elevation. At the maximum inundation level of 985 feet, the entire Millerton

Lake Cave System would be inundated. At typical lower Temperance Flat RM 274 Reservoir levels, some portion of the cave system would be available to roosting bats. It is unclear whether the loss of Millerton Lake Cave System would result in a significant loss of bat roosting habitat. A California State University, Sacramento, report prepared in 2013 (Graening 2013) found Townsend's big-eared bat carcasses within the Millerton Lake Cave System. The report speculated that the structure of the caves could result in a sink for bat species because they might not be able to escape the caves; however, for purposes of this analysis, it is assumed that the Millerton Lake Cave System may still provide suitable habitat for some bat species.

Some bat species also roost in trees or rock piles that would be removed during project construction and the subsequent Temperance Flat RM 274 Reservoir inundation. It is assumed that vegetation would be removed consistent with the three vegetation removal prescriptions described in Chapter 2, "Alternatives," and little to no habitat value would remain for roosting bat species within the Temperance Flat Reservoir Area even during periods of Temperance Flat RM 274 Reservoir drawdown. This loss of potential roosting habitat would be substantial.

Construction lighting could result in prey items (insects) being attracted to construction areas, which could result in bat species using construction areas. This could create a higher potential for bats to collide with construction equipment or facilities during construction. This impact would be moderate in intensity.

This impact would be **significant** under the action alternatives. Mitigation for this impact is proposed below in the Mitigation Measures section.

Impact WLD-9: Substantial Impact on Migratory and Wintering Deer Herds

Primary Study Area

No Action Alternative   Implementing the No Action Alternative would not result in any impacts associated with the development of the Temperance Flat RM 274 Dam and Reservoir on natural habitats that support wildlife species or result in changes to existing management activities. Future development in Fresno and Madera counties would continue in accordance with these counties' respective general plans.

Limited rural residential development is expected to occur, resulting in loss of open space and degradation of wildlife habitat from increased noise, increased light and glare, and other disturbances associated with developed land uses.

There would be **no impact** under the No Action Alternative.

Action Alternatives The primary study area is known to support wintering deer ranges and migratory deer herds (see the Other Wildlife Resources section under Primary Study Area). Construction of the Temperance Flat RM 274 Dam and subsequent inundation could result in loss of wintering habitat for mule deer herds. Migrating mule deer could also encounter difficulty in crossing the San Joaquin River during times of high water. Suitable wintering habitat would remain above the inundation area after construction is complete and operation of the Temperance Flat RM 274 Reservoir is initiated. However, loss of a wintering ground could occur for any wintering grounds currently within the zone of inundation. This loss of potential wintering habitat would be moderate.

This impact would be **significant** under the action alternatives. Mitigation for this impact is proposed below in the Mitigation Measures section.

Impact WLD-10: Potential Conflict with Fresno County and Madera County General Plan Objectives and Guidelines

Primary Study Area
No Action Alternative Future development in Fresno and Madera counties would continue in accordance with these counties' respective general plans.

There would be **no impact** under the No Action Alternative.

Action Alternatives The Fresno County and Madera County General Plans have an objective to protect natural communities within their boundaries. Implementing any of the action alternatives would result in significant impacts on natural upland and wetland communities that provide habitat for wildlife species that are included in the county general plans.

This impact would be **significant** under the action alternatives. No feasible avoidance or minimization measures are available to reduce this impact below the level of significance. Mitigation for this impact is not proposed because no feasible mitigation is available to reduce the impact to a less-than-significant level.

Impact WLD-11: Potential Reduction in Habitat or Populations of Special-Status Invertebrates

Extended Study Area

No Action Alternative Under the No Action Alternative, continued modifications to San Joaquin River instream flows and channel dimensions will be implemented by the SJRRP. These changes would enhance ecosystem values of the river, benefiting a variety of fish and aquatic species. These changes are not expected to adversely affect habits for special-status invertebrates.

There would be **no impact** under the No Action Alternative.

Action Alternatives Most of the special-status invertebrates known to occur in the vicinity of the extended study area between Friant Dam and the Merced River, as discussed above in the Affected Environment section, are found in habitats that occur above the alluvial plain, such as grassland, vernal pool, and alkaline scrub habitats. Special-status invertebrates associated with these habitat types would not be affected by water releases within the current channel capacity of the San Joaquin River and other conveyance channels.

Valley elderberry longhorn beetle is associated with elderberry shrubs, which occur in riparian woodland and scrub habitat from Friant Dam to the Delta. There is limited potential for elderberry shrubs to be present in areas occasionally receiving additional water supply from the Temperance Flat RM 274 Reservoir; elderberry shrubs are not commonly found growing immediately next to the river’s edge, but are often found on floodplain terraces or higher up the bank.

Implementing any of the action alternatives would increase water delivery reliability from Millerton Lake. This increased delivery would be conveyed within existing water conveyance channels. About 28 to 37 TAF of the added water supply provided by the new Temperance Flat RM 274 Reservoir would be discharged to the San Joaquin River for conveyance to SOD CVP and SWP water contractors; however, these additional water supplies would not exceed current channel capacity of the San Joaquin River or other waterways and would not result in a change in the current operation of Friant Dam. The host plant for valley elderberry longhorn beetle — blue elderberry—is adapted to annual variation in flooding and the overall flow patterns, water depth, and frequency and duration of flooding in these waterways would be within the current normal range of variation. The increased water supply is not likely to prevent establishment or substantially reduce the vigor of existing elderberry shrubs in the extended study area. Therefore, valley elderberry longhorn beetle would not be substantially affected by the additional water supply.

Elderberry shrubs that could serve as host species for valley elderberry longhorn beetle are also found along the San Joaquin River downstream from the Merced River and in the CVP and SWP water service areas. Because the contribution from Friant Dam becomes a smaller proportion of the total flow, because of contributions from other major tributaries (e.g., the Merced, Tuolumne, and Stanislaus Rivers), the additional water supply would not result in substantial changes in water levels, flood frequency or magnitude, or other conditions or events that could affect vegetation in the San Joaquin River from the Merced River to the Delta, or in the Delta. Thus, any changes downstream from the Merced River confluence, in the Delta, or in the CVP and SWP water service areas, would not be sufficient to affect special-status invertebrate species.

Project implementation is not expected to substantially alter potential habitat for special-status invertebrate species or result in direct removal of any special-status invertebrate occurrences in the extended study area.

This impact would be **less than significant** under the action alternatives. Therefore, mitigation for this impact is not needed and thus not proposed.

Impact WLD-12: Potential Reduction in Habitat or Populations of Special-Status Amphibians and Reptiles

Extended Study Area

No Action Alternative Under the No Action Alternative, continued modifications to San Joaquin River instream flows and channel dimensions will be implemented by the SJRRP. These changes would enhance ecosystem values of the river, benefiting a variety of fish and aquatic species. These changes are not expected to adversely affect habits for special-status amphibians and reptiles.

There would be **no impact** under the No Action Alternative.

Action Alternatives Most of the special-status amphibians and reptiles known to occur in the vicinity of the extended study area between Friant Dam and the Merced River, as discussed in the Affected Environment section, are found in habitats that occur above the alluvial plain, such as grassland and alkaline scrub habitats. Special-status amphibians and reptiles associated with these habitat types would not be affected by water releases within the current channel capacity of the San Joaquin River and other conveyance channels.

GGS, a species Federally and State listed as threatened, inhabits aquatic features such as emergent marsh and sloughs and adjacent upland habitat in isolated areas, particularly in suitable habitat within the San Luis NWR complex in the extended study area. GGS require, among other habitat components, adequate water during the snake's primary active period (i.e., early spring through mid-fall), abundant emergent, herbaceous wetland vegetation for escape cover and foraging habitat, and upland habitat for basking, cover, and retreat sites. Thus, there is limited potential for GGS to be present in areas occasionally receiving additional water supply from the Temperance Flat RM 274 Reservoir.

Western pond turtle is found throughout the extended study area in riparian habitat with abundant basking habitat and escape cover, particularly within the San Luis NWR complex. Western pond turtle use low-velocity areas of the main channels of the San Joaquin River and are not restricted to habitat closest to the water's surface. More suitable aquatic habitats generally have standing and slow-moving water, which typically occurs in off-channel areas, such as side channels and backwater areas.

Implementing any of the action alternatives would increase water delivery reliability from Millerton Lake. This increased delivery would be conveyed within existing water conveyance channels. About 28 to 37 TAF of the added water supply provided by the new Temperance Flat RM 274 Reservoir would be discharged to the San Joaquin River for conveyance to SOD CVP and SWP water contractors; however, these additional water supplies would not exceed current channel capacity of the San Joaquin River or other waterways and would not result in a change in the current operation of Friant Dam. GGS and western pond turtles are adapted to annual variation in flooding and the overall flow patterns, water depth, and frequency and duration of flooding in these waterways would be within the current normal range of variation. The increased water supply is not likely to eliminate foraging or basking habitat for either the GGS or western pond turtle, and is not expected to result in direct take of individuals at nest sites, because the water would not be released at a higher velocity.

GGS and western pond turtles are also found along the San Joaquin River downstream from the Merced River and in the CVP and SWP water service areas. Because the contribution from Friant Dam becomes a smaller proportion of the total flow because of contributions from other major tributaries (e.g., the Merced, Tuolumne, and Stanislaus Rivers), the additional water supply would not result in substantial changes in water levels, flood frequency or magnitude, or other conditions or events that could affect vegetation in the San Joaquin River from the Merced River to the Delta, or in the Delta. Thus, any changes downstream from the Merced River confluence, in the Delta, or in the CVP and SWP water service areas, would not be sufficient to affect special-status amphibian and reptile species.

Project implementation is not expected to substantially alter potential habitat for special-status amphibian and reptile species or result in direct removal of any special-status amphibian and reptile occurrences in the extended study area.

This impact would be **less than significant** under the action alternatives. Therefore, mitigation for this impact is not needed and thus not proposed.

Impact WLD-13 Potential Reduction in Habitat or Populations of Special-Status Bird Species

Extended Study Area
No Action Alternative Under the No Action Alternative, continued modifications to San Joaquin River instream flows and channel dimensions will be implemented by the SJRRP. These changes would enhance ecosystem values of the river, benefiting a variety of fish and aquatic species. These changes are not expected to adversely affect habits for special-status bird species.

There would be **no impact** under the No Action Alternative.

Action Alternatives Several special-status birds known to occur in the vicinity of the extended study area between Friant Dam and the Merced River, as discussed in the Affected Environment section, are found in habitats that occur above the alluvial plain, such as grassland, rock ledges, and alkaline scrub habitats. Special-status birds associated with these habitat types would not be affected by water releases within the current channel capacity of the San Joaquin River and other conveyance channels.

The riparian and wetland habitats along the San Joaquin River between Friant Dam and the Merced River provide potential nesting and foraging habitat for a wide array of protected bird species. Least Bell's vireo (Federally and State listed as endangered) and yellow warbler, for example, nest in riparian vegetation in channels of the San Joaquin River within the San Luis NWR. In addition, there are rookeries for species such as double-crested cormorant (Watch List species) which could occur in snags and trees within the stream channel. Raptors, such as Cooper's hawk (Watch List species), white-tailed kite (fully protected species), and Swainson's hawk (State listed as threatened) could nest in trees in the riparian woodlands within the stream channel.

Implementing any of the action alternatives would increase water delivery reliability from Millerton Lake. About 28 to 37 TAF of the added water supply provided by the new Temperance Flat RM 274 Reservoir would be discharged to the San Joaquin River for conveyance to SOD CVP and SWP water contractors; however, these additional water supplies would not exceed current channel capacity of the San Joaquin River or other waterways and would not result in a change in the current operation of Friant Dam. Birds that use riparian habitat within the San Joaquin Valley are adapted to annual variation in flooding; and the overall flow patterns, water depth, and frequency and duration of flooding in these waterways would be within the current normal range of variation. The increased water supply is not likely to substantially reduce the available roosting, foraging, or nesting habitat in the extended study area. Therefore, special-status bird species would not be substantially affected by the additional water supply.

Protected bird species, such as California black rail (State listed as threatened), Modesto population song sparrow (California Species of Special Concern) and yellow-headed blackbird (California Species of Special Concern), are also found along the San Joaquin River downstream from the Merced River and/or in the CVP and SWP water service areas. Because the contribution from Friant Dam becomes a smaller proportion of the total flow because of contributions from other major tributaries (e.g., the Merced, Tuolumne, and Stanislaus Rivers), the additional water supply would not result in substantial changes in water levels, flood frequency or magnitude, or other conditions or events that could affect vegetation in the San Joaquin River from the Merced River to the Delta, or in the Delta. Thus, any changes downstream from the Merced River confluence, in the Delta, or in the CVP and SWP water service areas, would not be sufficient to affect special-status bird species.

Project implementation is not expected to substantially alter potential habitat for special-status bird species or result in direct removal of any special-status birds in the extended study area.

This impact would be **less than significant** under the action alternatives. Therefore, mitigation for this impact is not needed and thus not proposed.

Impact WLD-14: Potential Reduction in Habitat or Populations of Special-Status Mammal Species

Extended Study Area

No Action Alternative Under the No Action Alternative, continued modifications to San Joaquin River instream flows and channel dimensions will be implemented by the SJRRP. These changes would enhance ecosystem values of the river, benefiting a variety of fish and aquatic species. These changes are not expected to adversely affect habits for special-status mammal species.

There would be **no impact** under the No Action Alternative.

Action Alternatives Several special-status mammals known to occur in the vicinity of the extended study area between Friant Dam and the Merced River, as discussed in the Affected Environment section, are found in habitats that occur above the alluvial plain, such as grassland, rock ledges, and alkaline scrub habitats. Special-status mammals associated with these habitat types would not be affected by water releases within the current channel capacity of the San Joaquin River and other conveyance channels.

Special-status mammals known to occur, or with the potential to occur, in the extended study area between Friant Dam and the Merced River include pallid bat, Townsend’s big-eared bat, western red bat, western mastiff bat, ringtail, riparian woodrat, and riparian brush rabbit. Riparian habitat can provide important foraging and roosting habitat for bats and ringtail, but none of the bat species listed are typically solely dependent on riparian habitats, and neither is the ringtail. Therefore, potential foraging and roosting habitat would not be substantially affected.

The riparian brush rabbit (Federally and State listed as endangered) and riparian woodrat (Federally listed as endangered, California Species of Special Concern) are more dependent on high-quality riparian habitat. The riparian brush rabbit is restricted to several populations at Caswell Memorial State Park, along the Stanislaus River near Manteca in San Joaquin County; and along Paradise Cut, a channel of the San Joaquin River in the southern part of the Delta. These populations inhabit woodlands dominated by dense wild rose and grape. In addition, the species was recently reintroduced on the San Joaquin River NWR (Williams 1993; Williams and Basey 1986). The riparian woodrat is known to occur only at Caswell Memorial State Park in riparian woodlands with live oak and shrub components. Both species are not expected to be present within the area between Friant Dam to the Merced River.

Implementing any of the action alternatives would increase water delivery reliability from Millerton Lake. This increased delivery would be conveyed within existing water conveyance channels. About 28 to 37 TAF of the added water supply provided by the new Temperance Flat RM 274 Reservoir would be discharged to the San Joaquin River for conveyance to SOD CVP and SWP water contractors; however, these additional water supplies would not exceed current channel capacity of the San Joaquin River or other waterways and would not result in a change in the current operation of Friant Dam. The increased water supply is not likely to eliminate foraging or nesting habitat for either the riparian brush rabbit or riparian woodrat.

As mentioned above, small, restricted populations of riparian brush rabbit and riparian woodrat are found adjacent to the San Joaquin River downstream from the Merced River west of Modesto. Because the contribution from Friant Dam becomes a smaller proportion of the total flow because of contributions from other major tributaries (e.g., the Merced, Tuolumne, and Stanislaus Rivers), the additional water supply would not result in substantial changes in water levels, flood frequency or magnitude, or other conditions or events that could affect vegetation in the San Joaquin River from the Merced River to the Delta or in the Delta. Thus, any changes downstream from the Merced River confluence, in the Delta, or in the CVP and

SWP water service areas, would not be sufficient to affect special-status mammal species.

Project implementation is not expected to substantially alter potential habitat for special-status mammal species or result in direct removal of any special-status mammal occurrences in the extended study area.

This impact would be **less than significant** under the action alternatives. Mitigation for this impact is not needed and thus not proposed.

Impact WLD-15: Potential Interference with Migratory Corridors or Nursery Sites

Extended Study Area

No Action Alternative Under the No Action Alternative, continued modifications to San Joaquin River instream flows and channel dimensions will be implemented by the SJRRP. These changes would enhance ecosystem values of the river, benefiting a variety of fish and aquatic species. These changes are not expected to adversely affect movement of migratory species, or migratory corridors, or nursery sites.

There would be **no impact** under the No Action Alternative.

Action Alternatives Because of historical habitat loss, many of the remaining areas that provide habitat connections between areas containing suitable habitat throughout the San Joaquin Valley are concentrated around numerous riparian corridors, including the San Joaquin River as it flows from Friant Dam until it reaches the Delta. These riparian corridors and their associated vegetation serve as some of the most important remaining functional wildlife corridors connecting natural lands throughout the Sacramento and San Joaquin Valley watersheds. The action alternatives would not interfere substantially with the movement of any native resident or migratory wildlife species, would not alter established native resident or migratory wildlife corridors, and wound not impede the use of native wildlife nursery sites. The average additional water supply delivery would not exceed current channel capacity of the San Joaquin River or other waterways and would not result in a change in the current operation of Friant Dam. This would not substantially change the riparian habitat within the channel.

This impact would be **less than significant** under the action alternatives. Mitigation for this impact is not needed and thus not proposed.

Impact WLD-16: Potential Impact on Riparian Habitat for Special-Status Bird Species

Extended Study Area

No Action Alternative Under the No Action Alternative, continued modifications to San Joaquin River instream flows and channel dimensions will be implemented by the SJRRP. These changes would enhance ecosystem values of the river, benefiting a variety of fish and aquatic species. These changes are not expected to adversely affect riparian habits for special bird species.

There would be **no impact** under the No Action Alternative.

Action Alternatives The flooding frequency could be reduced within the San Joaquin River system downstream from Friant Dam. Reduced frequency of scouring and sediment loading within riparian habitats could result in later successional stages of riparian habitat (i.e., more mature riparian) developing in areas that are currently subject to more frequent scouring.

Bird species that nest in early- to mid-successional riparian habitat, such as least Bell's vireo or yellow-breasted chat, could be substantially affected if this potential modification to riparian habitats were to occur. The SJRRP (anticipated under the No Action Alternative and action alternatives alike) includes monitoring and management activities to benefit riparian habitat. All action alternatives described in this Draft EIS would enhance riparian habitat restoration along the San Joaquin River under the SJRRP, by providing the following effects:

- The reduced frequency, magnitude, and duration of Friant Dam releases greater than Restoration Flows would:
    - Reduce the risk of damage to SJRRP instream and floodplain investments
    - Increase flexibility for managing riparian recruitment flows and flexible flow periods
    - Reduce the potential for riparian zone/bank erosion

- Reduce frequency, magnitude, and duration of floodplain habitat inundation
- Improve flexibility in management of Restoration Flows with no effect on water deliveries, including increased operational flexibility for providing buffer flows and pulse flows for gravel mobilization

Least Bell's vireo and yellow-breasted chat are not widespread within the San Joaquin River system currently, but as stated earlier, least Bell's vireo does appear to be spreading northward and expanding into historical parts of its range. Given the potential for riparian bird species that use mid-successional riparian stages to be present within the San Joaquin River system in the extended study area and the potential for conversion of existing riparian to more mature riparian habitat, this potential impact may substantially affect nesting habitat for these bird species.

This impact would be **potentially significant** under the action alternatives. Mitigation for this impact is proposed below in the Mitigation Measures section.

Impact WLD-17: Conflict with Local or Regional Policies Protecting Wildlife Resources

Extended Study Area

No Action Alternative Under the No Action Alternative, continued modifications to San Joaquin River instream flows and channel dimensions will be implemented by the SJRRP. Implementing the No Action Alternative would not result in changes to the current implementation of local or regional policies and plans protecting wildlife resources.

There would be **no impact** under the action alternatives.

Action Alternatives As discussed in Chapter 6, "Biological Resources – Botanical and Wetlands," there would be no change in existing use of adjacent lands or changes to habitat types that could substantially adversely affect resources for special-status wildlife protected under local and regional policies and plans. Implementing any of the action alternatives therefore would not conflict with local land use policies, such as county and city general plan policies.

There would be **no impact** under the action alternatives. Mitigation for this impact is not needed and thus not proposed.

Impact WLD-18: Potential Conflict with Adopted Conservation Plans

Extended Study Area

No Action Alternative Implementing the No Action Alternative would not result in conflicts with adopted conservation plans.

There would be **no impact** under the No Action Alternative.

Action Alternatives There would be no change in existing use of adjacent lands or changes to habitat types that could substantially adversely affect resources for special-status wildlife protected under adopted conservation plans.

Implementing any of the action alternatives would not change the regular operation of Friant Dam so it would not interfere with the recovery or maintenance goals for covered wildlife species within the extended study area. Therefore, implementing any of the action alternatives would not conflict with goals of conserving protected wildlife species.

Implementing any of the action alternatives also would not conflict with CALFED Bay-Delta Program objectives up through the Delta and in the CVP and SWP water service areas, as described in Chapter 7, "Biological Resources – Botanical and Wetlands." Implementing any of the action alternatives therefore would not conflict with goals of adopted conservation plans.

There would be **no impact** under the action alternatives. Therefore, mitigation for this impact is not needed and thus not proposed.

Mitigation Measures

This section discusses mitigation measures for each significant impact described in the Direct and Indirect Impacts section.

No mitigation is required for Impacts WLD-11 through WLD-18 within the primary study area or for Impacts WLD-1 through WLD-15, WLD-17, and WLD-18 within the extended study area because there would be no impact or the impact would be less than significant for all action alternatives.

Impacts WLD-1, WLD-2, and WLD-4 through WLD-9 within the primary study area would be significant. Implementing Mitigation Measures WLD-1a through WLD-2d, and WLD-4d through WLD-9 would reduce these impacts to a **less-than-significant** level.

Impact WLD-3 within the primary study area would be significant. Implementing Mitigation Measures WLD-3a through WLD-3g would reduce this impact on California spotted owl, burrowing owl, American peregrine falcon, prairie falcon, merlin, Cooper's hawk, sharp-shinned hawk, osprey, and northern harrier to a less-than-significant level. Implementing Mitigation Measure WLD-3a would reduce the significant impact on bald eagle and golden eagle, but not to a less-than-significant level. This impact would be **significant and unavoidable**.

Impact WLD-10 within the primary study area would be significant. Mitigating Impact WLD-10 is infeasible because it would require an amendment to the Fresno County and Madera County general plans. An amendment to these plans is not considered likely in the near term. Therefore, Impact WLD-10 (within the primary study area) would be **significant and unavoidable**.

Impact WLD-16 within the extended study area would be potentially significant. Implementing Mitigation Measure WLD-16 would reduce this impact to a **less-than-significant** level.

Mitigation Measure WLD-1a: Mitigate Impacts on VELB

To avoid, minimize, or mitigate impacts on valley elderberry longhorn beetle, Reclamation will implement the following measures in accordance with the USFWS's *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999b):

a) Preconstruction surveys shall be conducted by a qualified biologist in accessible suitable habitat within the primary study area and a 100-foot buffer to identify all elderberry shrubs that could potentially be affected by construction and operation of the project. Observed elderberry shrubs shall be mapped with a GPS unit to determine whether the shrubs can be avoided during construction or would likely be located outside of the eventual Temperance Flat RM 274 Reservoir inundation area. The preconstruction survey shall be conducted in a suitable timeframe to allow for adequate time to develop an appropriate elderberry mitigation plan (approximately 1 year before the initiation of construction).

b) All elderberry shrubs within 100 feet of the construction area or the Temperance Flat RM 274 Reservoir area of inundation shall be assessed for stem counts and to determine whether potential valley elderberry longhorn beetle exit holes are present. If elderberry shrubs with a stem diameter greater than 1 inch are observed within 100 feet of the construction area or the area of inundation, Reclamation will consult with USFWS to determine the appropriate mitigation measures.

c) Elderberry shrubs to be avoided shall have a minimum 100-foot buffer zone established around each shrub to the extent possible. If the avoidance buffer must be less than 100 feet, USFWS shall be consulted as to whether a reduced buffer is adequate or whether the shrub shall require transplanting.

d) All shrubs to be avoided during construction shall be flagged before construction, and exclusion fencing shall be erected around the shrubs so that they are not inadvertently damaged during project construction activities. The fencing shall be placed at least 20 feet from the dripline of the shrub. Signs shall be placed every 50 feet on the fencing that state: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and it must not be disturbed. This species is protected by the ESA. Violators are subject to prosecution, fines, and imprisonment." The signs shall be clearly readable from a distance of 20 feet. The signs and the fencing shall be maintained for the duration of construction.

e) Before any work occurs in the primary study area, including grading, a qualified wildlife biologist shall conduct mandatory contractor/worker awareness training for all construction personnel. The awareness training will brief personnel on the need to avoid impacts on valley elderberry longhorn beetle and the penalties for not complying with biological mitigation requirements. If new construction personnel are added to the project, the contractor shall ensure that the personnel receive the mandatory training before starting work.

f) Dust control measures shall be implemented for all ground-disturbing activities in the primary study area. These measures could include application of water to graded and disturbed areas that are unvegetated. To avoid attracting Argentine ants, at no time will water be sprayed within the driplines of elderberry shrubs.

g) For elderberry shrubs located in previously inaccessible habitat during the preconstruction survey, as well as shrubs that cannot be avoided within the primary study area, Reclamation will consult with USFWS to identify the appropriate mitigation ratio for shrub transplantation in a designated area or purchase credits in a USFWS-approved valley elderberry longhorn beetle mitigation bank. USFWS general compensation guidelines call for replacement of elderberry plants in designated mitigation areas at a ratio from 1:1 to 8:1 depending on stem size, habitat, and evidence of occupancy by beetles. Replacement stock shall be obtained from local sources.

h) Transplantation of shrubs shall occur during the shrub’s dormancy phase as prescribed by the USFWS guidelines.

i) Reclamation will prepare a summary report for submittal to USFWS documenting the number of shrubs transplanted, associated plantings, and location of transplantation. If shrubs are transplanted by Reclamation, Reclamation will be responsible for providing periodic monitoring reports to USFWS to document the success or failure of transplants according to USFWS reporting guidelines (USFWS 1999b). If valley elderberry longhorn beetle mitigation credits are purchased, the mitigation bank operator shall be responsible for the preparation of monitoring reports.

Implementing Mitigation Measure WLD-1a would reduce the significant impact on valley elderberry longhorn beetle to a **less-than-significant** level.

Mitigation Measure WLD-1b: Mitigate Impacts on Pipevine Swallowtail

To avoid, minimize, or mitigate impacts on the pipevine swallowtail, the following measures shall be implemented by Reclamation or its designated representative where habitat with California pipevine populations occurs:

a) Preconstruction surveys shall be conducted by a qualified biologist to locate and map populations of the host plant for pipevine swallowtail (California pipevine) within the primary study area, where accessible. Surveys shall be conducted sufficiently in advance of project construction to allow for development of a mitigation plan as needed for pipevine swallowtail (approximately 6 to 8 months before construction begins).

b) All identified suitable pipevine swallowtail habitat shall be avoided, if feasible, during construction activities. California pipevine plants to be avoided during construction shall be flagged, and orange construction fencing shall be erected with a 10-foot buffer around the plants.

c) A qualified wildlife biologist shall conduct mandatory contractor/worker awareness training for construction personnel as described in the discussion of Mitigation Measure WLD-1a that includes a summary of pipevine swallowtail habitat to be avoided during construction. The awareness training shall be provided to all construction personnel to brief them on the need to avoid impacts on pipevine swallowtail.

d) Dust control measures shall be implemented for all ground-disturbing activities in the primary study area. These measures could include application of water to graded and disturbed areas that are unvegetated.

e) For California pipevine populations located in habitats that were previously inaccessible during the preconstruction survey, as well as for plants that cannot be avoided within the primary study area, including the inundation area, Reclamation will consult with BLM to use the appropriate mitigation ratio for pipevine restoration, transplanting, or propagation in an approved riparian habitat conservation easement with suitable habitat. Reclamation will prepare a monitoring plan for any transplanted or nursery-grown pipevine plants that includes appropriate success criteria to reasonably assure the continued persistence of California pipeline populations within the primary study area.

Implementing Mitigation Measure WLD-1b would reduce the significant impact on pipevine swallowtail to a **less-than-significant** level.

Mitigation Measure WLD-1c: Mitigate Impacts on Listed Vernal Pool Branchiopods

To avoid, minimize, or mitigate impacts on listed vernal pool branchiopods, the following measures shall be applied where suitable vernal pool habitat for listed vernal pool branchiopods occurs within the primary study area.

a) To the extent possible, Reclamation will design the transmission lines and associated ground-disturbing features, such as access roads, to avoid vernal pool habitat. Vernal pool habitat would be considered to not be affected if towers and transmission poles are located a minimum of 250 feet from the outer edge of any vernal pool, swale or other suitable wetland feature for vernal pool invertebrates. Alternatively, Reclamation and USFWS may conduct site visits to inspect the unique characteristics of specific vernal pool habitat and approve reductions to the 250-foot buffer, if appropriate. Buffers shall be marked by brightly colored fencing or flagging throughout the construction process.

b) Construction personnel shall participate in a USFWS-approved worker environmental awareness program that shall include avoidance and minimization measures for working in or near suitable vernal pool invertebrate habitat. A qualified biologist approved by USFWS shall inform all construction personnel about the life history of listed vernal pool invertebrates, and the importance of avoiding their habitat.

If impacts on vernal pool habitat cannot be fully avoided, the following measures shall be implemented:

a) Protocol-level surveys shall be conducted based on USFWS protocols (USFWS 1996b) to determine presence or absence of listed vernal pool branchiopod species within vernal pools or other wetlands that represent potential habitat. The results of those surveys are subject to approval by USFWS. If Reclamation does not conduct protocol-level surveys, then presence shall be assumed.

b) Mitigation for loss of suitable vernal pool branchiopod habitat shall be achieved by one of the following means:

   1. Acquire creation and preservation vernal pool credits in a USFWS-approved mitigation bank at an acreage ratio approved by USFWS.

   2. Create and manage suitable vernal pool habitat and preserved vernal pool habitat in perpetuity at the same acreage ratio as required under the mitigation bank credit option above. USFWS shall approve any habitat preservation and creation that is proposed by Reclamation.

Implementing Mitigation Measure WLD-1c would reduce the potentially significant impact on listed vernal pool branchiopods to a **less-than-significant** level.

Mitigation Measure WLD-2a: Mitigate Impacts on California Tiger Salamander and Western Spadefoot

To avoid, minimize, or mitigate impacts on California tiger salamander and western spadefoot, the following measures shall be implemented where suitable habitat for these species occurs within the primary study area:

a) Habitat assessments shall be conducted by a qualified biologist within suitable breeding, and associated upland refugia habitat that is accessible to the species and within the maximum dispersal distance (up to 1 mile) from suitable breeding habitat, within the primary study area to identify all potential California tiger salamander and western spadefoot habitat that could potentially be affected by construction and operation of the project. The habitat assessment shall be conducted in a suitable timeframe to allow for adequate time to develop an appropriate California tiger salamander and western spadefoot mitigation plan (approximately 1 year before the expected initiation of construction).

b) To the extent possible, suitable breeding habitat and associated accessible upland habitat for California tiger salamander and western spadefoot within the primary study area shall be avoided. Suitable breeding habitat shall be considered to be avoided if construction activities and the Temperance Flat RM 274 Reservoir zone of inundation are located outside of the modeled watershed of potential California tiger salamander and western spadefoot breeding habitat.

c) Protocol-level surveys of California tiger salamander are infeasible within most portions of the primary study area because of steep terrain that precludes establishment of drift fences. Therefore, any suitable breeding habitat and associated upland habitat that cannot be precluded as occupied to the satisfaction of CDFW and USFWS shall require mitigation.

d) Habitat mitigation for California tiger salamander and western spadefoot shall be incorporated into the overall habitat mitigation plan for the project. Mitigation lands shall be required to support all life cycles of California tiger salamander and western spadefoot.

e) A special-status amphibian and reptile relocation plan shall be prepared by a biologist familiar with the herpetofauna that could potentially occur within the primary study area. The relocation plan shall include handling techniques for California tiger salamander and western spadefoot individuals and shall identify a designated relocation area outside of the construction area. The relocation plan shall be approved by USFWS and CDFW before the initiation of construction within suitable breeding habitat or associated upland habitat.

f) Preconstruction surveys shall be performed by a permitted and USFWS- and CDFW-approved biologist no more than 30 days before construction activities that occur within suitable California tiger salamander or western spadefoot breeding habitat that is or would be naturally inundated during the time of construction. Any California tiger salamander or western spadefoot individuals located during the preconstruction survey shall be relocated to the designated relocation area identified in the special-status amphibian and reptile relocation plan. The permitted biologist shall report the results of the preconstruction survey, including information on the relocation of California tiger salamander or western spadefoot within 30 days of completion of the survey.

Implementing Mitigation Measure WLD-2a would reduce the significant and potentially significant impacts on California tiger salamander and western spadefoot to a **less-than-significant** level.

Mitigation Measure WLD-2b: Mitigate Impacts on Foothill Yellow-Legged Frog and California Red-Legged Frog

To avoid, minimize, or mitigate impacts on foothill yellow-legged frog and California red-legged frog, the following measures shall be implemented where suitable habitat for these species occurs within the primary study area:

a) Habitat assessments shall be conducted by a qualified biologist within suitable breeding habitat and adjacent upland refugia habitat accessible to the species within the primary study area that is within the known dispersal distance of the species (up to 1 mile) to identify all potential foothill yellow-legged frog and California red-legged frog habitat that could potentially be affected by construction and operation of the project and all accessible upland refugia habitat that could potentially be affected by the project. The habitat survey shall be conducted in a suitable timeframe to allow for adequate time to develop an appropriate mitigation plan as needed (approximately 1 year before the expected initiation of construction).

b) To the extent possible, suitable breeding habitat and associated accessible upland habitat for foothill yellow-legged frog and California red-legged frog within the primary study area shall be avoided.

c) If determined to be necessary by USFWS and CDFW, protocol-level surveys for foothill yellow-legged frog and California red-legged frog shall be conducted within the primary study area to assist in the determination of the presence or absence of foothill yellow-legged frog and California red-legged frog and the usage patterns of habitat within the primary study area by these species. The results of those surveys shall be presented to USFWS and CDFW.

d) Habitat mitigation for foothill yellow-legged frog and California red-legged frog shall be incorporated into the overall habitat mitigation plan for the project if the species are found to occur within the primary study area and their habitat would be affected by construction and operation of the project. Any mitigation lands for foothill yellow-legged frog and California red-legged frog shall be required to support all life cycles of foothill yellow-legged frog and California red-legged frog.

e) A special-status amphibian and reptile relocation plan shall be prepared by a biologist familiar with the herpetofauna that could potentially occur within the primary study area including foothill yellow-legged frog and California red-legged frog. The relocation plan shall be approved by USFWS and CDFW before the initiation of construction within suitable breeding habitat or associated upland habitat.

f) Preconstruction surveys shall be performed by a permitted and USFWS- and CDFW-approved biologist no more than 30 days before construction activities that occur within suitable foothill yellow-legged frog or California red-legged frog breeding habitat that is or would be naturally inundated during the time of construction. Any foothill yellow-legged frog or California red-legged frog individuals located during the preconstruction survey shall be relocated to the designated relocation area identified in the special-status amphibian and reptile relocation plan. The permitted biologist shall report the results of the preconstruction survey, including information on the relocation of California red-legged frog or foothill yellow-legged frog individuals, within 30 days of the completion of the survey.

Implementing Mitigation Measure WLD-2b would reduce the significant impact on foothill yellow-legged frog and California red-legged frog to a **less-than-significant** level.

Mitigation Measure WLD-2c: Mitigate Impacts on Western Pond Turtle

To avoid, minimize, or mitigate impacts on western pond turtle, Reclamation will implement the following measures where suitable habitat for this species occurs within the primary study area:

a) Habitat surveys shall be conducted by a qualified biologist within accessible suitable habitat within the primary study area and up to a 1,650-foot buffer, depending on accessibility of upland habitat to western pond turtle, to identify all potential western pond turtle habitat that could potentially be affected by construction and operation of the project and all accessible upland refugia habitat that could potentially be affected by the project. The habitat survey shall be conducted in a suitable timeframe to allow for adequate time to develop an appropriate mitigation plan as needed (approximately 1 year before the expected initiation of construction).

b) To the extent possible, suitable habitat for western pond turtle within the primary study area shall be avoided.

c) Habitat mitigation for western pond turtle shall be incorporated into the overall habitat mitigation plan for the project if the species is found to occur within the primary study area and its habitat would be affected by construction and operation of the project.

d) A special-status amphibian and reptile relocation plan shall be prepared by a biologist familiar with the herpetofauna that could potentially occur within the primary study area including western pond turtle. The relocation plan shall be approved by USFWS and CDFW before the initiation of construction within suitable breeding habitat or associated upland habitat.

e) Preconstruction surveys shall be performed by a permitted and USFWS- and CDFW-approved biologist no more than 30 days before construction activities that occur within suitable western pond turtle habitat that is or would be naturally inundated during the time of construction. Any western pond turtle individuals located during the preconstruction survey shall be relocated to the designated relocation area identified in the special-status amphibian and reptile relocation plan. The permitted biologist shall report the results of the preconstruction survey, including information on the relocation of western pond turtle individuals, within 30 days of the completion of the survey.

Implementing Mitigation Measure WLD-2c would reduce the significant and potentially significant impacts on western pond turtle to a **less-than-significant** level.

Mitigation Measure WLD-2d: Mitigate Impacts on Coast Horned Lizard

To avoid, minimize, or mitigate impacts on coast horned lizard, the following measures shall be implemented where suitable habitat for this species occurs within the primary study area:

a) Habitat mitigation for coast horned lizard shall be incorporated into the overall habitat mitigation plan for the project.

b) A special-status amphibian and reptile relocation plan shall be prepared by a biologist familiar with the herpetofauna that could potentially occur within the primary study area, including coast horned lizard. The relocation plan shall be approved by USFWS and CDFW before the initiation of construction within suitable habitat.

c) Any coast horned lizards found during project construction shall be moved to a designated relocation area as prescribed in the special-status amphibian and reptile relocation plan.

Implementing Mitigation Measure WLD-2d would reduce the significant impact on coast horned lizard to a **less-than-significant** level.

Mitigation Measure WLD-3a: Mitigate Impacts on Bald Eagle and Golden Eagle

To avoid, minimize, or mitigate impacts on bald eagle and golden eagle, Reclamation will prepare and implement a plan to protect bald eagles and golden eagles that incorporates guidelines found in the USFWS *Bald Eagle Management Guidelines* (USFWS 2007) and that is approved by USFWS and CDFW. The plan shall be prepared before the initiation of construction that could affect suitable habitat for bald and golden eagle within the primary study area. Specific to nesting eagles in the primary study area, the plan shall describe in detail actions for:

- Survey protocols for each species

- Nest monitoring for each species with conditions based on type and intensity of construction or recreational activity that could potentially affect an eagle nest

- Population monitoring within the primary study area after the majority of construction activities have been completed and the Temperance Flat RM 274 Reservoir has been inundated

- Improving nesting sites at existing locations in adjacent habitat, such as retrofitting transmission lines for nesting golden eagles, and reporting data on use of those features to USFWS and CDFW

- Habitat conservation for bald and golden eagles, including management guidelines for determining the quality of existing eagle nesting and foraging habitat and measures to enhance and preserve existing habitat; success criteria shall be established for mitigation sites, including annual long-term nest monitoring of eagle populations and reporting those data to the USFWS and CDFW each year

Reclamation will implement the following measures to avoid, minimize, or mitigate impacts on bald eagle and golden eagle:

a) Whenever feasible, construction near currently or recently active nest sites shall start outside the active nesting season (from December 15 through August 15 for bald eagles, and from January through August 15 for golden eagles).

b) If ground-breaking activities begin during the nesting period, a qualified biologist shall perform a preactivity survey 14 to 30 days before the start of each new activity phase to search for eagle nests within 0.5 mile of proposed activities. If active nests are not identified, no further action is required and construction may proceed. If active nests are identified, the avoidance guidelines identified below shall be implemented:

    - Construction contractors shall observe CDFW avoidance guidelines, which stipulate a minimum 0.25-mile buffer zone around active eagle nests. Buffer zones shall remain until young have fledged or until a qualified biologist has determined that the nest is no longer active. For activities conducted with agency approval within this buffer zone, a qualified biologist shall monitor construction activities and the eagle nest(s) at least twice weekly to monitor eagle reactions to activities. If activities are deemed to have a negative impact on nesting eagles, the biologist shall immediately inform the construction manager that work shall be halted, and CDFW shall be consulted to address potential impacts on active nests.

- After construction has been completed, Reclamation will have a qualified biologist survey for and monitor eagle nesting sites in the primary study area within 0.5 mile of known recreational sites to ensure that recreational activity and other beneficial uses of the Temperance Flat RM 274 Reservoir do not disrupt eagle nest sites. Surveys shall be performed at the beginning of the nesting season and continue throughout the nesting season at a schedule to be determined in the eagle management plan. Recreational access and other disruptive activities shall be suspended within 0.25 mile of active eagle nests until the young eagles have fledged or until a qualified biologist has determined that the nest is no longer active.

- The qualified biologist shall report the results of the preconstruction surveys and observed nests, including information on the success of the nest, within 30 days of the completion of the surveys.

c) A qualified biologist shall conduct a training session for all construction personnel. This training shall focus on the protection and conservation of protected, nonlisted special-status wildlife species, including bald eagles and golden eagles.

d) All food-related trash items (such as wrappers, cans, bottles, and food scraps) shall be disposed of in closed containers and removed daily from buffer zones near active nest sites to avoid attracting avian predators.

e) To prevent harassment and mortality of eagles or their nests during construction, no pets shall be allowed in the primary study area.

A substantial amount of suitable foraging habitat for golden eagle would be inundated as a result of construction of Temperance Flat RM 276 Dam. Although implementing a habitat mitigation plan would protect important oak woodland habitat that is suitable habitat to support golden eagle foraging, impacts on these habitats cannot be fully mitigated because the overall net loss of habitat that would result from construction and operation of the project would be substantial.

Implementing Mitigation Measure WLD-3a would reduce the significant impact on bald eagle and golden eagle, but not to a less-than-significant level. Impact WLD-3 would be **significant and unavoidable** because of the loss of a known bald eagle nesting location and foraging habitat for golden eagles within the primary study area.

Mitigation Measure WLD-3b: Mitigate Impacts on California Spotted Owl

To avoid, minimize, or mitigate impacts on California spotted owl, the following measures shall be implemented:

a) Whenever feasible, construction near recently active nest sites shall start outside the active nesting season (February 1 through August 31).

b) A protocol-level survey shall be conducted during the nesting season for at least one breeding season before the initiation of construction within the primary study area. A protocol-level survey shall be led by a qualified biologist experienced conducting California spotted owl surveys. The qualified biologist shall be approved by Reclamation and CDFW before preparing a protocol survey plan or conducting surveys. The protocol survey plan shall be prepared by the qualified biologist and submitted to Reclamation and CDFW for review and approval.

c) If ground-breaking activities begin during the nesting period, a qualified biologist shall perform a preactivity survey 14 to 30 days before the start of each new activity phase to search for California spotted owl nests within 0.5 mile of proposed activities in suitable habitat. If active nests are not identified, no further action is required and construction may proceed. If active nests are identified, the avoidance guidelines identified below shall be implemented:

    - Construction contractors shall observe a minimum 0.25-mile buffer zone around active California spotted owl nests. Buffer zones shall remain until young have fledged. For activities conducted with agency approval within this buffer zone, a qualified biologist shall monitor construction activities and the owl nest(s) to monitor owl reactions to activities. If activities are deemed to have a negative impact on nesting spotted owls, the biologist shall immediately inform the construction manager that work shall be halted, and CDFW shall be consulted.

- The permitted biologist shall report the results of the preconstruction surveys and observed nests, including information on the success of the nest, within 30 days of the completion of the nest monitoring.

d) A qualified biologist shall conduct a training session for all construction personnel. This training shall focus on the protection and conservation of protected, nonlisted special-status wildlife species, including California spotted owls.

e) All food-related trash items (such as wrappers, cans, bottles, and food scraps) shall be disposed of in closed containers and removed daily from buffer zones near active nest sites to avoid attracting avian predators.

f) To prevent harassment and mortality of California spotted owls or their nests, no pets shall be allowed during construction in the primary study area.

g) The habitat mitigation plan for the project shall include suitable foraging and nesting habitat for California spotted owls.

Implementing Mitigation Measure WLD-3b would reduce the significant impact on California spotted owl to a **less-than-significant** level.

Mitigation Measure WLD-3c: Mitigate Impacts on Burrowing Owl

To avoid, minimize, or mitigate impacts on burrowing owl, Reclamation will follow the guidelines set forth by the Staff Report on Burrowing Owl Mitigation (CDFW 2012), including the following measures:

a) *Nonbreeding season surveys*. Whenever feasible, construction near burrowing owl habitat shall start outside the active nesting season, from February 1 through August 31. For construction activity within suitable habitat during the nonbreeding season the following mitigation is required for burrowing owls:

- A qualified biologist shall conduct at least four visits within suitable burrowing owl habitat spread evenly throughout the non-breeding season. If active burrows are not identified, no further action is required and construction may proceed. If active burrows are identified, the avoidance guidelines identified below shall be implemented:

  i. Construction exclusion areas (e.g., orange exclusion fence or signage) shall be established around occupied burrows, where no disturbance shall be allowed. During the nonbreeding season (September 1 through January 31), the exclusion zone shall extend at least 164 feet around occupied burrows.

  ii. If required construction work areas conflict with owl burrows and associated buffers, passive relocation of on-site owls may be implemented as an alternative, but only during the nonbreeding season and only with CDFW approval. Passive relocation shall be accomplished by installing one-way doors on the entrances of burrows within164 feet of the primary study area. The one-way doors shall be left in place for 48 hours to ensure the owls have left the burrow. The burrows shall then be excavated with a qualified biologist present. Construction shall not proceed until the primary study area is deemed free of owls.

  iii. Unoccupied burrows within the immediate construction area shall be excavated using hand tools, and then filled to prevent reoccupation. If any burrowing owls are discovered during the excavation, the excavation shall cease and the owl shall be allowed to escape. Excavation could be completed when the biological monitor confirms the burrow is empty.

  iv. CDFW-approved methods shall be established to prevent recolonization by ground squirrels in the immediate construction area.

  v. If feasible, artificial nesting burrows shall be provided as a temporary measure when natural burrows are lacking. To compensate for lost nest burrows, artificial burrows shall be provided outside the buffer zone. The alternate burrows shall be monitored to confirm that the owls have moved in and acclimated to the new burrow.

vi. The qualified biologist shall report the results of the preconstruction surveys and observed burrows, including information on the success of the burrows, within 30 days of the completion of the burrow surveys and monitoring. Any monitoring of artificial nesting burrows shall also be reported to CDFW within 30 days following the completion of the monitoring.

b) *Breeding season surveys*. If ground-breaking activities will begin between February 1 and August 31, breeding season surveys shall be performed by a qualified biologist to determine the status of burrowing owl in suitable habitat within a suitable distance of construction boundaries according to the staff report. The staff report recommends conducting a total of four survey visits with at least one site visit between February 15 and April 15, and a minimum of three survey visits, at least 3 weeks apart, between April 15 and July 15, with at least one visit after June 15. A report of the breeding season surveys shall be provided to CDFW within 30 days of the completion of surveys.

c) *Take avoidance surveys*. As recommended in the staff report, take avoidance surveys shall be conducted in suitable burrowing owl habitat no less than 14 days before the initiation of construction, and a subsequent final survey shall be conducted in suitable burrowing owl habitat within 24 hours before ground disturbance. If active burrows are not identified, no further action is required and construction may proceed. If active burrows are identified, the avoidance guidelines identified below shall be implemented:

- During the breeding season (February 1 through August 31), impacts shall be minimized by establishing an appropriately sized buffer (according to the staff report) for all project-related construction activities until a qualified biologist confirms that the burrow is no longer active and CDFW concurs, or consultations with CDFW specifically allow certain construction activities to continue. The size of the buffer may be adjusted in consultation with CDFW. CDFW also shall be consulted to determine whether it is necessary to temporarily preserve foraging habitat (in addition to the buffer area) until the nest is no longer active.

- For activities conducted with agency approval within this buffer zone, a qualified biologist shall monitor construction activities and owl burrows to observe owl reactions to activities. If activities are deemed to have a negative impact on nesting owls, the biologist shall immediately inform the construction manager that work shall be halted, and CDFW shall be consulted.

d) A qualified biologist shall conduct a training session for all construction personnel. This training shall focus on the protection and conservation of protected, nonlisted special-status wildlife species, including burrowing owls.

e) All food-related trash items (such as wrappers, cans, bottles, and food scraps) shall be disposed of in closed containers and removed daily from buffer zones near active nest sites to avoid attracting avian predators.

f) To prevent harassment and mortality of owls or their nests, no pets shall be allowed during construction in the primary study area.

g) The habitat mitigation plan for the project shall include suitable foraging and nesting habitat for burrowing owls.

Implementing Mitigation Measure WLD-3c would reduce the significant impact on burrowing owl to a **less-than-significant** level.

Mitigation Measure WLD-3d: Mitigate Impacts on American Peregrine Falcon and Prairie Falcon

To avoid, minimize, or mitigate impacts on American peregrine falcon and prairie falcon, the following measures shall be implemented:

a) Whenever feasible, construction near recently active nest sites shall start outside the active nesting season (February 1 through August 31).

b) A nest monitoring protocol following the USFWS nest monitoring guidelines for peregrine falcons (USFWS 2003) shall be initiated for any construction activity that occurs within 0.5 mile of a known peregrine nest site. The USFWS nest monitoring guidelines call for a minimum of two, 4-hour monitoring periods to determine if a nest is not active.

- Construction contractors shall observe a minimum 0.25-mile buffer zone around active falcon nests. Buffer zones shall remain until young have fledged or until the qualified biologist has determined that the nest is no longer active. For activities conducted with agency approval within this buffer zone, a qualified biologist shall monitor construction activities and the falcon nest(s) to monitor falcon reactions to activities. If activities are deemed to have a negative impact on nesting falcons, the biologist shall immediately inform the construction manager that work shall be halted, and CDFW shall be consulted.

- The biologist shall report the results of the preconstruction surveys and observed nests, including information on the success of the nest, within 30 days of completion of the nest monitoring.

c) A qualified biologist shall conduct a training session for all construction personnel. This training shall focus on the protection and conservation of protected, nonlisted special-status wildlife species, including American peregrine falcon and prairie falcon.

d) The habitat mitigation plan for the project shall include suitable foraging habitat and cliff nesting habitat for American peregrine falcon and prairie falcon.

Implementing Mitigation Measure WLD-3d would reduce the significant impact on American peregrine falcon and prairie falcon to a **less-than-significant** level.

Mitigation Measure WLD-3e: Mitigate Impacts on Cooper's Hawk and Sharp-Shinned Hawk

To avoid, minimize, or mitigate impacts on Cooper's hawk and sharp-shinned hawk, the following measures shall be implemented:

a) Whenever feasible, construction near recently active nest sites shall start outside the active nesting season (February 1 through August 31).

b) If ground-breaking activities begin during the nesting period, a qualified biologist shall perform a preactivity survey 14 to 30 days before the start of each new activity phase to search for raptor nests within 0.25 mile of proposed activities in suitable habitat. If active nests are not identified, no further action is required and construction may proceed. If active nests are identified, the avoidance guidelines identified below shall be implemented:

- Construction contractors shall observe a minimum 500-foot buffer zone around active Cooper's hawk or sharp-shinned hawk nests. Buffer zones shall remain until young have fledged or until a qualified biologist determines that the nest is no longer active. For activities conducted with agency approval within this buffer zone, a qualified biologist shall monitor construction activities and the raptor nest(s) to monitor raptor reactions to activities. If activities are deemed to have a negative impact on nesting raptors, the biologist shall immediately inform the construction manager that work shall be halted, and CDFW shall be consulted.

- The qualified biologist shall report the results of the preconstruction surveys and observed nests, including information on the success of the nest, within 30 days of the completion of the survey.

c) A qualified biologist shall conduct a training session for all construction personnel. This training shall focus on the protection and conservation of protected, nonlisted special-status wildlife species, including Cooper's hawk and sharp-shinned hawk.

d) All food-related trash items (such as wrappers, cans, bottles, and food scraps) shall be disposed of in closed containers and removed daily from buffer zones near active nest sites to avoid attracting avian predators.

e) To prevent harassment and mortality of raptors or their nests, no pets shall be allowed in the primary study area during construction.

f) The habitat mitigation plan for the project shall include suitable foraging and nesting habitat for Cooper's hawk and sharp-shinned hawk.

Implementing Mitigation Measure WLD-3ewould reduce the significant impact on Cooper's hawk and sharp-shinned hawk to a **less-than-significant** level.

Mitigation Measure WLD-3f: Mitigate Impacts on Osprey
To avoid, minimize, or mitigate impacts on osprey, the following measures shall be implemented:

a) Whenever feasible, construction near recently active nest sites shall start outside the active nesting season (February 1 through August 31).

b) If ground-breaking activities begin during the nesting period, a qualified biologist shall perform a preactivity survey 14 to 30 days before the start of each new activity phase to search for osprey nests within 0.25 mile of proposed activities in suitable habitat. If active nests are not identified, no further action is required and construction may proceed. If active nests are identified, the avoidance guidelines identified below shall be implemented:

- Construction contractors shall observe a minimum 500-foot buffer zone around active osprey nests. Buffer zones shall remain until young have fledged or until a qualified biologist has determined that the nest is no longer active. For activities conducted with agency approval within this buffer zone, a qualified biologist shall monitor construction activities and the osprey nest(s) to monitor osprey reactions to activities. If activities are deemed to have a negative impact on nesting osprey, the biologist shall immediately inform the construction manager that work shall be halted, and CDFW shall be consulted.

- The qualified biologist shall report the results of the preconstruction surveys and observed nests, including information on the success of the nest, within 30 days of the completion of the survey.

c) A qualified biologist shall conduct a training session for all construction personnel focused on the protection and conservation of protected, nonlisted special-status wildlife species, including osprey.

d) All food-related trash items (such as wrappers, cans, bottles, and food scraps) shall be disposed of in closed containers and removed daily from buffer zones near active nest sites to avoid attracting avian predators.

e) To prevent harassment and mortality of ospreys or their nests, no pets shall be allowed in the primary study area during construction.

f) The habitat mitigation plan for the project shall include suitable oak woodland nesting habitat for osprey.

Implementing Mitigation Measure WLD-3f would reduce the significant impact on osprey to a **less-than-significant** level.

Mitigation Measure WLD-3g: Mitigate Impacts on Northern Harrier

To avoid, minimize, or mitigate impacts on northern harrier, the following measures shall be implemented:

a) Whenever feasible, construction shall start outside the active nesting season (February 1 through August 31).

b) If ground-breaking activities begin during the nesting period, a qualified biologist shall perform a preactivity survey 14 to 30 days before the start of each new activity phase to search for harrier nests within 0.5 mile of proposed activities in suitable habitat. If active nests are not identified, no further action is required and construction may proceed. If active nests are identified, the avoidance guidelines identified below shall be implemented:

- Construction contractors shall observe a minimum 0.25-mile buffer zone around active harrier nests. Buffer zones shall remain until young have fledged or until a qualified biologist determines that the nest is no longer active. For activities conducted with agency approval within this buffer zone, a qualified biologist shall monitor construction activities and the harrier nest(s) to monitor harrier reactions to activities. If activities are deemed to have a negative impact on nesting harriers, the biologist shall immediately inform the construction manager that work shall be halted, and CDFW shall be consulted.

- The qualified biologist shall report the results of the preconstruction surveys and observed nests, including information on the success of the nest, within 30 days of the completion of the nest survey.

c) A qualified biologist shall conduct a training session for all construction personnel. This training shall focus on the protection and conservation of protected, nonlisted special-status wildlife species, including northern harrier.

d) All food-related trash items (such as wrappers, cans, bottles, and food scraps) shall be disposed of in closed containers and removed daily from buffer zones near active nest sites to avoid attracting avian predators.

e) To prevent harassment and mortality of harriers or their nests, no pets shall be allowed in the primary study area during construction.

f) The habitat mitigation plan for the project shall include suitable grassland and marsh foraging and nesting habitat for northern harrier.

Implementing Mitigation Measure WLD-3g would reduce the significant impact on northern harrier to a **less-than-significant** level.

Mitigation Measure WLD-4a: Mitigate Impacts on Yellow Warbler

To avoid, minimize, or mitigate impacts on yellow warbler, the following measures shall be implemented:

a) Whenever feasible, construction near recently active nest sites shall start outside the active nesting season (February 1 through August 31).

b) If ground-breaking activities begin during the nesting period, a qualified biologist shall perform a preactivity survey 7 to 14 days before the start of each new activity phase to search for nests within 500 feet of proposed activities in suitable habitat. If active nests are not identified, no further action is required and construction may proceed. If active nests are identified, the avoidance guidelines identified below shall be implemented:

- Construction contractors shall observe a minimum 300-foot buffer zone around active yellow warbler nests. Buffer zones shall remain until young have fledged or until a qualified biologist has determined that the nest is no longer active. For activities conducted with agency approval within this buffer zone, a qualified biologist shall monitor construction activities and the nest(s) to monitor reactions to activities. If activities are deemed to have a negative impact on yellow warbler nests, the biologist shall immediately inform the construction manager that work shall be halted, and CDFW shall be consulted.

- The qualified biologist shall report the results of the preconstruction surveys and observed nests, including information on the success of the nest, within 30 days of the completion of the surveys.

c) A qualified biologist shall conduct a training session for all construction personnel. This training shall focus on the protection and conservation of protected, nonlisted special-status wildlife species, including yellow warbler.

d) All food-related trash items (such as wrappers, cans, bottles, and food scraps) shall be disposed of in closed containers and removed daily from buffer zones near active nest sites to avoid attracting avian predators.

e) To prevent harassment and mortality of yellow warbler or their nests, no pets shall be allowed in the primary study area.

f) The habitat mitigation plan for the project shall include suitable riparian foraging and nesting habitat for yellow warbler.

Implementing Mitigation Measure WLD-4a would reduce the significant impact on yellow warbler to a **less-than-significant** level.

Mitigation Measure WLD-4b: Mitigate Impacts on Grasshopper Sparrow and California Horned Lark

To avoid, minimize, or mitigate impacts on grasshopper sparrow and California horned lark, the following measures shall be implemented:

a) Whenever feasible, construction near recently active nest sites shall start outside the active nesting season (February 1 through August 31).

b) If ground-breaking activities begin during the nesting period, a qualified biologist shall perform a preactivity survey 7 to 14 days before the start of each new activity phase to search for nests within 500 feet of proposed activities in suitable habitat. If active nests are not identified, no further action is required and construction may proceed. If active nests are identified, the avoidance guidelines identified below shall be implemented:

    - Construction contractors shall observe a minimum 250-foot buffer zone around active grasshopper sparrow or California horned lark nests. Buffer zones shall remain until young have fledged or until a qualified biologist determines that the nest is no longer active. For activities conducted with agency approval within this buffer zone, a qualified biologist shall monitor construction activities and the nest(s) to monitor reactions to activities. If activities are deemed to have a negative impact on nests, the biologist shall immediately inform the construction manager that work shall be halted, and CDFW shall be consulted.

    - The qualified biologist shall report the results of the preconstruction surveys and observed nests, including information on the success of the nest, within 30 days of the completion of the surveys.

c) A qualified biologist shall conduct a training session for all construction personnel. This training shall focus on the protection and conservation of protected, nonlisted special-status wildlife species, including grasshopper sparrow and California horned lark.

d) All food-related trash items (such as wrappers, cans, bottles, and food scraps) shall be disposed of in closed containers and removed daily from buffer zones near active nest sites to avoid attracting avian predators.

e) To prevent harassment and mortality of grasshopper sparrow and California horned lark or their nests, no pets shall be allowed in the primary study area.

Implementing Mitigation Measure WLD-4b would reduce the significant impact on grasshopper sparrow and California horned lark to a **less-than-significant** level.

Mitigation Measure WLD-4c: Mitigate Impacts on Loggerhead Shrike

To avoid, minimize, or mitigate impacts on loggerhead shrike, the following measures shall be implemented:

a) Whenever feasible, construction near recently active nest sites shall start outside the active nesting season (February 1 through August 31).

b) If ground-breaking activities begin during the nesting period, a qualified biologist shall perform a preactivity survey 7 to 14 days before the start of each new activity phase to search for shrike nests within 500 feet of proposed activities in suitable habitat. If active nests are not identified, no further action is required and construction may proceed. If active nests are identified, the avoidance guidelines identified below shall be implemented:

   - Construction contractors shall observe a minimum 250-foot buffer zone around active shrike nests. Buffer zones shall remain until young have fledged. For activities conducted with agency approval within this buffer zone, a qualified biologist shall monitor construction activities and the shrike nest(s) to monitor reactions to activities. If activities are deemed to have a negative impact on shrike nests, the biologist shall immediately inform the construction manager that work shall be halted, and CDFW shall be consulted.

   - The qualified biologist shall report the results of the preconstruction surveys and observed nests, including information on the success of the nest, within 30 days of the completion of the surveys.

c) A qualified biologist shall conduct a training session for all construction personnel. This training shall focus on the protection and conservation of protected, nonlisted special-status wildlife species, including loggerhead shrike.

d) All food-related trash items (such as wrappers, cans, bottles, and food scraps) shall be disposed of in closed containers and removed daily from buffer zones near active nest sites to avoid attracting avian predators.

e) To prevent harassment and mortality of loggerhead shrikes or their nests, no pets shall be allowed in the primary study area during construction.

f) The habitat mitigation plan for the project shall include suitable savanna and grassland foraging and nesting habitat for loggerhead shrike.

Implementing Mitigation Measure WLD-4c would reduce the significant impact on loggerhead shrike to a **less-than-significant** level.

Mitigation Measure WLD-4d: Mitigate Impacts on Bird Species Protected by the Migratory Bird Treaty Act

To avoid, minimize, and mitigate for impacts on nesting bird species protected under the MBTA, Reclamation will consult with CDFW and USFWS to implement the following measures:

a) Whenever feasible, construction within the primary study area shall start outside the active avian nesting season (February 1 through August 31).

b) If ground-breaking activities would occur during the avian nesting season, Reclamation will have a qualified biologist perform preactivity surveys to determine presence of nesting birds that project activities may affect. Surveys shall be conducted an appropriate distance beyond the construction area, typically 300 feet for passerine birds and 500 feet for raptors. Larger survey buffers may be required in specific instances or in specific habitats. Wildlife agencies will be involved in determining final survey protocols for nesting birds. If no nests are found, then no further mitigation is required.

c) If biologists observe active nests (i.e., those containing eggs or live young) of species protected under the MBTA, the biologist shall establish a buffer zone based on species biology and characteristics of the project activity between the nest and the construction activity. The buffer zone may be reduced upon consultation with

CDFW and the presence of a qualified biologist monitoring the nest and adult behavior for signs of distress or nest failure. If activities are deemed to have a negative impact on a nest, the biologist shall immediately inform the construction manager that work shall be halted, and CDFW shall be consulted.

d) The qualified biologist shall report the results of the preconstruction surveys and observed nests, including information on the success of the nest, within 30 days of the completion of the surveys.

e) A qualified biologist shall conduct a training session for all construction personnel focused on the protection and conservation of wildlife species including bird species protected under the MBTA.

f) All food-related trash items (such as wrappers, cans, bottles, and food scraps) shall be disposed of in closed containers and removed daily from buffer zones near active nest sites to avoid attracting avian predators.

g) To prevent harassment and mortality of avian nesters, no pets shall be allowed in the primary study area during construction.

Implementing Mitigation Measure WLD-4d would reduce the significant impact on bird species protected under the MBTA to a **less-than-significant** level.

Mitigation Measure WLD-5: Mitigate Impacts on Ringtail

To avoid, minimize, or mitigate impacts on ringtail, the following measures shall be implemented where suitable habitat for ringtail occurs within the primary study area:

a) A qualified biologist shall conduct a training session for all construction personnel. This training shall focus on the protection and conservation of protected, nonlisted special-status wildlife species, including ringtails. At a minimum, the training shall include a species and habitat description for the ringtail and shall identify the general measures that are being implemented to minimize impacts on the species.

b) All food-related trash items (such as wrappers, cans, bottles, and food scraps) shall be disposed of in closed containers and removed daily.

c) To prevent harassment and mortality of ringtails, no pets shall be allowed.

d) The habitat mitigation plan for the project shall include suitable habitat for ringtail within the known range of occurrence of the species.

Implementing Mitigation Measure WLD-5 would reduce the significant impact on ringtail to a **less-than-significant** level.

Mitigation Measure WLD-6: Mitigate Impacts on American Badger

To avoid, minimize, or mitigate impacts on American badger, the following measures shall be implemented where suitable habitat for this species occurs within the primary study area:

a) A qualified biologist shall perform a preactivity survey to identify the presence of American badgers or dens within the primary study area. A formal survey protocol for this species is not available; therefore, the project biologist shall discuss survey protocols with CDFW and USFWS. Examples of badger surveys conducted in similar habitat types also will be considered. If this species is not found, no further mitigation shall be required.

b) A qualified biologist shall prepare a relocation plan for American badgers. The relocation shall be prepared and approved by CDFW before the initiation of construction that may affect suitable habitat for American badger. The relocation plan shall include techniques for relocation of badgers, potentially including passive or active relocation of individuals to designated relocation sites within the primary study area.

c) A qualified biologist shall conduct a training session for all construction personnel focused on the protection and conservation of protected, nonlisted special-status wildlife species, including American badgers.

d) If badgers are identified within the primary study area that may be affected by project construction, a qualified biologist shall implement the appropriate measures included in the relocation plan. The biologist shall have authority to halt construction work to allow for the implementation of appropriate measures as specified in the relocation plan.

e) To minimize the possibility of inadvertent badger mortality, project-related vehicles shall observe a maximum 20-mile-per-hour speed limit on private roads.

f) To prevent accidental entrapment of badgers or other animals during construction, all excavated holes or trenches greater than 2 feet deep shall be covered with suitable materials at the end of each work day, or escape routes constructed of earthen materials or wooden planks shall be provided. Before filling, such holes shall be thoroughly inspected for trapped animals.

g) All food-related trash items (such as wrappers, cans, bottles, and food scraps) shall be disposed of in closed containers and removed daily.

h) To prevent harassment and mortality of badgers or destruction of their dens, no pets shall be allowed.

i) The habitat mitigation plan for the project shall include habitat for American badger within the known range of the species.

Implementing Mitigation Measure WLD-6 would reduce the significant impact on American badger to a **less-than-significant** level.

Mitigation Measure WLD-7: Mitigate Impacts on San Joaquin Pocket Mouse

To avoid, minimize, or mitigate impacts on San Joaquin pocket mouse within the primary study area, the following measure shall be implemented:

a) The habitat mitigation plan for the project shall include suitable habitat for San Joaquin pocket mouse within the known range of the species.

Implementing Mitigation Measure WLD-7 would reduce the significant impact on San Joaquin pocket mouse to a **less-than-significant** level.

Mitigation Measure WLD-8: Mitigate Impacts on Special-Status Bat Species

To avoid, minimize, or mitigate impacts on special-status bat species, the following measures shall be implemented:

a) Reclamation shall conduct preconstruction surveys for special-status bats no more than 60 days before the initiation of construction. Preconstruction surveys shall include all areas that could potentially support roosting bats, including trees, caves, abandoned structures, bridges, or other potential roosting habitat within 200 feet of the construction area.

b) Buffers shall be established around active bat roosting sites found during preconstruction surveys (April 15 through August 15).

c) Removal of trees showing evidence of active bat activity shall occur during the period least likely to affect bats, as determined by a qualified bat biologist (generally between February 15 and October 15 for winter hibernacula, and between August 15 and April 15 for maternity roosts).

d) If the exclusion of bats from potential roost sites is necessary to prevent indirect impacts due to construction noise and human activity, bat exclusion (e.g., installation of netting to block roost entrances) shall also be conducted during the periods of low activity as defined above. Any bat exclusion measures shall be coordinated with approved by CDFW before their initiation.

e) The habitat mitigation plan for the project shall include suitable foraging and roosting habitat for bats.

Implementing Mitigation Measure WLD-8 would reduce the significant impact on special-status bat species to a **less-than-significant** level.

Mitigation Measure WLD-9: Mitigate Impacts on Migratory and Wintering Deer Herds

To avoid, minimize, or mitigate impacts on migratory deer and deer fawning grounds within the primary study area, the following measures shall be implemented:

a) The habitat mitigation plan for the project shall include potential fawning grounds for deer herds in the vicinity of the primary study area.

b) If deer migration is expected to be significantly affected by construction and operation of the project, crossing opportunities shall be made available within the primary study area as available.

Implementing Mitigation Measure WLD-9 would reduce the significant impact on migratory deer and deer fawning grounds to a **less-than-significant** level.

Mitigation Measure WLD-16: Monitor and Manage Riparian Vegetation Structure Within Extended Study Area

To avoid, minimize, or mitigate impacts on riparian habitat for nesting bird species within the extended study area due to project operations, the following measure shall be implemented:

a) Conduct annual riparian vegetation monitoring within the extended study area through the duration of the SJRRP, but not less than 30 years following the start of operation of the project. The monitoring shall occur during the growing season and preferably during the peak nesting season (April-June) to determine which bird species are utilizing the riparian habitat and successional stages of the riparian habitat. At least 20 permanent monitoring locations shall be established within riparian habitat within the extended study area. The first year (year 0) of monitoring will be conducted before the initiation of project operations to establish a baseline condition of riparian habitat within the extended study area. Monitoring will be conducted every three years.

b) In conjunction with the above-described monitoring activities, photographs will be taken from permanent photo point locations to be established in riparian habitat within the extended study area. Photo point locations will be selected during the first year (Year 0) of monitoring and recorded with a submeter GPS unit for future relocation needs.

A qualified botanist or biologist shall prepare a Riparian Monitoring Report for each year that an inspection of riparian habitat is conducted.

The Riparian Monitoring Report shall include at a minimum:

1. A description of the physical, biological, and ecological conditions of the monitoring locations including river gage data, rainfall, and information on flood events, where available;

2. Specific discussions of the general conditions of the riparian habitat at each monitoring location including health and structure of riparian habitats relative to previous monitoring periods;

3. A brief summary of relevant land use changes in any lands immediately adjacent to the monitoring locations (e.g., cropland conversion, road widening, housing development, etc.);

4. A brief summary of plant and wildlife species found during monitoring with an emphasis on special-status bird species that may be nesting in the vicinity based on nesting behaviors exhibited;

5. Recommendations for any corrective actions or adaptive management; and

6. Photographs from established photo-documentation points highlighting riparian structure and health. A map showing the location and photo direction of these points will be included. Latitude and longitude information (in UTM or any other convenient coordinate system) will also be included.

If substantial degradation of riparian habitat would occur, Reclamation will review and, as appropriate, implement the Riparian Monitoring Report recommendations for adaptive management and mitigation within the corridor. Implementing Mitigation Measure WLD-16 would reduce the potentially significant impact on riparian habitat for special-status nesting birds to a **less-than-significant** level.

Chapter 8
Climate Change

This chapter provides a summary of existing and potential future climate conditions in the Study Area; an assessment of the action alternatives under projected climate conditions; and a discussion of the potential for anticipated impacts of action alternatives, as described in Chapters 4 through 7 and 9 through 26, to change under future climate conditions. Emissions of GHGs contributing to global climate change are described separately in Chapter 4, "Air Quality and Greenhouse Gas Emissions."

Affected Environment

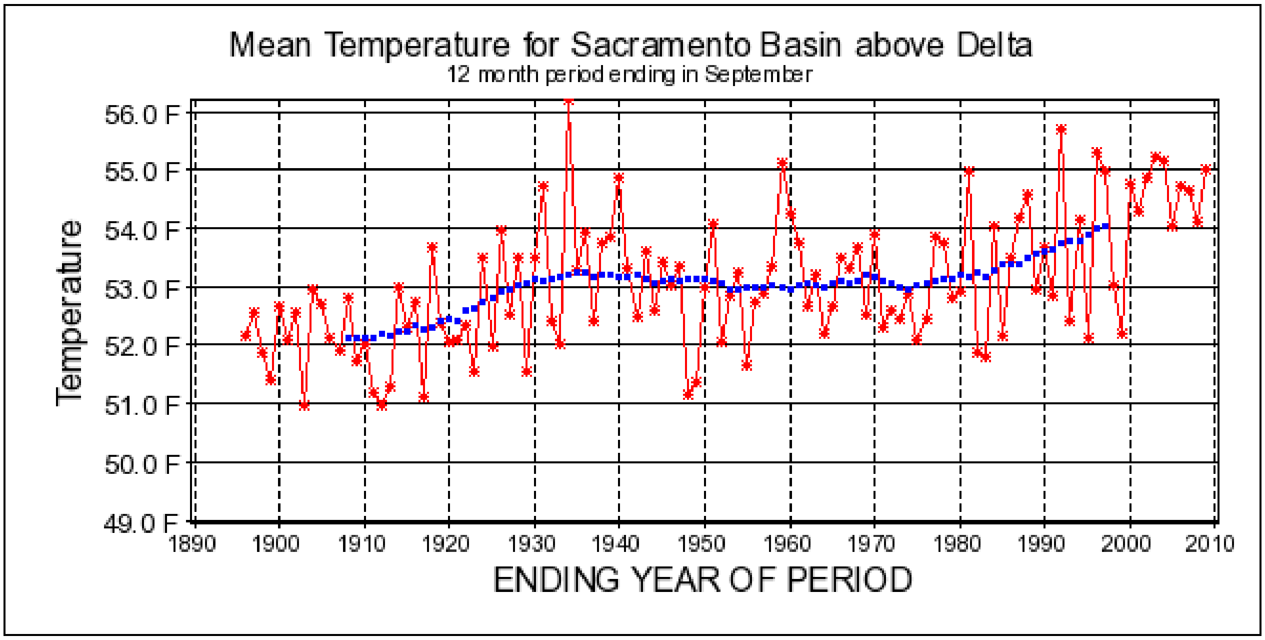
Historical Climate

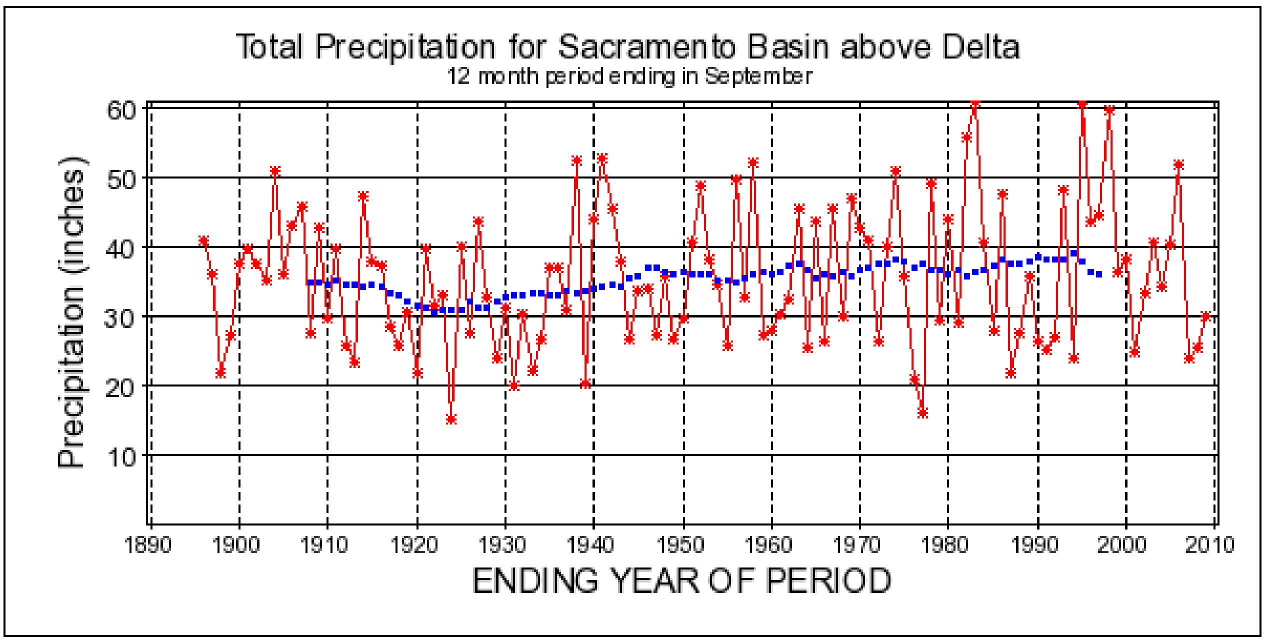
The historical climate of the Central Valley is characterized by hot, dry summers and cool, damp winters. Summer daytime temperatures can reach 90°F with occasional heat waves bringing temperatures exceeding 115°F. The majority of precipitation occurs from mid-autumn to mid-spring. In winter, temperatures below freezing may occur, but snow is rare in the valley lowlands and foothills. The Central Valley typically has a frost-free growing season ranging from 225 to 300 days. During the growing season, relative humidity is characteristically low; in the winter, humidity is usually moderate to high, and ground fog may form.

The inter-annual variability of the Central Valley climate is strongly influenced by conditions occurring in the Pacific Ocean, including the El Nino Southern Oscillation and the existence of a semi-permanent high-pressure area in the northern Pacific Ocean (or Pacific high). During the summer season, the northerly position of the Pacific high blocks storm tracks well to the north and results in little summertime precipitation. During the winter months, the Pacific high typically moves southward allowing storms into the Central Valley. Such storms often bring widespread, moderate rainfall to the Central Valley lowlands and foothills, and the accumulation of snow in the surrounding mountainous regions. When strong El Nino Southern Oscillation global circulation patterns occur, storm centers can approach the California coast from a southwesterly direction, carrying large amounts of tropical moisture, resulting in heavy rains that can produce high runoff and the potential for widespread flooding in the Central Valley.

Over the course of the 20th century, warming has been prevalent over the Central Valley, including the San Joaquin River basin. Basin average mean-annual temperature has increased by approximately 2°F during the course of the 20th century for both the Sacramento River Basin above the Delta (Figure 8-1) and the San Joaquin River Basin above the Delta (Figure 8-2).

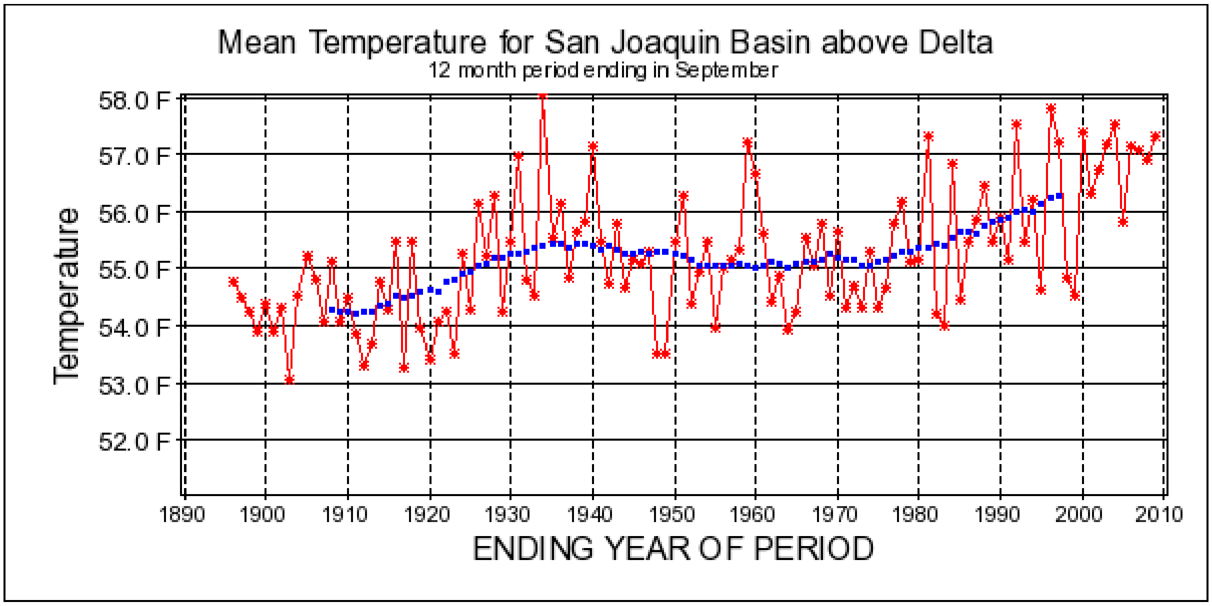
Warming has not occurred steadily throughout the 20th century. Increases in air temperatures occurred primarily during the early part of the 20th century between 1910 and 1935. Subsequently, renewed warming began again in the mid-1970s and appears to be continuing at present, as shown for the Sacramento River Basin in Figure 8-1. Similar results are apparent for the San Joaquin River Basin (Figure 8-2) and have been reported in other studies. Cayan et al. (2001) reported that Western United States spring temperatures have increased 1.8 to 5.4°F since the 1970s; whereas increased winter temperature trends in central California were observed to average about 0.9°F per decade (Dettinger and Cayan 1995). In both the Sacramento River and San Joaquin River basins, the overall 20th century warming has been about 3°F.

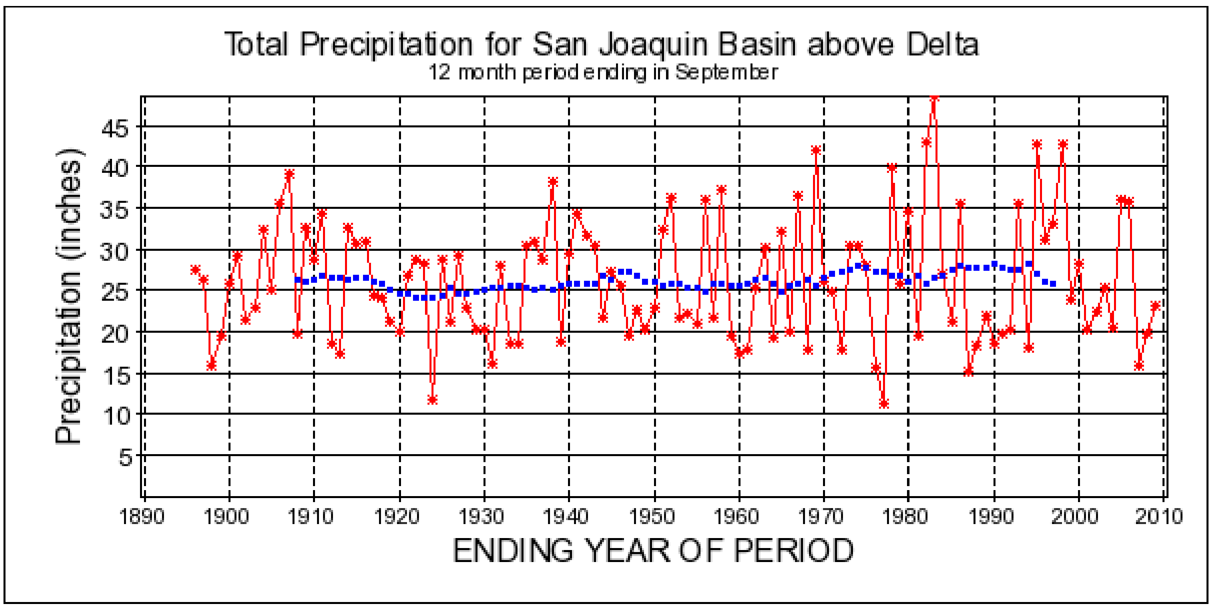




Source: WestMap 2010.

Figure 8-1. Observed Annual (red) and Moving-Mean Annual (blue) Temperature and Precipitation, Averaged over the Sacramento River Basin





Source: WestMap 2010.

Figure 8-2. Observed Annual (red) and Moving-Mean Annual (blue) Temperature and Precipitation, Averaged over the San Joaquin River Basin

Figure 8-1 shows that the warming trend in the Sacramento River Basin has been accompanied by a gradual trend toward increasing precipitation, beginning in 1930 (WestMap 2010). However, a similar precipitation trend is not evident in the San Joaquin River Basin (Figure 8-2). Other studies, such as Regonda et al. (2005), have shown similar results. The variability of annual precipitation appears to have increased in the latter part of the 20th century, as can be seen by comparing the range of differences in high and low values of the solid red line in Figure 8-1 and Figure 8-2. These extremes in wet and dry years have been especially frequent since the mid-1970s in both the Sacramento River and San Joaquin River basins.

Streamflow in the Sacramento River and San Joaquin River basins has historically varied considerably from year to year. Runoff also varies geographically; during any particular year, some portions of the basin may experience relatively greater runoff while other areas experience relatively less runoff (e.g., more abundant runoff in the northern Sacramento Valley versus relatively drier conditions in southern San Joaquin Valley). On a monthly to seasonal basis, runoff is generally greater during the winter to early summer months, with winter runoff generally originating from rainfall-runoff events and spring to early summer runoff generally supported by snowmelt from the Cascade Mountains and Sierra Nevada.

These historical changes in climate have resulted in several important effects on the hydrology of the Sacramento River and San Joaquin River basins. Although annual precipitation may have slightly increased or remained relatively unchanged, corresponding increases in mean annual runoff in the Sacramento and San Joaquin rivers did not occur (Dettinger and Cayan 1995). However, a shift in the seasonal timing of runoff has been observed in the Sacramento River Basin; a decrease of about 10 percent in the fraction of total runoff occurring between April and July has been observed over the course of the 20th century (Roos 1991). Dettinger and Cayan (1995) reported similar results for the combined Sacramento River and San Joaquin River runoff.

Along with the declining spring runoff, corresponding increases in winter runoff have been observed. Peterson et al. (2008) found earlier runoff trends for 18 Sierra Nevada river basins. Analyses such as Cayan (2001) have indicated that increasing spring temperatures, rather than increased winter precipitation, was the primary cause of the observed trends. Studies by these researchers and others showed correlation between the magnitude of decreases in April through July runoff with the altitude of the basin watershed. High altitude basins, like the San Joaquin River Basin, exhibited less decrease in spring runoff than lower elevation watersheds, such as the Sacramento River Basin. However, it is noted that the appearance of runoff trends in the basins is dependent on location within the basin and the period of record assessed.

Other historical studies of 20th century spring snowpack, as measured by April 1st Snow Water Equivalent (SWE), showed a decreasing trend in the latter half of the 20th century (Mote 2005). Coincident with these trends, reduced snowpack and snowfall ratios are evidenced by analyses of SWE measurements made from 1948 through 2001 at 173 Western United States stations (Knowles et al. 2007). Additionally, Regonda et al. (2005) reported decreasing spring SWE trends in 50 percent of Western United States locations evaluated.

Within the Sacramento River and San Joaquin River basins, the abovementioned observations of temperature, precipitation, and snowpack are sensitive to uncertainties of station measurements as well as the temporal (period of record) and geographic scope of analyses. Observed trends of temperature, precipitation, snowpack, and streamflow over the Western United States may be partially explained by anthropogenic (e.g., human) influences on climate (e.g., Barnett et al. 2008; Pierce et al. 2008; Bonfils et al. 2008; Hidalgo et al. 2009; and Das et al. 2009). However, it remains difficult to attribute observed changes in climate to historical human influences or anthropogenic forcings. This is particularly the case for trends in precipitation (Hoerling et al. 2010), and for trends in basin-scale conditions rather than at the larger Western United States scale (Hidalgo et al. 2009).

Sea level change is also an important factor in assessing the effect of climate on California's water resources, because of its effect on water quality in the Delta. Higher sea levels are associated with increasing salinity in the Delta, which influences the suitability of Delta water supplies for agricultural, urban, and environmental uses. The global rate of msl change was estimated by the Intergovernmental Panel on Climate Change (IPCC) (2007) to be 1.8 +/- 0.5 millimeters per year (mm/year) (0.07 +/- 0.02 in/year) from 1961–2003 and 3.1 +/- 0.7 mm/year (0.12 +/0.03 in/year) during 1993–2003. During the 20th century, msl at Golden Gate Bridge in San Francisco Bay has risen by an average of 2 mm/year (0.08 in/year) (Anderson et al. 2008). Rates of sea level rise in San

Francisco Bay appear to be accelerating based on tidal gauges and remote sensing measurements (Church and White 2006; Beckley et al. 2007).

Projections of Future Climate

This section summarizes results from prior, relevant studies focused on potential future climate and hydrologic conditions within the Sacramento River and San Joaquin River basins. Literature relevant to the Study Area is summarized, followed by a discussion of results from Reclamation (2011b).

Summary of Relevant Studies of Future Climate and Hydrology

Potential changes in Central Valley climate and hydrology have been the subject of numerous studies. Moser et al. (2009) reports specifically on future climate possibilities for Central Valley watersheds and suggests warming temperatures during the 21st century, with an end-of-century increase of 3°F to 10.5°F. Mean annual precipitation in California is projected to decrease by 10 to 15 percent by the end of the 21st century.

Maurer (2007) assessed the effects of projected changes in future climate for four river basins in the western Sierra Nevada draining to the Central Valley, finding a tendency toward increased winter precipitation. Models analyzed by Maurer (2007) consistently exhibited similar increases in temperature and SWE, while increases in winter precipitation were variable. Increases in temperatures within the Central Valley were shown by Kapnick and Hall (2008) to result in a shift in the date of peak of snowpack accumulation from 4 to 14 days earlier in the winter season by end of century.

Using 2°C, 4°C, and 6°C increases in mean-annual air temperature relative to historical conditions to represent warming scenarios, Null et al. (2010) reported on climate change impacts for 15 western-slope watersheds in the Sierra Nevada. Under these scenarios, total runoff decreased; earlier runoff was projected in all watersheds; and decreased runoff quantities were expected to be most severe in the northern part of the Central Valley. Null et al. (2010) also indicated that the high elevation southern-central region of the Sierra Nevada was the most susceptible to earlier runoff, and the central region was the most vulnerable to longer low flow periods.

Sea level changes also have been projected to occur during the 21st century due to increasing air temperatures causing thermal expansion of the oceans and additional melting of the land-based Greenland and Antarctic ice sheets (IPCC 2007). The CALFED Independent Science Board estimated a range of sea level rise at Golden Gate of 1.6 feet to 4.6 feet by the end of the 21st century (CALFED 2007). DWR 2009a used 12 future climate projections to estimate future sea levels, which indicate sea level rise by mid-century ranging from 0.8 feet to 1.0 feet with an uncertainty range spanning 0.5 feet to 1.3 feet. By the end of the 21st century, sea level was projected to rise between 1.8 feet and 3.1 feet, with an uncertainty range spanning from 1.0 feet to 3.9 feet. There is also the potential for increased extremely high sea level events to occur when high tides coincide with winter storms (Moser et al. 2009).

Summary of Future Climate Projections by Reclamation

This section summarizes climate projections developed by Reclamation (2011b) consistent with Public Law 111-11, Subtitle F (the SECURE Water Act). The Reclamation study encompassed a western United States-wide hydrologic analysis to identify risks to water supplies throughout the Colorado, Columbia, Klamath, Missouri, Rio Grande, Sacramento, San Joaquin, and Truckee river basins. The methods and assumptions used to develop the projections are described in detail in a report titled *West-Wide Climate Risk Assessments: Bias-Corrected and Spatially Downscaled Surface Water Projections* (Reclamation 2011a).

A summary of projected future climate projections developed in Reclamation 2011b is presented in Table 8-1 for two locations in the Sacramento River Basin and two locations in the San Joaquin River Basin. The climate change projections described herein reflect results derived from multiple models and simulations, known as ensembles. Ensembles provide a range of potential conditions for planning purposes with consideration of uncertanties, and have been shown to better reflect historical conditions than single model runs. Before summarizing climate projection and climate change information, it should be noted that the projected changes exhibit geographic variation and temporal variation (changes vary through time), and the progression of change through time varies among climate projection ensemble members. Additional descriptions of the mean and range of hydroclimate metrics are included in the Climate Change Attachment to the Modeling Appendix.

Table 8-1. Summary of Simulated Changes in Decade-Mean Hydroclimate for Several Subbasins in the Sacramento River and San Joaquin River Basins

Hydroclimate Metric (change from 1990s)	2020s	2050s	2070s
Sacramento River at Bend Bridge			
Mean Annual Temperature (°F)	1.3	3.0	4.2
Mean Annual Precipitation (%)	1.0	1.8	-0.9
Mean April 1st Snow Water Equivalent (%)	-58.7	-79.0	-90.8
Mean Annual Runoff (%)	3.3	4.1	-3.8
Mean December–March Runoff (%)	7.0	11.6	8.6
Mean April–July Runoff (%)	-8.8	-17.7	-30.9
Mean Annual Maximum Week Runoff (%)	10.8	16.2	17.0
Mean Annual Minimum Week Runoff (%)	-0.4	-0.7	-1.0
Sacramento River at Freeport			
Mean Annual Temperature (°F)	1.3	3.0	4.2
Mean Annual Precipitation (%)	-0.3	0.6	-2.7
Mean April 1st Snow Water Equivalent (%)	-53.4	-75.9	-88.6
Mean Annual Runoff (%)	3.5	2.5	-3.6
Mean December–March Runoff (%)	9.0	13.6	11.0
Mean April–July Runoff (%)	-11.1	-23.0	-36.1
Mean Annual Maximum Week Runoff (%)	12.9	18.4	18.3
Mean Annual Minimum Week Runoff (%)	-0.3	-0.5	-0.6
San Joaquin River at Friant Dam			
Mean Annual Temperature (°F)	1.4	3.3	4.5
Mean Annual Precipitation (%)	-1.3	-5.3	-8.6
Mean April 1st Snow Water Equivalent (%)	-23.1	-39.6	-48.7
Mean Annual Runoff (%)	0.7	-8.7	-10.7
Mean December–March Runoff (%)	13.9	15.8	31.0
Mean April–July Runoff (%)	-6.1	-20.2	-25.0
Mean Annual Maximum Week Runoff (%)	-2.3	-6.6	-16.0
Mean Annual Minimum Week Runoff (%)	-4.0	-6.4	-7.6
San Joaquin River at Vernalis			
Mean Annual Temperature (°F)	1.3	3.1	4.3
Mean Annual Precipitation (%)	-1.0	-4.2	-7.7
Mean April 1st Snow Water Equivalent (%)	-27.2	-45.9	-56.3
Mean Annual Runoff (%)	0.8	-5.9	-8.4
Mean December–March Runoff (%)	10.1	10.7	17.2
Mean April–July Runoff (%)	-4.8	-20.6	-25.8
Mean Annual Maximum Week Runoff (%)	1.6	-1.8	-4.9
Mean Annual Minimum Week Runoff (%)	-1.2	-1.9	-2.3

Key:
ºF = degree Fahrenheit
% = percent

Climate Change Impact Assessment

Reclamation policy and NEPA guidance state that the characterization of uncertainty, including uncertainty related to climate change, is an important aspect of making informed decisions. The methodology implemented in this assessment is a scenario-based approach that addresses future uncertainties by considering multiple socioeconomic-climate scenarios. These scenarios are not forecasts of future conditions but, rather, are projections intended to characterize a wide range of potential future conditions; examination of these conditions may indicate the sensitivity of resource impacts identified in this Draft EIS to future climate uncertainties.

This section describes the methods and assumptions for the impact assessment, as well as results for simulated conditions with and without a project. Further details on the methodology, tools, and results of this climate change impact assessment are provided in the Climate Change attachment to the Modeling Appendix, and in Reclamation (2013).

Methods and Assumptions

The climate change impact assessment characterizes the sensitivity of Millerton Lake operations to uncertainties in potential future socioeconomic and climatic conditions. The assessment is intended as a sensitivity analysis, and is conducted at a level of detail sufficient for assessing the potential sensitivity of identified environmental impacts to future socioeconomic-climate uncertainties.

The analyses assess a particular socioeconomic-climate scenario under Baseline and Representative Alternative conditions. The term “Baseline” refers to a future socioeconomic-climate scenario simulated without a project in place. The action alternatives are simulated using a single, simplified Representative Alternative; consequently, the Representative Alternative does not fully represent all physical or operational details included in specific action alternatives described elsewhere in this Draft EIS (see Chapter 2, “Alternatives”). The effects of the Representative Alternative can be evaluated by comparison with the corresponding Baseline. However, results should not be directly compared to operational results for the No Action Alternative and action alternatives discussed within other chapters of this Draft EIS.

Modeling tools used for the climate change impact assessment presented herein are different from models used to support quantitative impact assessments presented in other chapters. The climate change impact assessment tools are simplified representations, not intended to capture the detailed operation or complexity of CVP, SWP, and other water management systems in the Central Valley. Consequently, some results used to evaluate impact sensitivity under climate change may differ from quantified results presented in Chapters 4 through 7 and 9 through 27 of this Draft EIS.

An important aspect of the assessment relates to analysis uncertainties. Two major uncertainties affecting future impacts are socioeconomic and climate conditions, both of which are dynamic in nature. This aspect of the assessment was addressed by employing a transient analysis in which both socioeconomic and climate conditions are continuously changing over time. Uncertainties in future socioeconomic conditions are based on a series of different population and land use projections from present day to 2100. The climate uncertainties are addressed by including multiple 21st century projections from general circulation model or global climate model (GCM) simulations to represent a wide range of potential future climate conditions. Socioeconomic and climate futures were used to inform the operations, water quality, reservoir and river temperature modeling, and hydropower modeling performed for the Baseline and Representative Alternative under climate change and are described below. Descriptions of water supply, water quality, reservoir and river temperature, and hydropower modeling are described in detail in the Climate Change attachment of the Modeling Appendix.

Socioeconomic and Climate Future Scenarios

Water supplies and demands in the 21st century would be affected by changing socioeconomic and climate conditions. Socioeconomic conditions have a direct impact on water demands; as population increases, water demands for municipal, commercial, and industrial water supplies tend to increase. Furthermore, land use changes can have important effects on water demands, and urban growth can influence adjacent agricultural lands and demands for agricultural water supplies. Climate is the most important factor influencing water supply availability; changes in amount of precipitation directly affects water supplies, while changes in the seasonality of precipitation may also affect how much precipitation is available to meet particular water supply needs.

Several socioeconomic and climate scenarios were used in this assessment to address uncertainties in potential future socioeconomic and climate conditions, as described below.

Socioeconomic Future Scenarios

Three socioeconomic future scenarios, originally developed by DWR in the California Water Plan Update 2009 (DWR 2009b), were used to represent changes in population and land use during the 21st century:

- **Current Trends (CT)**, which assumes that recent trends will to continue into the future.
- **Slow Growth (SG)**, which assumes that future development is less resource intensive than under recent conditions.
- **Expansive Growth (EG)**, which assumes that future development is more resource intensive than under recent conditions.

For this assessment, 2005 (Base), 2050, and 2100 population projections in the Sacramento, San Joaquin, and Tulare Lake hydrologic regions were developed under each of the above growth trends, based on data by the California Department of Finance (DOF)(DOF 2007). Similarly, projected changes in irrigated lands were developed for these periods and regions using information in the California Water Plan Update 2009 (DWR 2009b).

Climate Futures

Eighteen climate projections were employed to characterize a wide range of future hydroclimate uncertainties as part of this sensitivity analysis:

- **No Climate Change (NoCC) Scenario**, which included simulations of hydroclimatic conditions under the historical climate.
- **Future Climate – Ensemble-Informed Scenario** used 5 ensemble-informed scenarios that were developed by the CVP IRP based on downscaled GCM projections.
- **Future Climate – Downscaled Climate Projections** used the 12 specific GCM projections identified by the State of California's Climate Action Team (CAT) for

use in climate studies performed by DWR for the California Water Plan.

The NoCC scenario was developed by using the unadjusted historical climate sequence from 1915 through 2003 to simulate the future period of 2011 through 2099. For the 17 climate change projections, temperature and precipitation projections were developed for a similar future period as the NoCC scenario.

The five ensemble-informed climate projections were developed from 112 GCM simulations, which were previously bias-corrected and spatially downscaled by Reclamation and others (Maurer 2007), as described in Reclamation (2013). The five projections include a central tendency projection (Q5) that is based on the bias-corrected and spatially downscaled projections near the median of changes in temperature and precipitation. The remaining four projections are based on ensembles of bias-corrected and spatially downscaled projections that differ from the central tendency by being drier with less warming (Q1); drier with more warming (Q2); wetter with more warming (Q3); and wetter with less warming than Q5 (Q4).

The 12 CAT projections were developed from six GCMs, and are described in DWR 2009a. These GCMs were selected by the State's CAT based on ability to reasonably simulate historical climatic conditions, including seasonal precipitation, temperature, and variability of annual precipitation in California, as well as important global climate conditions such as tropical Pacific Ocean sea surface temperatures associated with the El Nino Southern Oscillation. Additional details regarding the development of climate projections used in this sensitivity analysis are available in the Climate Change attachment of the Modeling Appendix.

Sea Level Changes

The CALFED Science Program, State of California, National Academy of Sciences, and others have assessed the range of potential future sea level rise through 2100. These studies indicate that as sea level rise progresses during the 21st century, the hydrodynamics of the Delta would change, causing the salinity of water in the Delta to increase. This increasing salinity is likely to have substantial impacts on water management throughout the Central Valley and other regions of the State.

Several transient sea level rise projections were developed based on the National Research Council (NRC) report projections (NRC 2012). The report suggested that the mean sea level rise projection in the San Francisco Bay would be approximately 6, 12, 36 inches by 2030, 2050, and 2100, respectively. These mean sea level rise projections were used in operations and water quality modeling that were performed for the Investigation, as discussed in the Climate Change Attachment of the Modeling Appendix.

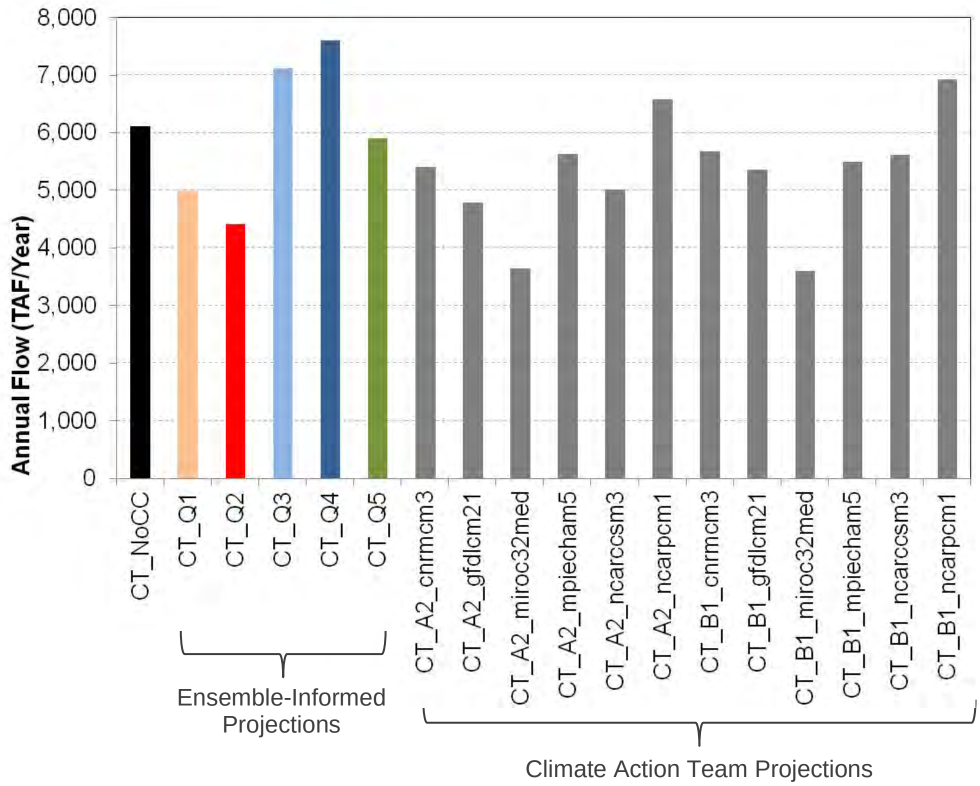
Climate Change Sensitivity Analysis–Baseline

As described previously, conditions without the Representative Alternative in place were evaluated for different projected future socioeconomic-climate scenarios using the methodology described above; these conditions are referred to herein as Baselines. The results of the Baselines sensitivity analysis are summarized below for the following categories:

- Water supplies
- Water demands
- CVP and SWP system operations
- Supplies and demands in CVP divisions
- Results of other performance-assessment tools including economics, water temperature, hydropower and GHG emissions

Water Supplies

Figure 8-3 shows the projected average annual runoff upstream from Vernalis in the San Joaquin River Hydrologic Region for the CT socioeconomic projection combined with the NoCC, six ensemble-informed climate projections (Q1, Q2, Q3, Q4, and Q5), and 12 CAT projections for the period of water years 2012 through 2099. As shown in the figure, substantial differences are evident in runoff among the different climate scenarios, and the range of the CAT projections is consistent with the range of the ensemble-informed projections.

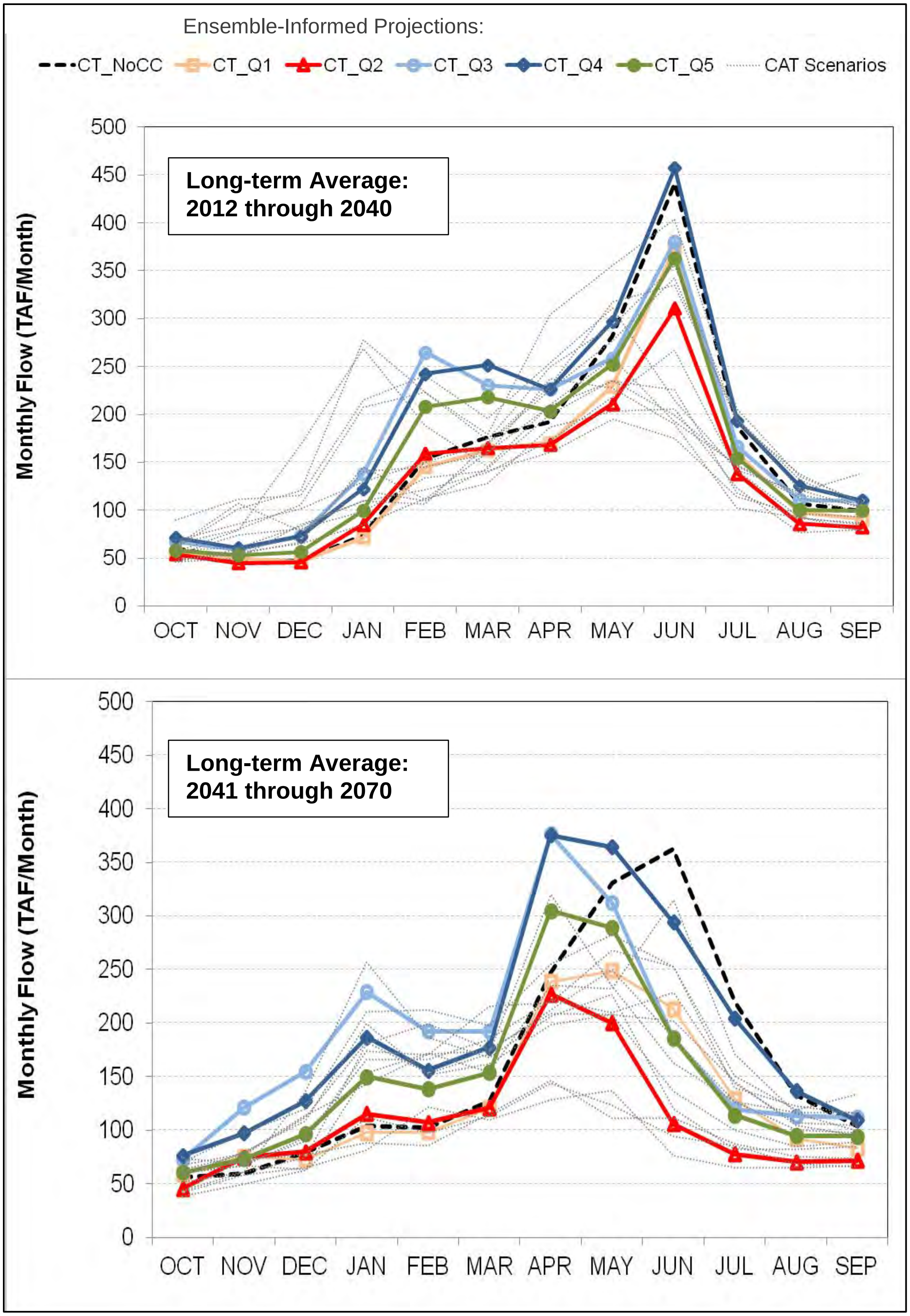


Key:
CT = current trends
NoCC = no climate change
TAF = thousand acre-feet

Figure 8-3. Average Annual Runoff in the San Joaquin River System under Future Climate Scenarios

Among the scenarios, the projected average annual runoff in the San Joaquin River Basin ranges between 3,604 and 7,609 TAF/year over the simulation period (water years 2012 through 2099). In the median climate scenario (Q5), average annual runoff is about 4 percent lower than the NoCC scenario. Compared with the NoCC scenario, the drier climate scenarios (Q1 and Q2) show substantially lower average annual runoff (ranging from 18 to 28 percent), while the wetter climate scenarios (Q3 and Q4) show substantially higher average annual runoff (ranging from 16.5 to 24.5 percent). Across the range of all climate scenarios, average annual runoff show a declining trend over the simulation period.

Figure 8-4 shows the monthly pattern of projected inflow into Millerton Lake in the early, mid, and late 21st century. The future climate scenarios exhibit a pattern similar to the CT_NoCC scenario (dashed line), but with a shift to more runoff in the winter and less in the spring months. This projected shift occurs because higher temperatures during winter cause more precipitation to occur as rainfall, which increases runoff and reduces snowpack. This seasonal shift is most evident in basins where historical snowpack occurs at lower elevations and is, therefore, more susceptible to warming induced changes. For example, in the winter months (December to February) CT_Q5 projects greater runoff than CT_NoCC, but in the spring (March to May) CT_NoCC projects greater runoff.



Key:
CT = current trends
NoCC = no climate change
TAF = thousand acre-feet

Figure 8-4. Average Monthly Runoff into Millerton Lake by Climate Scenario

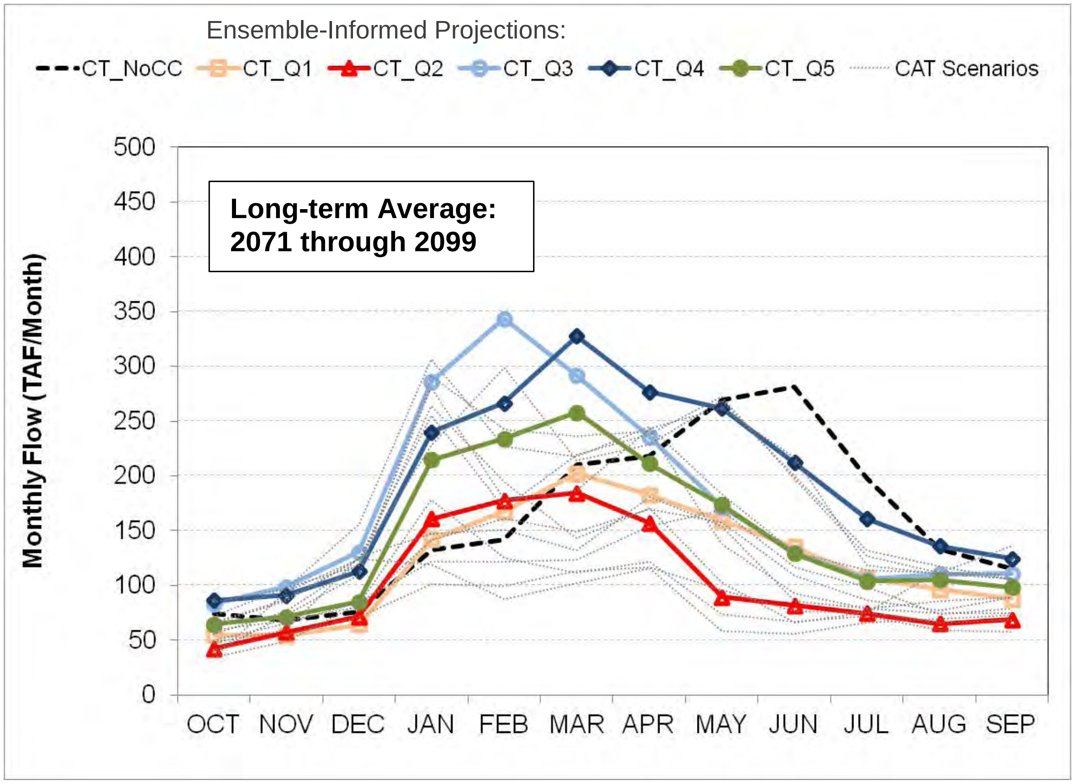


Figure 8-4. Average Monthly Runoff into Millerton Lake by Climate Scenario (contd.)

Figure 8-5 and Figure 8-6 shows the annual time series of runoff in the San Joaquin River and Tulare Lake hydrologic regions under each socioeconomic-climate scenario during the period from 2012 through 2099. The methodology used to develop the future time series uses the same inter-annual variability as observed during the historical period; extended drought periods with lower runoff values occur from 2025-2030 (corresponding to 1929-1934 dry period) and from 2083-2088 (corresponding to 1987-1992 drought), and a very substantial dry period occurs from 2072-2073 (corresponding to 1976-1977 minimum precipitation years). However, as can be observed in the figures, the magnitude of these hydrologic events differs from historical conditions (CTNoCC).

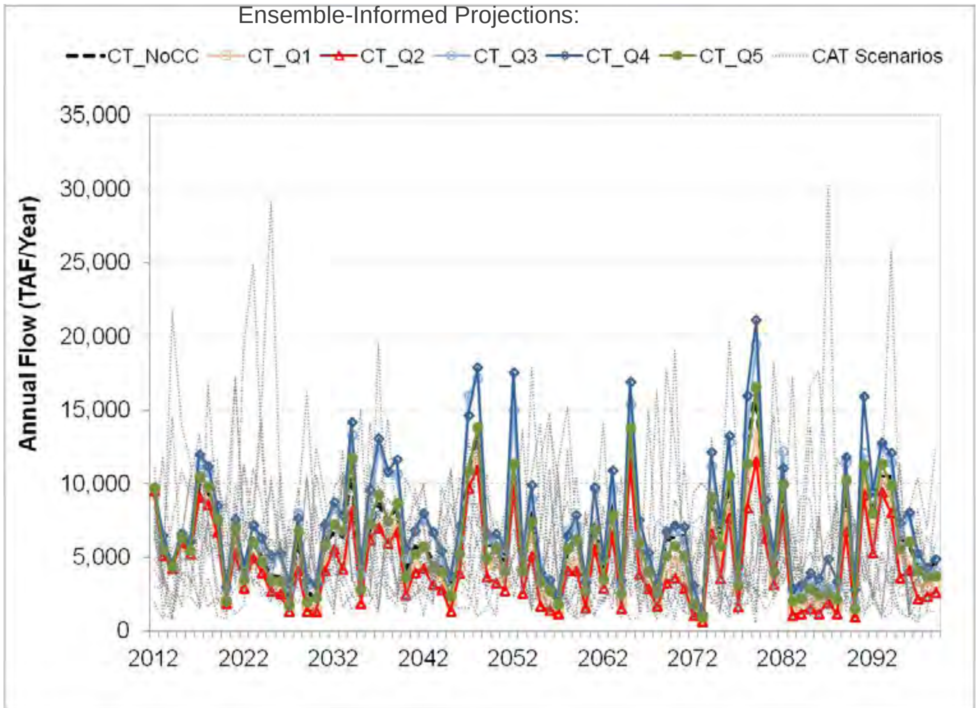


Figure 8-5. Annual Time Series of Runoff in the San Joaquin River Hydrologic Region in each Climate Scenario

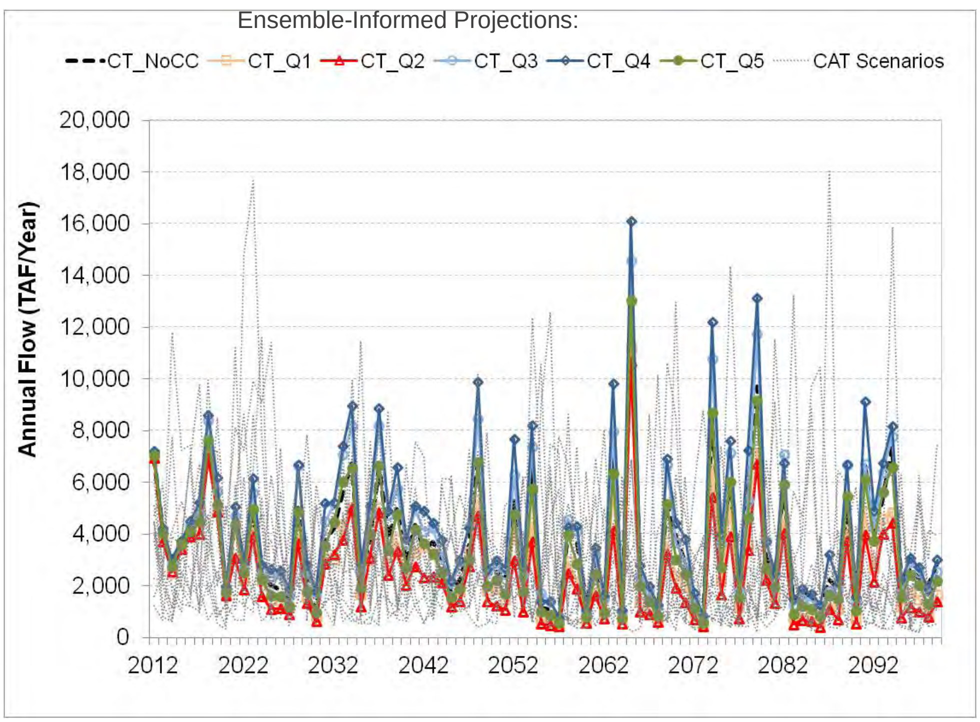


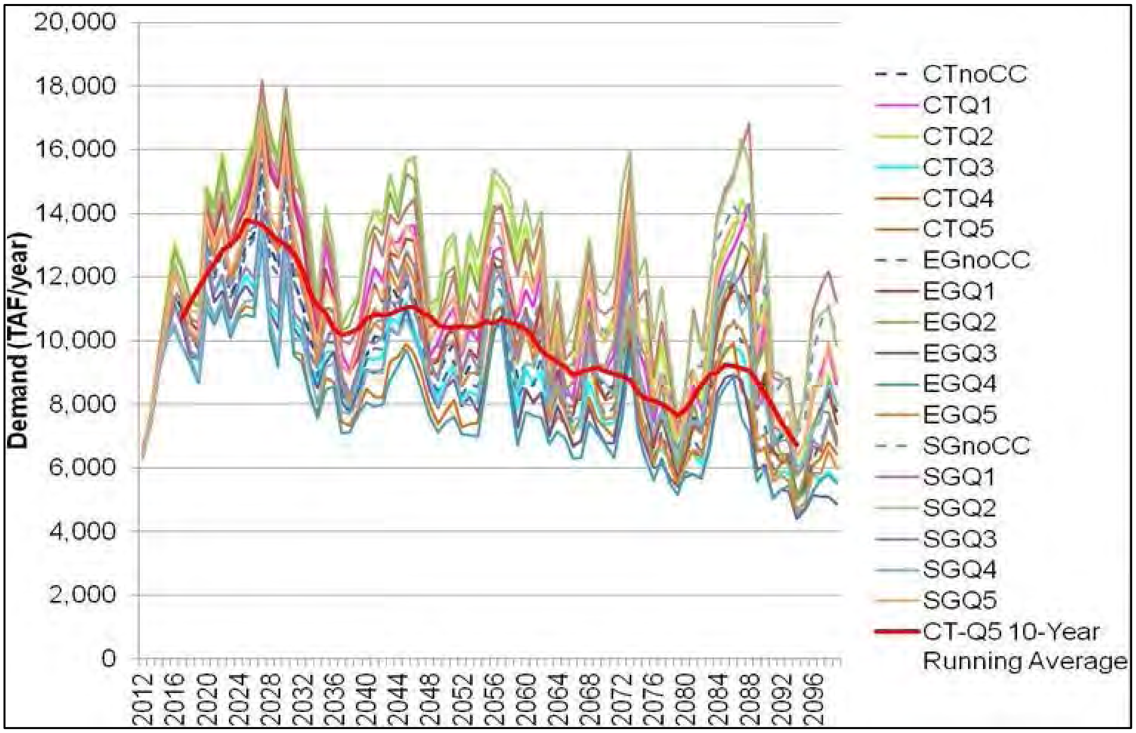
Figure 8-6. Annual Time Series of Runoff in the Tulare Lake Hydrologic Region in each Climate Scenario

In the San Joaquin River Basin, the mean annual change in runoff over the 21st century ranges from -27.9 percent (CT_Q2) to +24.5 percent (CT_Q4) with the central tendency projection being +-3.5 percent. In the Tulare Lake region, the mean annual change in runoff over the 21st century ranges from -33.4 percent (CT_Q2) to +23.8 percent (CT_Q4) with the central tendency projection being -7.4 percent. These ranges underscore the wide range of potential change in runoff volumes under climate change.

Water Demands

The impacts of potential climate changes on urban and agricultural water demands were assessed for each major hydrologic region in the Study Area. Additional water demand projections for each hydrologic region are presented in the Climate Change attachment of the Modeling Appendix.

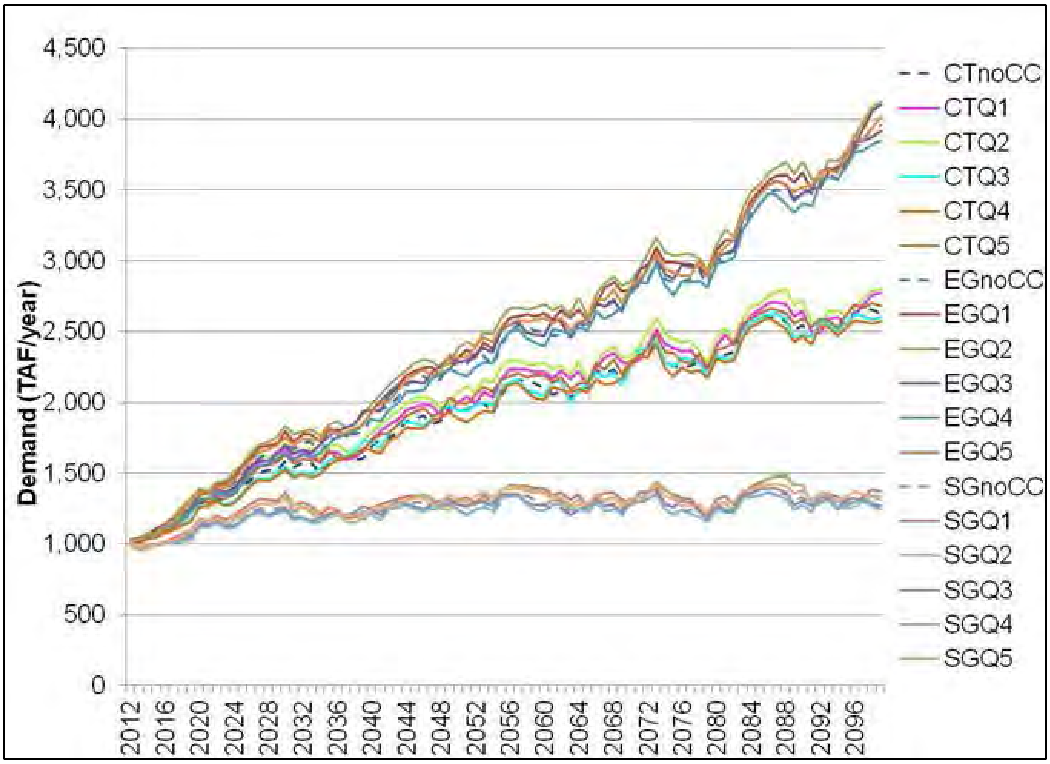
Figure 8-7 presents the annual time series of projected total agricultural water demand in Central Valley CVP water service areas for 18 socioeconomic-climate scenarios. The short-term demand variability seen in the figure is highly correlated with the variability in annual precipitation. In years of low precipitation, agricultural water demand is higher; and in years of high precipitation, water demands decrease. The longer-term trends include the effects of decreased irrigated lands and increasing carbon dioxide, especially in the latter half of the 21st century.



Key:
CT = current trends
EG=Expansive Growth scenario
NoCC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

Figure 8-7. Annual Time Series of Agricultural Applied Water Demand in the CVP Water Service Area in Each Socioeconomic-Climate Scenario

Figure 8-8 presents a similar annual time series of projected total urban water demands. In contrast to agricultural demands, urban demands do not show as large a degree of year-to-year variability because much of the urban demand is for indoor uses, which are assumed insensitive to precipitation variability. Because urban demands are driven largely by population, they tend to increase steadily over time with the growth in population and expansion of commercial activities.



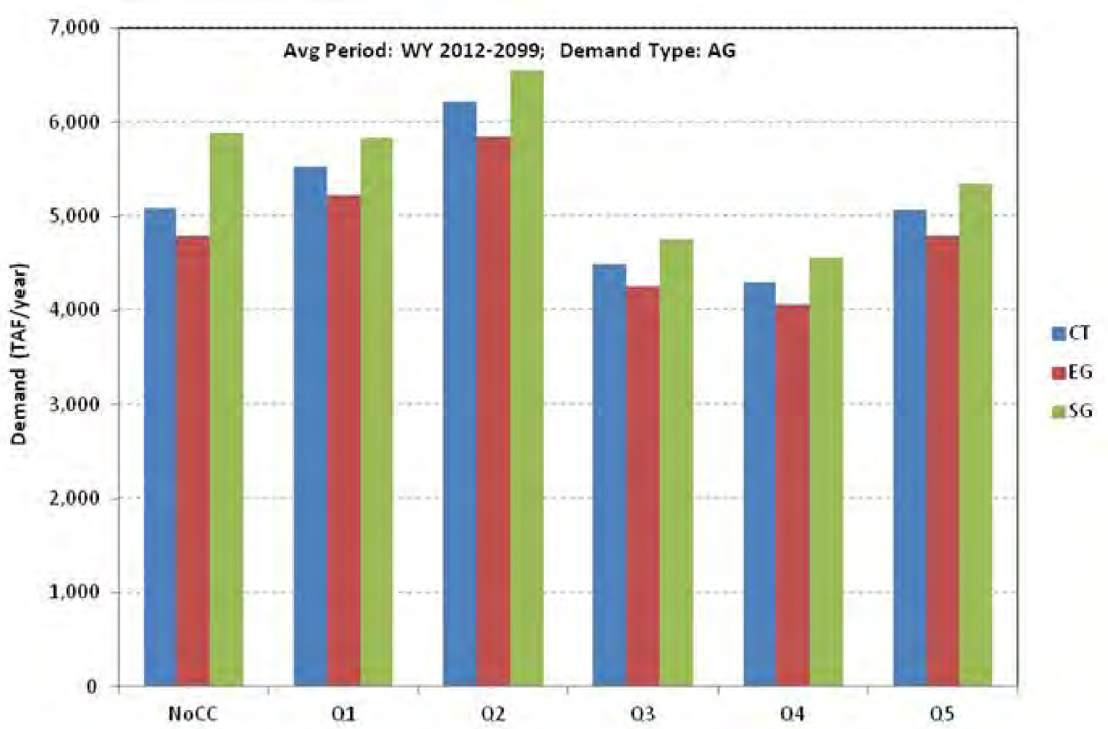
Key:
CT = current trends
EG=Expansive Growth scenario
NoCC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

Figure 8-8. Annual Time Series of Urban Applied Water Demand in the CVP Water Service Area in each Socioeconomic-Climate Scenario

Figure 8-9 through Figure 8-12 show the average annual agricultural and urban applied water demands for the CVP, SWP, and non-project water users in the San Joaquin River and Tulare Lake hydrologic regions for each socioeconomic-climate scenario over the projected period of water years from 2012 through 2099.

Total agricultural and urban water demands (including CVP, SWP, and non-project) vary across both the range of socioeconomic scenarios and the range of climate scenarios. Although the magnitudes differ between basins because of differences in crops and acreages, the overall relationship between precipitation and agricultural demand is similar in all basins. While the median climate scenario (Q5) has similar demands to the NoCC, the drier climate scenarios (Q1 and Q2) have higher average demands than the NoCC, and the wetter climate scenarios (Q3 and Q4) have lower average demands than the NoCC. Among the socioeconomic scenarios, the EG scenario has lower agricultural demands than the CT scenario because the assumed rate of urban expansion into agricultural lands is greater. Conversely, the SG scenario has higher agricultural demands than the CT scenario because it reflects less agricultural to urban land conversion.

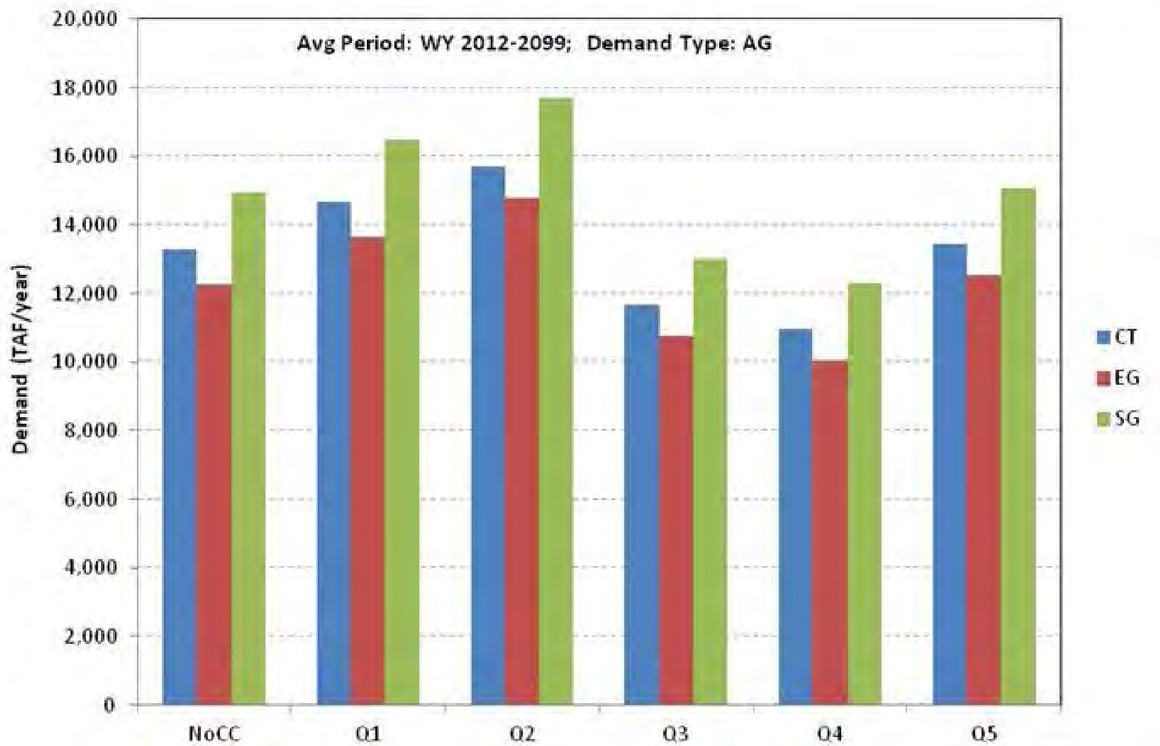
In the San Joaquin River hydrologic region, the overall average agricultural demand change relative to the no climate change scenario is 0 to +0.9 percent in Q5, ranging from an 11 to 22 percent decrease in the wetter Q3 and Q4 scenarios to a 10 to 22 percent increase in the drier Q1 and Q2 scenarios.



AG = agricultural
Avg = average
NoCC = No Climate Change
CT = Current Trends scenario
EG = Expansive Growth scenario
SG = Slow Growth scenario
TAF = thousand acre-feet
WY = water year

Figure 8-9. Average Annual Agricultural Applied Water Demand in the San Joaquin River Hydrologic Region in each Socioeconomic-Climate Scenario

In the Tulare Lake hydrologic region, the overall average agricultural demand change relative to the NoCC scenario is 1 to 2 percent higher in Q5, ranging from a 12 to 18 percent decrease in the wetter Q3 and Q4 scenarios to a 10 to 20 percent increase in the drier Q1 and Q2 scenarios.

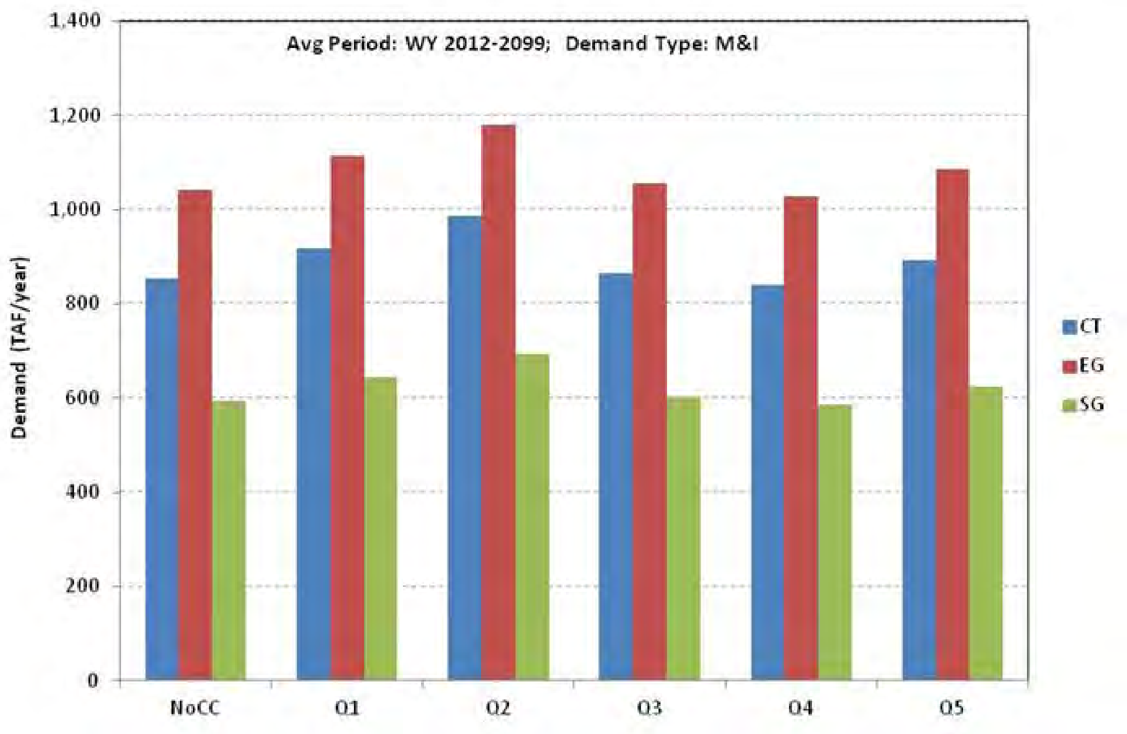


Key:
AG = agricultural
Avg = average
NoCC = No Climate Change
CT = Current Trends scenario
EG = Expansive Growth scenario
SG = Slow Growth scenario
TAF = thousand acre-feet
WY = water year

Figure 8-10. Average Annual Agricultural Applied Water Demand in the Tulare Lake Hydrologic Region in each Socioeconomic-Climate Scenario

In contrast with agricultural demands, the effect of precipitation variability on urban demands is minimal while the effect of population is significant. Consequently, the EG scenario has the largest urban demands and the SG scenario has the least. Across all climate scenarios and basins, the overall urban demand is about 4.4 to 4.8 MAF/year in the CT socioeconomic scenario, ranging from a low of about 2.9 to 3.1 MAF/year in the SG scenario to a high of about 5.2 to 5.7 MAF/year in the EG scenario.

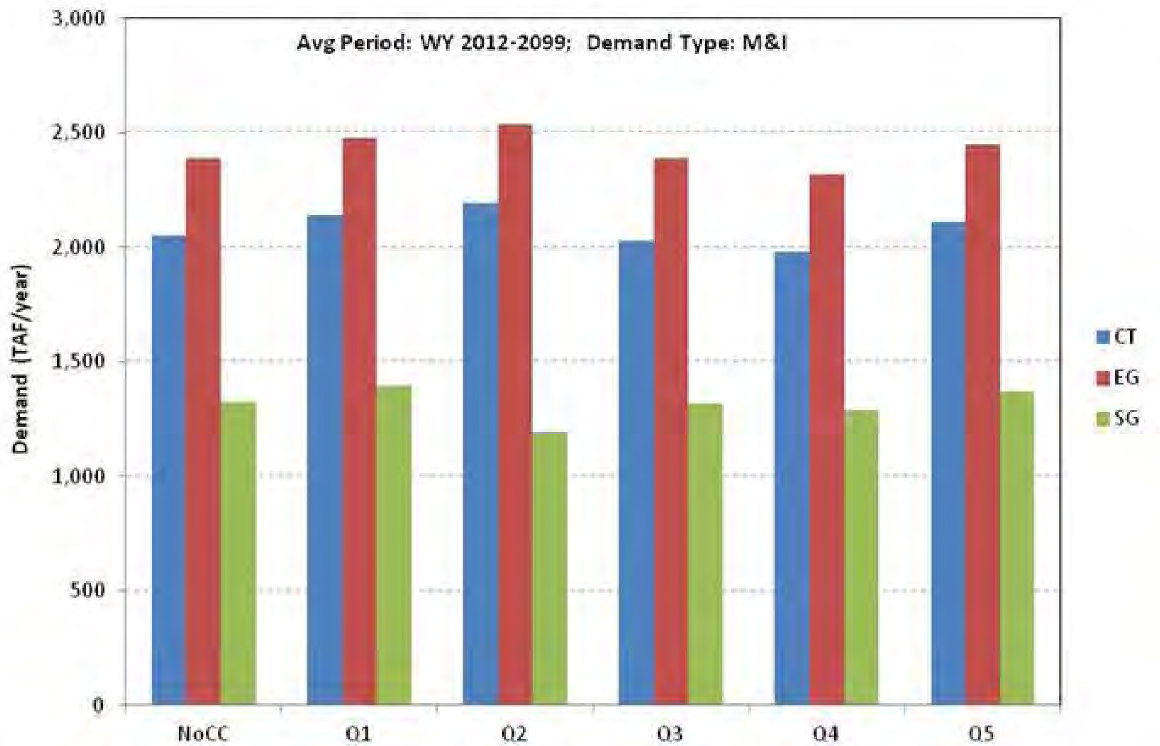
In the San Joaquin River hydrologic region, the average Q5 urban demand change is +4 to +5 percent, ranging from –1 percent to +2 percent in the wetter climate scenarios to +7 percent to +17 percent in the drier climate scenarios.



Key:
Avg = average
M&I = municipal and industrial
NoCC = No Climate Change
CT = Current Trends scenario
EG = Expansive Growth scenario
SG = Slow Growth scenario
TAF = thousand acre-feet
WY = water year

Figure 8-11. Average Annual Urban Applied Water Demand in the San Joaquin River System in each Socioeconomic-Climate Scenario

Trends in the Tulare Lake hydrologic region are similar to those observed in the San Joaquin River hydrologic region. The average Q5 urban demand change is +3 percent to +4 percent, ranging from 0 percent to -3 percent in the wetter Q3 and Q4 climate scenarios and from -10 percent to 7 percent in the drier Q1 and Q2 climate scenarios.



Key:
Avg = average
M&I = municipal and industrial
NoCC = No Climate Change
CT = Current Trends scenario
EG = Expansive Growth scenario
SG = Slow Growth scenario
TAF = thousand acre-feet
WY = water year

Figure 8-12. Average Annual Urban Applied Water Demand in the Tulare Lake Region in each Socioeconomic-Climate Scenario

CVP and SWP System Operations

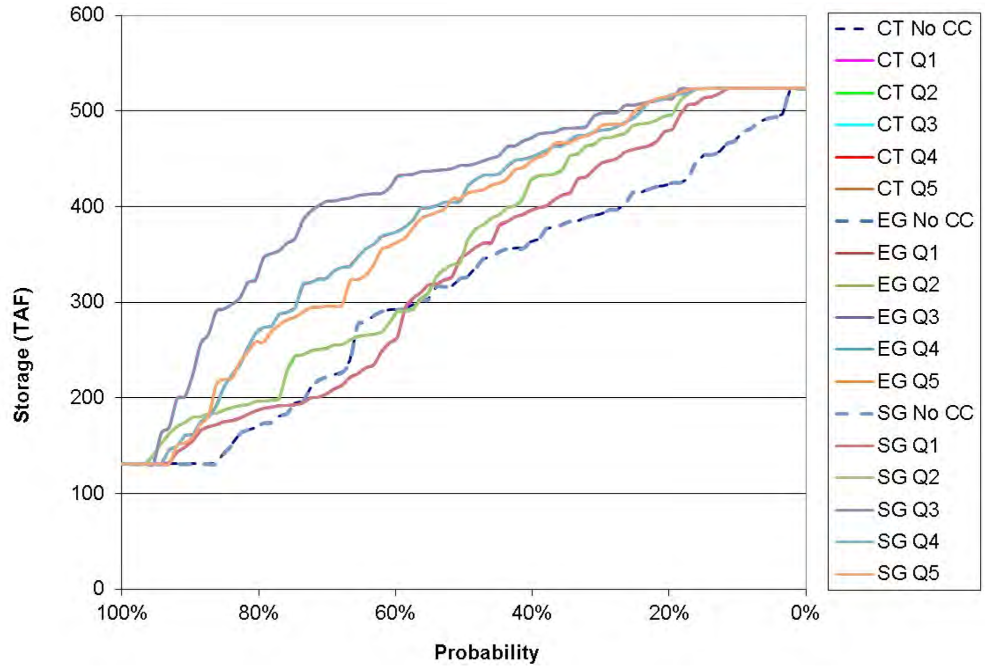
The following sections summarize projected without-project storage, Delta export and outflow, and Delta salinity associated with the CVP and SWP under the socioeconomic and climate scenarios.

CVP and SWP Project Storage Exceedence plots of the end of May and end of September storages in Millerton Lake under each of the 18 socioeconomic-climate scenarios during the 21st century are presented on Figure 8-13 and Figure 8-14. The end of May storage typically represents the water supply available for meeting agricultural, urban and environmental water demands while end of September storage is an indicator of carryover storage that is reserved to meet demands in subsequent years. A 50 percent probability of exceedence may be interpreted as the average reservoir storage volume over the entire 21st century period.

The reservoir storage results indicate limited variability between the different socioeconomic scenarios, but significant variability between the different climate scenarios. Reservoir storage is slightly higher under the EG scenario because this scenario reflects the largest decrease over time in agricultural demands (the largest demand type).

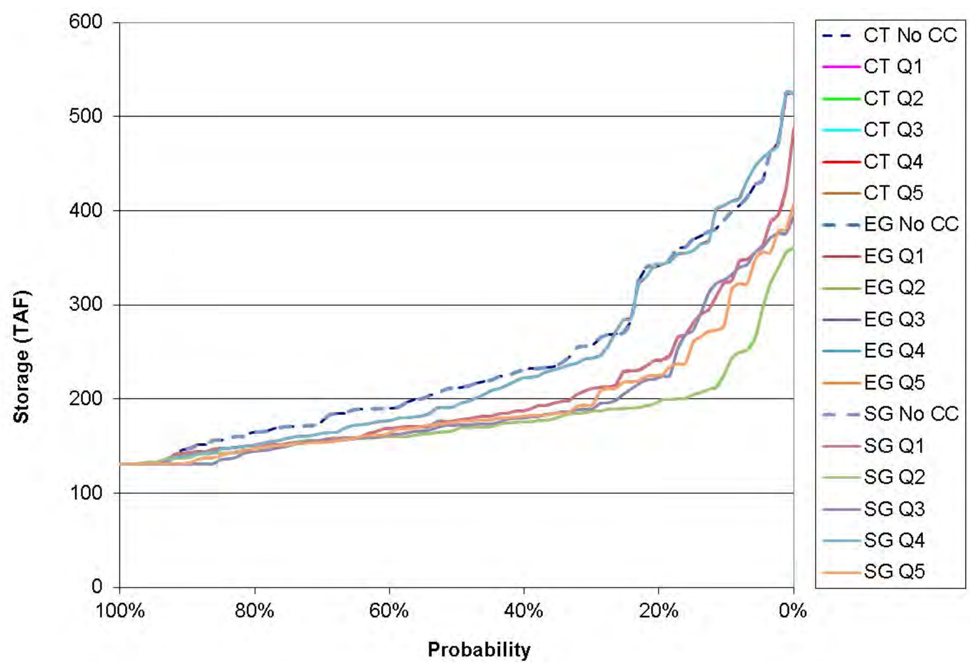
The median climate scenario (Q5) indicates storage levels slightly below the NoCC scenarios. The storage levels in both May and September are higher under the wetter climate scenarios (Q3 and Q4) than under the NoCC scenarios, with the highest storage levels in the wetter, less warming scenario (Q4). Conversely, storage levels in both months are lower under the drier climate scenarios (Q1 and Q2) than under the no climate change scenarios, with the lowest storage levels in the drier, more warming climate scenario (Q2).

The end of May storage in Millerton Lake under climate change scenarios is projected to be typically above the NoCC projections due to the occurrence of increased fall and early winter runoff. However, end of September storage is projected to be typically below the NoCC scenarios, with the lowest storage levels reflecting increased demands associated with the warmer, drier Q2 projections. It is also important to note that Millerton Lake storage volumes do not change with the different socioeconomic scenarios since it is assumed that any storage not directly released from Millerton Lake to meet agricultural demands would be released and used for groundwater recharge in the Friant Division water service area. Further, reservoir operations may be adapted under climate change to maintain greater end of September carryover storage than described here. Similar information on San Luis Reservoir carry-over storage is available in the Climate Change attachment to the Modeling Appendix.



Key:
CT = current trends
EG=Expansive Growth scenario
NoCC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

Figure 8-13. Exceedence of Millerton Lake End-of-May Storage in each Socioeconomic-Climate Scenario



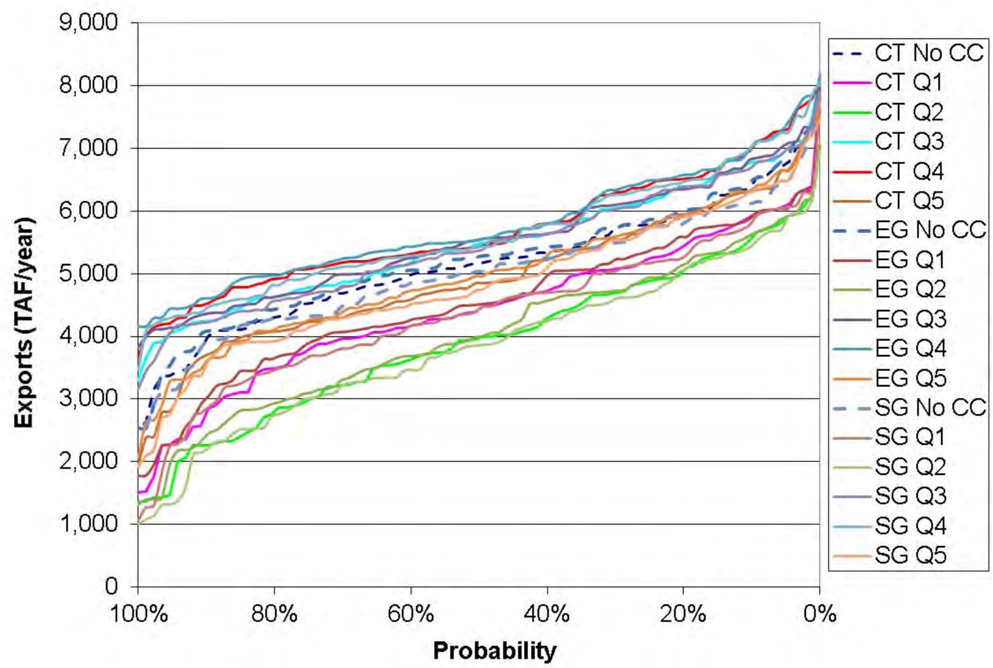
Key:
CT = current trends
EG=Expansive Growth scenario
NoCC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

Figure 8-14. Exceedence of Millerton Lake End-of-September Storage in each Socioeconomic-Climate Scenario

CVP and SWP Delta Exports and Delta Outflow Annual exceedence plots and box plots of total CVP and SWP exports (at Banks Pumping Plant and C.W. “Bill” Jones Pumping Plant (Jones Pumping Plant)) and Delta outflow are presented in Figure 8-15 through Figure 8-18. The box plots depict the mean (red triangle), median (black line), 25th and 75th percentile (gray rectangle), minimum and maximum values (line tip) for the annual flows in each socioeconomic-climate scenario.

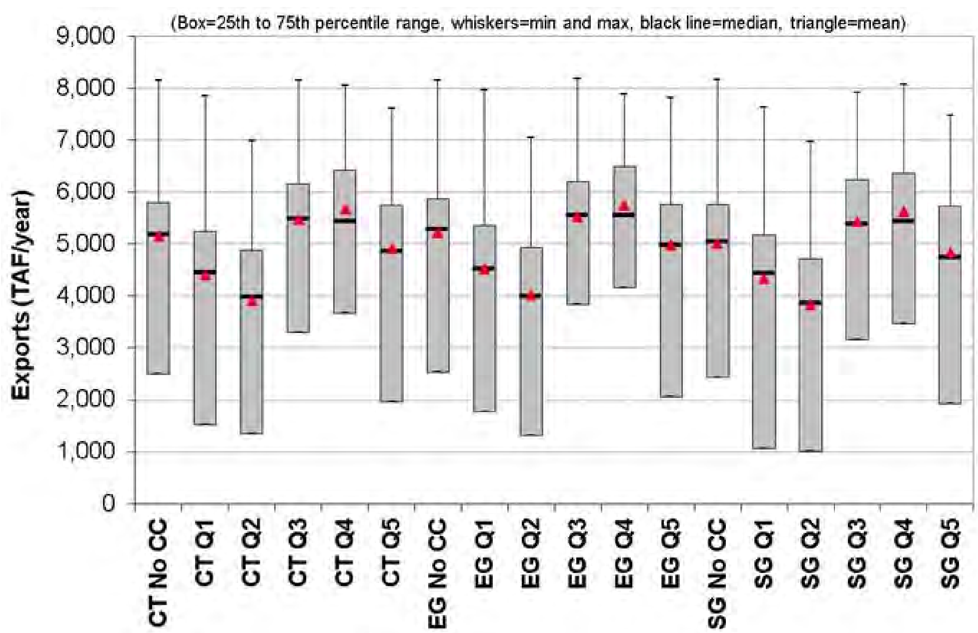
With respect to total exports (both pumping plants), the socioeconomic scenarios exert only small influences on Delta pumping and outflow, whereas the drier climate projections (Q1 and Q2) result in exports below the NoCC simulations. The central tendency projections (Q5) are slightly less than NoCC projections, corresponding to the slightly drier climate predictions in Q5.

Delta exports and outflows are lower under climate scenarios Q5, Q1, and Q2 than under the corresponding NoCC, with the lowest flows occurring in the warmer-drier Q2 scenario. Conversely, annual flows are greater under climate scenarios Q3 and Q4 than corresponding NoCC scenarios, with the highest flows occurring in the less warm-wetter Q4 climate scenario. The drier climate scenarios (Q1 and Q2) show a greater difference in Delta exports relative to corresponding NoCC scenarios than do the wetter climate scenarios (Q3 and Q4) because exports in the wetter climate scenarios are frequently limited by Delta conveyance capacities and Delta regulatory requirements. Total Delta exports are about 0.2 MAF/year and outflows 0.6 MAF/year lower for the central tendency Q5 than NoCC. For the warmer, drier Q2 projection, Delta exports are approximately 1.2 MAF/year lower and outflow is 4.2 to 5.0 MAF/year lower than corresponding NoCC scenarios. Conversely, total exports are about 0.5 MAF/year higher and Delta outflow is ranges from 6.0 to 6.2 MAF/year higher under the wetter Q4 projections than under the NoCC scenarios.



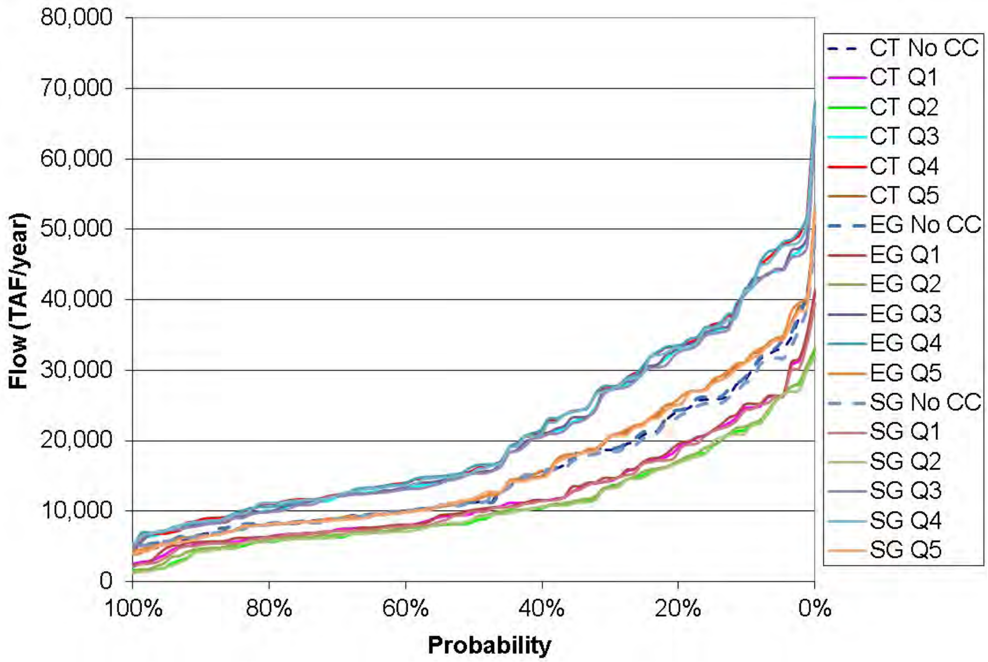
Key:
CT = current trends No CC = no climate change
EG=Expansive Growth scenario
TAF = thousand acre-feet
SG = Slow Growth scenario

Figure 8-15. Exceedence of Total Annual Delta Export Pumping in each Socioeconomic-Climate Scenario



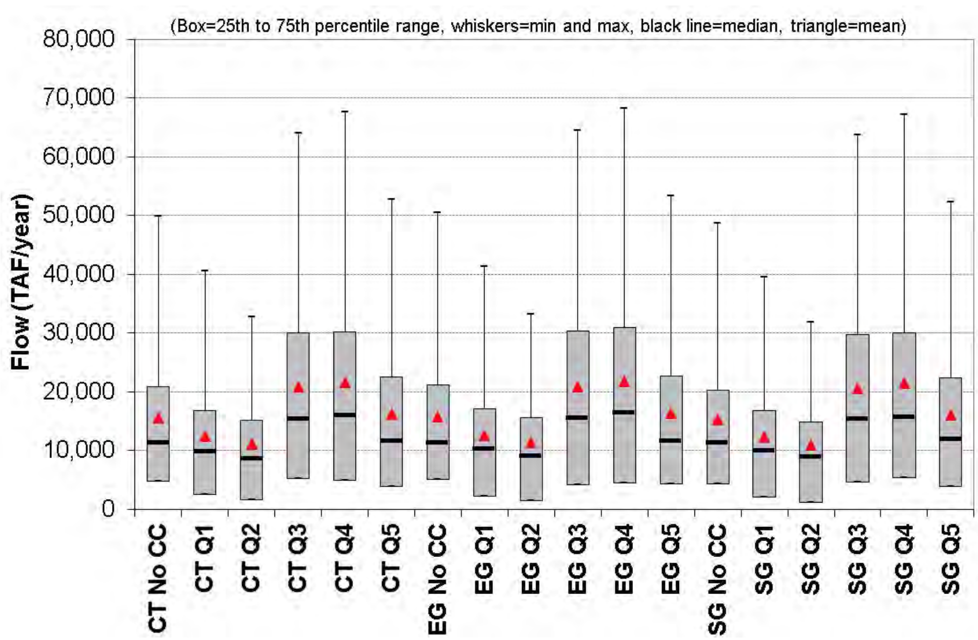
Key:
CT = current trends No CC = no climate change
EG=Expansive Growth scenario
TAF = thousand acre-feet
SG = Slow Growth scenario

Figure 8-16. Box Plot of Total Annual Delta Export Pumping in each Socioeconomic-Climate Scenario



Key:
CT = current trends
EG=Expansive Growth scenario
No CC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

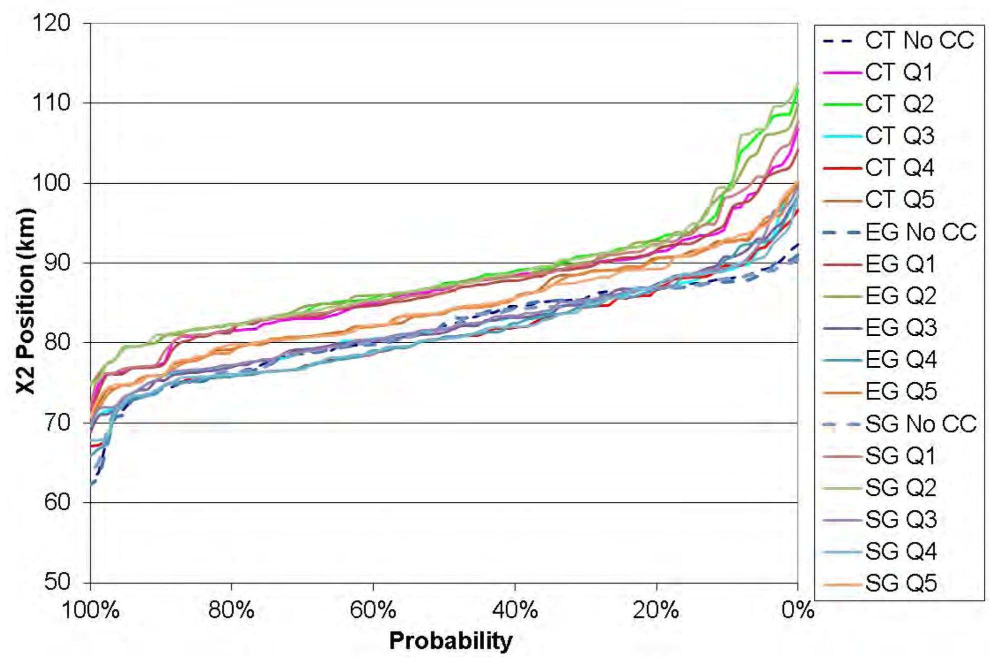
Figure 8-17. Annual Exceedence of Total Annual Delta Outflow in each Socioeconomic-Climate Scenario



Key:
CT = current trends
EG=Expansive Growth scenario
No CC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

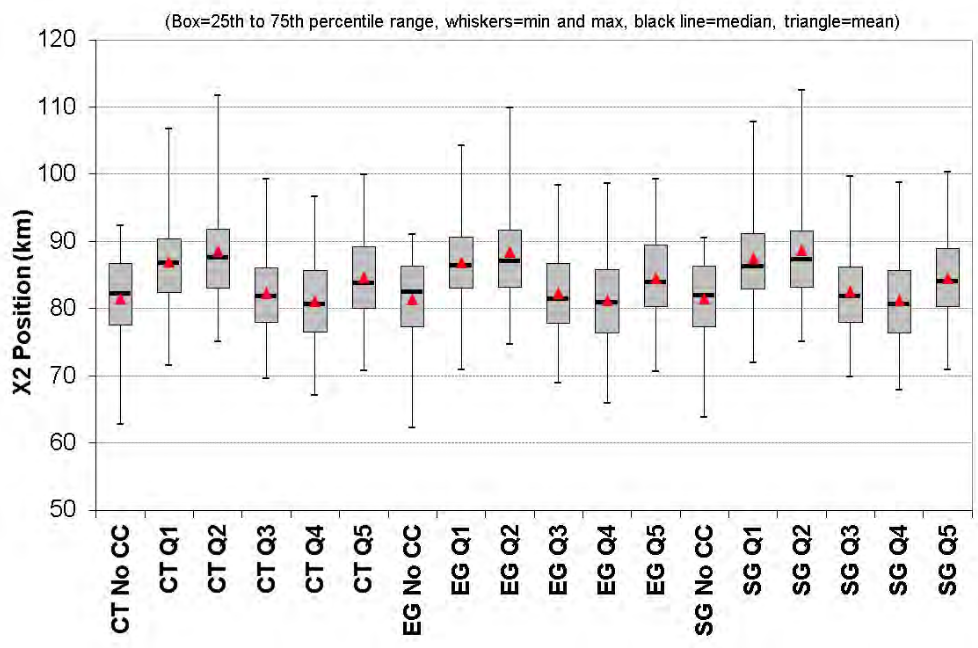
Figure 8-18. Box Plot of Total Annual Delta Outflow in each Socioeconomic-Climate Scenario

Delta Salinity Figure 8-19 and Figure 8-20 show exceedence and box plots, respectively, of the average distance measured from the Golden Gate Bridge of the X2 position (location in the Delta of 2 parts per thousand salinity concentration) from February through June for each socioeconomic-climate scenario. Greater X2 positions indicate that salinity has moved farther eastward into the Delta. During the period from February through June, CVP and SWP reservoirs are operated to maintain the location of X2 within the Delta to meet certain regulatory requirements. As shown, the X2 results are very similar between the different socioeconomic scenarios but differ significantly relative to the different climate scenarios.



Key:
CT = current trends
EG=Expansive Growth scenario
No CC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

Figure 8-19. Exceedence of Average February-to-June X2 Position in Each Socioeconomic-Climate Scenario



Key:
CT = current trends
EG=Expansive Growth scenario
No CC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

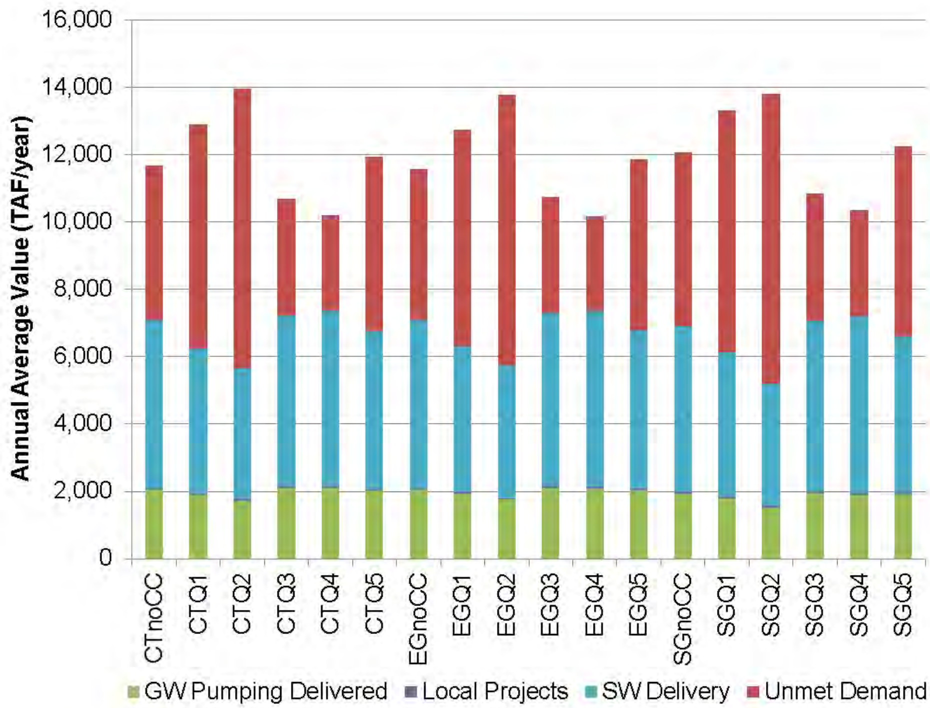
Figure 8-20. Box Plot of Average February-to-June X2 Position in each Socioeconomic-Climate Scenario

The X2 position results under the wetter climate scenarios (Q3 and Q4) are similar to corresponding NoCC scenarios because the increased flows into the Delta in those wetter scenarios compensate for increased sea level rise. The average X2 distance in the wetter Q4 scenario is about 0.4 km farther to the east than without climate change. However, the X2 location is greater under the central tendency Q5 scenario than the NoCC scenario by approximately 3 km eastward. The largest changes occur under the warmer-drier Q2 climate scenario in which the average X2 distance from February through June is about 7 km farther east with respect to the NoCC scenarios.

Supplies and Demands in CVP Divisions

Figure 8-21 shows the average annual total CVP water service area supplies from various sources during the 21st century, including surface water, groundwater, and local supply projects. Also shown on Figure 8-21 is the average annual unmet demand (defined as total demands minus surface water deliveries, groundwater pumping, and the effects of any local supply enhancement actions) for the CVP water service area. In general, changes in climate have a greater influence on supplies and demands than changes in socioeconomics. In all scenarios, local supplies are relatively small compared with other supplies.

Over the 21st century, the average projected unmet demands in the CVP service area range from 2.8 to 8.6 MAF/year. The central tendency Q5 unmet demands are approximately 0.6 MAF/year greater than corresponding NoCC scenarios. The largest unmet demands occur in the warmer-drier Q2 climate scenarios and range from increases of 3.4 to 3.7 MAF/year, while the largest unmet demand decreases occur in the less warming-wetter Q4 climate scenarios and range from 1.6 to 1.9 MAF/year.



Key:
CT = Current Trends scenario
EG=Expansive Growth scenario
GW = groundwater
NoCC = no climate change
SG = Slow Growth scenario
SW = surface water
TAF = thousand acre-feet

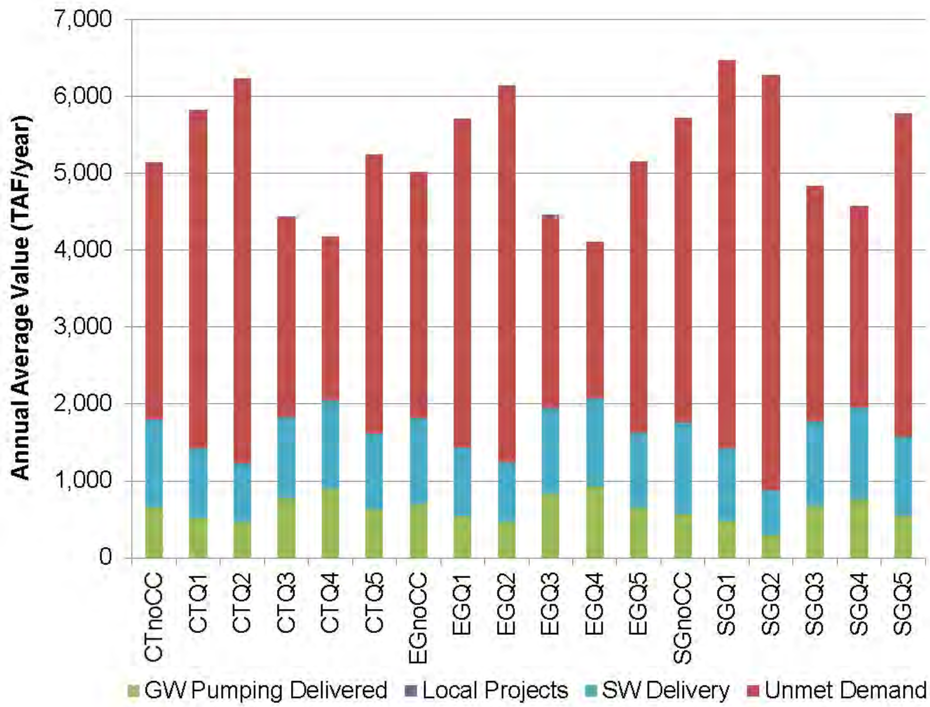
Figure 8-21. Average Annual Supplies and Unmet Demand in the CVP Water Service Area in Each Socioeconomic-Climate Scenario

Average annual surface water deliveries in the CVP water service area range from a minimum of 3.7 to a maximum of 5.1

MAF/year. The central tendency Q5 surface water deliveries are approximately 0.3 MAF/year less than corresponding NoCC scenarios. Surface water deliveries decrease in the warmer-drier Q2 climate scenarios (from 1.0 to 1.3 MAF/year less than the corresponding NoCC scenarios), while surface water deliveries increase in the less warming-wetter Q4 climate scenarios (from 0.2 to 0.3 MAF/year greater than the corresponding NoCC scenarios).

Average groundwater pumping in the CVP water service area ranges from 1.5 to 2.1 MAF/year. The greatest groundwater pumping occurs in the wetter Q3 and Q4 climate scenarios; this is because aquifer recharge is greater under the wetter climate scenarios, resulting in higher groundwater levels and less constraints on pumping relative to the drier Q1 and Q2 climate scenarios. Groundwater pumping in the central tendency Q5 is approximately 0.03 MAF/year less than NoCC scenarios. Groundwater pumping in the warmer-drier Q2 climate scenarios ranges from 0.3 to 0.4 MAF/year less than NoCC scenarios, while pumping in the less warming-wetter Q4 climate scenarios ranges from a slight increase of 0.04 MAF/year to a slight decrease 0.02 MAF/year compared to NoCC scenarios.

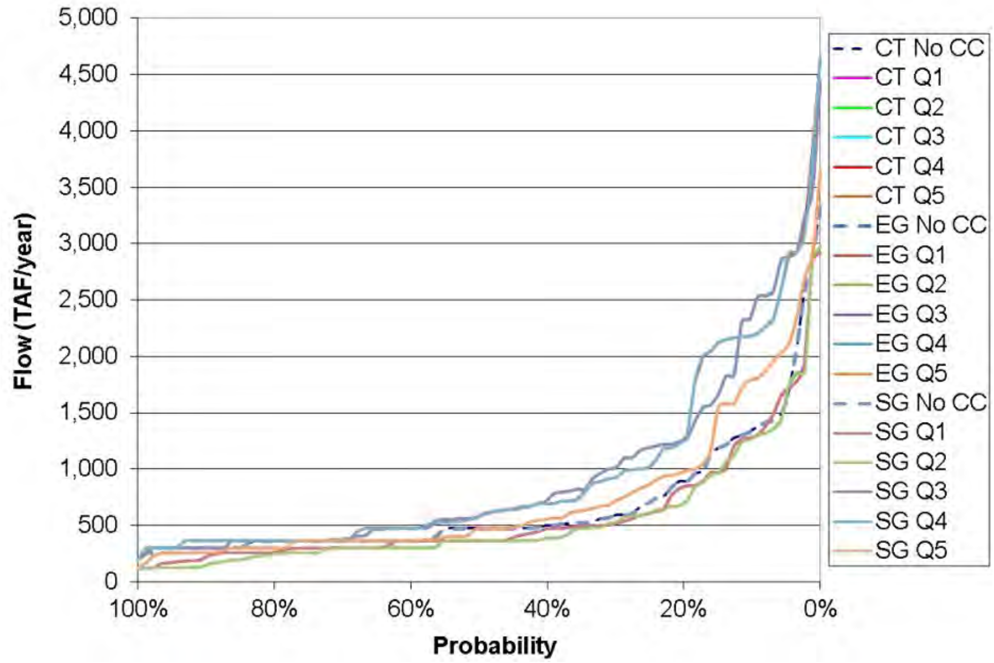
Figure 8-22 presents similar supply and demand information for the Friant Division of the CVP. The overall 21st century projected average annual unmet demands were 3,680 TAF/year, with a range from 2,040 to 5,400 TAF/year across all socioeconomic-climate scenarios. During this period, average annual surface water deliveries were 995 TAF/year, with a range from 590 to 1,190 TAF/year. Groundwater pumping averaged 630 TAF/year, with a range from 300 to 930 TAF/year.



Key:
CT = Current Trends scenario
EG=Expansive Growth scenario
GW = groundwater
NoCC = no climate change
SG = Slow Growth scenario
SW = surface water
TAF = thousand acre-feet

Figure 8-22. Average Annual Supplies and Unmet Demand in the Friant Division of the CVP in Each Socioeconomic-Climate Scenario

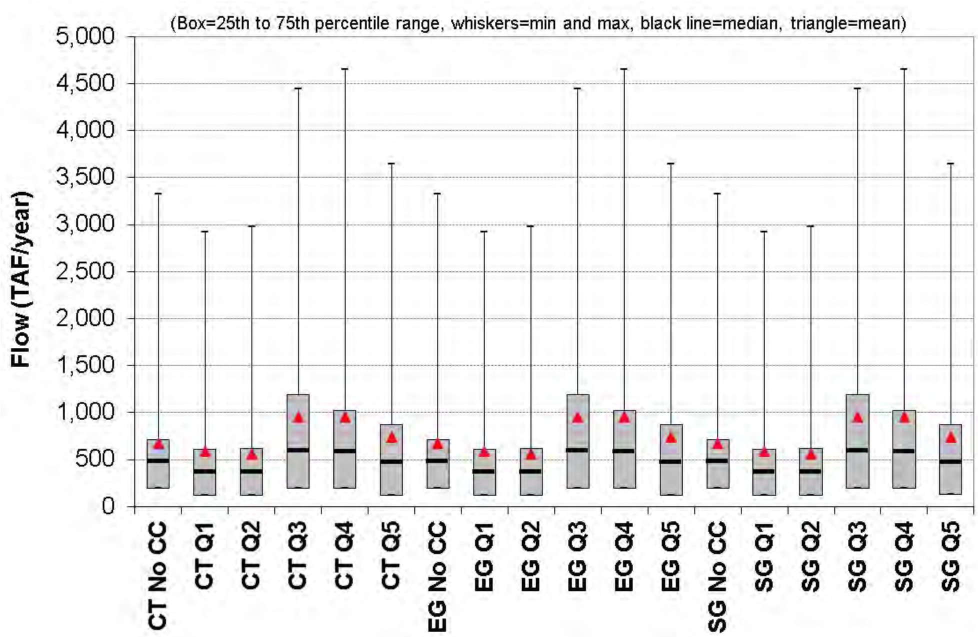
Figures 8-23 through 8-28 present additional exceedence and box plots showing the effects of potential climate changes on supplies and deliveries in the Friant Division of the CVP. Over all scenarios, 21st century average annual Friant Dam releases to the San Joaquin River range from 560 to 960 TAF/year. The central tendency Q5 releases are approximately 70 TAF/year greater than NoCC scenarios. Friant Dam releases in the warmer-drier Q2 climate scenarios decrease by about 100 TAF/year relative to NoCC scenarios, while releases in the less warming-wetter Q4 climate projections increase by about 285 TAF/year.



Key:

CT = current trends	No CC = no climate change	TAF = thousand acre-feet
EG=Expansive Growth scenario	SG = Slow Growth scenario	

Figure 8-23. Annual Exceedence of Friant Dam Releases to San Joaquin River in Each Socioeconomic-Climate Scenario

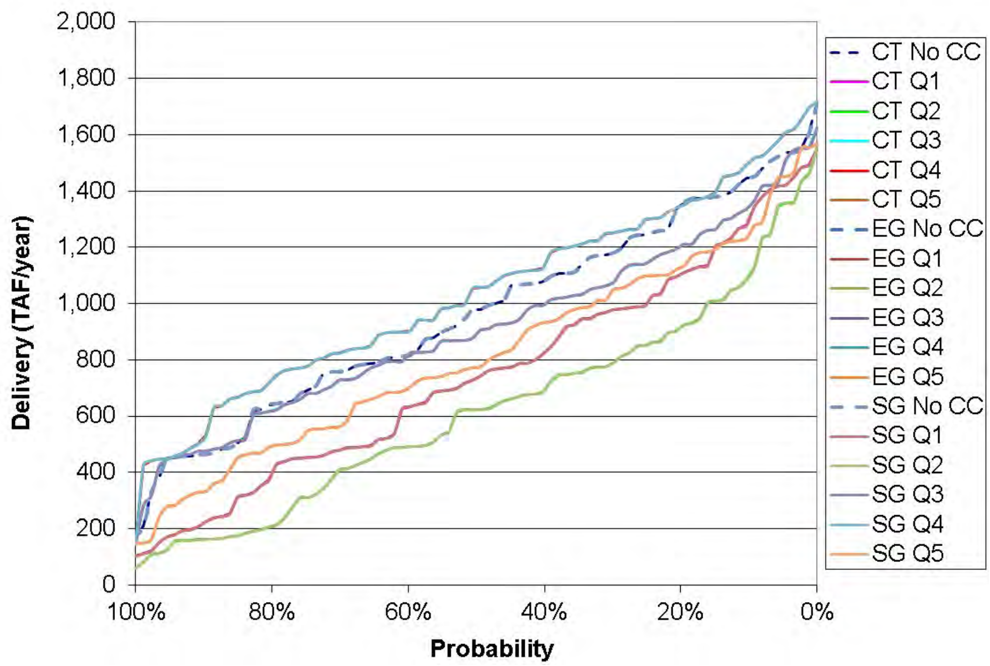


Key:

CT = current trends	No CC = no climate change	TAF = thousand acre-feet
EG=Expansive Growth scenario	SG = Slow Growth scenario	

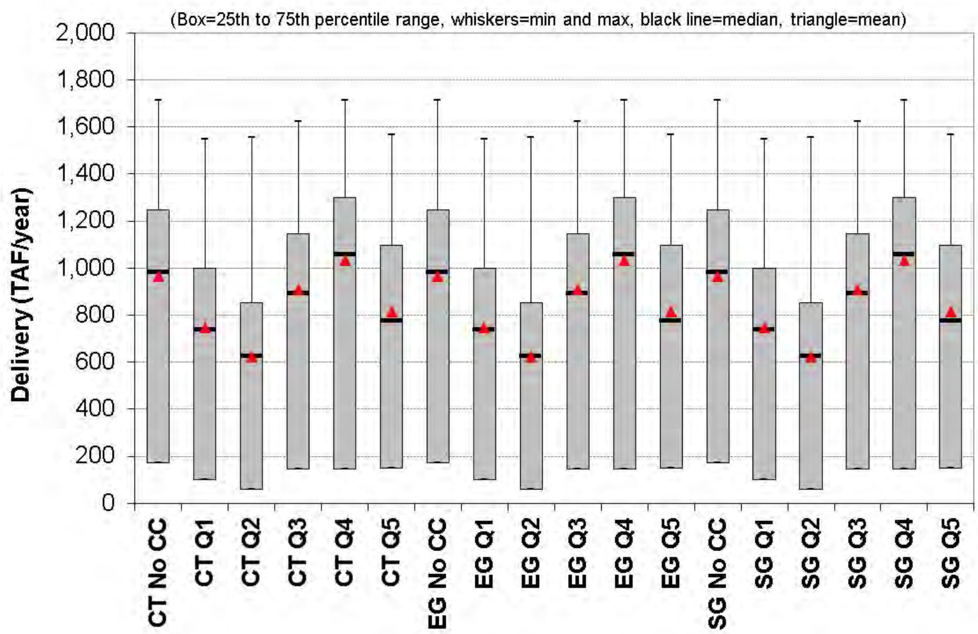
Figure 8-24. Box Plot of Friant Dam Releases to San Joaquin River in Each Socioeconomic-Climate Scenario

Across the scenarios shown in Figure 8-25 and Figure 8-26, mean annual Friant-Kern Canal deliveries range from approximately 600 TAF/year to 1 MAF/year. The central tendency Q5 Friant-Kern Canal deliveries are approximately 150 TAF/year less than NoCC. Friant-Kern Canal deliveries in the warmer-drier Q2 climate scenarios are approximately 340 TAF/year less than NoCC, while deliveries in the less warming-wetter Q4 climate projections increase by approximately 70 TAF/year.



Key:
CT = current trends
EG=Expansive Growth scenario
No CC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

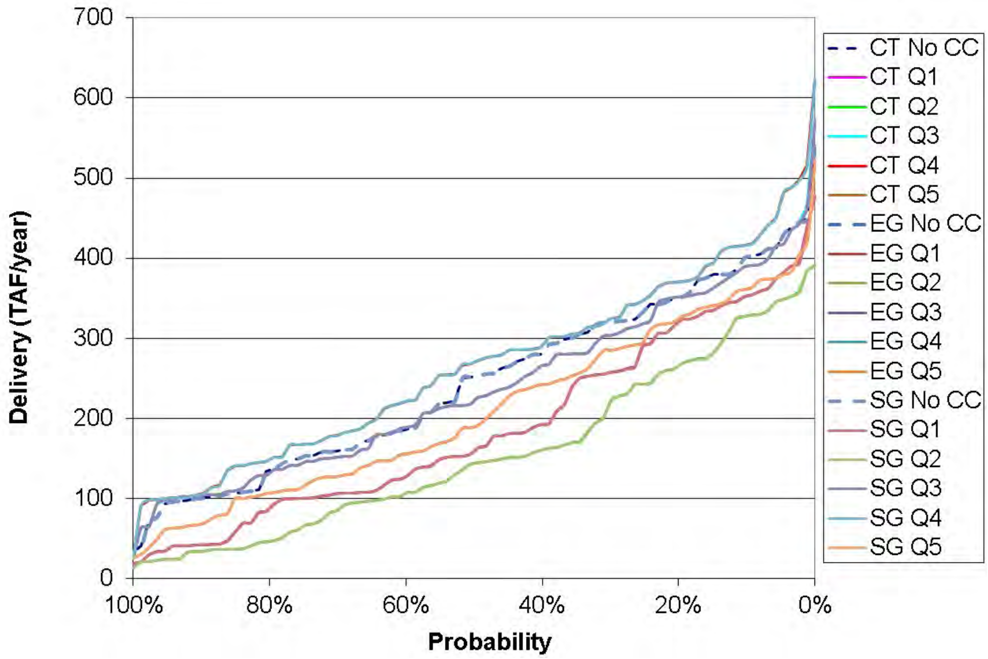
Figure 8-25. Annual Exceedence of Friant-Kern Canal Deliveries in Each Socioeconomic-Climate Scenario



Key:
CT = current trends
EG=Expansive Growth scenario
No CC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

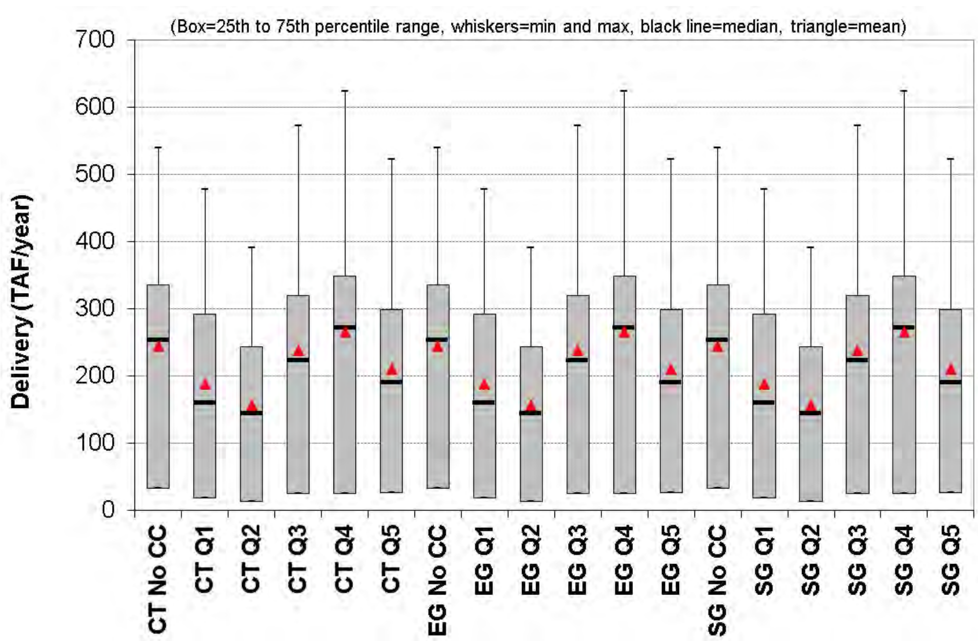
Figure 8-26. Box Plot of Friant-Kern Canal Deliveries in Each Socioeconomic-Climate Scenario

As shown in Figure 8-27 and Figure 8-28, mean annual Madera Canal deliveries over the 21st century range from approximately 190 TAF/year to 260 TAF/year. The central tendency Q5 Madera Canal deliveries are approximately 35 TAF/year less than NoCC. Friant-Kern Canal deliveries in the warmer-drier Q2 socioeconomic-climate scenarios are approximately 90 TAF/year less than NoCC, while deliveries in the less warming-wetter Q4 climate projections are approximately 20 TAF/year greater.



Key:
CT = current trends
EG=Expansive Growth scenario
No CC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

Figure 8-27. Annual Exceedence of Madera Canal Deliveries in Each Socioeconomic-Climate Scenario

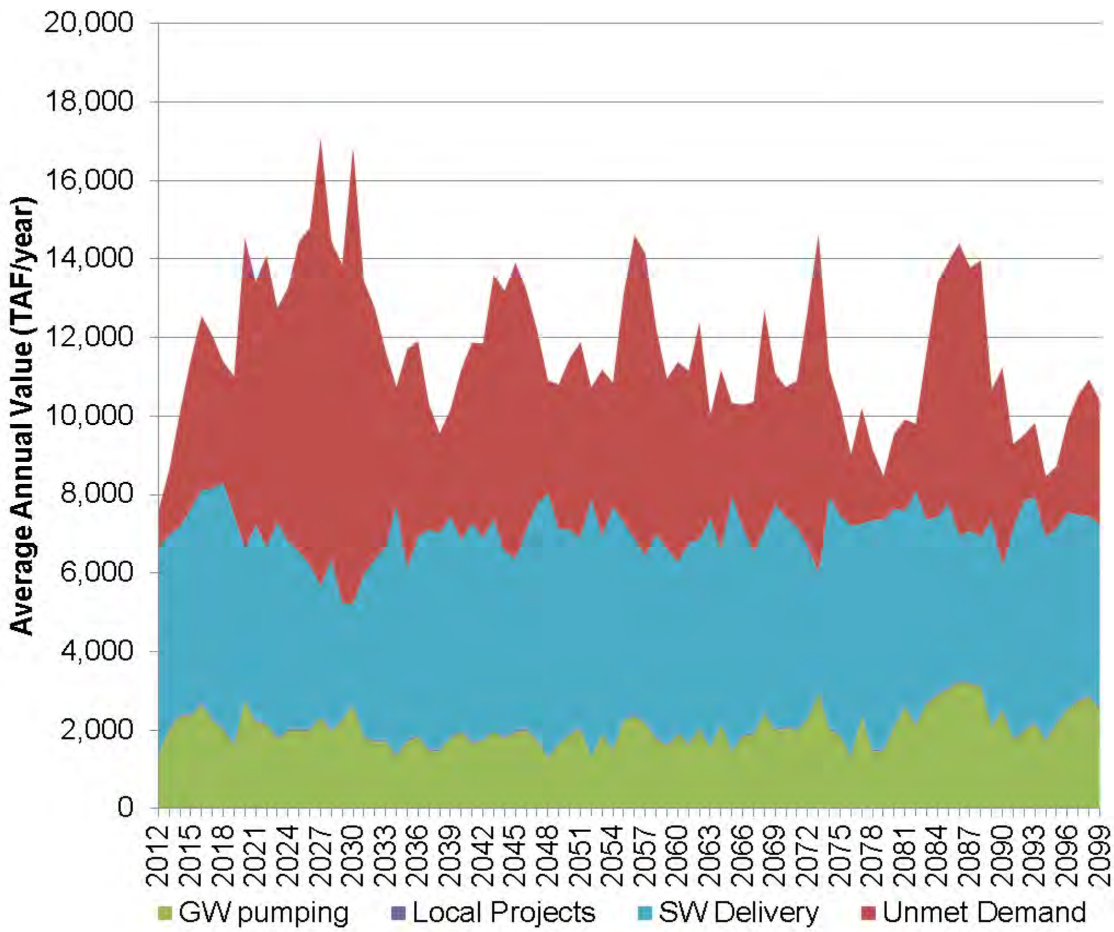


Key:
CT = current trends
EG=Expansive Growth scenario
No CC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

Figure 8-28. Box Plot of Madera Canal Deliveries in Each Socioeconomic-Climate Scenario

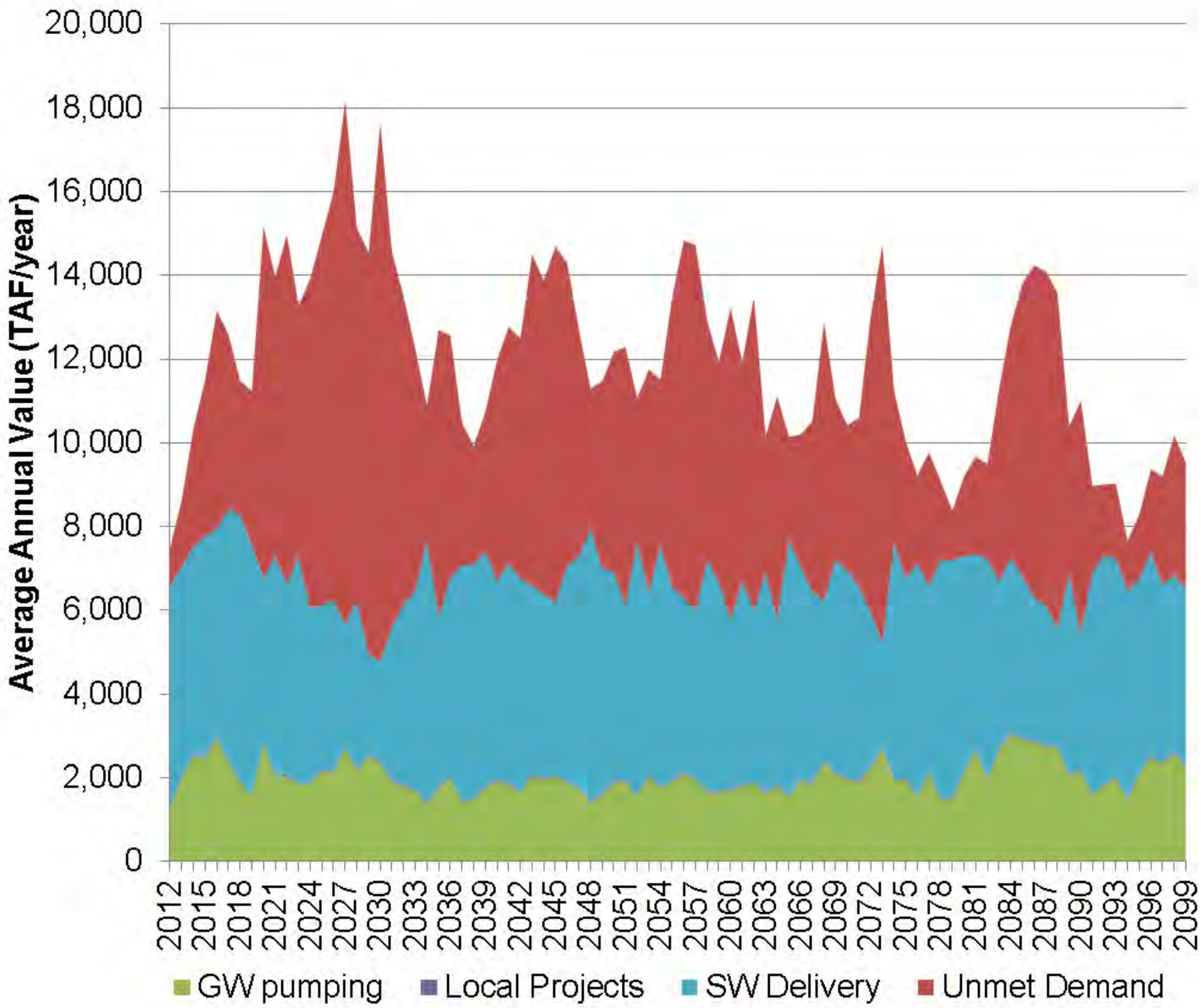
Figure 8-29 through Figure 8-32 present annual time series of groundwater, surface water, and local project supplies and unmet demands for the entire CVP water service area. The projected socioeconomic-climate scenarios analyzed under Baseline conditions include the current trends–median climate scenario (CT-Q5) to represent a midrange projection of socioeconomic-climate effects; expansive growth-warmer-drier scenario (EG-Q2) to represent the upper range of socioeconomic-climate effects; and slow growth-less warming-wetter scenario (SG-Q4) to represent the lower range of socioeconomic-climate effects.

The CT-NoCC time series, shown in Figure 8-29, is presented for comparison with other future climate projections using the same current trends socioeconomic scenario.



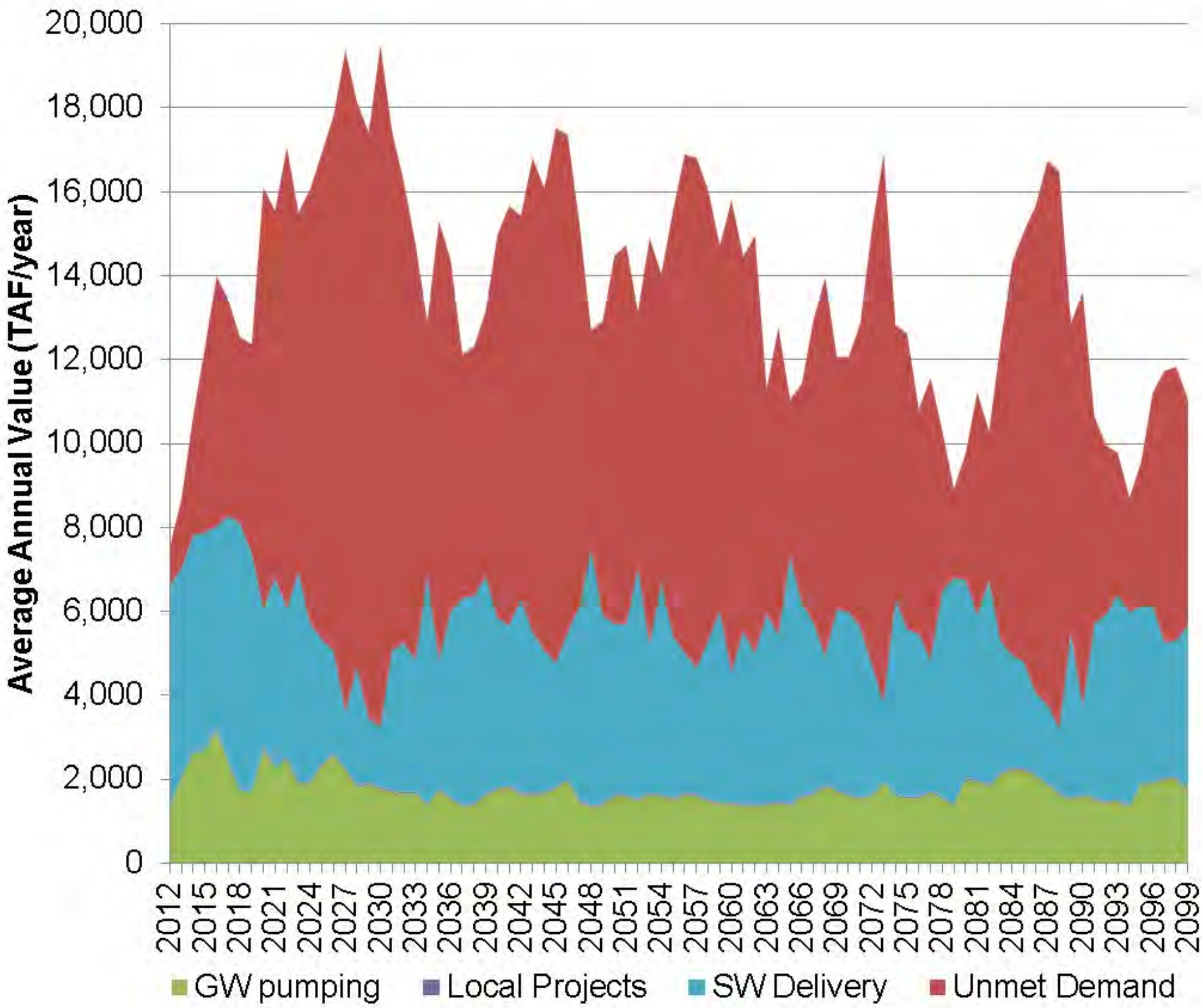
Key:
GW = groundwater
SW = surface water
TAF = thousand acre-feet

Figure 8-29. Annual Time Series of Supplies and Unmet Demands in CVP Water Service Area, CT–NoCC Socioeconomic-Climate Scenario



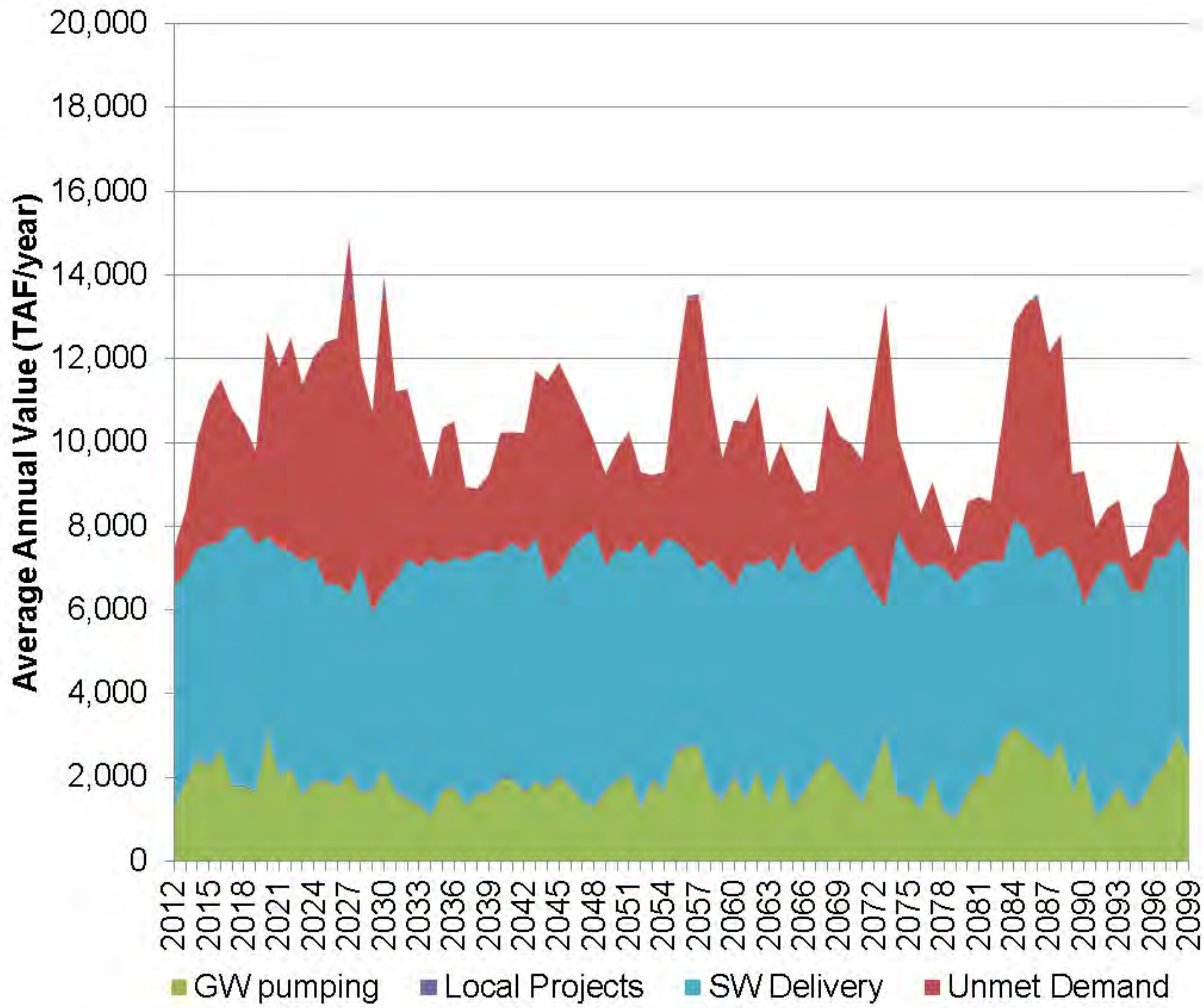
Key:
GW = groundwater
SW = surface water
TAF = thousand acre-feet

Figure 8-30. Annual Time Series of Supplies and Unmet Demands in CVP Water Service Area, CT–Q5 Socioeconomic-Climate Scenario



Key:
GW = groundwater
SW = surface water
TAF = thousand acre-feet

Figure 8-31. Annual Time Series of Supplies and Unmet Demands in CVP Water Service Area, EG–Q2 Socioeconomic-Climate Scenario



Key:
GW = groundwater
SW = surface water
TAF = thousand acre-feet

Figure 8-32. Annual Time Series of Supplies and Unmet Demands in CVP Water Service Area, SG–Q4 Socioeconomic-Climate Scenario

Over the 21st century, total supplies in the current trends–median climate projection (CT-Q5) range from a minimum of 4.8 to a maximum of 8.4 MAF/year, while unmet demands range from a minimum of 0.9 to a maximum of 12.8 MAF/year. For the expansive growth-warmer-drier scenario (EG-Q2), total supplies range from a minimum of 3.2 to a maximum of 8.3 MAF/year, while unmet demands range from a minimum of 0.9 to a maximum of 16.2 MAF/year. In the slow growth-less warming-wetter scenario (SG- Q4), total supplies range from a minimum of 5.9 to a maximum of 8.2

MAF/year, while unmet demands range from a minimum of 0.7 to a maximum of 8.4 MAF/year.

Results of Other Performance Assessment Tools

The following sections describe the results of other performance assessment tools for the Baseline condition. The projected socioeconomic-climate scenarios analyzed under Baseline conditions include the current trends–median climate scenario (CT-Q5) to represent a midrange projection of socioeconomic-climate effects; expansive growth-warmer-drier scenario (EG-Q2) to represent the upper range of socioeconomic-climate effects; and slow growth-less warming-wetter scenario (SG-Q4) to represent the lower range of socioeconomic-climate effects.

Because of the sensitivity of economic and temperature models to climate inputs, additional socioeconomic scenarios without climate change were simulated to better understand the effects of climate change on the results. Results of these simulations are described below, with further detail provided in the Climate Change attachment to the Modeling Appendix.

Economics The results from four economically based water management models are presented in this section:

- Least Cost Planning Simulation Model (LCPSIM) provides economic results for the South San Francisco Bay-South Region, used to represent California urban areas outside the Central Valley.

- Other Municipal Water Economics Model (OMWEM) provides economic results for urban regions in Central Valley.

- South Bay Water Quality Model (SBWQM) estimates salinity costs for deliveries to the South San Francisco Bay Region, used to represent California urban areas outside of the Central Valley.

- Statewide Agricultural Production Model (SWAP) provides economic results for agricultural regions in the Central Valley.

These economic models analyze differences between two scenarios rather than the absolute values of a single scenario; consequently, results are summarized in terms of differences in average annual net benefit between the different socioeconomic-climate scenarios described above. In addition, results are presented at three future levels of development (LOD) representing early (2025), mid (2050) and late (2085) 21st century socioeconomic and climate conditions. This approach allows for a clearer understanding of how socioeconomic and climate changes affect net economic benefits in the CVP service area over different timeframes during the 21st century.

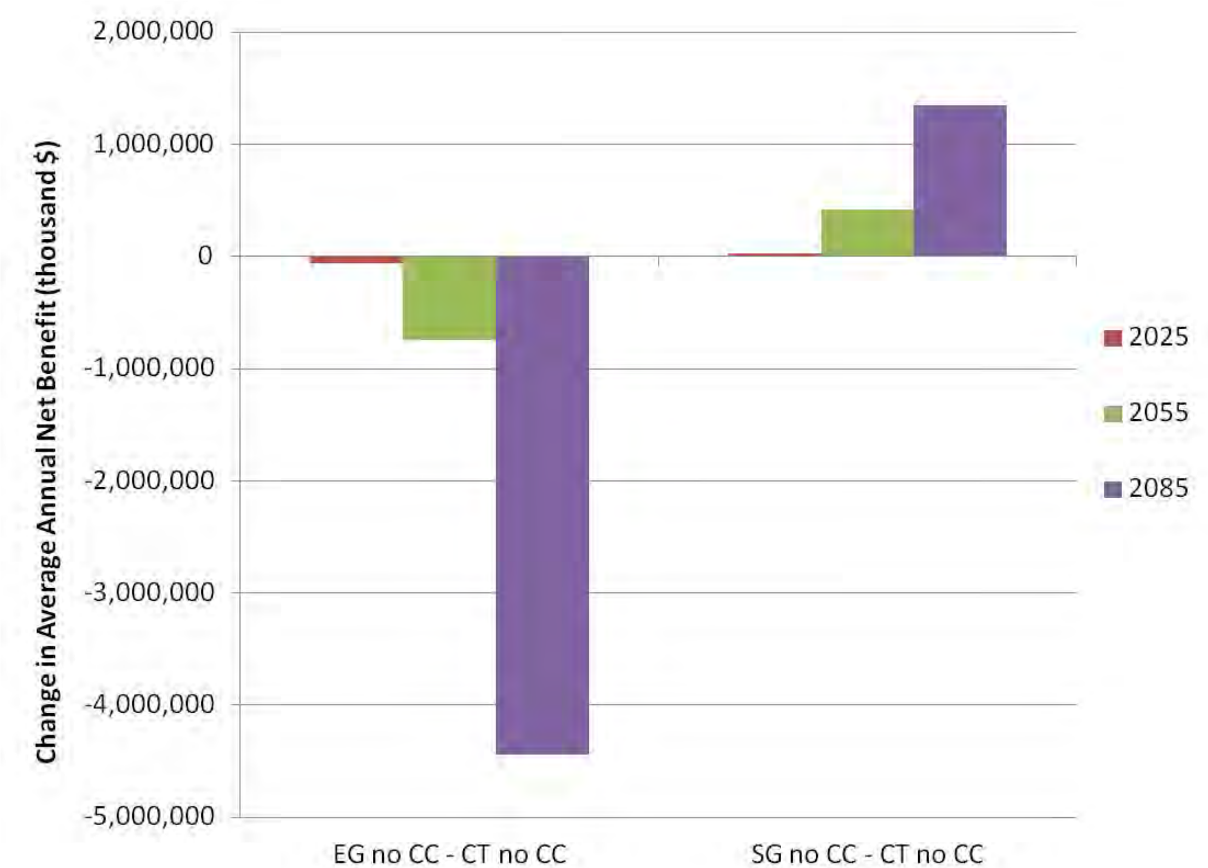
The following discussion presents the results in two steps:

1. Comparisons of the three socioeconomic scenarios without climate change, to understand the effect of socioeconomic changes

2. Comparisons of CT-Q5, EG-Q2, and SG-Q4 socioeconomic-climate scenarios with the corresponding NoCC scenario, to understand the effects of climate changes

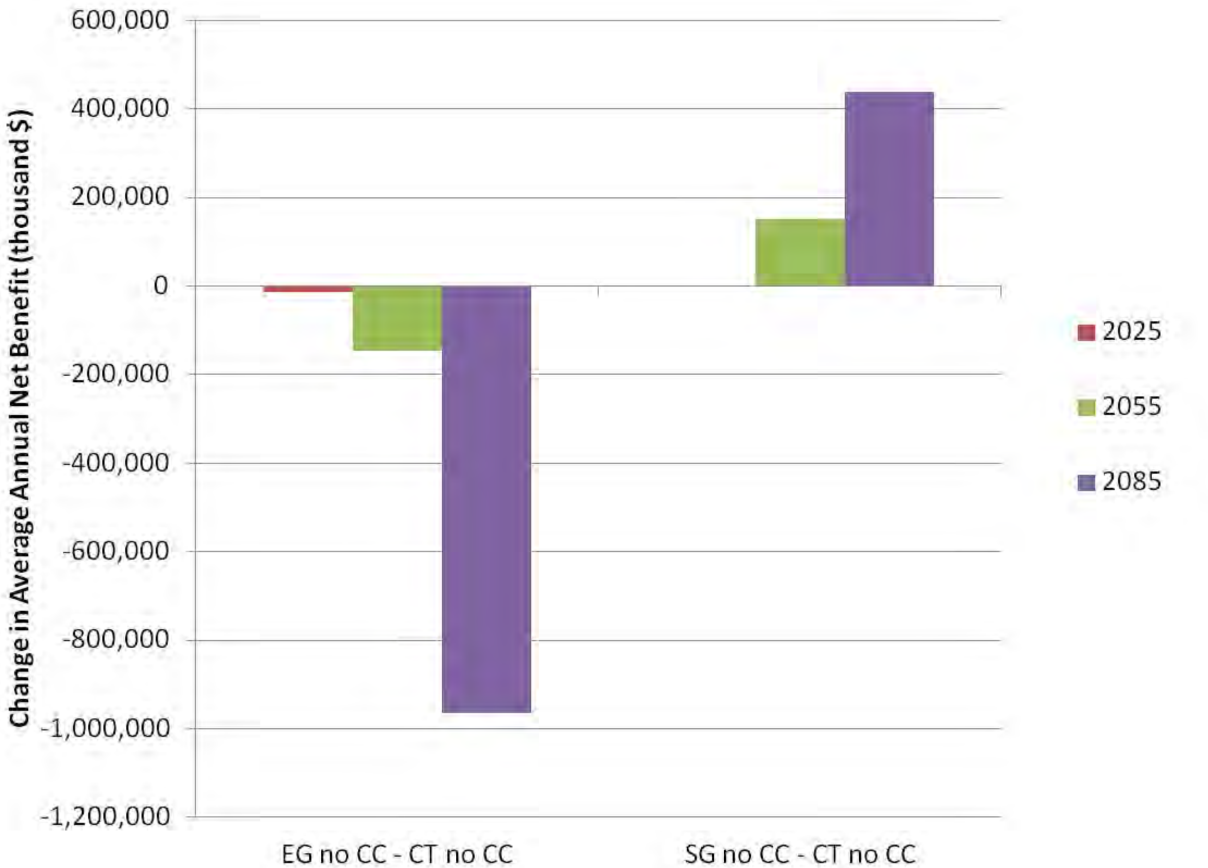
Figure 8-33 through Figure 8-35 show the changes in net water supply system costs in LCPSIM and OMWEM and in net revenue in SWAP for the EG and SG scenarios relative to the CT, at the 3 LODs. The SBWQM is not capable of producing comparisons between simulations at different socioeconomic conditions and is therefore not included in this comparison. A brief discussion of these models is included herein, with further documentation available in Reclamation 2013.

All three models indicate significantly less net water supply system costs and significantly more net revenue in the slow growth scenario than in the current trends scenario, and significantly more net water supply system costs and significantly less net revenue in the expansive growth scenario than in the current trends scenario. Furthermore, these differences increase over the course of the 21st century. The primary factors accounting for these differences are changes in population and corresponding agricultural- to-urban land use conversion. The expansive growth scenario represents the greatest increase in population and land conversion, reflected in higher water supply system costs in the urban models and the lowest net revenue in the agricultural model as compared to the current trends scenario. Conversely, the slow growth scenario has the lowest increase in population and the smallest conversion of agricultural land to urban, which results in lower water supply system costs in the urban models and greater net revenue in the agricultural model relative to current trends.



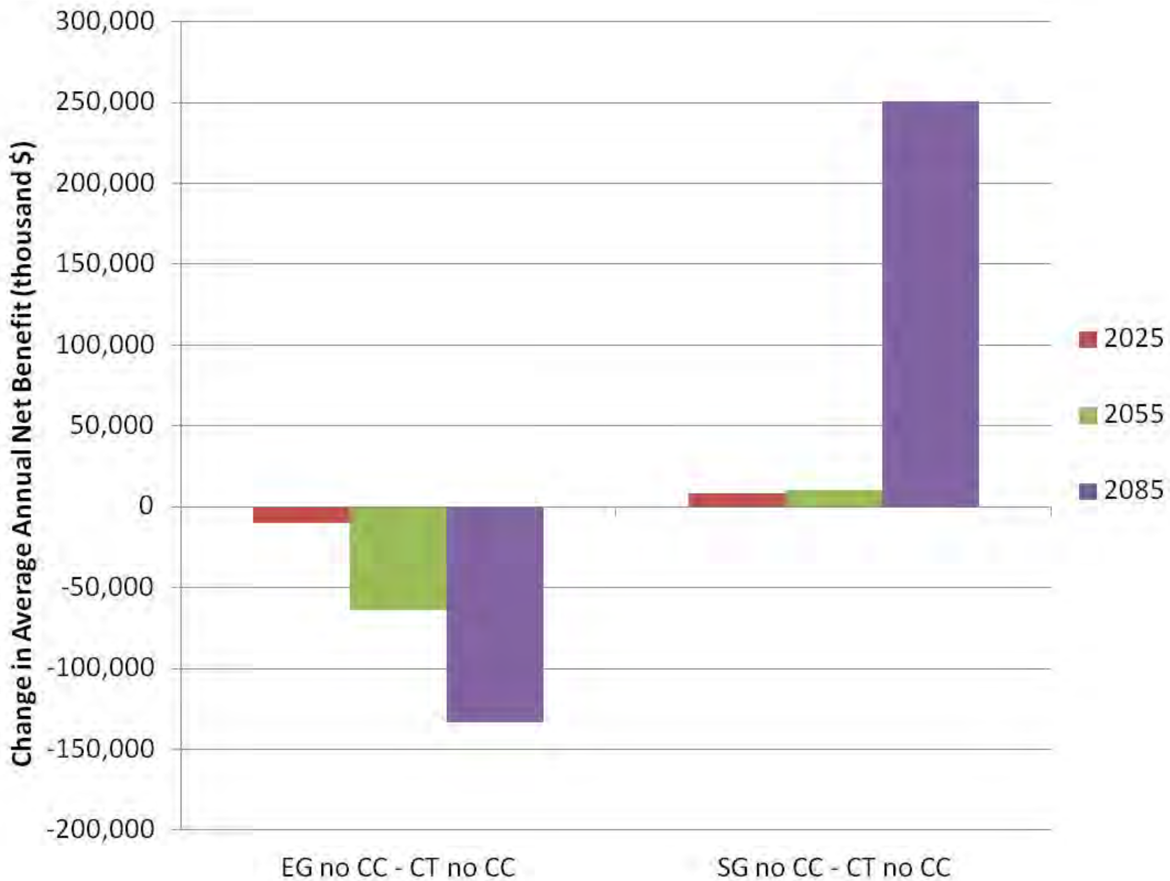
Key:
CT = Current Trends
EG = Expansive Growth
NoCC = no climate change
SG = Slow Growth thousand acre-feet

Figure 8-33. Change in Average Annual Net Benefit in South San Francisco Bay Region from LCPSIM



Key:
CT = Current Trends
EG = Expansive Growth
NoCC = no climate change
SG = Slow Growth thousand acre-feet

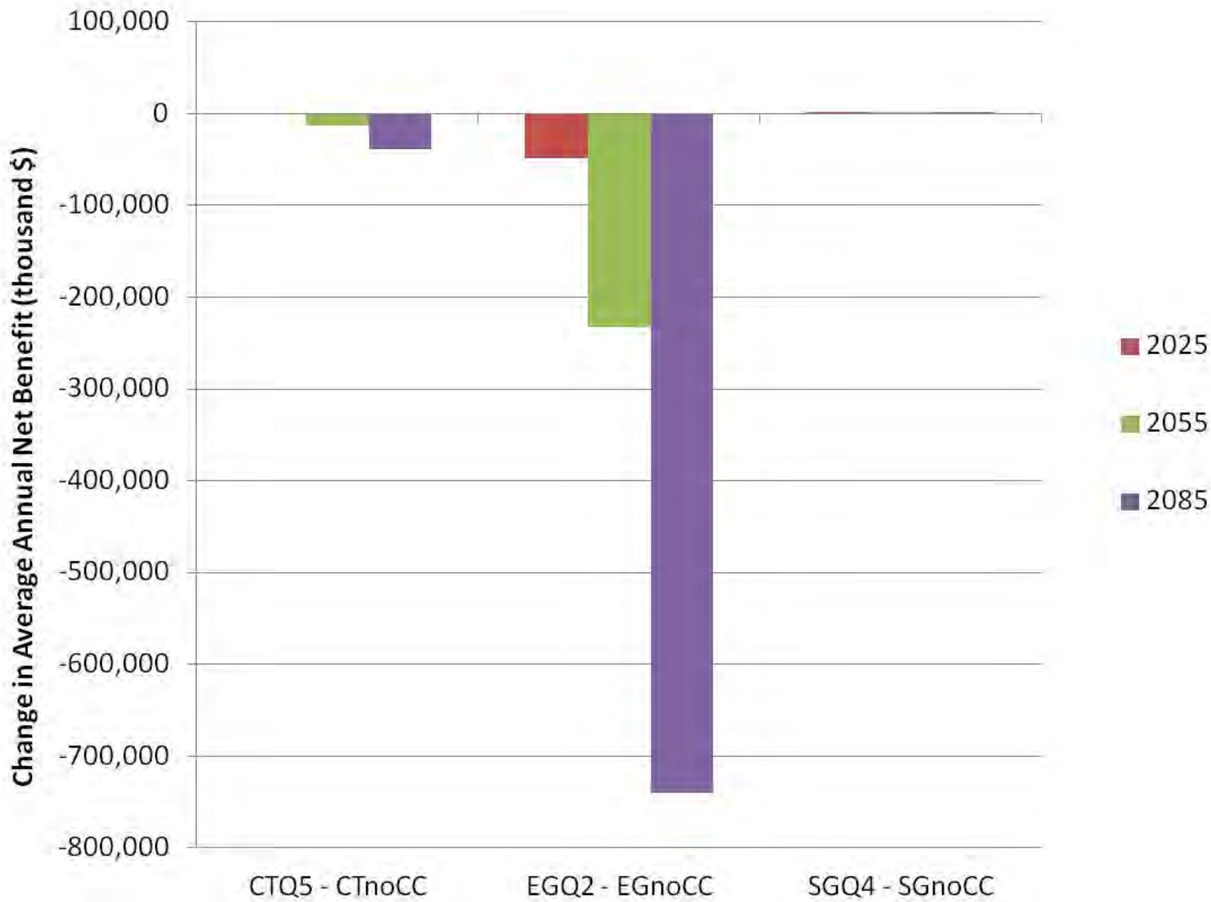
Figure 8-34. Change in Average Annual Net Benefit in Central Valley Urban Areas from OMWEM



Key:
CT = Current Trends
EG = Expansive Growth
NoCC = no climate change
SG = Slow Growth thousand acre-feet

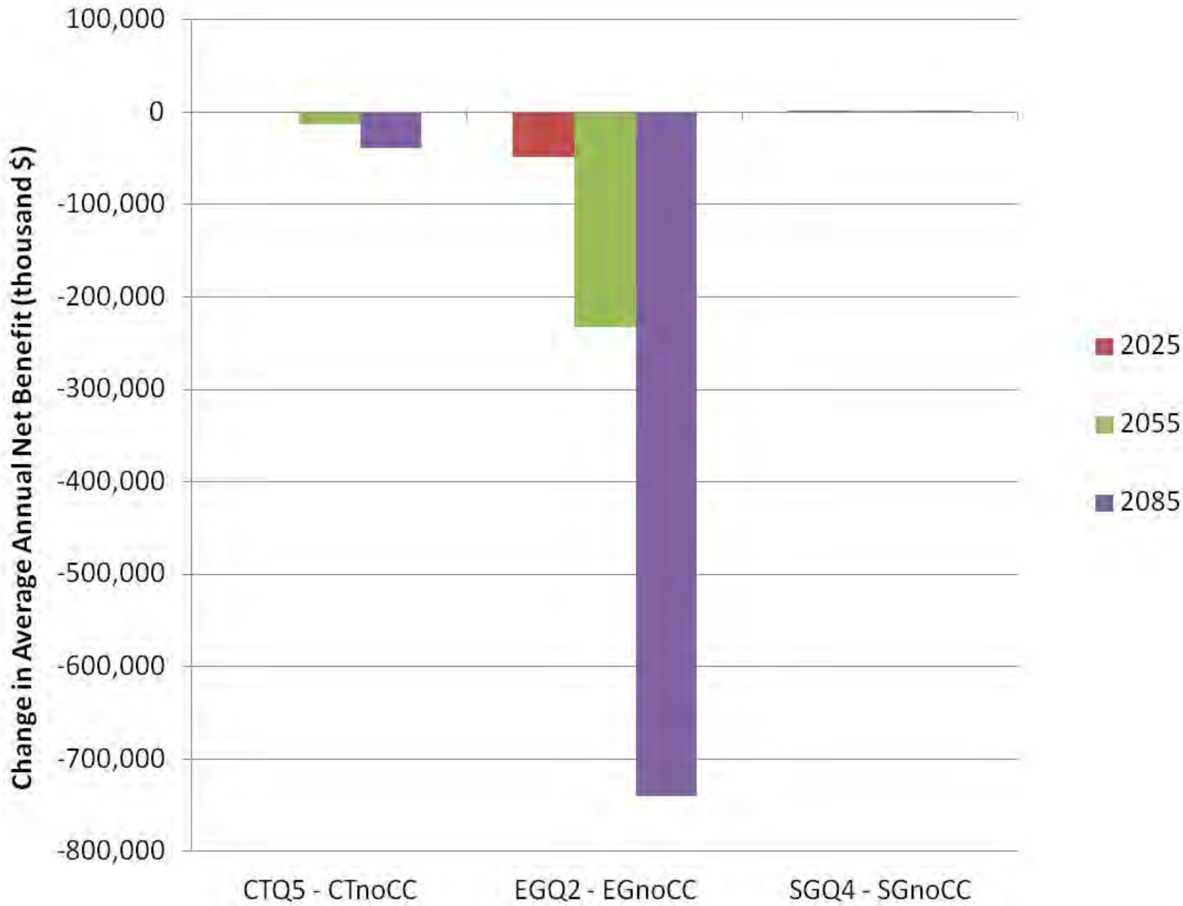
Figure 8-35. Change in Average Annual Net Benefit in Central Valley Agricultural Areas from SWAP

To evaluate the effects of changes in climate on net economic benefits independent of socioeconomics, simulations of all three climate scenarios were compared with corresponding NoCC socioeconomic scenarios. Figures 8-36 through 8-39 show the changes in net economic benefits for scenarios CT-Q5 relative to CT-NoCC, EG-Q2 relative to EG-NoCC, and SG-Q4 relative to SG-NoCC, at the 3 LODs. In general, net economic benefits decrease for scenarios in which Delta salinity increases (reducing Delta exports), and increase for scenarios in which Central Valley deliveries increased and/or agricultural production increased (due to increasing CO_2, for example).



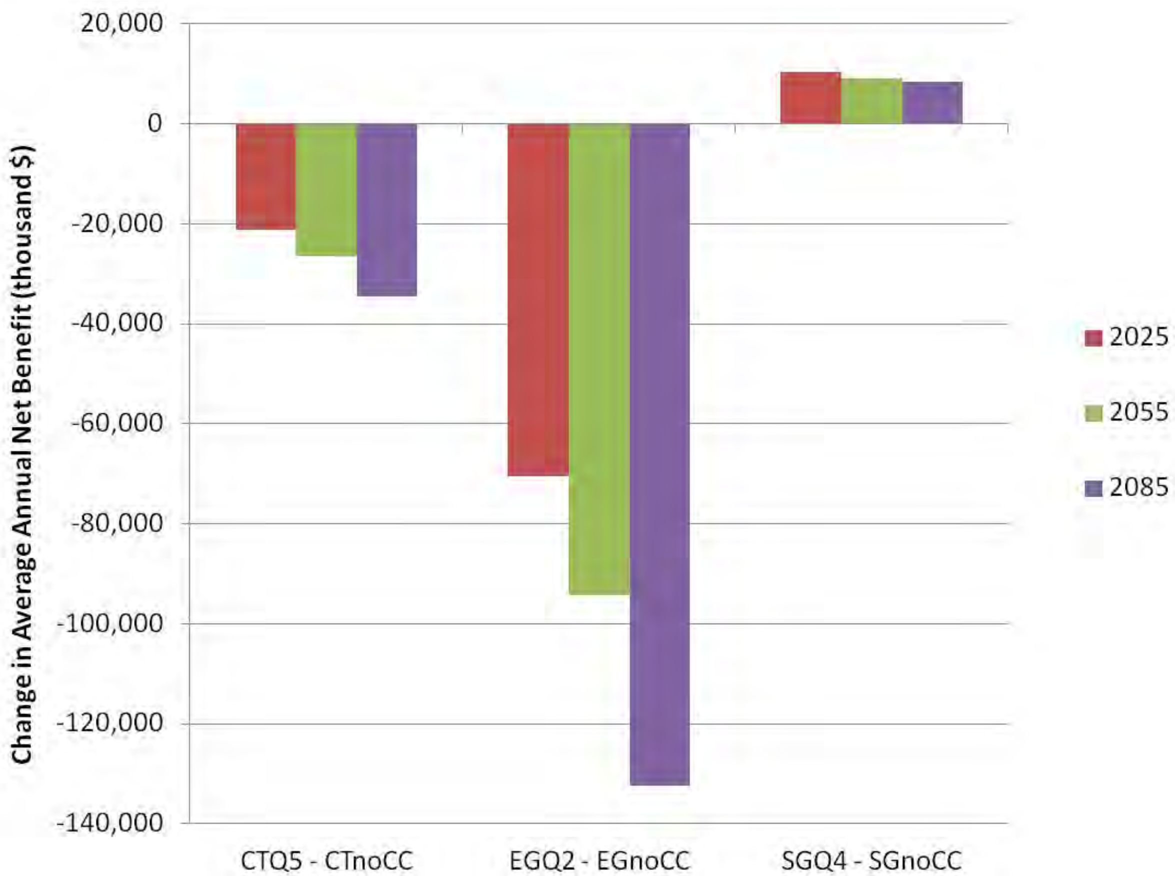
Key:
CT = Current Trends
EG = Expansive Growth
NoCC = no climate change
SG = Slow Growth thousand acre-feet

Figure 8-36. Change in Average Annual Net Benefit in South San Francisco Bay Region from LCPSIM



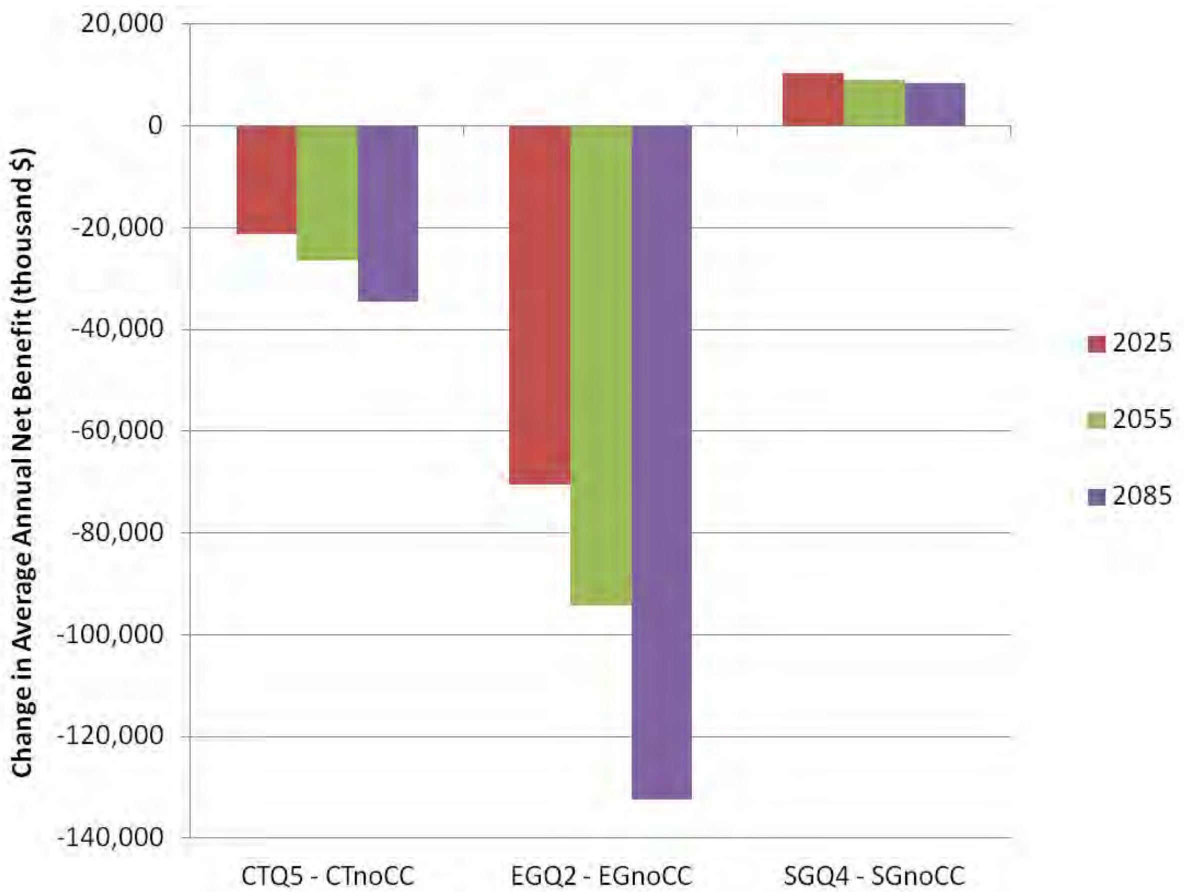
Key:
CT = Current Trends
EG = Expansive Growth
NoCC = no climate change
SG = Slow Growth thousand acre-feet

Figure 8-37. Change in Average Annual Net Benefit in Central Valley Urban Areas from OMWEM



Key:
CT = Current Trends
EG = Expansive Growth
NoCC = no climate change
SG = Slow Growth thousand acre-feet

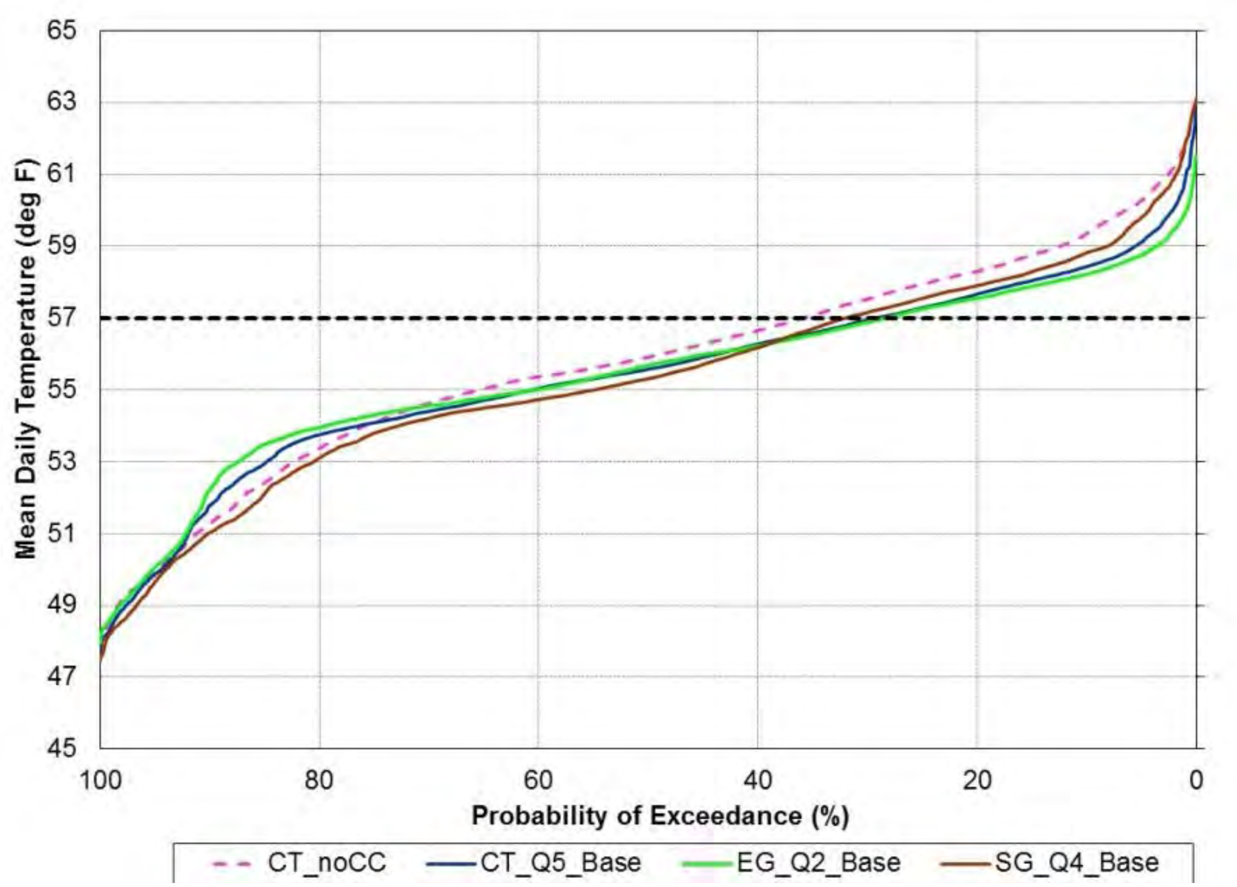
Figure 8-38. Change in Average Annual Net Benefit in South San Francisco Bay Region Salinity Costs from SBWQM



Key:
CT = Current Trends
EG = Expansive Growth
NoCC = no climate change
SG = Slow Growth thousand acre-feet

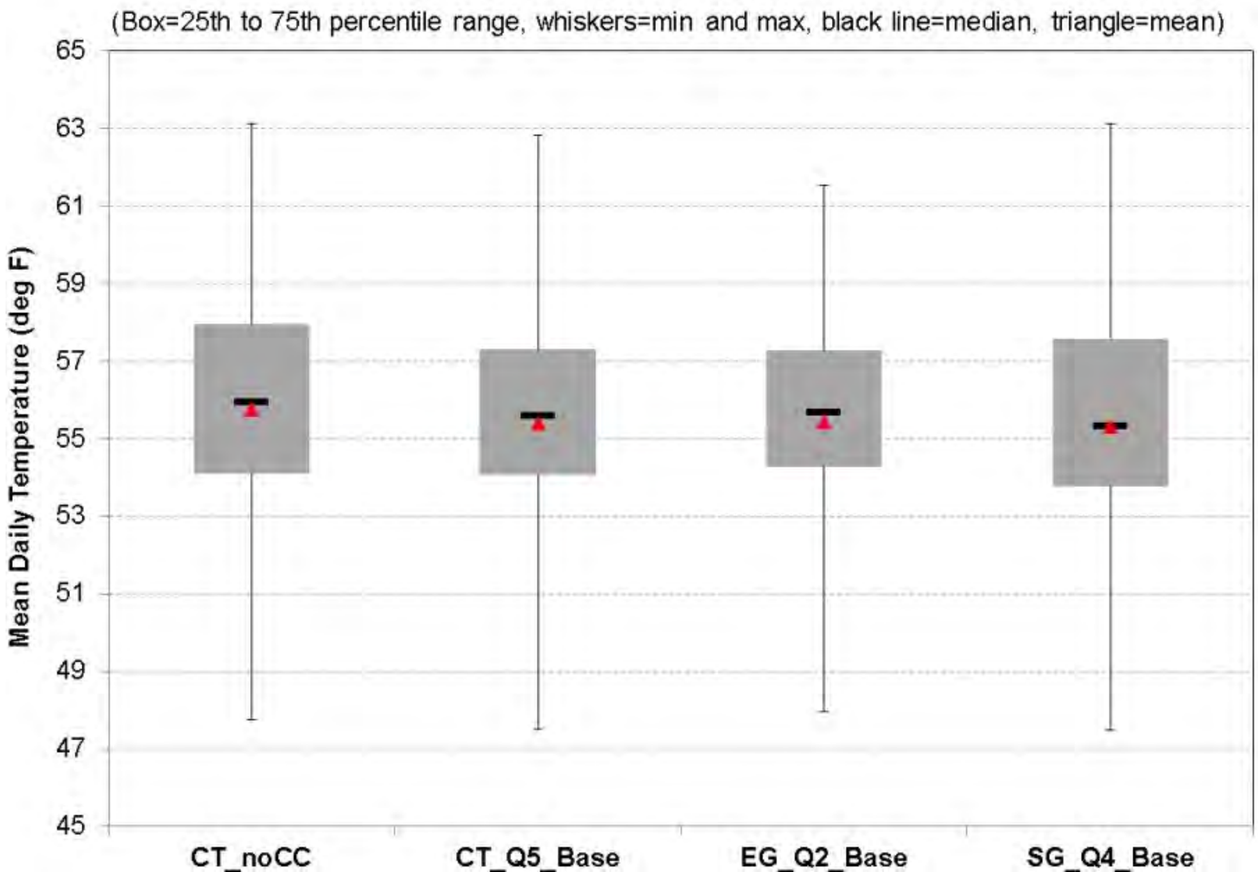
Figure 8-39. Change in Average Annual Net Benefit in Central Valley Agricultural Areas from SWAP

Water Temperature To understand the effects of climate change on river temperatures, the San Joaquin temperature (SJRWQM) models were used to simulate the CT-NoCC scenario as well as the CT-Q5, EG-Q2, and SG-Q4 socioeconomic-climate scenarios. Figure 8-40 through 8-45 provide exceedence plots and box plots of daily temperatures in the San Joaquin River at Lost Lake, Gravelly Ford, and Vernalis locations, from August through November, for these four socioeconomic-climate scenarios. The bold, dashed horizontal lines on the exceedence plots represent desired water temperatures during the period.



Key:
Base = Baseline
CT = current trends
EG= Expansive Growth scenario
No CC = no climate change
TAF = thousand acre-feet

Figure 8-40. Exceedence of Average Daily Water Temperature on San Joaquin River at Lost Lake from August-to-November in Select Socioeconomic-Climate Scenarios

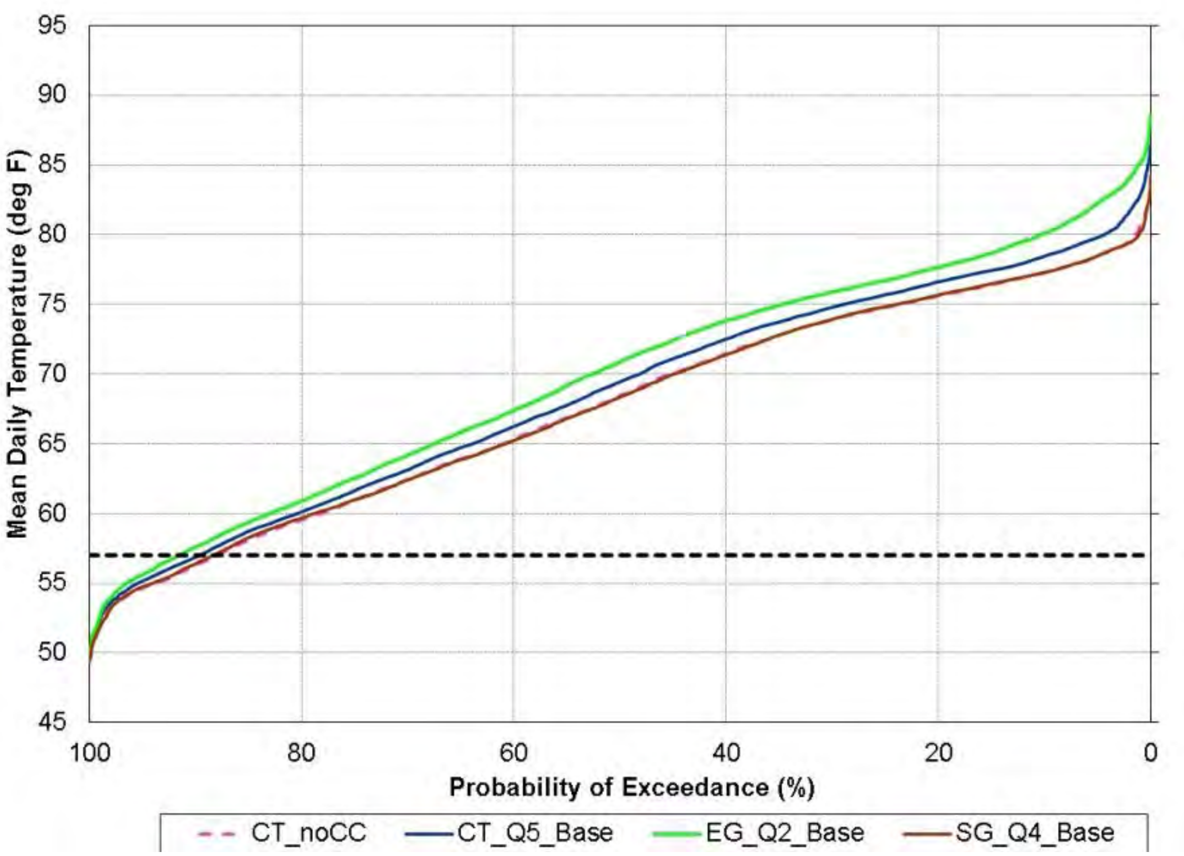


Key:
Base = Baseline
CT = current trends
EG= Expansive Growth scenario
No CC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

Figure 8-41. Box Plot of Average Daily Water Temperature on San Joaquin River at Lost Lake from August-to-November in Select Socioeconomic-Climate Scenarios

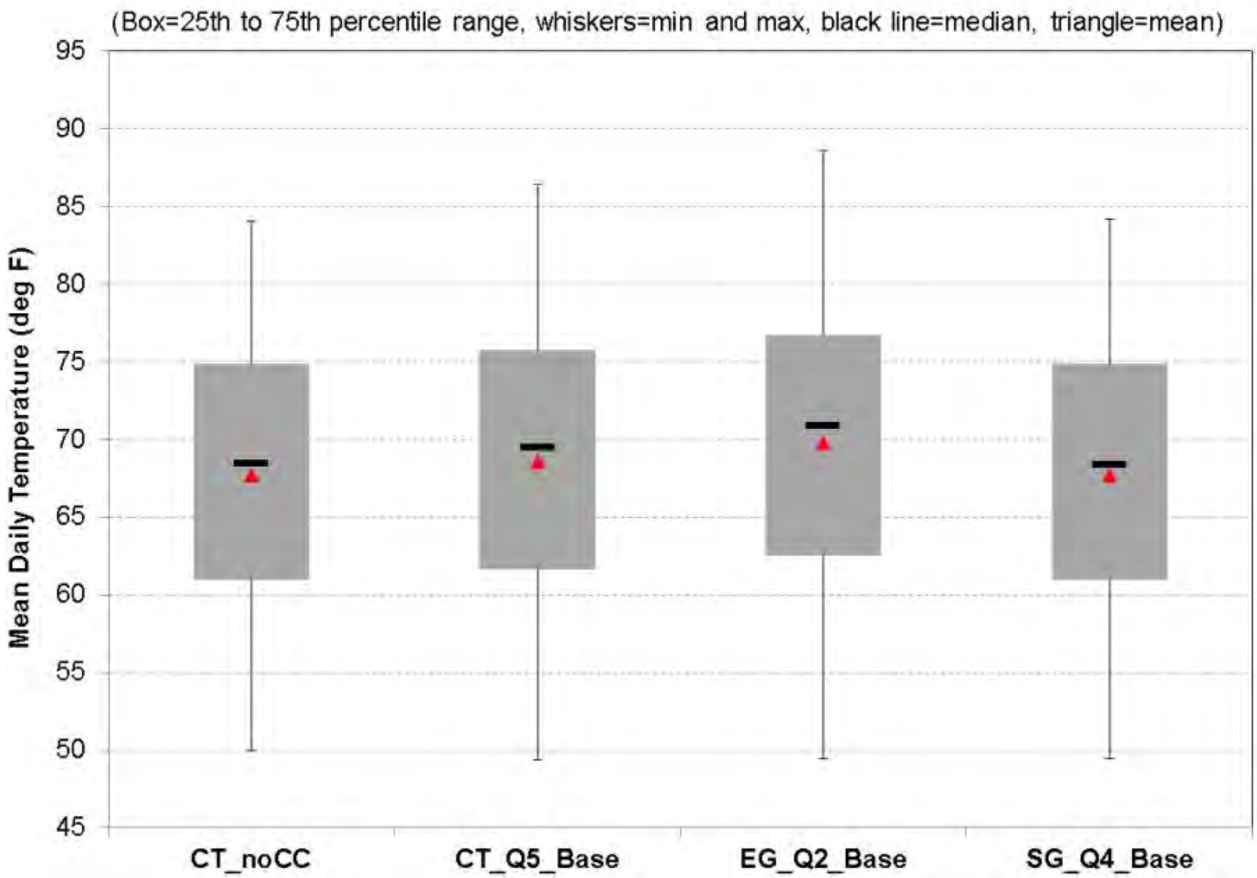
The mean daily temperatures for the San Joaquin River at Lost Lake (just downstream from Friant Dam) during these months range from 55.3 to 55.8°F across the four scenarios. Scenarios CT-Q5, EG-Q2, and SG-Q4 generally show reduced temperatures at this location relative to the CT-NoCC scenario. The lowest temperatures occur in the SG-Q4 scenario, and the highest temperatures occur in the CT-Q5 and EG-Q2 scenarios. Only minor water temperature cooling occurs under SG-Q4 despite the wetter hydrology because Millerton Lake has limited capacity to hold high flows; when there are higher inflows to Millerton Lake (as occurs more frequently in climate scenario Q4) and the thermocline in the lake is disturbed as high flows flush out any cold water stored in the lake. Similarly, when there are lower inflows into Millerton Lake (as occurs frequently in climate scenario Q2) the thermocline in the Lake is maintained more frequently and the water released from Friant Dam is colder, resulting in cooler temperatures at Lost Lake, as observed in the EG-Q2 scenario.

Farther downstream on the San Joaquin River at Gravelly Ford, the mean daily water temperatures increase under all climate scenarios due to the effects of distance downstream and lower elevation (higher air temperatures). The water temperature increase is greatest in the warmer Q2 scenario and only minimal in less warm Q4 scenario. At Gravelly Ford, the mean daily water temperature during these months ranges from a low of 67.7°F in CT-NoCC and SG-Q4 to a high of 69.7°F in EG-Q2.



Key:
Base = Baseline
CT = current trends
EG=Expansive Growth scenario
No CC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

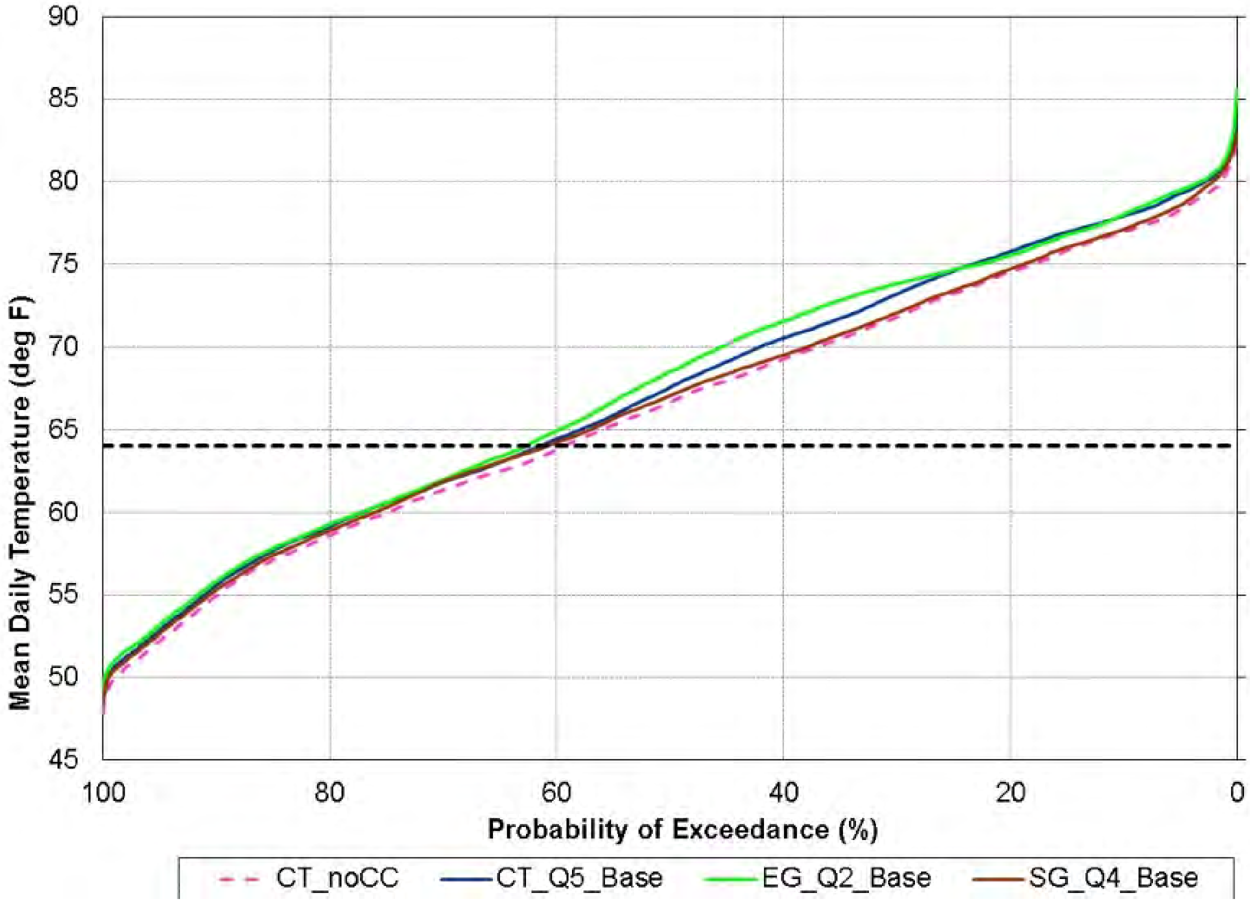
Figure 8-42. Exceedence of Average Daily Water Temperature on San Joaquin River at Gravelly Ford from August-to-November in Select Socioeconomic-Climate Scenarios



Key:
Base = Baseline
CT = current trends
EG=Expansive Growth scenario
No CC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

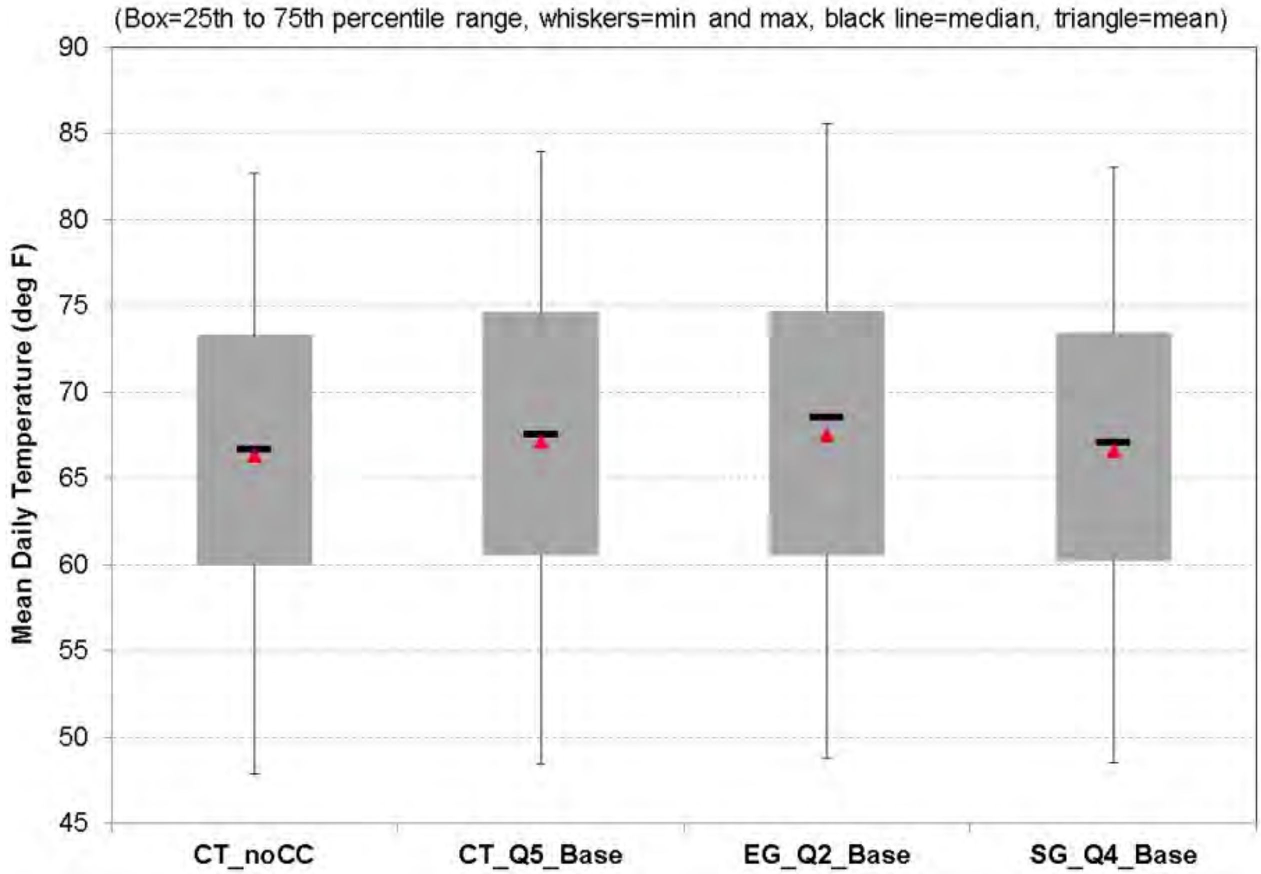
Figure 8-43. Box Plot of Average Daily Water Temperature on San Joaquin River at Gravelly Ford from August-to-November in Select Climate Scenarios

The temperature results for San Joaquin River at Vernalis, which reflect the impacts of all operations in the San Joaquin River system including the upstream tributaries, show warming under all climate scenarios. The mean daily average temperature at Vernalis in the CT-NoCC scenario is 66.3°F. For the three climate scenarios displayed, the mean daily temperatures at Vernalis ranges from 66.6°F to 67.6°F, with lowest in the SG-Q4 scenario and highest in the EG-Q2 scenario.



Key:
Base = Baseline
CT = current trends
EG=Expansive Growth scenario
No CC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

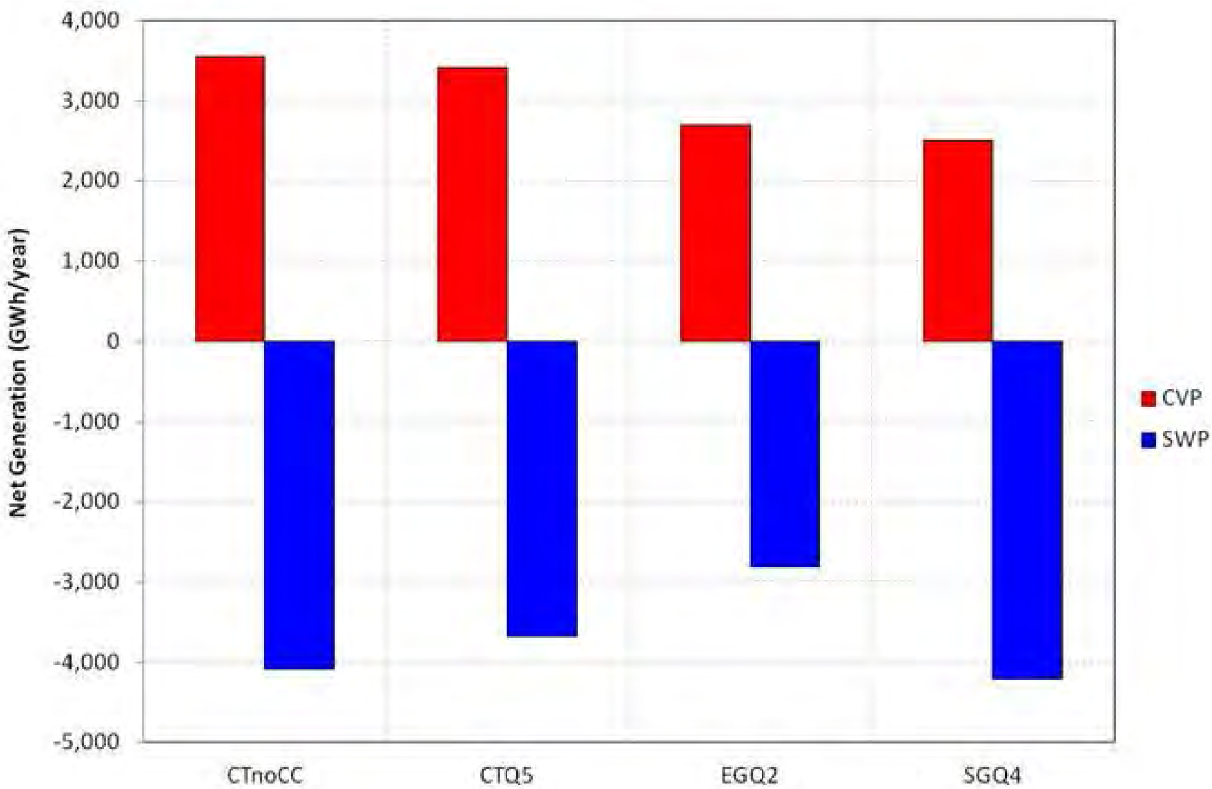
Figure 8-44. Exceedence of Average Daily Water Temperature on San Joaquin River at Vernalis from August-to-November in Select Climate Scenarios



Key:
Base = Baseline
CT = current trends
EG=Expansive Growth scenario
No CC = no climate change
SG = Slow Growth scenario
TAF = thousand acre-feet

Figure 8-45. Box Plot of Average Daily Water Temperature on San Joaquin River at Vernalis from August-to-November in Select Climate Scenarios

Hydropower and Greenhouse Gas Emissions Figure 8-46 shows the average annual net energy generation expressed as GWh/year for the CVP and SWP systems under the CT-NoCC, CT-Q5, EG-Q2, and SG-Q4 scenarios based on the results from the LongTerm_Gen model for the CVP and SWP_Power model for the SWP. Net energy generation is defined as the difference between hydropower production and usage by the CVP and SWP.

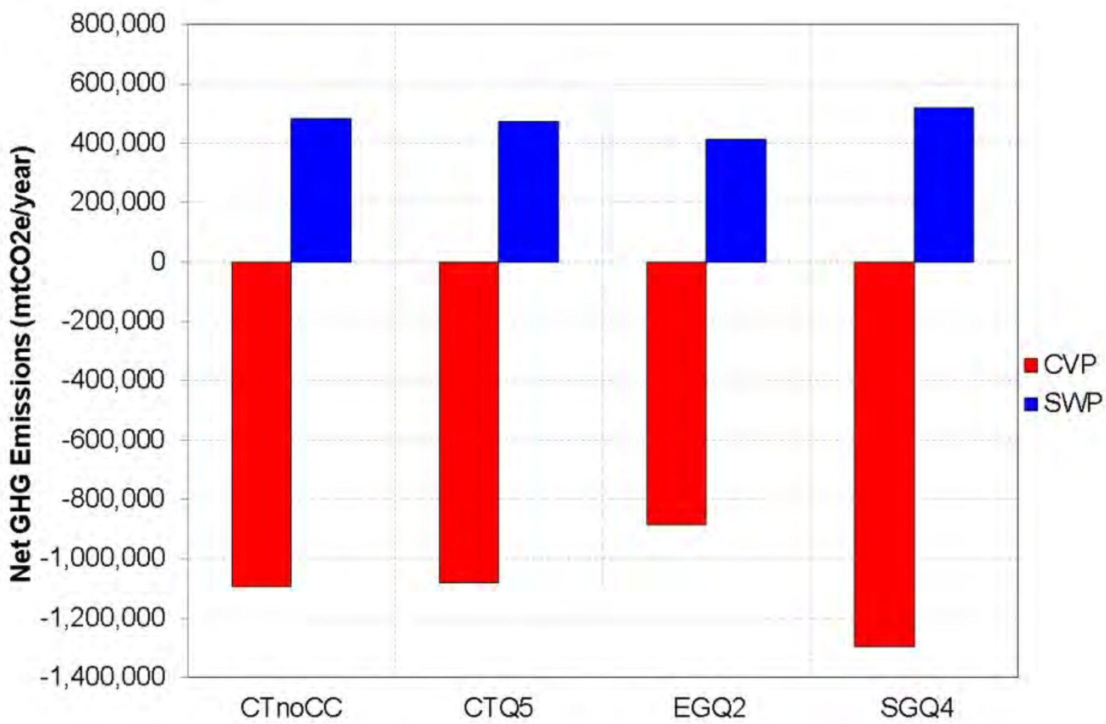


Key:
CT = Current Trends
CVP = Central Valley Project
EG = Expansive Growth
GWh = gigawatt hours
NoCC = No Climate Change
SG = Slow Growth
SWP = State Water Project

Figure 8-46. Average Annual Net Energy Generation for the CVP and SWP Systems in Select Socioeconomic-climate Scenarios

In all four socioeconomic-climate scenarios, the CVP system has more hydropower generation than energy use, while the SWP system has more energy use than hydropower generation. The relative levels of net generation between the four scenarios are consistent with the CVP storage and the SWP Banks pumping results for each scenario. The slightly drier conditions in the CT-Q5 relative to CT-NoCC result in slightly reduced net generation for the CVP and slightly less hydropower usage for the SWP. The wetter SG-Q4 scenario has the highest storage levels in CVP reservoirs for generation but also higher usage for conveyance, resulting in lower net generation. Similarly, SWP Banks pumping and conveyance usage is greatest in the SG-Q4 resulting in its most negative net generation. Conversely, the EG-Q2 scenario has the lowest storage levels in CVP reservoirs resulting in less power production but also less water supply for exports. Banks pumping is also reduced, therefore the SWP has the least net generation in this scenario, which is drier than CT-NoCC scenario.

Figure 8-47 presents the average annual net GHG emissions from power generation used to pump CVP and SWP supplies, expressed as metric tons of CO_2 equivalents per year (mtCO2e/year) for the CVP and SWP systems under the CT-Q5, EG-Q2 and SG-Q4 scenarios. These results are consistent with the net generation results for the CVP and SWP in each scenario. The CVP system has negative net GHG emissions (i.e., potential GHG offsets) because it has positive net hydropower generation, while the SWP system has positive net GHG emissions because it has negative net hydropower generation. In addition, the net GHG emissions are greatest in SG-Q4 where the net generation results are greatest and lowest in EG-Q2 where the net generation results are lowest.



Key:
CT = Current Trends scenario
CVP = Central Valley Project
EG = Expansive Growth scenario
mtC02e = million tons $C0_2$ equivalent
NoCC = No Climate Change
SG = Slow Growth scenario
SWP = State Water Project

Figure 8-47. Average Annual Net GHG Emissions for the CVP and SWP Systems in Select Climate Scenarios

Climate Change Sensitivity Analysis–Representative Alternative

As described under "Methods and Assumptions," the Representative Alternative was designed to quantitatively investigate the sensitivity of water supply and San Joaquin River temperature benefits from new storage in the Temperance Flat RM 274 Reservoir to future socioeconomic and climate conditions in the 21st century. The sensitivity analysis uses the CVP IRP CalLite model and the same socioeconomic-climate scenarios used in the Baseline conditions analyses. The results of the Representative Alternative simulations can be compared to the corresponding Baseline assessment results to better understand action alternative benefits under potential future conditions.

In the CVP IRP CalLite model, the Representative Alternative is simulated with a maximum storage capacity of 1,331 TAF, and the maximum Millerton Lake storage is reduced by 71 TAF to account for previous storage, which would be within the Temperance Flat RM 274 Reservoir footprint. Restoration Flows are assumed for all simulations. Temperance Flat RM 274 Reservoir operations in the CVPIRP CalLite model are a simplified representation of operations under the action alternatives. These operations, and the differences from the more detailed CalSim II operations, are summarized below.

- **Integration with CVP/SWP System –** The CVP IRP CalLite model does not fully reflect the level of detail of CVP/SWP operations included in the CalSim II model. However, the CVP IRP model was calibrated by comparing its system wide performance characteristics with those of the more detailed CalSim II model.

- **Limitations –** Limitations of the Representative Alternative simulation in CVP IRP CalLite include the following:

  - Simplified model schematic and CVP/SWP operations compared to CalSim II

  - Does not provide a full representation of the extent of potential benefits

  - Only a single simplified representation of Temperance Flat RM 274 Reservoir operations is simulated

- CVPIA (b)(2) requirements are excluded from the simulation

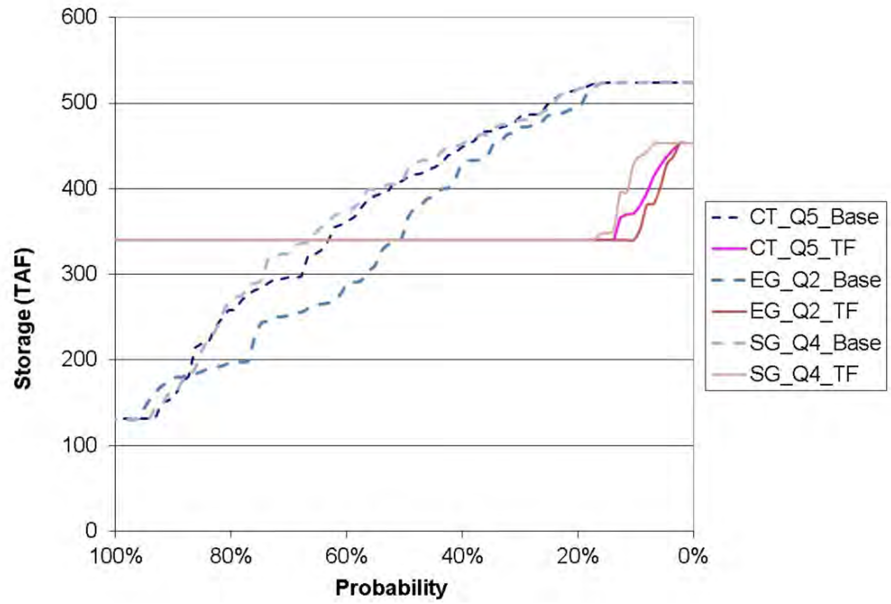
- No explicit delivery of water to Mendota Pool for exchange with other CVP water is simulated

The primary difference between the CVP IRP CalLite and CalSim II representations is that CVP IRP CalLite does not release water for delivery to SWP and CVP contractors at Mendota Pool. Instead, it provides all water delivery benefits from Temperance Flat RM 274 Reservoir via the Friant-Kern and Madera canals. Thus, there is no explicit representation of the various alternative operations simulated by the CalSim II model. In addition, because the CalSim II model has a more detailed representation of Temperance Flat RM 274 Reservoir and Millerton Lake operations, CalSim II results are considered quantitatively more accurate. However, the CVP IRP CalLite model representation provides results useful for evaluating the sensitivity of Temperance Flat RM 274 Reservoir to potential future socioeconomic-climate uncertainties.

CVP and SWP System Operations

The following sections summarize projected storage, Delta export and outflow, Delta salinity, and supply and demand conditions associated with the CVP and SWP under various socioeconomic and climate scenarios for the Representative Alternative.

CVP and SWP Project Storage Figure 8-48 and Figure 8-49 compare exceedence plots over the 21st century under the socioeconomic climate scenarios for the Baseline and Representative Alternative for end-of-May storage available for water supply, and end-of-September carryover storage conditions at Millerton Lake. Conditions are shown for socioeconomic-climate scenarios CT-Q5, EG-Q2, and SG-Q4. As in the Baseline, the highest storage levels occur in the wetter SG-Q4 scenario, and the lowest storage levels occur in the drier EG-Q2 scenario. Changes in Millerton Lake storage are primarily a result of how the Representative Alternative is operated to keep Millerton Lake at an essentially constant level. As can be seen in Figure 8-48 and Figure 8-49, storage in Millerton Lake is relatively constant except in years of exceptionally high precipitation when the reservoir level reaches the flood storage pool, and when there are additional releases to the San Joaquin River from Friant Dam.

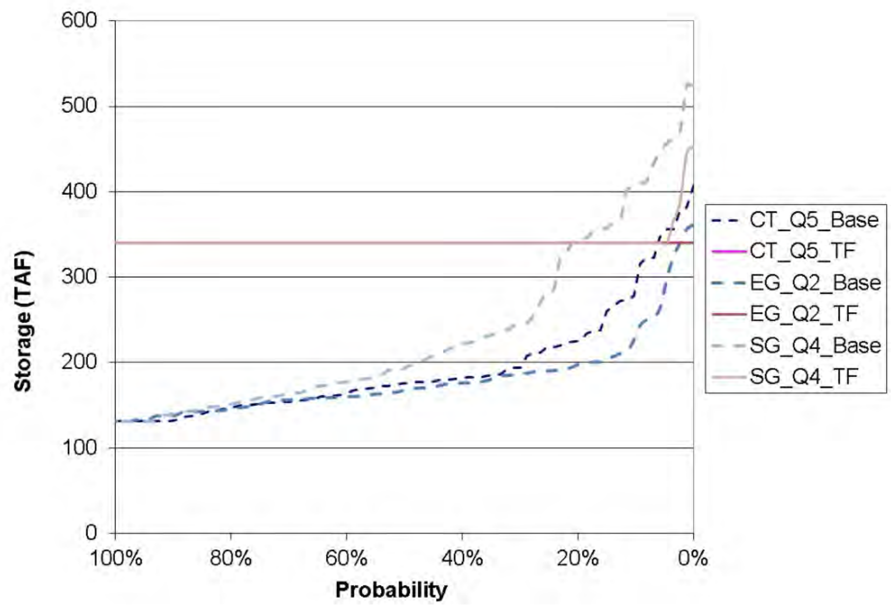


Note: For each scenario, the Baseline is represented by dashed lines and Representative Alternative by solid lines.

Key:

Base = Baseline	SG = Slow Growth
CT = Current Trends	TAF = thousand acre feet
EG = Expansive Growth	TF = Temperance Flat (a.k.a. Representative Alternative)

Figure 8-48. Exceedence of Millerton Lake End-of-May Storage



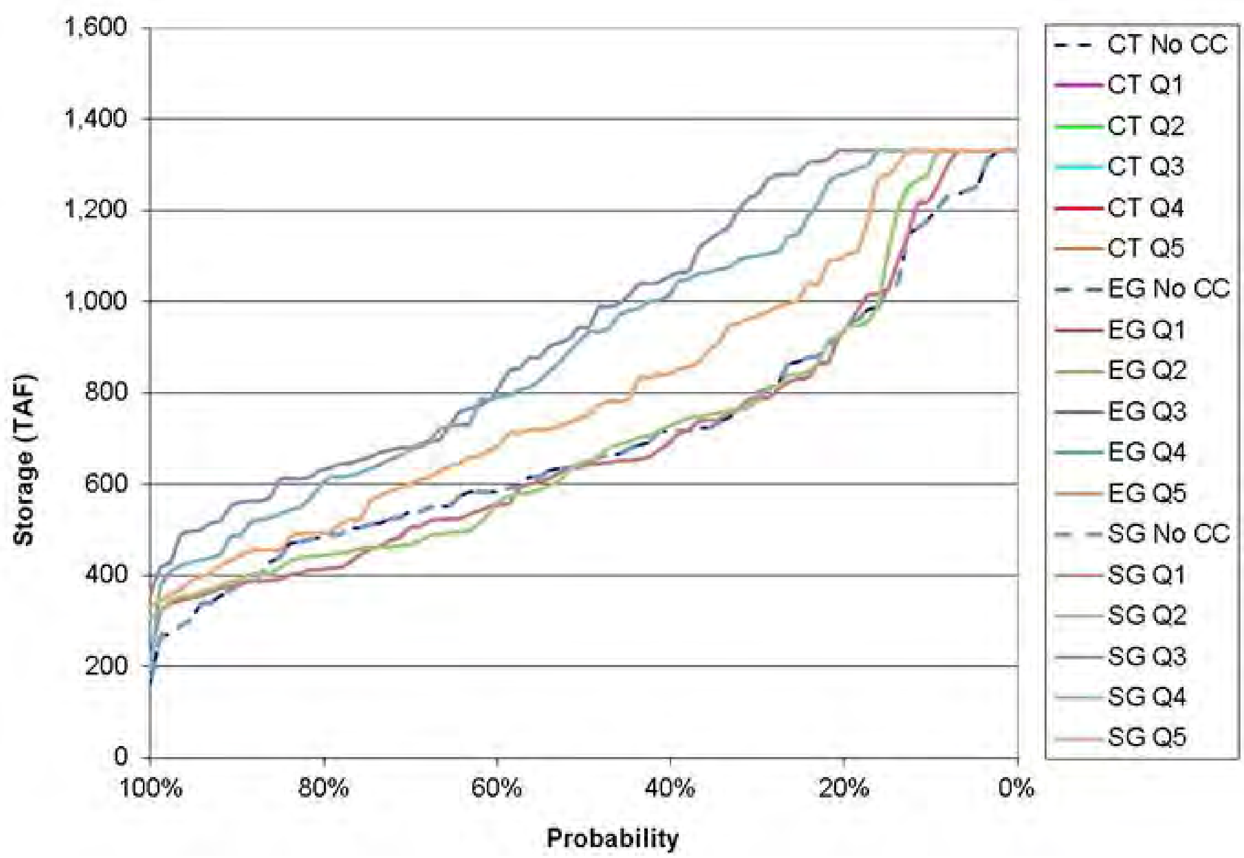
Note: For each scenario, the Baseline is represented by dashed lines and Representative Alternative by solid lines.

Key:

Base = Baseline	SG = Slow Growth
CT = Current Trends	TAF = thousand acre feet
EG = Expansive Growth	TF = Temperance Flat (a.k.a. Representative Alternative)

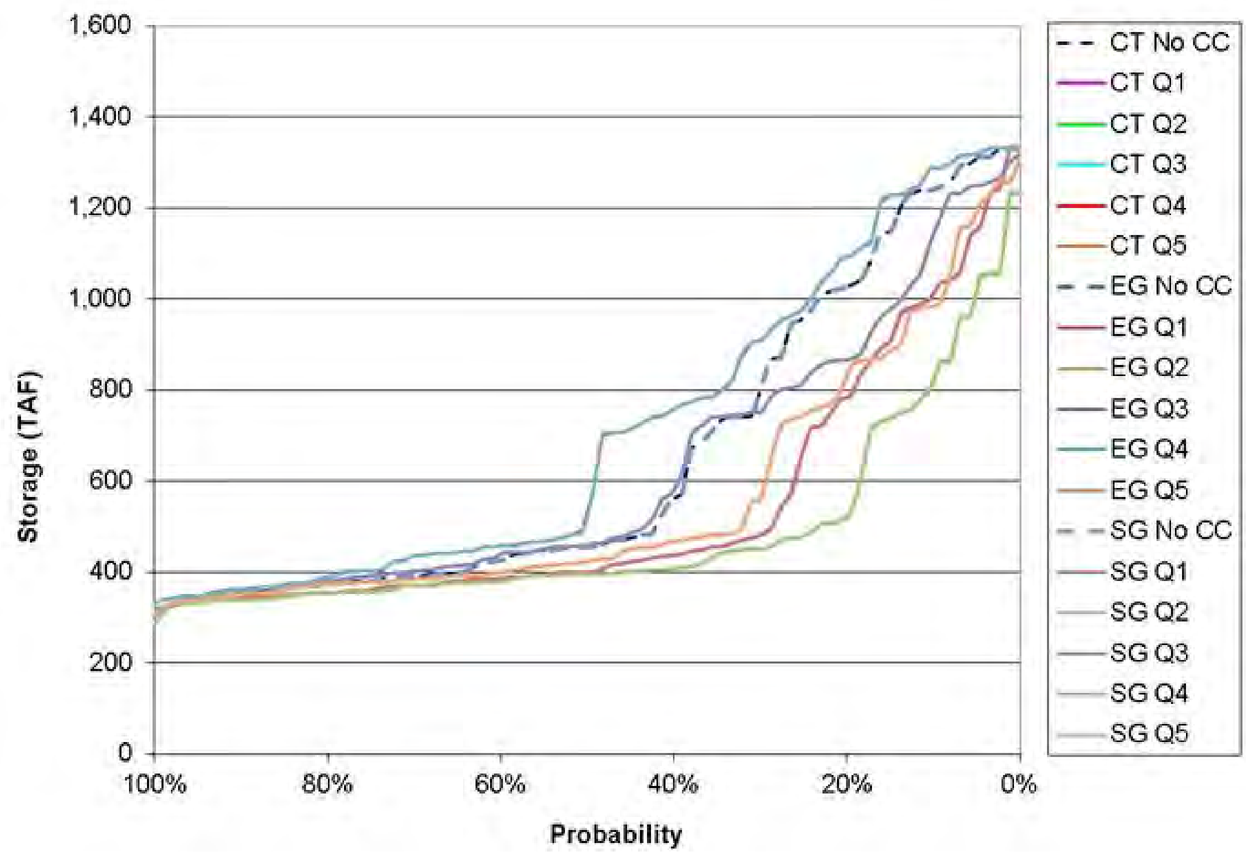
Figure 8-49. Exceedence of Millerton Lake End-of-September Storage

Figure 8-50 and Figure 8-51 show exceedence plots of Temperance Flat RM 274 Reservoir storage at the end-of-May and end-of-September for the Representative Alternative over the range of socioeconomic-climate scenarios. In these figures, only the lines for the slow growth socioeconomic scenario are visible because there is no difference in Millerton Lake, Madera Canal, and Friant-Kern Canal operations between different socioeconomic and climate scenarios. This result occurs because it was assumed that Madera Canal and Friant-Kern Canal deliveries are not constrained by consumptive use demands. In those years when excess water supplies existed, additional deliveries were made to recharge groundwater in the Friant Division of the CVP.



Note: The No Climate Change scenarios (NoCC) are represented by dashed lines, and climate change scenarios by solid lines.
Key:
CT = Current Trends
EG = Expansive Growth
No CC = no climate change
SG = Slow Growth
TAF = thousand acre feet

Figure 8-50. Representative Alternative End-of-May Monthly Storage Exceedence Under Various Climate Change Scenarios

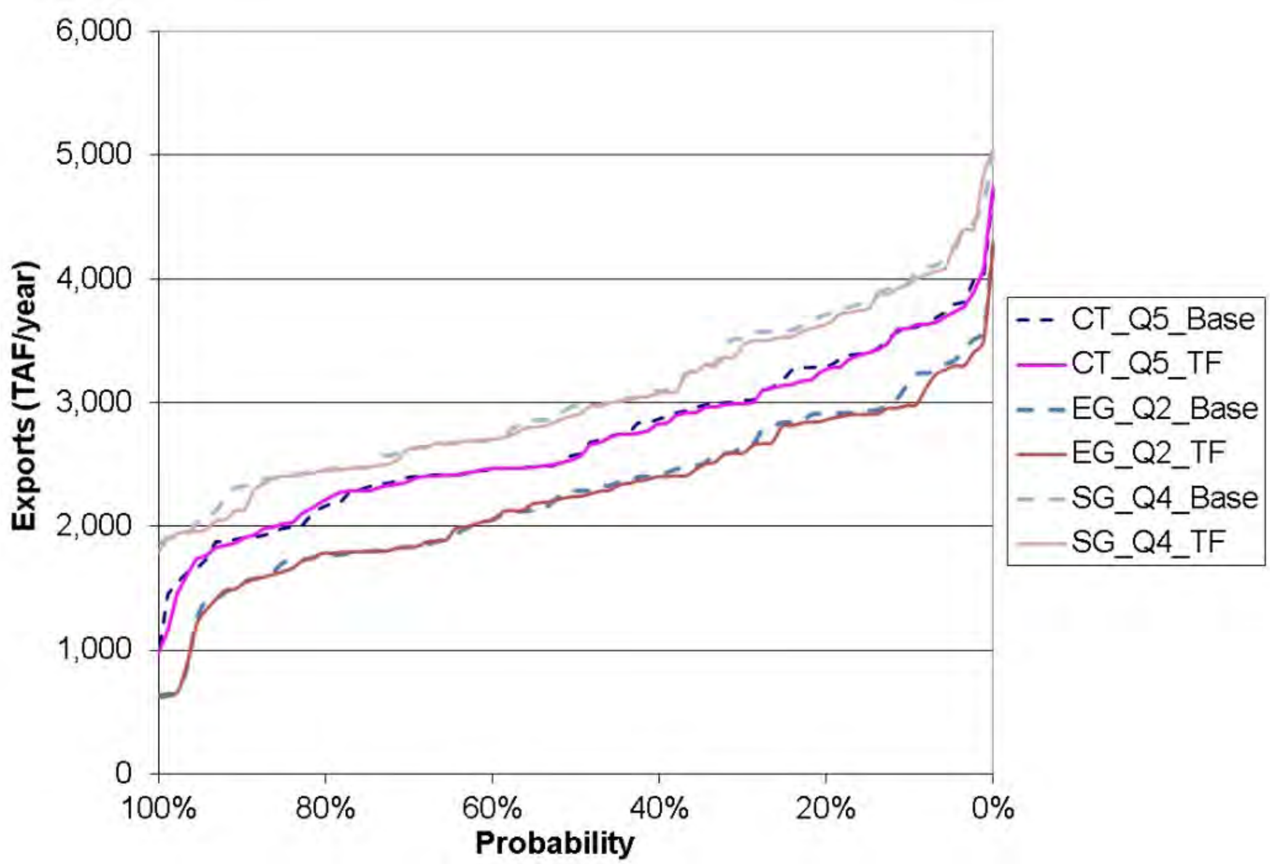


Note: The No Climate Change scenarios (NoCC) are represented by dashed lines, and climate change scenarios by solid lines.
Key:
CT = Current Trends
EG = Expansive Growth
No CC = no climate change
SG = Slow Growth
TAF = thousand acre feet

Figure 8-51. Representative Alternative End-of-September Monthly Storage Exceedence Under Various Climate Change Scenarios

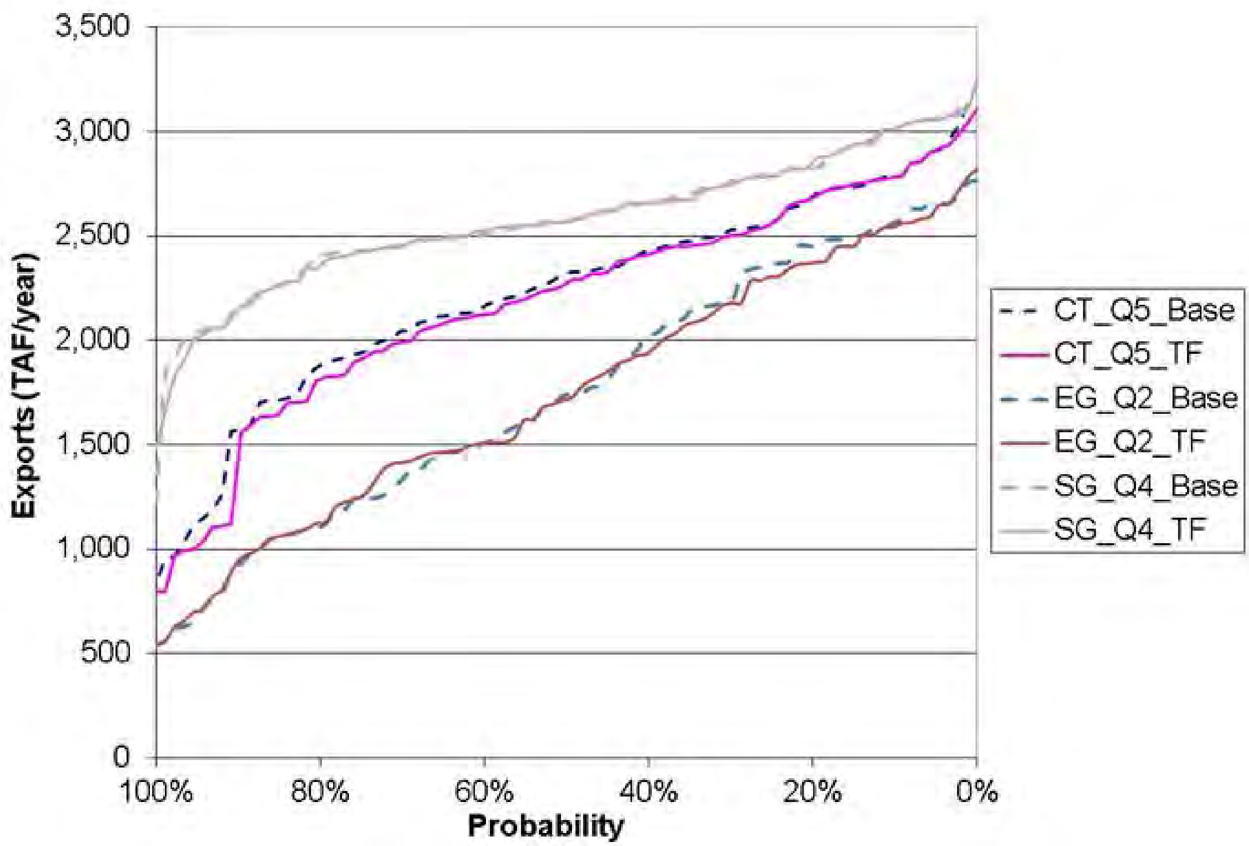
As shown on Figure 8-50 and Figure 8-51, end-of-month storage levels primarily reflect differences in climate projections. At the end of May, the wetter projections (Q3 and Q4) have the largest storage volumes while the drier projections (Q1 and Q2) have storage similar to NoCC. The central tendency Q5 projections are intermediate in volume with an average end-of-May storage of approximately 750 TAF. All climate projections, with the exception of the wetter, less warming projections (Q4), have less carryover storage than the NoCC. The drier projections (Q1 and Q2) have the lowest storage levels and the lowest levels of carryover storage.

Delta Exports and Delta Outflow Figure 8-52 and Figure 8-53 are annual exceedence plots of Delta exports from Banks and Jones pumping plants comparing the Representative Alternative to the corresponding Baselines for select socioeconomic-climate scenarios. As shown, Delta export pumping at both the Jones and Banks pumping plants is only slightly affected by the operations of the Representative Alternative. Changes in total Delta exports range from a minimum decrease of 10 TAF/year to maximum decrease of 55 TAF/year.



Note: For each scenario, the Baseline is represented by dashed lines and Representative Alternative by solid lines.
Key:
Base = Baseline
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth
TAF = thousand acre feet
TF = Temperance Flat (a.k.a. Representative Alternative)

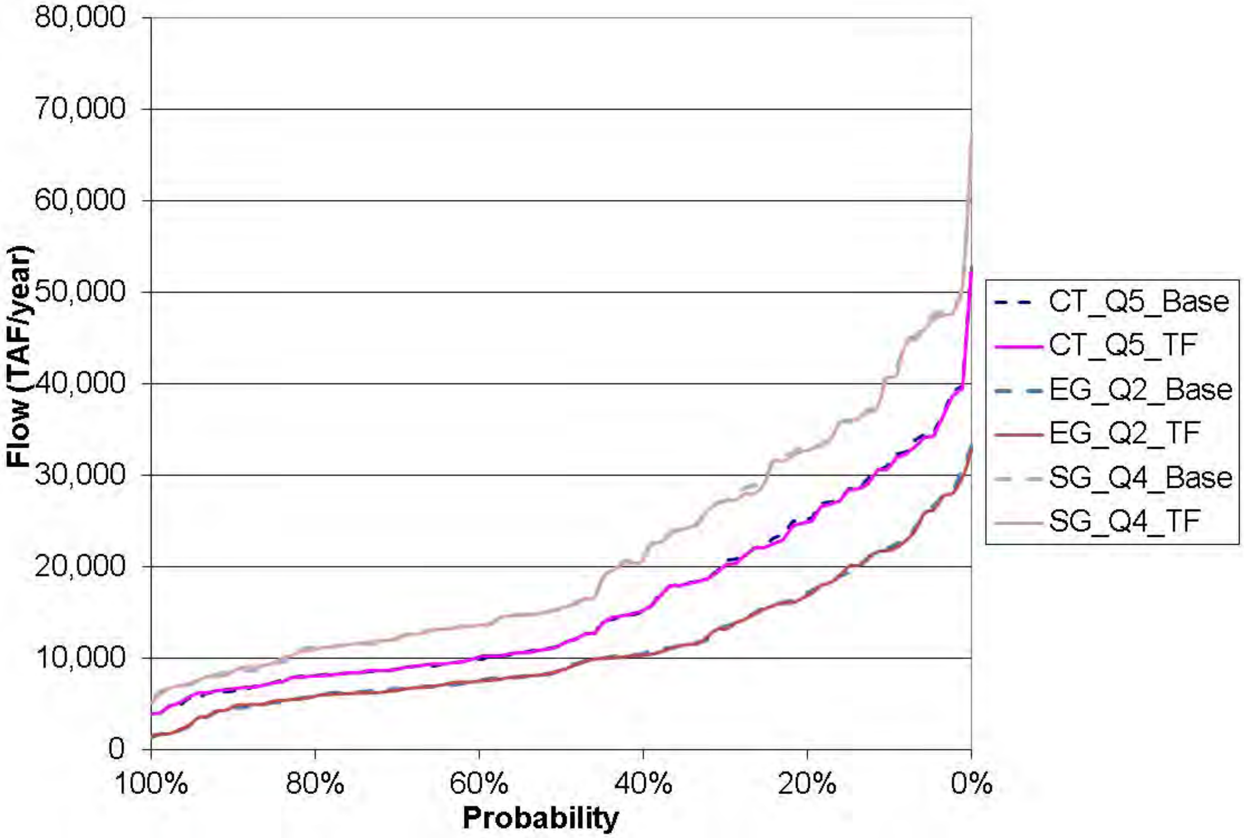
Figure 8-52. Exceedence of Annual Banks Pumping Under Various Climate Change Scenarios



Note: For each scenario, the Baseline is represented by dashed lines and Representative Alternative by solid lines.
Key:
Base = Baseline
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth
TAF = thousand acre feet
TF = Temperance Flat (a.k.a. Representative Alternative)

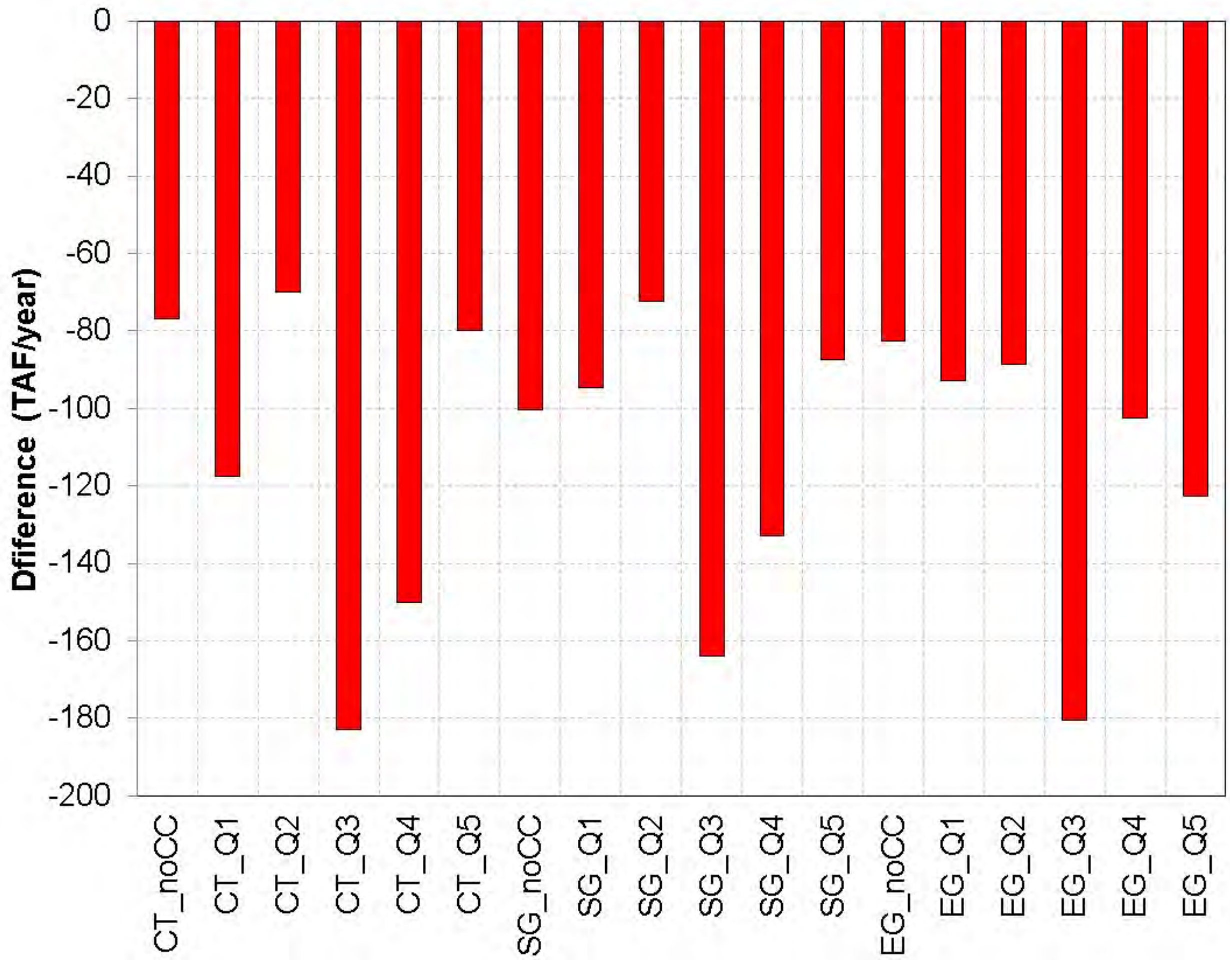
Figure 8-53. Annual Exceedence of Jones Pumping Under Various Climate Change Scenarios

Figure 8-54 is a similar exceedence plot of annual Delta outflows. The Representative Alternative has only slight impacts on Delta outflows. Figure 8-55 shows the magnitude of changes in Delta outflows for all 18 socioeconomic-climate scenarios. Decreases in outflow range from a minimum of 70 TAF/year to a maximum of 180 TAF/year, with the central tendency Q5 projections showing average decreases ranging from approximately 80 to 120 TAF/year.



Note: For each scenario, the Baseline is represented by dashed lines and Representative Alternative by solid lines.
Key:
Base = Baseline
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth
TAF = thousand acre feet
TF = Temperance Flat (a.k.a. Representative Alternative)

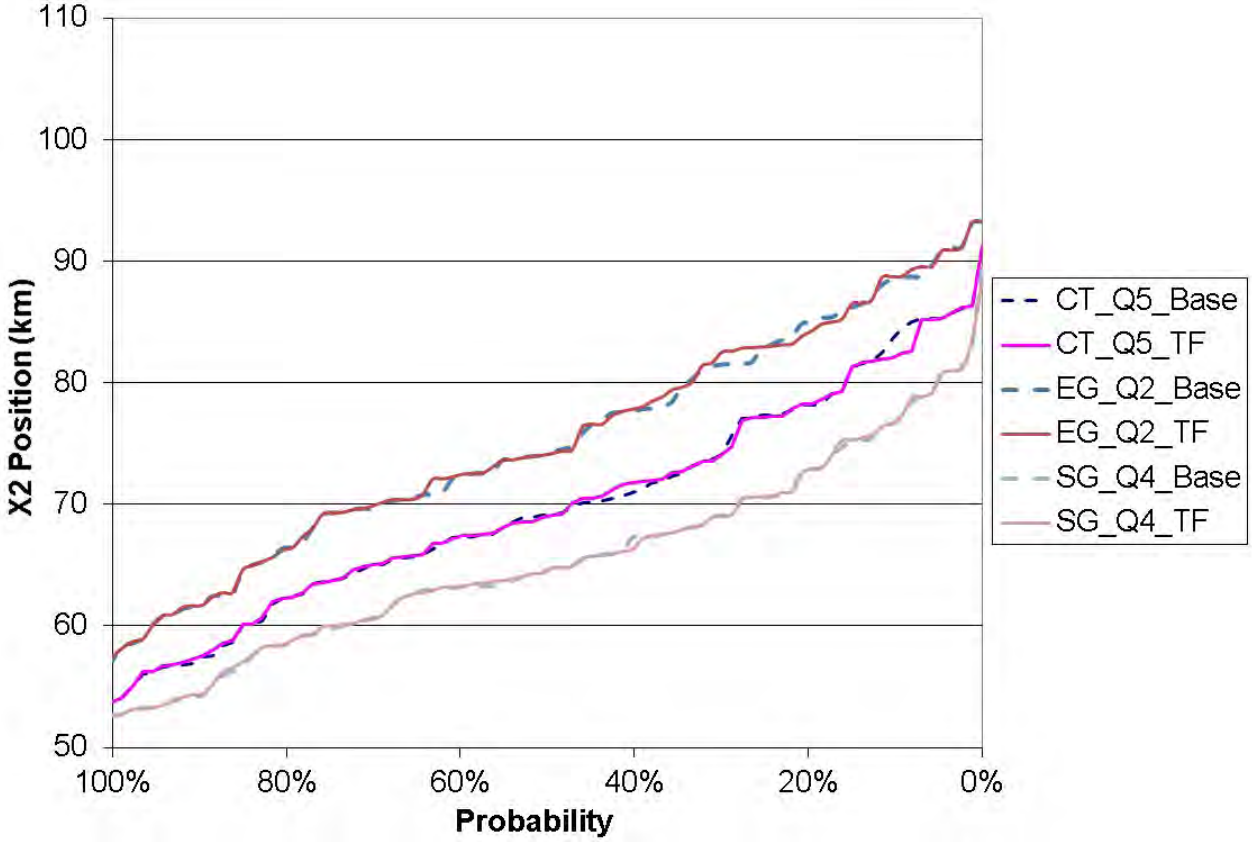
Figure 8-54. Annual Exceedence of Delta Outflow under Various Climate Change Scenarios



Key:
CT = Current Trends
EG = Expansive Growth
NoCC = no climate change
SG = Slow Growth
TAF = thousand acre feet
TF = Temperance Flat (a.k.a. Representative Alternative)

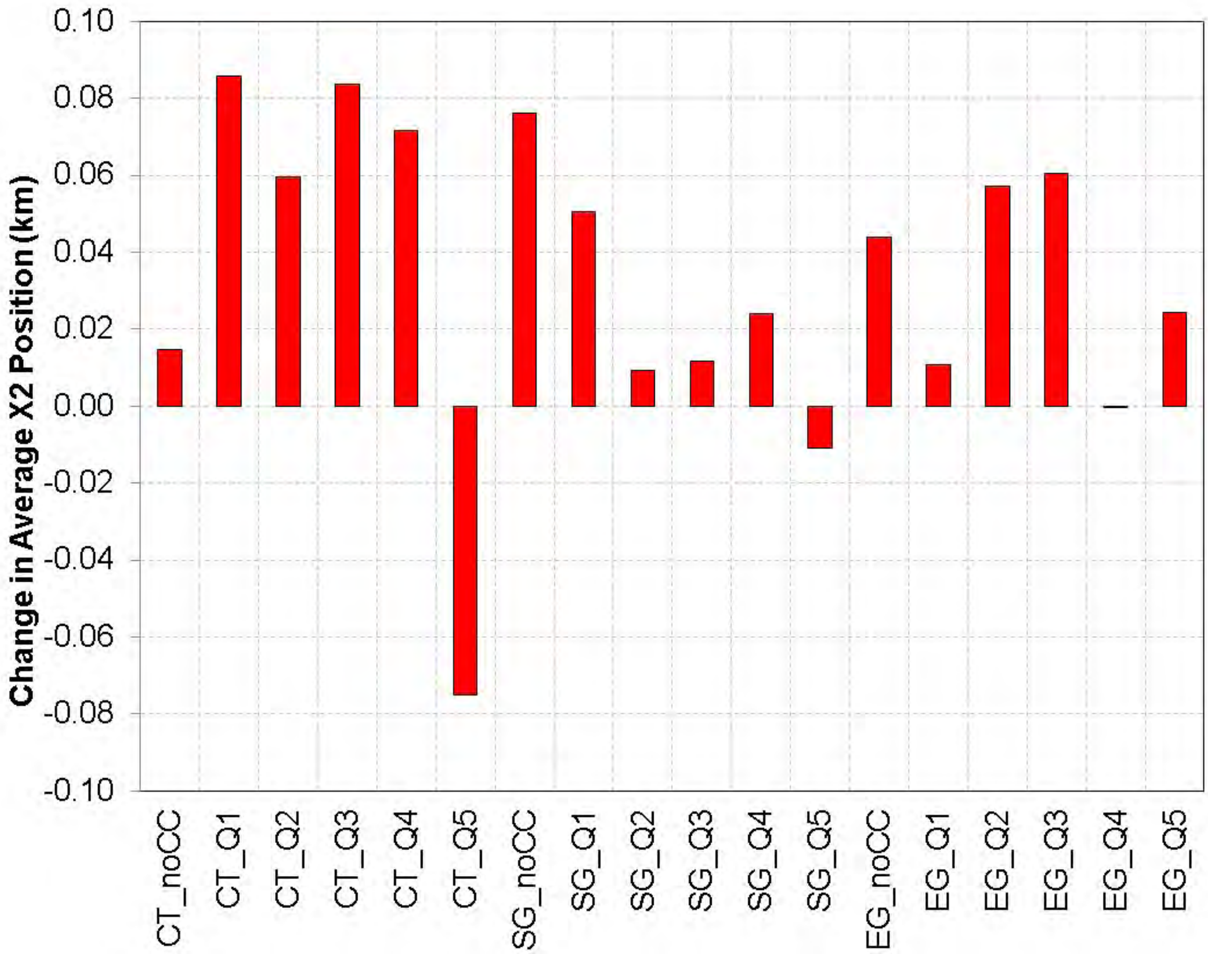
Figure 8-55. Average Annual Change in Delta Outflow for Comparing the Baseline to Representative Alternative in Each Socioeconomic-Climate Scenario

Delta Salinity Figure 8-56 shows exceedence plots of average X2 position during the 21st century from February through June under socioeconomic-climate scenarios CT-Q5, EG-Q2, and SG-Q4. Figure 8-57 shows the change in average X2 position for all 18 socioeconomic-climate scenarios for the months of February through June comparing Representative Alternative to the Baseline simulations. As can be observed from the figure, the Representative Alternative has very little impact on the X2 location. The maximum change is less than 0.1 km either to the east or west.



Note: For each scenario, the Baseline is represented by dashed lines and Representative Alternative by solid lines.
Key:
Base = Baseline
CT = Current Trends
EG = Expansive Growth
km = kilometer
SG = Slow Growth
TF = Temperance Flat (a.k.a. Representative Alternative)

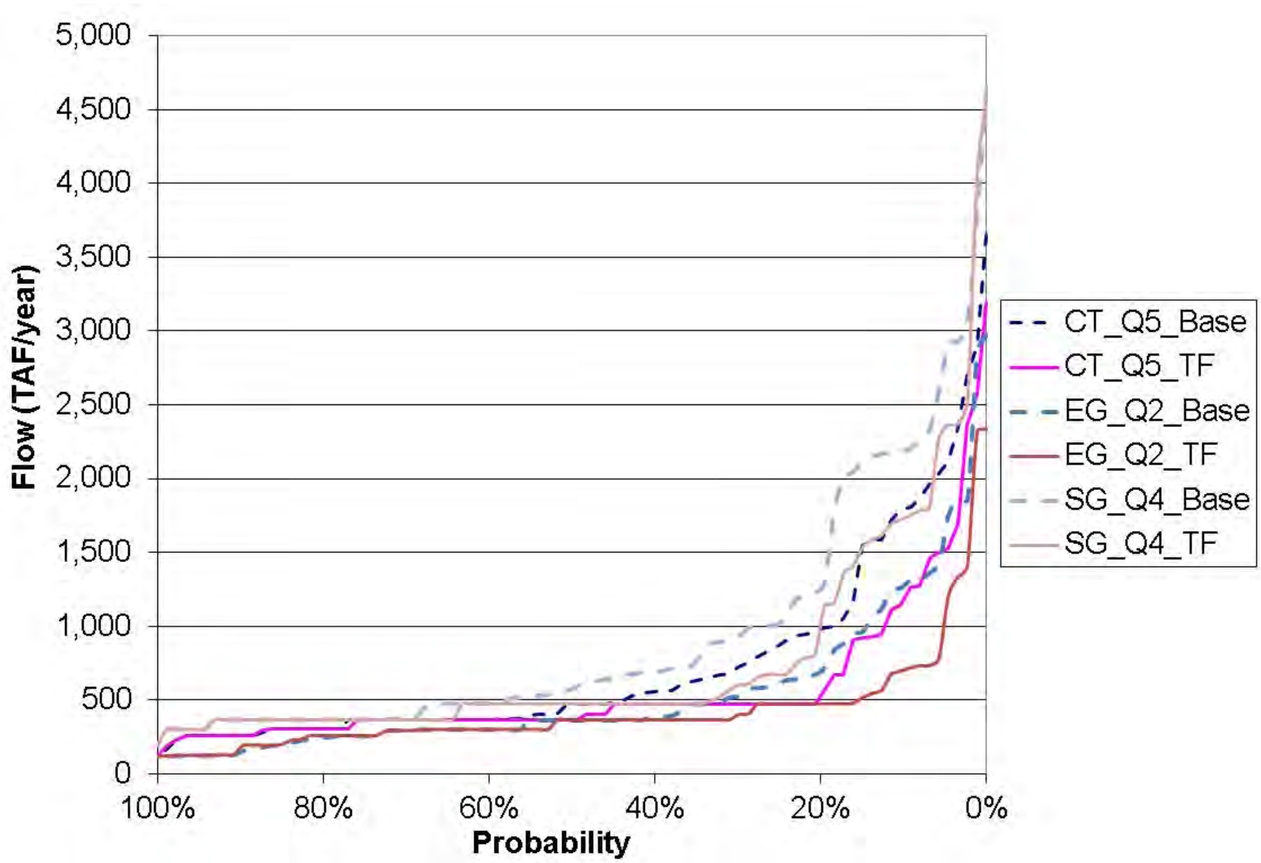
Figure 8-56. Exceedence of Average February-to-June X2 Position Under Various Climate Change Scenarios



Key:
CT = Current Trends
EG = Expansive Growth
km = kilometer
NoCC = no climate change
SG = Slow Growth
TF = Temperance Flat (a.k.a. Representative Alternative)

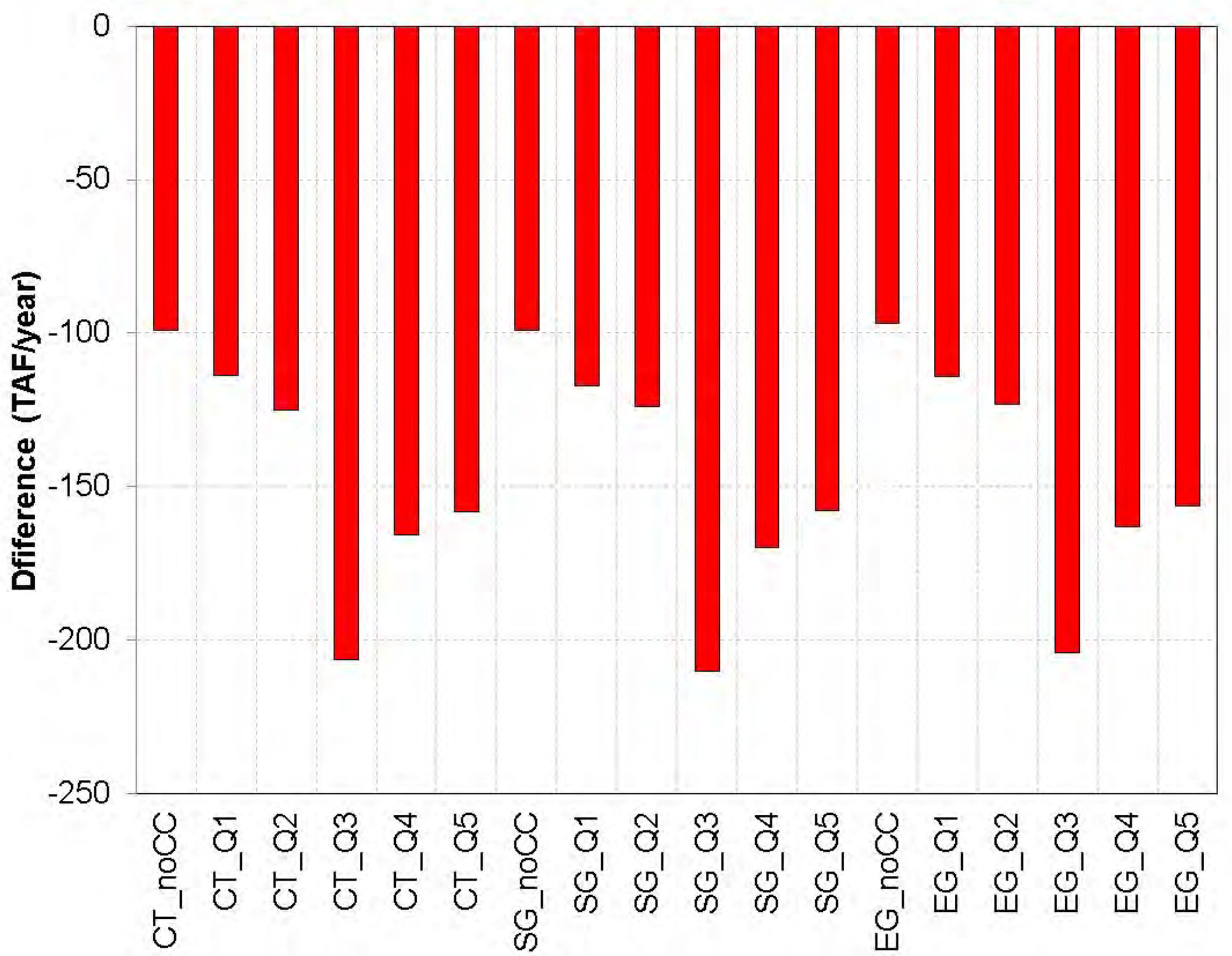
Figure 8-57. Change in Average February-to-June X2 Position Comparing the Baseline to Representative Alternative in Each Socioeconomic Climate Scenario

Water Supplies and Demands Figure 8-58 is an exceedence plot of annual releases from Millerton Lake into the San Joaquin River. The figure indicates that Millerton Lake releases under the Representative Alternative are reduced in the highest flow years, reflecting the ability of Temperance Flat RM 274 Reservoir to capture watershed runoff that otherwise would have been released from Millerton Lake for flood control purposes. Figure 8-59 shows the magnitude of these changes for each of the 18 socioeconomic-climate scenarios. Only small differences between the socioeconomic scenarios occur, the largest of which occur in the wetter Q3 and Q4 projections and range from a minimum of approximately 165 TAF to a maximum of 210 TAF. The central tendency Q5 projections result in a reduction of releases of about 155 TAF.



Note: For each scenario, the Baseline is represented by dashed lines and Representative Alternative by solid lines.
Key:
Base = Baseline
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth
TAF = thousand acre feet
TF = Temperance Flat (a.k.a. Representative Alternative)

Figure 8-58. Exceedence Annual Releases from Friant Dam Comparing Baseline and Representative Alternative

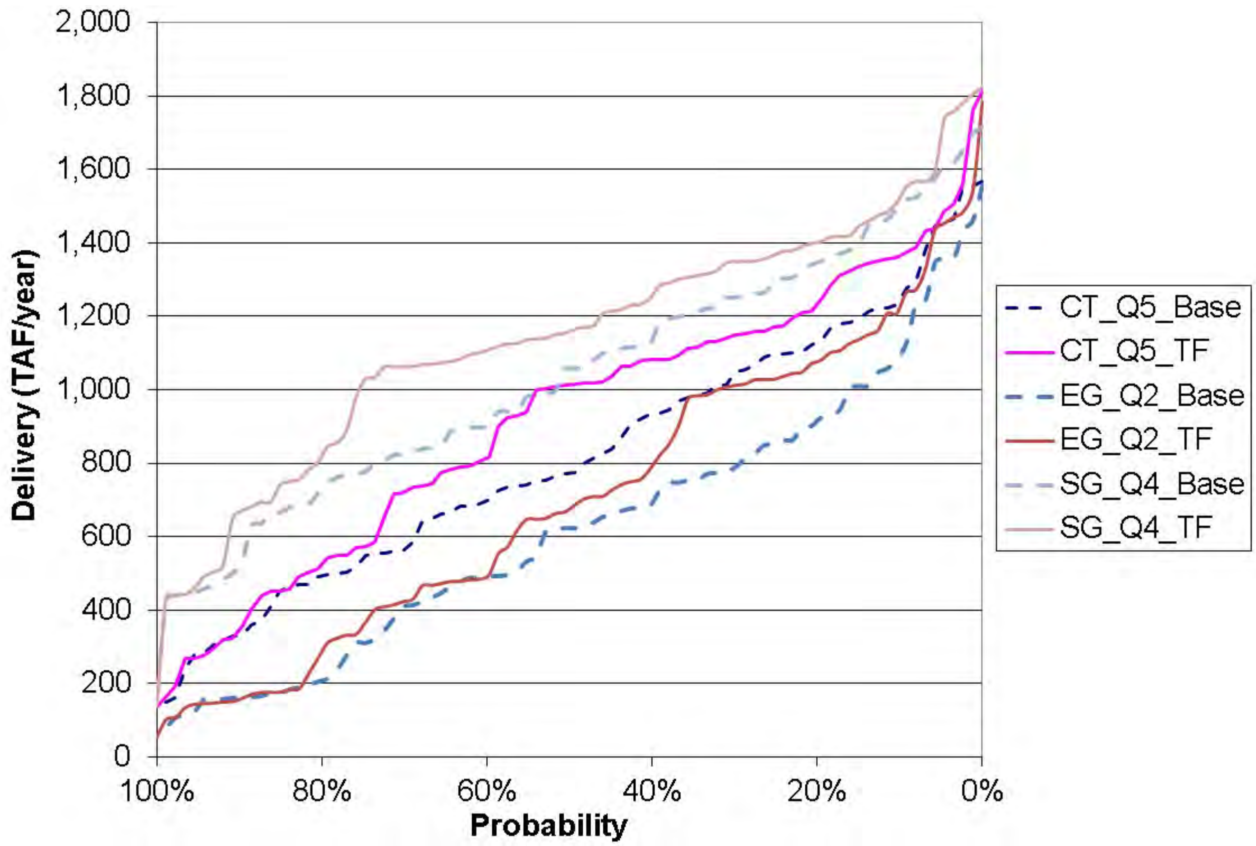


Key:
CT = Current Trends
EG = Expansive Growth
NoCC = no climate change
SG = Slow Growth
TAF = thousand acre feet

Figure 8-59. Average Annual Change in Friant Dam Releases for Comparing the Baseline to Representative Alternative in each Socioeconomic-Climate Scenario

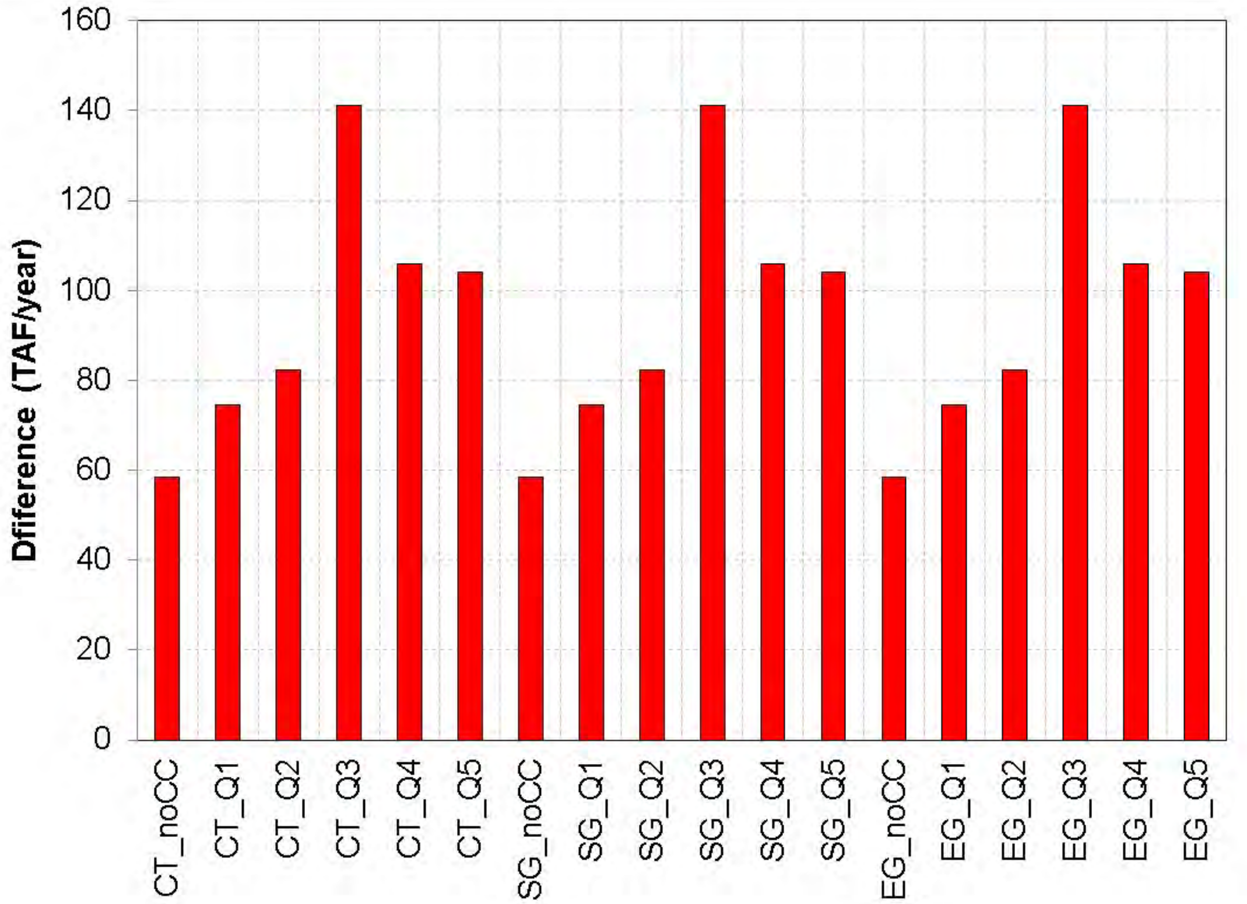
Figure 8-60 through Figure 8-63 show changes in annual exceedence for the Representative Alternative in deliveries from Friant-Kern and Madera canals relative to the Baseline. As shown on Figure 8-60 and 8-62, water supply deliveries in the wettest years are slightly reduced due to Temperance Flat RM 274 Reservoir being used to capture excess runoff for carryover storage; in drier years, canal deliveries with Temperance Flat RM 274 Reservoir are similar to the Baseline results. However, as shown in Figures 8-61 and 8-63, over the 21^{st} century, the operation of the Representative Alternative results in an average increase in deliveries across the range of all 18 socioeconomic-climate scenarios considered.

For the Friant-Kern Canal, increases in deliveries range from a minimum of about 60 TAF/year in the drier Q2 climate scenarios to a maximum of about 140 TAF/year in wetter Q3 climate scenarios. The central tendency Q5 deliveries increase by approximately 100 TAF/year.



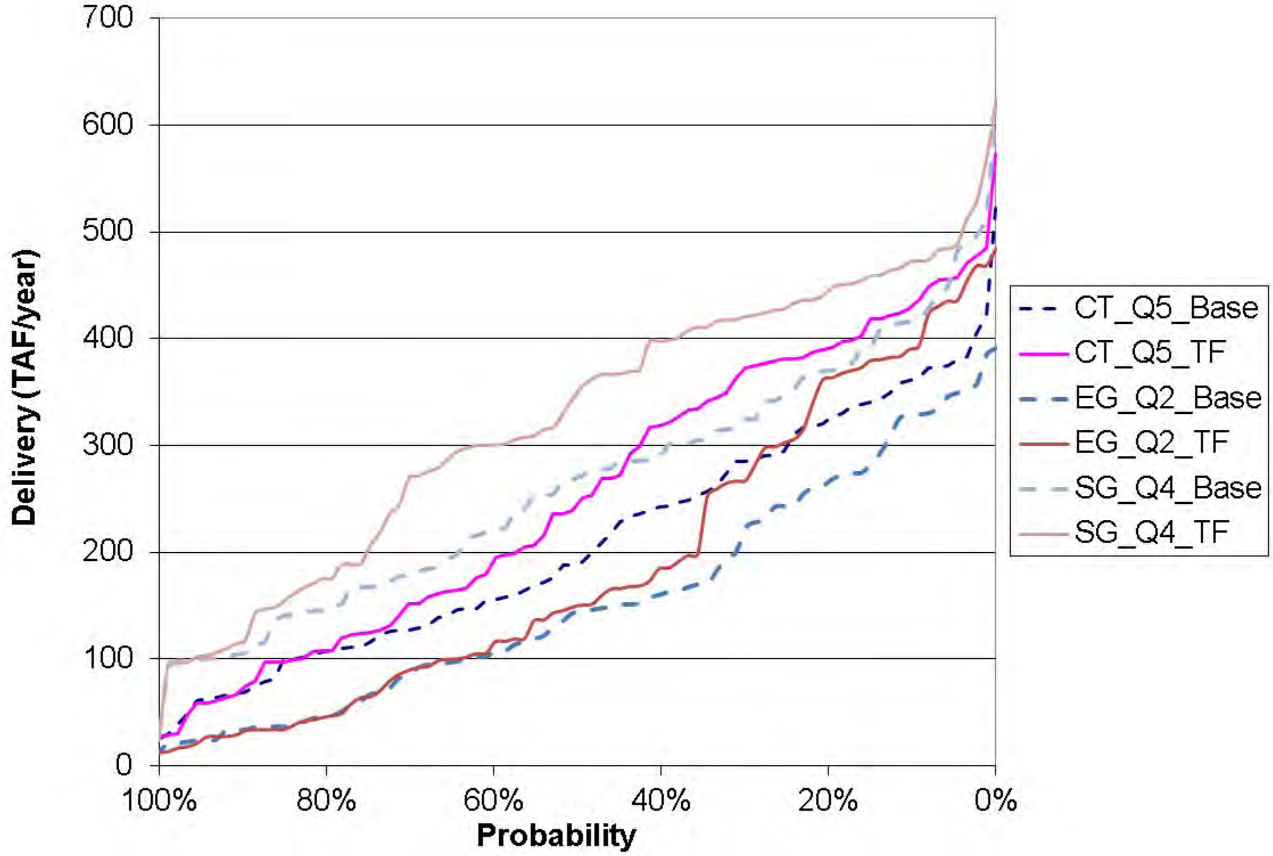
Key:
Base = Baseline
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth
TF = Temperance Flat (a.k.a. Representative Alternative)

Figure 8-60. Exceedence of Annual Friant-Kern Canal Deliveries Comparing Baseline and Representative Alternative



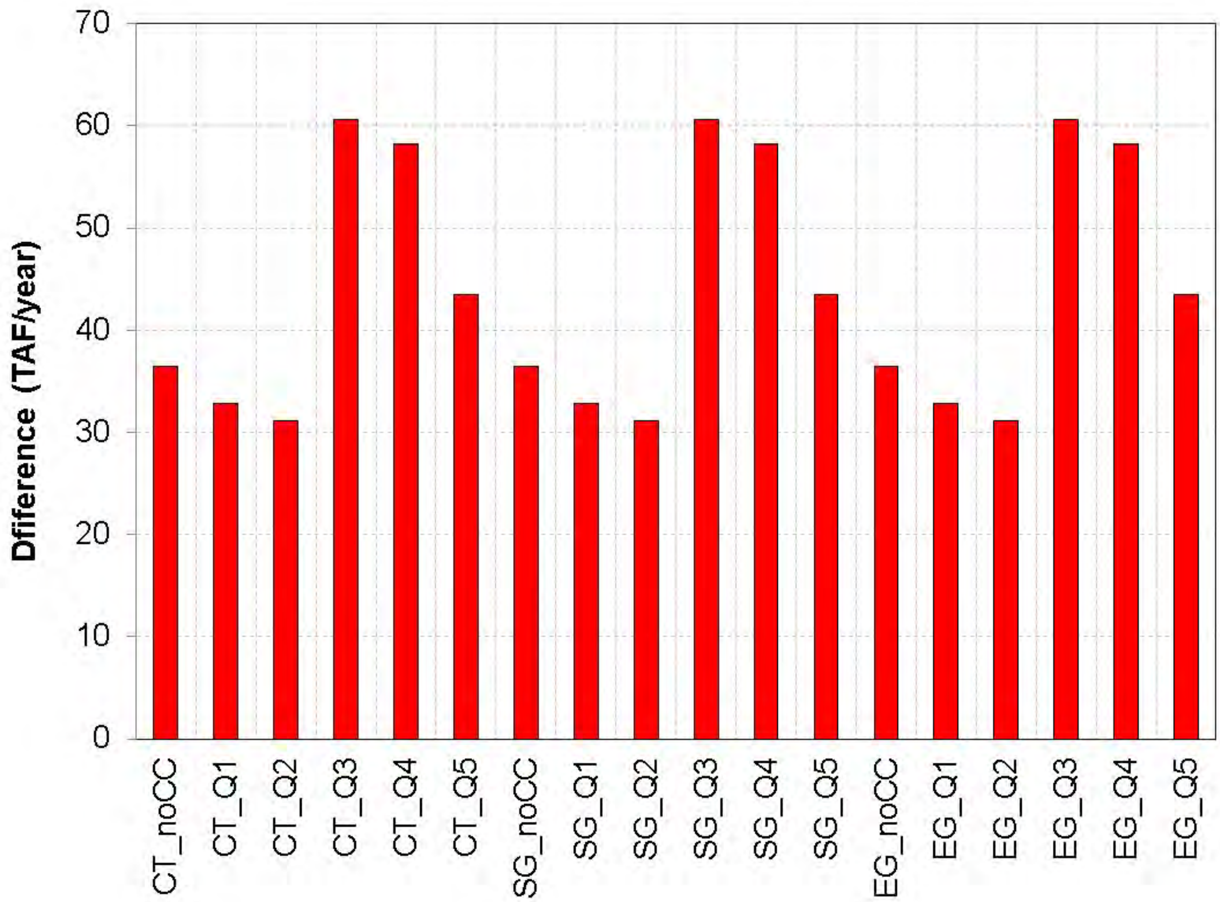
Key:
CT = Current Trends
EG = Expansive Growth
NoCC = No Climate Change
SG = Slow Growth
TAF = thousand acre-feet

Figure 8-61. Average Annual Change in Friant-Kern Canal Deliveries Comparing Baseline and Representative Alternative in Each Socioeconomic-Climate Scenario



Key:
Base = Baseline
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth
TAF = thousand acre-feet
TF = Temperance Flat (a.k.a. Representative Alternative)

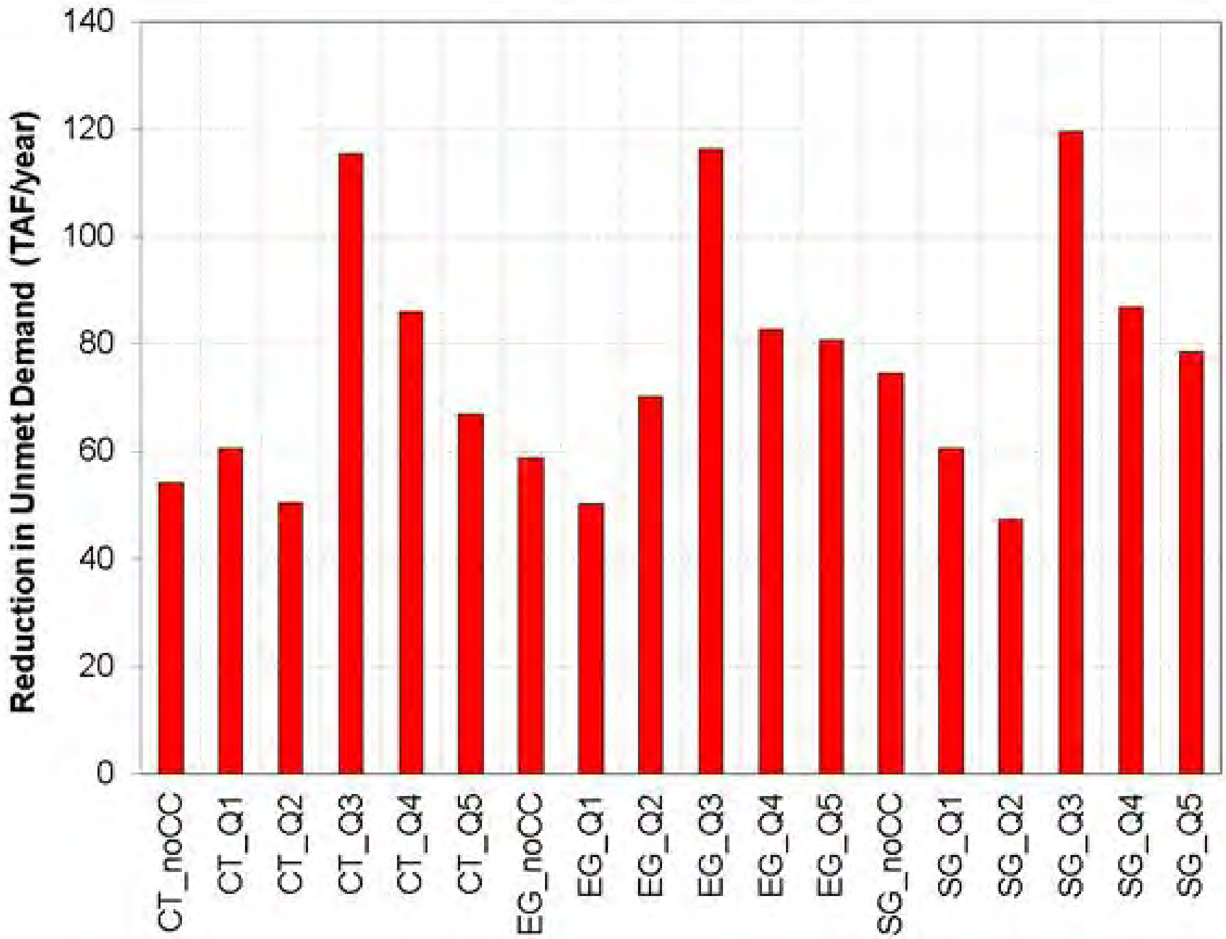
Figure 8-62. Exceedence of Annual Madera Canal Delivery Comparing Baseline and Representative Alternative



Key:
CT = Current Trends
EG = Expansive Growth
NoCC = No Climate Change
SG = Slow Growth
TAF = thousand acre-feet

Figure 8-63. Average Annual Change in Madera Canal Delivery for Comparing Baseline to Representative Alternative in Each Socioeconomic-Climate Scenario

Figure 8-64 shows the change in average annual unmet demands in the CVP water service area with the operation of Temperance Flat RM 274 Reservoir. Overall, with the Representative Alternative, reductions in unmet demands range from a minimum of approximately 50 TAF/year to a maximum of 120 TAF/year. The central tendency Q5 unmet demands decrease by between 70 and 80 TAF/year.



Key:
CT = Current Trends
EG = Expansive Growth
NoCC = No Climate Change
SG = Slow Growth
TAF = thousand acre-feet

Figure 8-64. Average Annual Reduction in Unmet Demand in the CVP Water Service Area Comparing Baseline to Representative Alternative in Each Socioeconomic-Climate Scenario

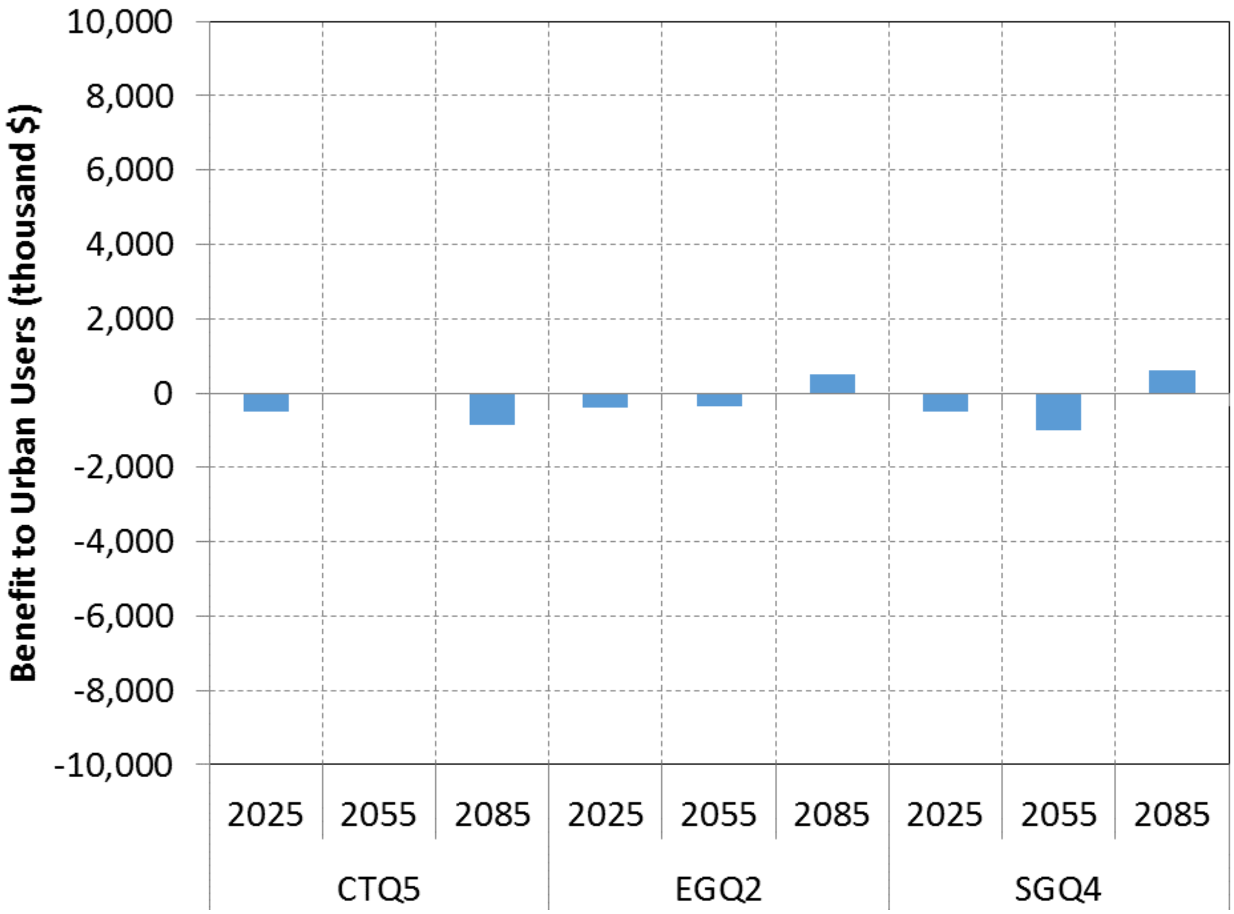
Results of Other Performance-Assessment Tools

Results for the representative alternative relative to other performance tools, including economic, water temperature, and hydropower, are described below.

Economics Figure 8-65 through Figure 8-68 show the net change in water supply system costs from the urban economic models LCPSIM and OMWEM; the net change in avoided cost from the water quality economic model SBWQM; and the change in agricultural net revenue from SWAP for the

Representative Alternative in the CT-Q5, EG-Q2 and SG-Q4 scenarios at the 2025, 2055, and 2085 LODs.

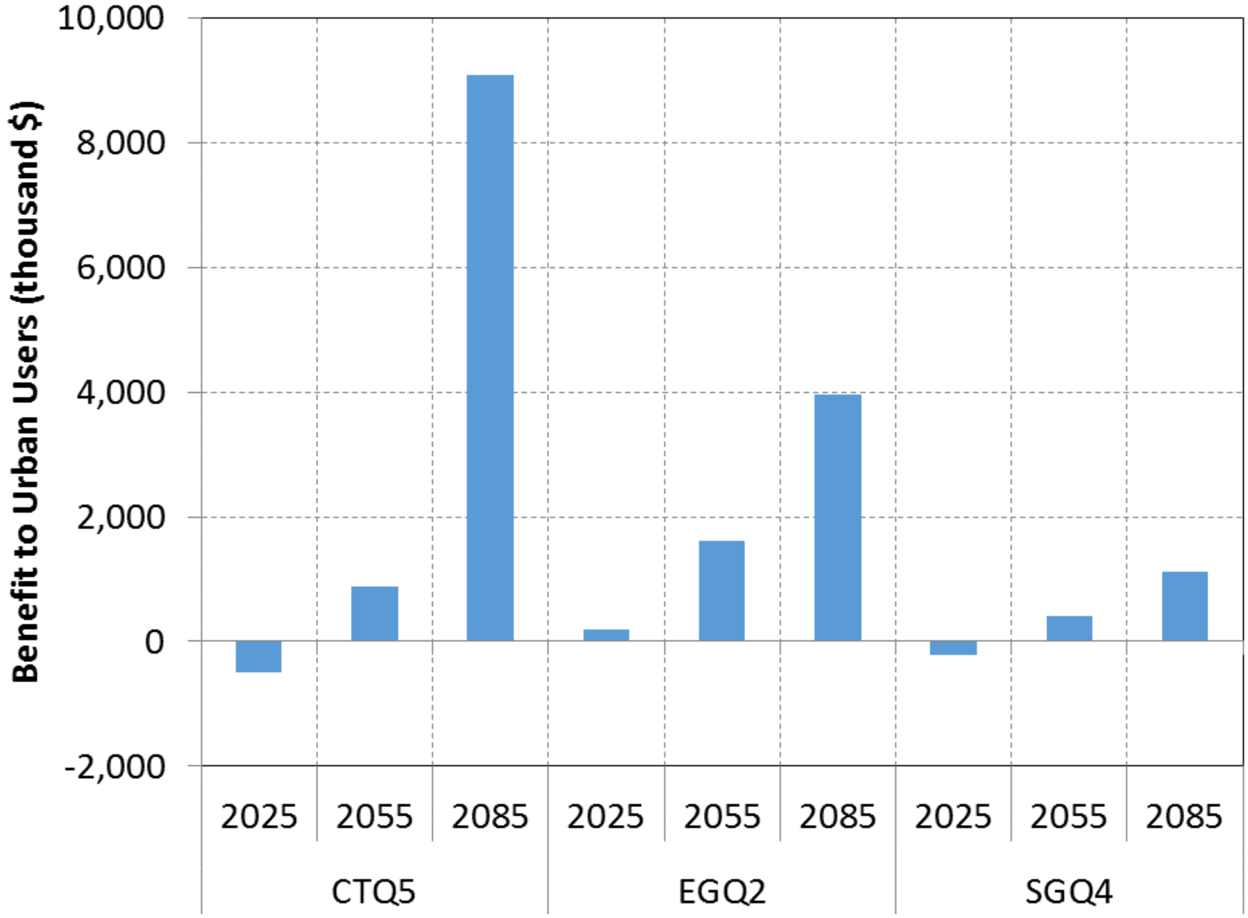
Figure 8-65 shows the change in cost of meeting urban water demand in the South Bay area with the Representative Alternative compared to the Baseline. Positive values indicate that the Representative Alternative provides a cost savings (a benefit) relative to the Baseline, while negative values indicate a cost increase relative to the Baseline. None of the socioeconomic-climate scenarios show an increase or decrease in costs greater than $1M in any year, with most changes much less. These small differences indicate no significant change in the costs of meeting urban water demand in the South Bay Area.



Key:
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth

Figure 8-65. Difference in Average Annual Costs of Meeting Urban Water Demand in the South Bay Area Region from LCPSIM with the Representative Alternative Relative to the Baseline, for Select Socioeconomic-Climate Scenarios

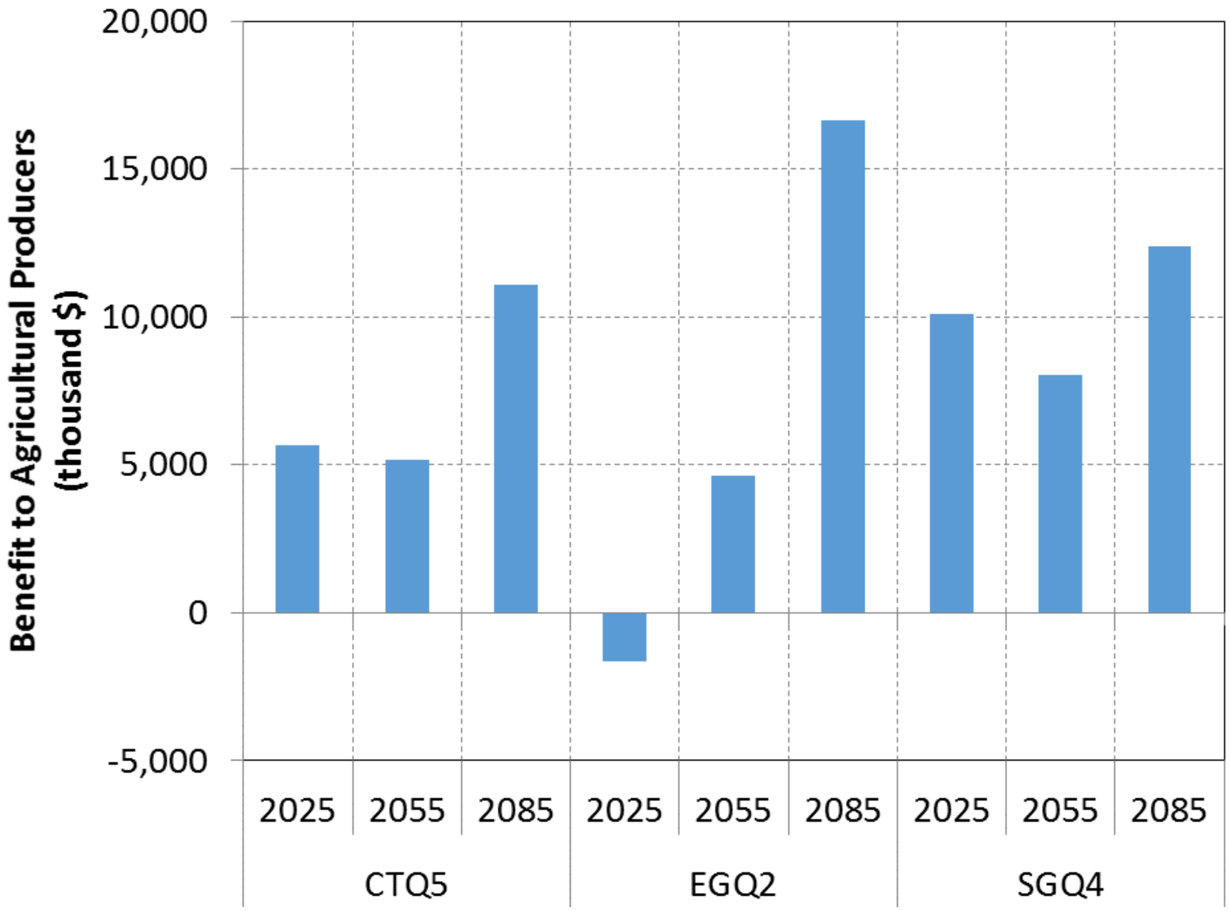
Figure 8-66 shows the cost of meeting urban water demand for CVP and SWP M&I contractors in the Central Valley, Central Coast, and American River Region with the Representative Alternative compared to the Baseline. Positive values indicate that the Representative Alternative provides a cost savings (a benefit) relative to the Baseline, while negative values indicate a cost increase relative to the Baseline. For Friant Division M&I contractors receiving additional CVP delivery, the benefit is the avoided cost of groundwater pumping. All three socioeconomic scenarios show benefits from avoided groundwater pumping costs in 2055 and 2085, with the greatest cost savings in CTQ5 in 2085.



Key:
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth

Figure 8-66. Difference in Average Annual Costs of Meeting Urban Water Demand in the Central Valley from OMWEM with the Representative Alternative Relative to the Baseline, for Select Socioeconomic-Climate Scenarios

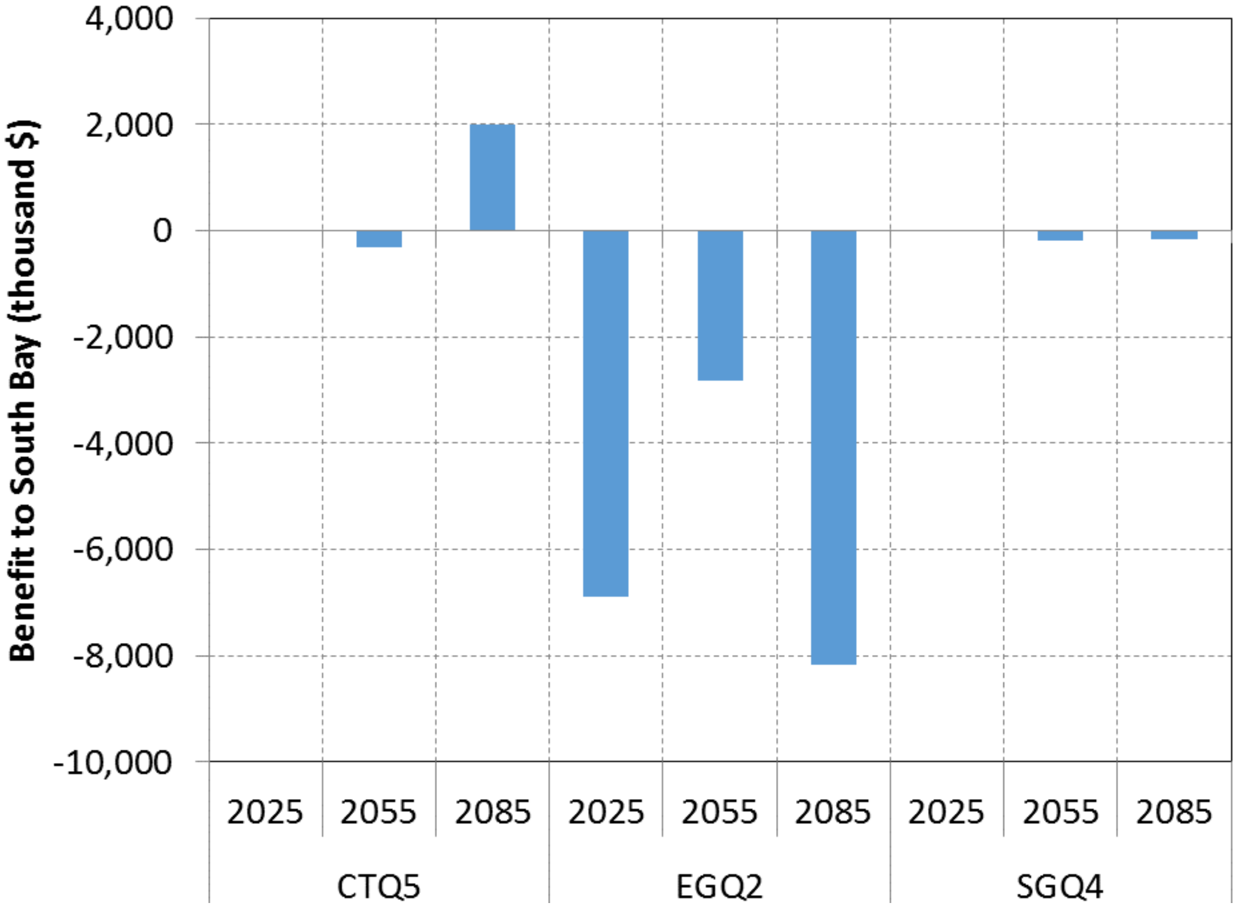
Figure 8-67 shows the change in agricultural net revenues in the Central Valley with the Representative Alternative compared to the Baseline. The values displayed are measured by subtracting average annual net revenue without the Representative Alternative (Baseline) from the average annual net revenue with the Representative Alternative. Positive values indicate higher net revenues with the Representative Alternative than with the Baseline. In scenarios CTQ5, EGQ2, and SGQ4 (all scenario/year combinations but one), Representative Alternative provides an improvement in average annual agricultural net revenues in the Central Valley. EGQ2 2085 shows the largest increase, with $60M in average annual net revenues to agriculture in the Central Valley.



Key:
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth

Figure 8-67. Change in Average Annual Agricultural Net Revenue in Central Valley from SWAP with the Representative Alternative Relative to the Baseline, for Select Socioeconomic-Climate Scenarios

Figure 8-68 shows the projected change in water quality-related costs for Contra Costa Water District and the South Bay area. In EGQ2, there is an increase in costs of $2 million per year to $8 million per year in all three periods due to higher salinity in the Delta with the Representative Alternative compared to the Baseline. This is caused by reductions in San Joaquin River inflow into the Delta with the Representative Alternative. By contrast, CTQ5 has a cost reduction benefit of about $2 million per year due to a modest improvement in Delta water quality.

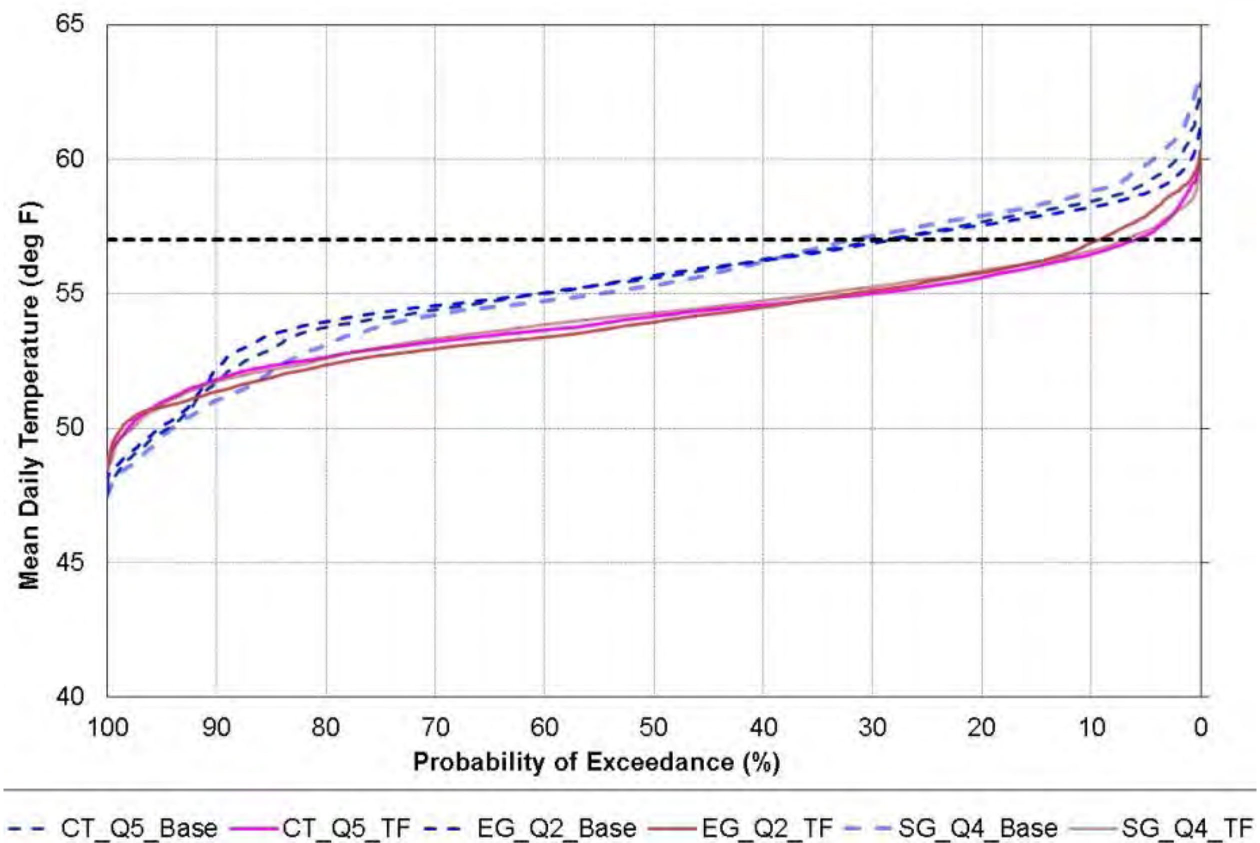


Key:
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth

Figure 8-68. Change in Average Annual Avoided Water Quality Costs in South Bay Region from SBWQM with the Representative Alternative Relative to the Baseline, for Select Socioeconomic-Climate Scenarios

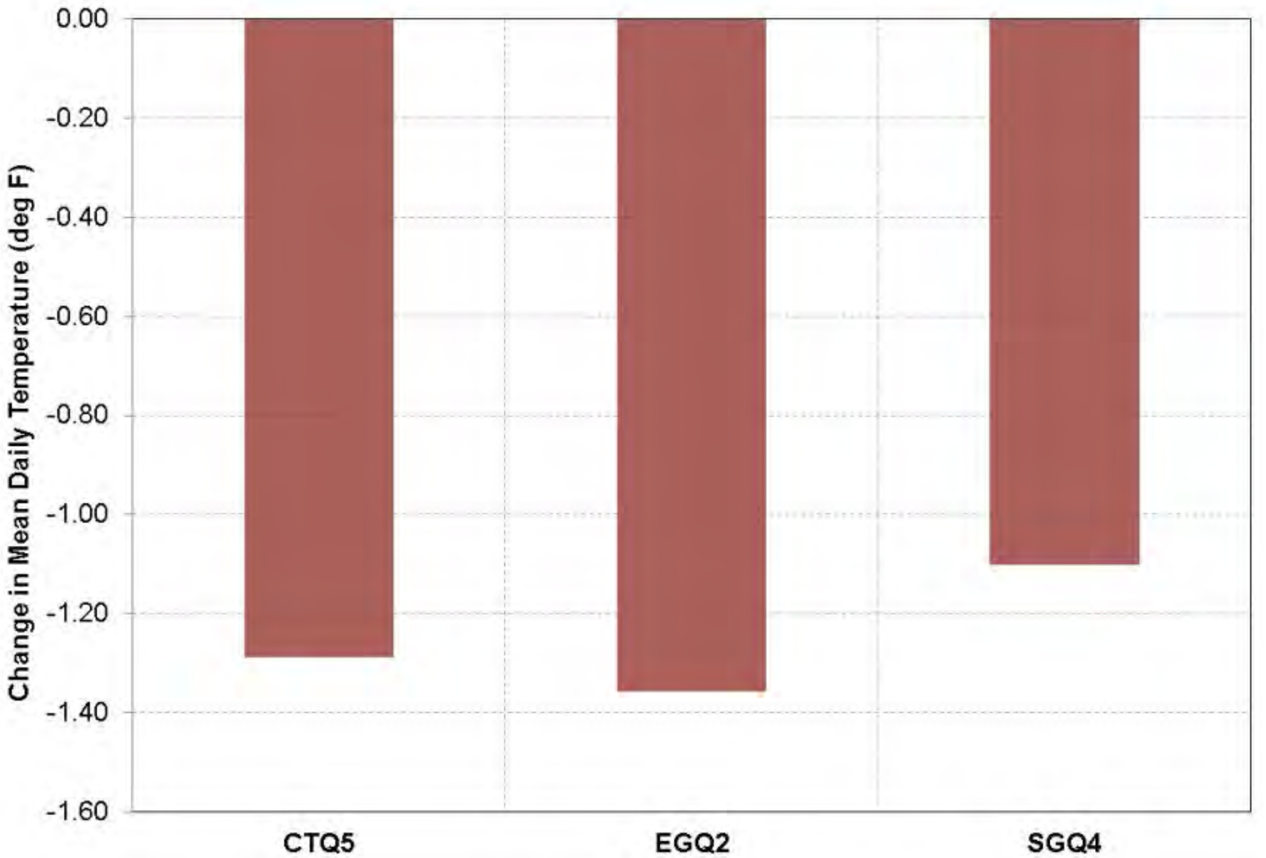
Water Temperature Figure 8-69 through Figure 8-74 are exceedence plots of average changes in mean daily temperatures relative to the Baseline for the CT-Q5, EG-Q2 and SG-Q4 scenarios at the 2025, 2055, and 2085 LODs in the San Joaquin River at Lost Lake, at Gravelly Ford, and at Vernalis.

As can be observed in Figure 8-69 and Figure 8-70, the Representative Alternative provides considerable reductions in water temperatures at Lost Lake relative to the Baselines. The probability of exceeding the 56°F threshold decreases from about 30 percent to 10 percent, with an average reduction of more than 1°F in all socioeconomic-climate scenarios.



Key:
Base = Baseline
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth
TF = Temperance Flat (a.k.a. Representative Alternative)

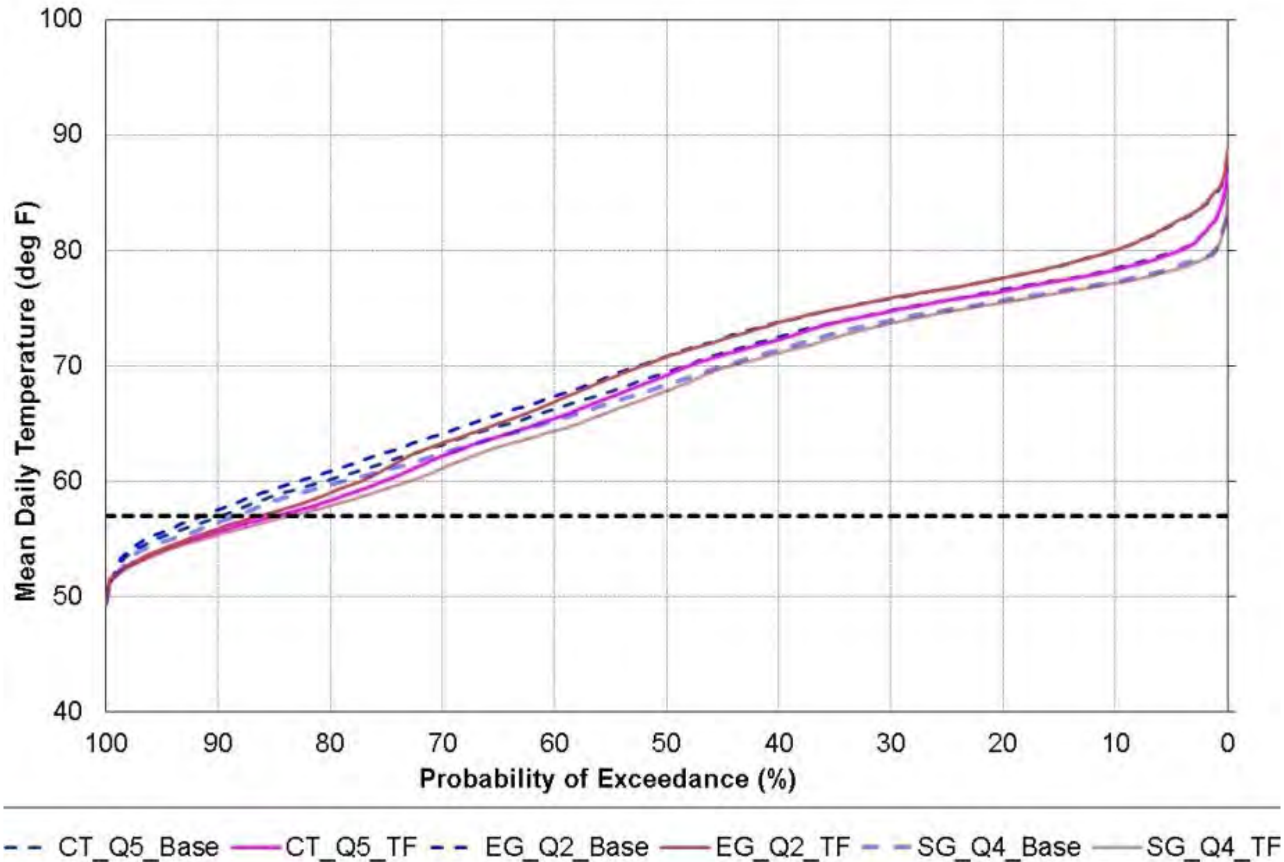
Figure 8-69. Exceedence of Mean Daily Temperature on San Joaquin River at Lost Lake from August-to-November with the Baseline and Representative Alternative



Key:
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth

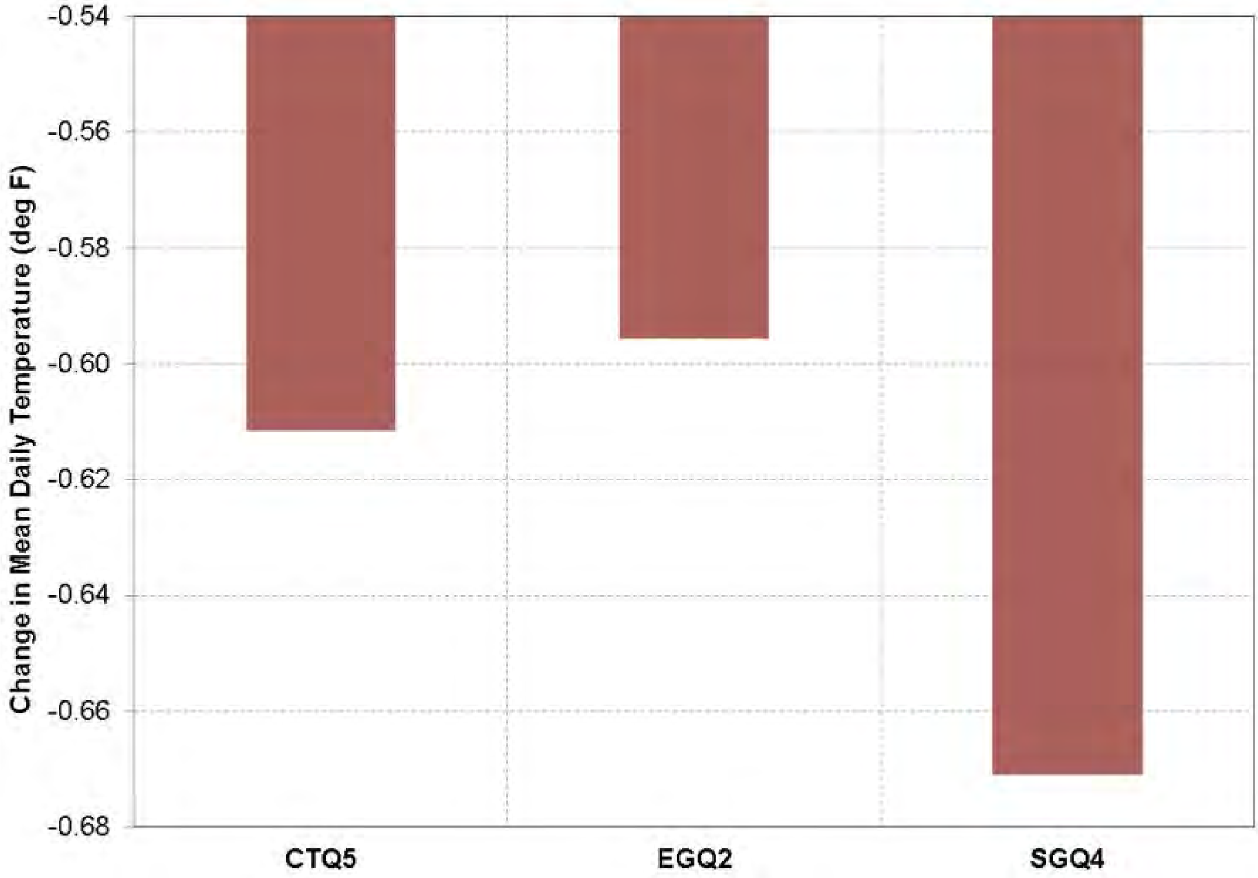
Figure 8-70. Change in Mean Daily Temperature on San Joaquin River at Lost Lake from August-to-November with the Representative Alternative Relative to the Baseline

As shown in Figure 8-71 and Figure 8-72, the results at Gravelly Ford are similar to Lost Lake; however, the changes in exceedance of the 56°F threshold (dashed horizontal line) occur with much higher probability (85 to 90 percent) and with much smaller, but still potentially significant, changes in water temperature (-0.59 to -0.67°F) relative to the Baseline.



Note: For each scenario, the Baseline is represented by dashed lines and Representative Alternative by solid lines.
Key:
Base = Baseline
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth
TF = Temperance Flat (a.k.a. Representative Alternative)

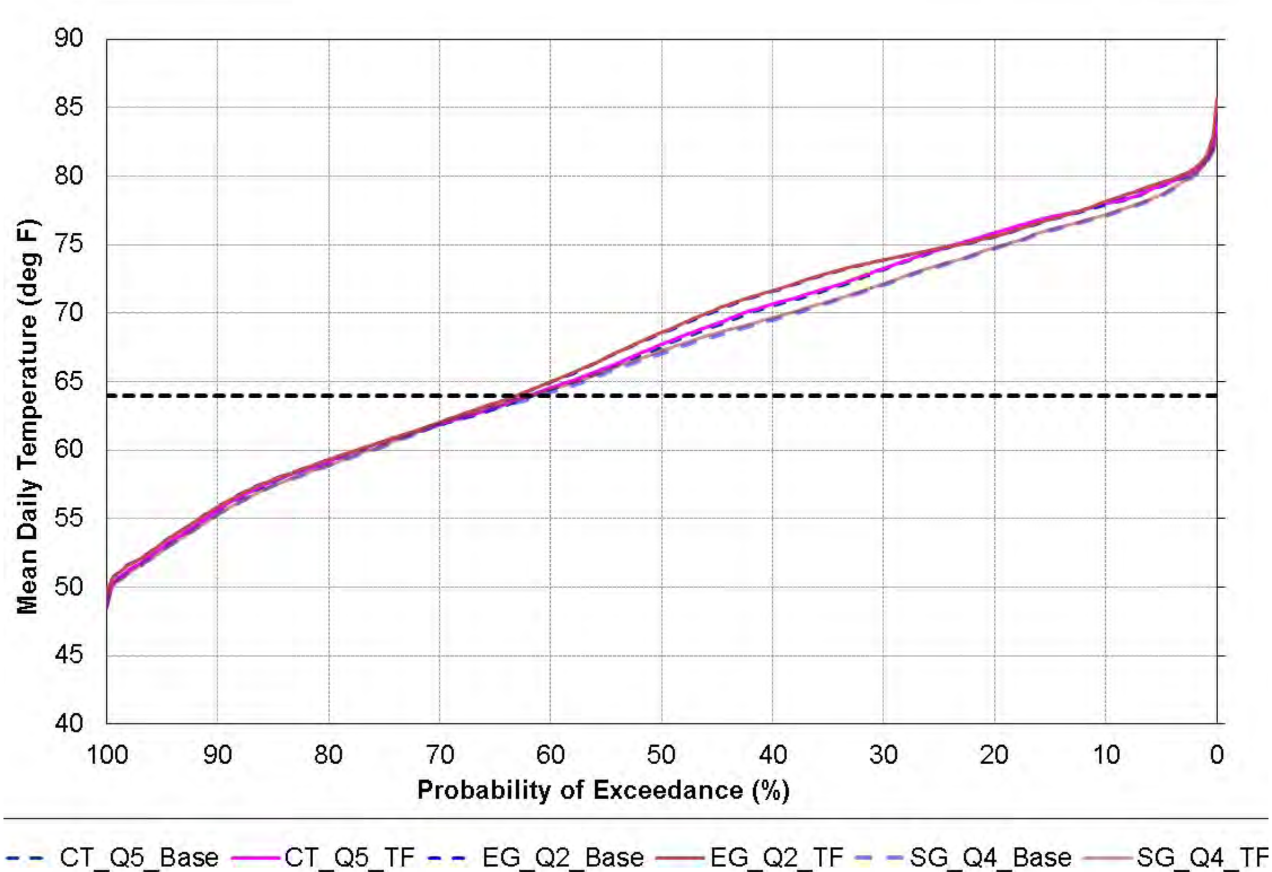
Figure 8-71. Exceedence of Mean Daily Temperature on San Joaquin River at Gravelly Ford from August-to-November with the Baseline and Representative Alternative



Key:
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth

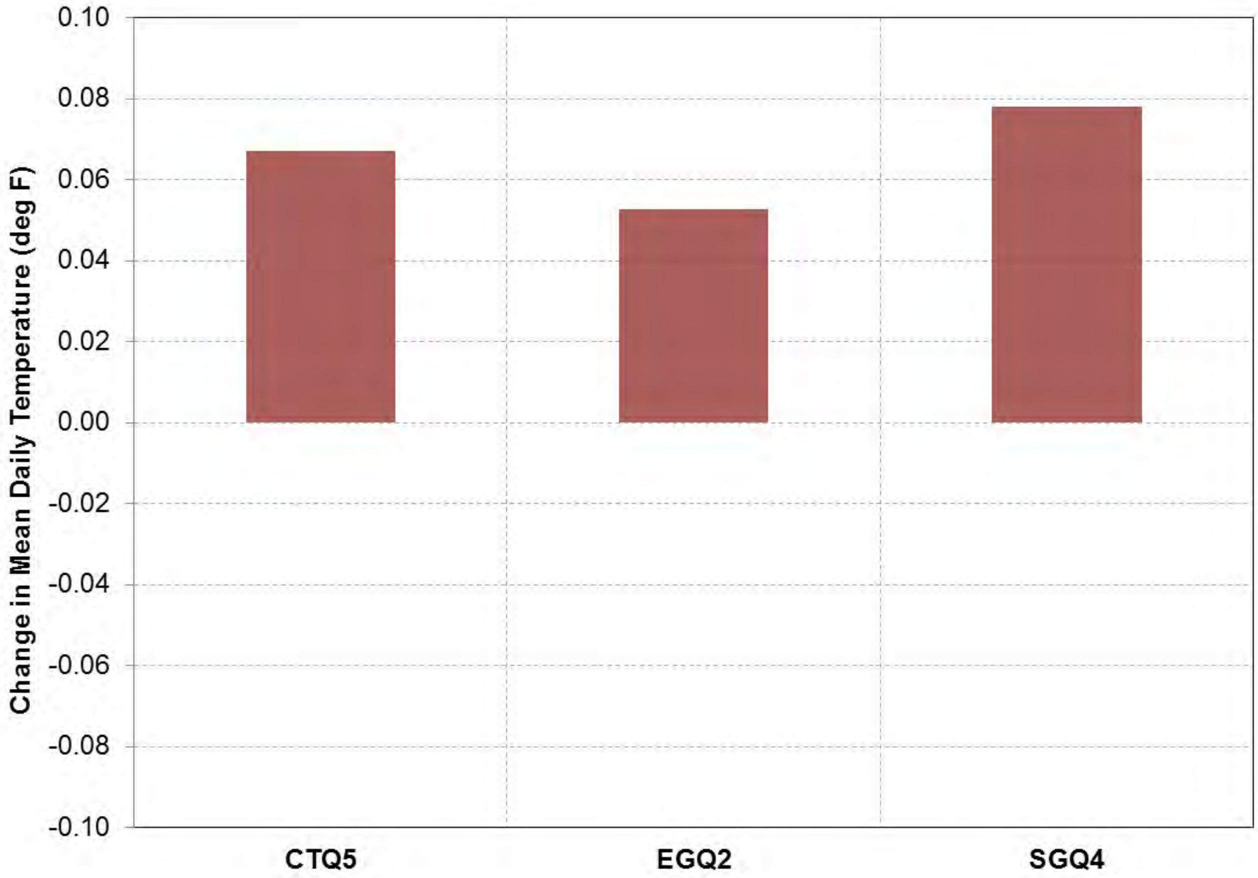
Figure 8-72. Change in Mean Daily Temperature on San Joaquin River at Gravelly Ford from August-to-November with the Representative Alternative Relative to the Baseline

In the San Joaquin River at Vernalis, the effects of socioeconomic and climate changes on the Representative Alternative on water temperatures are projected to be insignificant, because air temperature dominates the equilibrium water temperatures. This is shown in Figure 8-73 and Figure 8-74.



Note: For each scenario, the Baseline is represented by dashed lines and Representative Alternative by solid lines.
Key:
Base = Baseline
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth
TF = Temperance Flat (a.k.a. Representative Alternative)

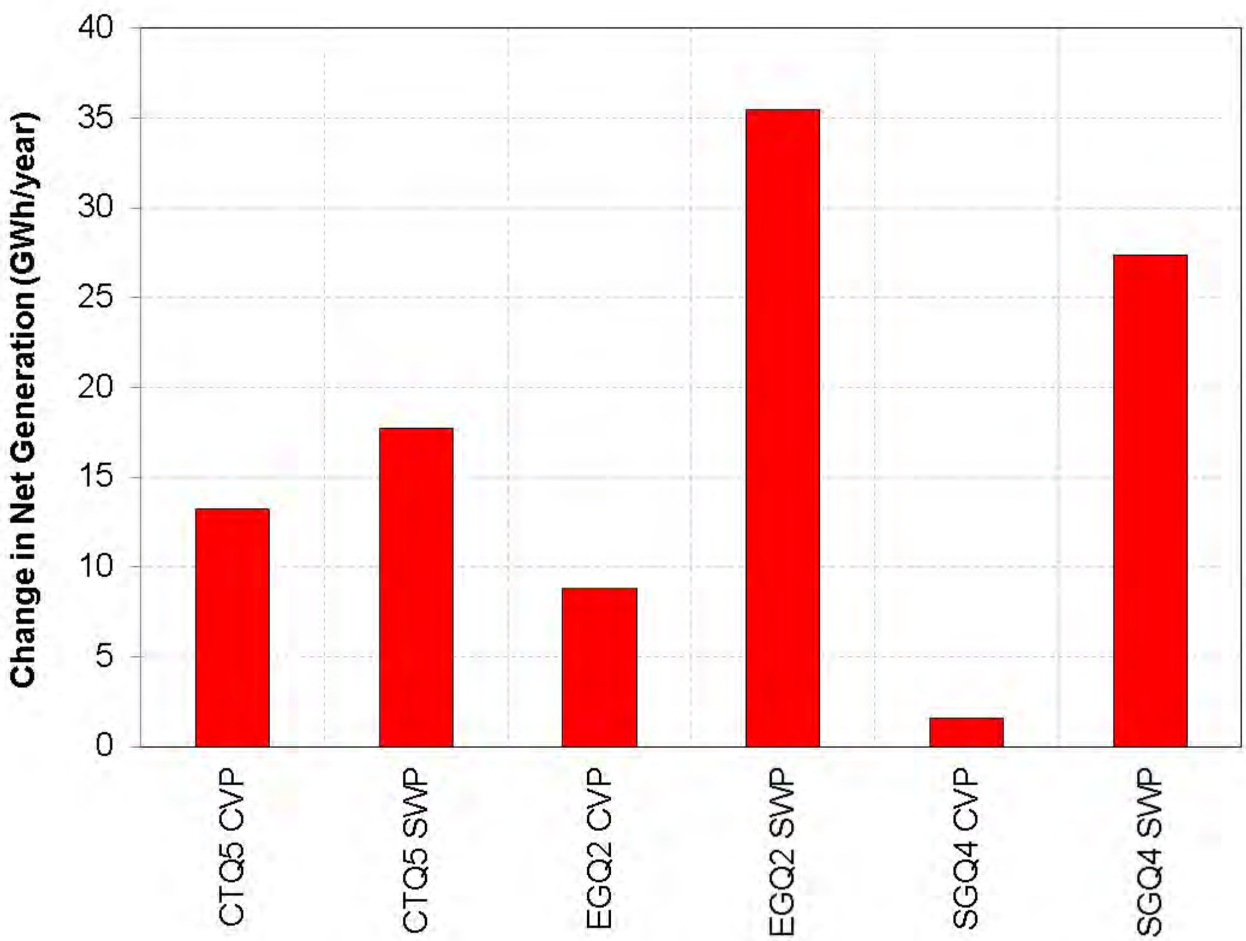
Figure 8-73. Exceedence of Mean Daily Temperature on San Joaquin River at Vernalis from August-to-November with the Baseline and Representative Alternative



Key:
CT = Current Trends
EG = Expansive Growth
SG = Slow Growth

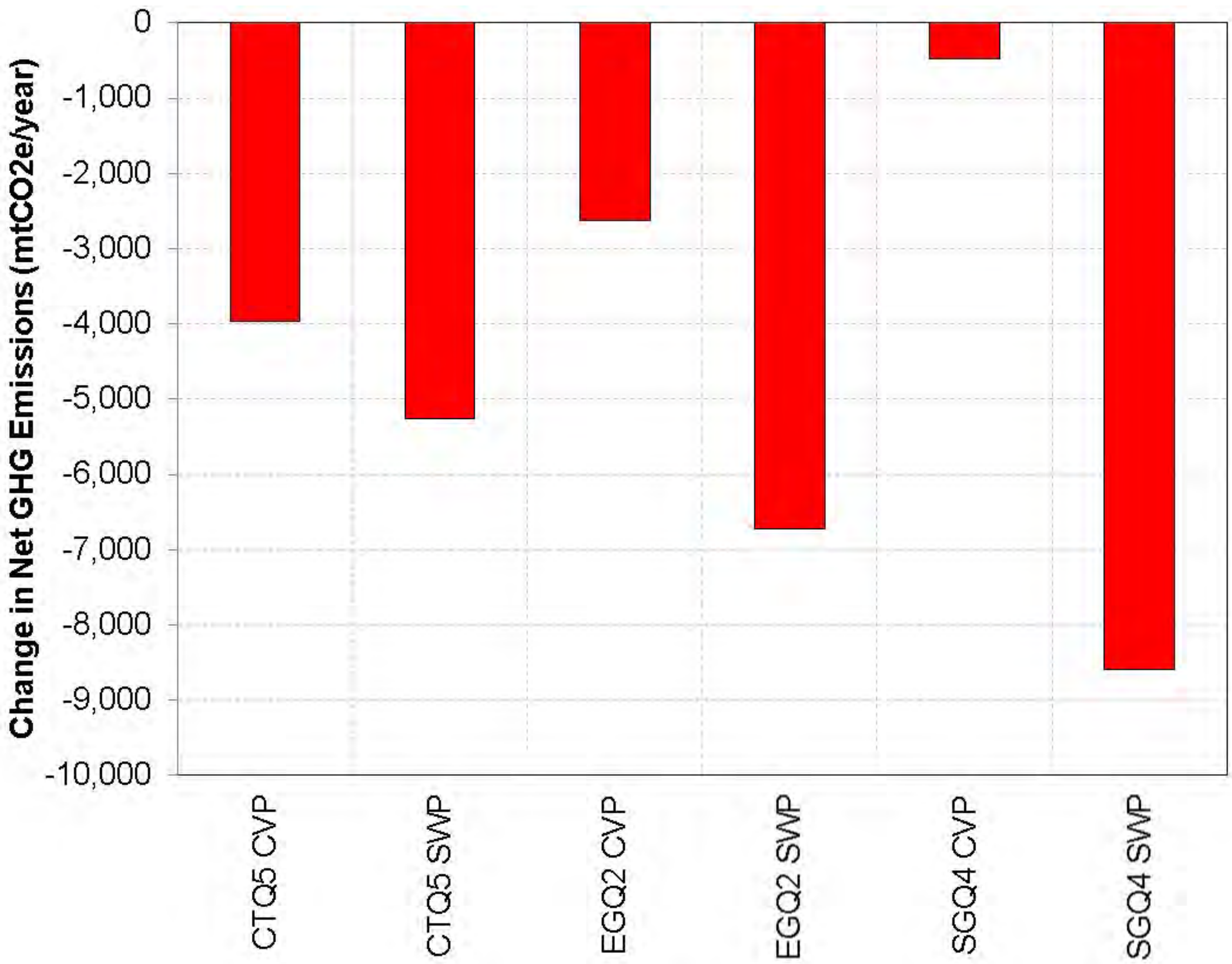
Figure 8-74. Change in Mean Daily Temperature on San Joaquin River at Vernalis from August-to-November with the Representative Alternative Relative to the Baseline

Hydropower and GHG Emissions Figure 8-75 and Figure 8-76 show the changes in net power generation and net GHG emissions in the CVP and SWP systems for the Representative Alternative relative to the Baseline. Across the range of socioeconomic-climate scenarios, the Representative Alternative increases net power generation for both the CVP and SWP systems. As the net power generation increases, the GHG emissions for both the CVP and SWP systems decrease.



Key:
CT = Current Trends
CVP = Central Valley Project
EG = Expansive Growth
GWh = gigawatt hour
SG = Slow Growth
SWP = State Water Project

Figure 8-75. Change in Average Annual Net Energy Generation for the CVP and SWP Systems with the Representative Alternative



Key:
CT = Current Trends
CVP = Central Valley Project
EG = Expansive Growth
GHG = greenhouse gas
mtCO2e = metric tons CO2 equivalent
SG = Slow Growth
SWP = State Water Project

Figure 8-76. Change in Average Annual Net GHG Emissions for the CVP and SWP Systems with the Representative Alternative

Effects of Climate Change on the Impacts Anticipated Under the Action Alternatives

This section examines the relationship of climate change effects to the environmental impacts and mitigation measures presented in Chapters 4 through 7, and 9 through 26, consistent with the guidance provided by CEQ on February 18, 2010, regarding the consideration of the effects of climate change in NEPA documents: "Agencies should consider specific effects of the proposed action (include the proposed actions' effect on the vulnerability of affected ecosystems), the nexus of those effects with projected climate change effects on the same aspects of our environment, and the implications for the environment to adapt to the projected effects of climate change." This guidance suggests that NEPA documentation should take climate change into account for any and all resources for which the effects of a proposed action might interact with climate changes. This section discusses impacts after implementation of proposed mitigation measures that are anticipated under the action alternatives for a range of possible future socioeconomic-climate scenarios. This discussion relies on information provided previously in this chapter and in greater detail in the Climate Change attachment to the Modeling Appendix.

Resources Eliminated from Further Analysis

The following resources are eliminated from further discussion because the effects of the proposed alternatives are not expected to interact with climate changes: environmental justice; cultural resources; Indian Trust Assets (ITA); noise and vibration; paleontological resources; transportation, circulation and infrastructure; and utilities and service systems. This may be the case either because (1) the action alternatives would have no impact (i.e., cultural resources; ITAs; environmental justice; noise and vibration; and paleontological resources in the extended study area) and, therefore, any climate change effects would be unrelated to the project, or (2) because climate change is not expected to alter the outcome of the impacts from the action alternatives (i.e., noise and vibration in the primary study area; paleontological resources; transportation, circulation and infrastructure in the primary or extended study areas).

Additionally, there would be no effects to air quality aside from GHG emissions, which are addressed in Chapter 4, "Air Quality and Greenhouse Gas Emissions."

Biological Resources – Fisheries and Aquatic Ecosystems

As discussed in Chapter 5, "Biological Resources – Fisheries and Aquatic Ecosystems," in the primary study area, the action alternatives could result in impacts related to the following:

- Loss of riverine habitat for lotic fish species (Impact FSH-1, significant and unavoidable)

- Short-term degradation of aquatic habitat from accidental spills or seepage of hazardous materials during construction of Temperance Flat RM 274 Dam and other facilities (Impact FSH-2, less than significant
- Short-term degradation of aquatic habitat from increased turbidity or sedimentation during construction of Temperance Flat RM 274 Dam and other facilities (Impact FSH-3, less than significant)
- Loss of reservoir fish habitat resulting from changes in water temperature (Impact FSH-4, less than significant)
- Changes to reservoir fish habitat caused by turbidity from increased surface area of exposed shoreline (Impact FSH-5, less than significant)
- Loss of reservoir fish caused by entrainment (Impact FSH-6, less than significant)
- Change in shallow-water habitat for largemouth bass, spotted bass, smallmouth bass and other sport fish species (Impact FSH-7, beneficial)
- Change in open-water habitat for striped bass and American shad (Impact FSH-8, beneficial)
- Loss of spawning habitat of American shad and striped bass (Impact FSH-9, significant and unavoidable)

In the extended study area, the action alternatives could result in impacts related to the following:

- Change in habitat potential for spring-run Chinook salmon (Impact FSH-10, less than significant and beneficial for Alternative Plans 1 through 4, potentially significant and unavoidable for Alternative Plan 5)
- Change in water temperature conditions supporting juvenile salmon and steelhead migration (Impact FSH-11, significant and unavoidable)
- Change to habitat for moderately tolerant native fish species from altered water temperatures (Impact FSH-12, less than significant and beneficial)

- Change to habitat for highly tolerant native fish species from altered water temperatures (Impact FSH-13, less than significant and beneficial)

- Changes to spawning and rearing habitat from changes to flood pulses and floodplain connectivity (Impact FSH-14, less than significant)

- Change in fish habitat and migratory behaviors resulting from changes in water temperatures (Impact FSH-15, no impact)

- Change in fish habitat and migratory behaviors resulting from changes in flows (Impact FSH-16, less than significant)

- Loss of fish habitat resulting from changes in tributary flows (Impact FSH-17, no impact)

- Effects on Delta fish habitat from changes in water temperatures and DO concentrations (Impact FSH-18, potentially significant and unavoidable)

- Loss of suitable fish habitat from salinity changes in the Delta (Impact FSH-19, less than significant)

- Loss of suitable fish habitat from change in flow patterns in the south Delta (Impact FSH-20, less than significant)

- Reduction in fish abundance from changes in exports and entrainment in the south Delta (Impact FSH-21, less than significant and beneficial)

- Loss of suitable fish habitat resulting from changes in X2 (Impact FSH-22, less than significant)

Primary Study Area

Climate change could result in Millerton Lake receiving more inflow from precipitation than from snowmelt, as compared to the NoCC scenarios. Inflows would also occur earlier in the year, as shown in Figure 8-4. This change could result in higher releases from Millerton Lake in the winter and spring to maintain flood control space given the earlier timing of snowmelt and increased percentage of precipitation occurring as rainfall (and potentially more intense storms), as compared to the action alternatives without climate change.

Further, increases in water temperature would occur in Millerton Lake overall, particularly later in the year as water levels decrease. Other water quality changes may also occur, as described in Chapter 15, "Hydrology – Surface Water Quality." It is expected that under climate change water temperatures would increase downstream from Friant Dam, as shown in Figure 8-69.

As stated in Chapter 5, "Biological Resources – Fisheries and Aquatic Ecosystems," black bass spawning production could benefit from increasing rates of egg and larval development at warmer water temperatures. However, spotted bass and largemouth bass cease spawning when water temperatures exceed about 72°F (Moyle 2002) and 76°F (Mitchell 1982), respectively, and these water temperatures are exceeded more frequently under the action alternatives, although to a less than significant level. Sufficient data are not available to determine if increasing water temperatures resulting from climate change would alter the overall survival for reservoir fish species under the action alternatives. However, because increased water temperatures would have both beneficial (creating conditions for increased rates of egg and larval development) and detrimental effects (once temperatures exceed suitable conditions) on reservoir fishes, it is assumed that the impact conclusions would not be substantially different with or without climate change.

High turbidity and sedimentation have a number of potentially adverse effects on fish, including smothering eggs, injury to gills, impairment of visual feeding, and reducing food web production (Kerr 1995). Increased turbidity under the action alternatives would potentially suppress fish production in the proposed Temperance Flat RM 274 Reservoir. Any such suppression under the action alternatives would be offset by improved habitat conditions in Millerton Lake and an overall increase in habitat availability by the addition of Temperance Flat RM 274 Reservoir. Erosion and sedimentation are expected to be similar with and without climate change (see the Geology and Soils section).

The increases in spawning production of largemouth bass and spotted bass due to reservoir habitat changes under the action alternatives (an increase in shallow water habitat and less water level fluctuation) would be beneficial. Effects of the action alternatives on production of smallmouth bass and other warm-water sport fishes (e.g., crappie and sunfish) would be similar to the results predicted by the Black Bass Spawning Production model simulations for largemouth and spotted bass. Under climate change, runoff would occur earlier in the water year than without climate change, and reservoir elevation could be low for a longer period of time. This could attenuate some benefits of increases in shallow water habitat for reservoir fish realized under the action alternatives. Because of the variability and uncertainty associated with potential climate change effects in conjunction with the action alternatives, it is unknown to what degree climate change would alter the outcome of the action alternatives in the respect. However, the overall significance conclusions presented in Chapter 5, “Biological Resources – Fisheries and Aquatic Ecosystems,” would not be expected to change.

Extended Study Area

Impacts relating to temperature and habitat changes (Impact FSH-11 and Impact FSH-18) were determined to be significant in the extended study area. The remaining impacts were determined to be beneficial, less than significant, or have no impact. In the extended study area, the action alternatives each have small beneficial but variable effects on spring-run Chinook salmon habitat potential (Impact FSH-10), with the effects varying by water year type and SAR scenario. Beneficial effects in Alternative Plans 1 through 4 are the result of decreases in water temperature conditions in Reaches 1 and 2; whereas these beneficial effects are absent in Alternative Plan 5.

Comparing Figure 8-40 and Figure 8-69, under climate change the Representative Alternative provides for lower water temperature releases from Millerton Lake under a wide range of potential future climate changes.

Impact FSH-14 addresses changes to spawning and rearing habitat from changes to flood pulses and floodplain connectivity. As stated in Chapter 5, “Biological Resources – Fisheries and Aquatic Ecosystems,” 10-year and more frequent flood pulses are strongly linked to floodplain habitat formation processes that are beneficial to native fish species. The action alternatives would have a less than significant impact on species like splittail and Chinook salmon that require or rely strongly on functional floodplain habitats (Matella and Merenlender 2014, Sommer et al. 1997). It is unknown how changes in flow regime under climate change, and associated changes in facility operation would change the outcome of this result; however, it is expected that the impact conclusions would not differ substantially with or without climate change.

Climate change is expected to result in sea-level rise during this century, which would have effects on Delta salinity levels due to greater tidal excursion. This, in turn, would affect the location of X2 from February through June, moving X2 upstream. This general trend is shown on Figure 8-19 (Baseline) and Figure 8-56 and Figure 8-57 (Representative Alternative) and would have adverse effects to native species in the Delta under both the No Action Alternative and action alternatives.

It is unknown how changes in flow regime would affect Delta hydrodynamics under climate change, or how associated changes in facility operation would change the outcome of this result, but it is expected that the impact conclusions would not differ substantially with or without climate change.

The degree that climate change would alter the outcome of the action alternatives is unknown because of the variability and uncertainty associated with potential climate change. The negative effects of climate change on water temperature, Delta salinity, and changes in flow regimes have the potential to be greater than the benefits realized from the action alternatives (Impact FSH-10) or to change some impacts from less than significant or no impact to significant.

Biological Resources – Botanical and Wetlands

As discussed in Chapter 6, “Biological Resources – Botanical and Wetlands,” implementing any action alternative would result in the following impacts on botanical resources and wetlands in the primary study area:

- Loss of special-status plants and loss or degradation of special-status plant habitat (Impact BOT-1, less than significant)

- Loss or riparian habitat and other sensitive communities (Impact BOT-2, significant and unavoidable)

- Loss or degradation of waters of the United States, including wetlands, and waters of the state (Impact BOT-3, less than significant)

- Introduction and spread of invasive plants (Impact BOT-4, less than significant)

- Elimination of a plant community or substantial reduction in the number of or restriction of the range of an endangered, rare, or threatened plant species (Impact BOT-5, less than significant)

- Conflict with local or regional policies and plans protecting wetland or botanical resources (Impact BOT-6, less than significant)

- Conflict with provisions of an adopted habitat conservation plan protecting wetland or botanical resources (Impact BOT-7, no impact)

In the extended study area, the action alternatives could result in impacts related to the following:

- Loss of special-status plants and loss or degradation of special-status plant habitat (Impact BOT-1, less than significant)

- Loss or riparian habitat and other sensitive communities (Impact BOT-2, less than significant)

- Introduction and spread of invasive plants (Impact BOT-4, less than significant)

Primary Study Area

Under climate change, terrestrial habitats could be negatively affected by increased spread of invasive species (EPA and DWR 2011). Increased temperatures and variations in precipitation (shown in the Climate Change attachment to the Modeling Appendix) may also displace some native species that may not compete well under changing conditions. Optimal climate conditions for native species may move to higher elevations; however, these areas may not always be available or suitable for colonization of plant species, depending on land use and other physical conditions, such as substrate characteristics. Climate change is expected to stress forested areas, making them more susceptible to pests and disease, which would further alter species composition. It is also projected that climate change would increase the frequency and intensity of wildfires (EPA and DWR 2011). Changes in the distribution of native plant species and habitats under climate change would exacerbate negative impacts on plant species and habitats from implementation of the action alternatives.

Regardless of whether an action alternative is implemented, climate change is likely to place additional stress on the botanical and wetlands resources within the primary study area, which have been and continue to be adversely affected by past, present, and reasonably foreseeable actions. Significant effects from the action alternatives, however, are not expected except for riparian habitat. Because the impacts on botanical and wetland resources within the primary study area are not expected to differ greatly with or without climate change, there would be no change in the impact significance conclusions for this resource topic.

Extended Study Area

Climate change effects on habitats and species in the extended study area would generally be the same as in the primary study area. However, significant effects from the action alternatives are not expected. Because the impacts on botanical and wetland resources within the extended study area are not expected to differ greatly with or without climate change, there would be no change in the impact significance conclusions for this resource topic.

Biological Resources – Wildlife

As described in Chapter 7, “Biological Resources – Wildlife,” the action alternatives may affect various wildlife species in the primary study area related to the following:

- Substantial impact on special-status invertebrates (Impact WLD-1, less than significant)
- Substantial impact on special-status amphibians and reptiles (Impact WLD-2, less than significant)
- Substantial impacts on special-status raptors (Impact WLD-3, significant and unavoidable)
- Substantial impact on special-status passerines of birds protected by the Migratory Bird Treaty Act (Impact WLD-4, less than significant)
- Substantial impact on ringtail (Impact WLD-5, less than significant)
- Substantial impact on American badger (Impact WLD-6, less than significant)
- Substantial impact on San Joaquin Pocket Mouse (Impact WLD-7, less than significant)

- Substantial impact on special-status bat species (Impact WLD-8, less than significant)

- Substantial impact on migratory and wintering deer herds (Impact WLD-9, less than significant)

- Potential Conflict with Fresno County and Madera County General Plan Objectives and Guidelines (Impact WLD-10, significant and unavoidable)

- Conflict with local or regional policies protecting wildlife resources (Impact WLD-17, no impact)

- Potential Conflict with adopted conservation plans (Impact WLD-18, no impact)

In the extended study area, the action alternatives could result in impacts related to the following:

- Potential reduction in habitat or populations of special-status invertebrates (Impact WLD-11, less than significant)

- Potential reduction in habitat or populations of special-status amphibians and reptiles (Impact WLD-12, less than significant)

- Potential reduction in habitat or populations of special-status bird species (Impact WLD-13, less than significant)

- Potential reduction in habitat or populations of special-status mammal species (Impact WLD-14, less than significant)

- Potential interference with migratory corridors or nursery sites (Impact WLD-15, less than significant)

- Potential impact on riparian habitat for special-status bird species (Impact WLD-16, less than significant)

- Conflict with local or regional policies protecting wildlife resources (Impact WLD-17, no impact)

- Potential Conflict with adopted conservation plans (Impact WLD-18, no impact)

Primary Study Area

Few impacts on wildlife would occur under the action alternatives after mitigation. Climate change would not change these impact conclusions. As stated in the Biological Resources – Botanical and Wetlands section of this chapter, climate change may affect species and habitat composition due to changes in temperature and precipitation. Therefore, although the impact conclusions would not change, climate change has the potential to cause negative impacts on wildlife due to detrimental effects on habitat.

Extended Study Area

In the extended study area, the action alternatives were determined to have no impact or less-than-significant impacts for all wildlife resources evaluated. Although climate change would have negative effects on species and habitat, as discussed above, these effects are not expected to change the impact conclusions for action alternatives.

Geology and Soils

As discussed in Chapter 11, “Geology and Soils,” the action alternatives could result in local impacts in the primary study area related to the following:

- Exposure of structures and people to geologic hazards resulting from seismic conditions and slope instability (Impact GEO-1, less than significant)
- Alteration of fluvial geomorphology and hydrology that would adversely affect aquatic habitat (Impact GEO-2, significant and unavoidable)
- Loss or diminished availability of known mineral resources that would be of future value to the region or State (Impact GEO-3, less than significant)
- Substantial soil erosion or loss of topsoil due to construction and operations (Impact GEO-4, potentially significant and unavoidable)
- Failure of septic tanks or alternative wastewater disposal systems due to soils that are unsuited to land application of waste (Impact GEO-5, less than significant)

In the extended study area, the action alternatives could result in impacts related to the following:

- Alteration of fluvial geomorphology and hydrology of aquatic habitats (Impact GEO-2, less than significant)
- Loss or diminished availability of known mineral resources that would be of future value to the region (Impact GEO-3, less than significant)
- Substantial soil erosion or loss of topsoil due to construction and operations (Impact GEO-4, less than significant)

Primary Study Area

Under the action alternatives, alteration of fluvial geomorphology and hydrology of aquatic habitats would occur related to formation of the proposed Temperance Flat RM 274 Reservoir. As discussed in Chapter 11, “Geology and Soils,” when the reservoir is high and regional flooding occurs, sediment transported from the uplands would be deposited as deltas at the confluence of the streams and lake. When the lake level is low, stream channels within the inundation zone are likely to be channelized as streamflows downcut into delta deposits.

Under climate change, inflow peaks would occur earlier in the water year (Figure 8-4) and, therefore, delta formation at the confluence of lakes and streams would occur earlier in the water year; further, more channelization could occur from downcutting into the delta deposits during the remainder of the year. Certain climate change scenarios could also result in greater inflows to Temperance Flat RM 274 Reservoir (Figure 8-4). Erosion along the shorelines of Millerton Lake and Temperance Flat RM 274 Reservoir would be similar with or without climate change, but would reflect the change in the zone of fluctuation (i.e., occurring at higher elevations during the winter months, and lower elevations during the remainder of the water year).

Because the impacts on geology and soils within the primary study area are not expected to differ greatly with or without climate change, there would be no change in the impact significance conclusions for this resource topic.

Extended Study Area

As previously mentioned and shown in Figure 8-4, climate change could result in an increase in winter inflow into the upper San Joaquin River Basin, necessitating higher reservoir releases from Millerton Lake during these periods to maintain flood storage space and manage resulting flood events. The potential increase in releases from the reservoir could lead to long-term changes in downstream channel equilibrium. Although the action alternatives would potentially diminish these effects by increasing storage capacity, as described in Chapter 11, “Geology and Soils,” the action alternatives are not expected to result in long-term changes to channel equilibrium or shoreline erosion downstream from Friant Dam either with or without climate change.

Because the impacts on geology and soils within the extended study area are not expected to differ greatly with or without climate change, there would be no change in the impact significance conclusions for this resource topic.

Hydrology – Flood Management

As discussed in Chapter 12, “Hydrology – Flood Management,” the action alternatives could result in impacts in the primary study area related to the following:

- Exposure of people or structures to a significant risk or loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam (Impact FLD-1, less than significant)

- Substantially alter the existing drainage pattern of the site or area, including alternating the course of a stream or river, or substantially increasing the rate or amount of surface runoff in a manner that would result in onsite or offsite flooding (Impact FLD-2, less than significant)

- Place within a 100-year flood hazard area structure which would impede or redirect flood flows (Impact FLD-3, no impact)

In the extended study area, the action alternatives could result in impacts related to the following:

- Exposure of people or structures to a significant risk or loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam (Impact FLD-1, less than significant and beneficial)

- Substantially alter the existing drainage pattern of the site or area, including through the alternation of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in onsite or offsite flooding (Impact FLD-2, less than significant)

- Place within a 100-year flood hazard area structure which would impede or redirect flood flows (Impact FLD-3, no impact)

Primary Study Area

The action alternatives would increase local runoff to San Joaquin RM 274 from construction-related activities and from permanent structures near Temperance Flat RM 274 Reservoir (Impact FLD-2, less than significant). However, implementation of BMPs would minimize runoff from permanent facilities. Climate change effects of runoff occurring earlier in the year (Figure 8-4) are not expected to result in significant changes to the effects from the action alternatives. The action alternatives would have no impact related to impeding or redirecting flood flows in the primary study area; this result would not change when considered in the context of climate change, and the impact significance conclusions for this resource topic are not expected to change.

Extended Study Area

Under the action alternatives, the additional storage provided by Temperance Flat RM 274 Reservoir would reduce the magnitude and frequency of flood releases from Friant Dam and therefore lower the potential for loss, injury, or death involving flooding in the extended study area. As previously mentioned, climate change could result in earlier inflow into the upper San Joaquin River Basin, necessitating higher reservoir releases from Millerton Lake during these periods to maintain the flood pool and manage resulting flood events. The action alternatives would potentially diminish these climate-related effects by increasing storage capacity; therefore, no long-term changes are expected for the exposure of people or structures to a significant risk of loss, injury, or death involving flooding with or without climate change.

The action alternatives would not alter the course of the San Joaquin River or alter the rate or amount of surface runoff downstream from Friant Dam, and are expected to have only residual impacts in the extended study area, due to the use of BMPs in the primary study area. Climate change would result in runoff occurring earlier in the year (Figure 8-4) and could result in greater flood peaks, especially under the wetter Q4 climate change scenarios (Figure 8-23 and Figure 8-24). However, the action alternatives would have no impact related to impeding or redirecting flood flows in the extended study area, and this result would not change when considered in the context of climate change.

Because the impacts on flood management within the extended study area are not expected to differ greatly with or without climate change, there would be no change in the impact significance conclusions for this resource topic.

Hydrology – Groundwater

As discussed in Chapter 13, "Hydrology - Groundwater," because of the speculative nature of impacts on groundwater resources in the primary study area, only impacts in the extended study area were identified, and would be related to the following:

- Change in groundwater levels (Impact GRW-1, less than significant [Alternative Plans 1 and 5], less than significant and beneficial [Alternative Plans 2, 3, and 4])
- Change in groundwater quality (Impact GRW-2, less than significant [Alternative Plans 1 and 5], less than significant and beneficial [Alternative Plans 2, 3, and 4])

Primary Study Area

The action alternatives would have no impact on groundwater in the primary study area. No additional impacts would be anticipated when climate change is considered.

Extended Study Area

Impacts GRW-1 and GRW-2 are linked, in that increased pumping would both decrease groundwater levels and could degrade groundwater quality. Alternative Plan 1 could slightly increase reliance on groundwater pumping in the CVP SOD water service area because of a small reduction in surface water deliveries relative to the No Action Alternative. Several future reasonably foreseeable actions (e.g., groundwater recharge/banking projects, increased regulation of groundwater by the State) could affect groundwater pumping in the extended study area. However, the action alternatives would have either a less-than-significant (Alternative Plans 1 and 5) or less-than-significant and beneficial (Alternative Plans 2 through 4) impact on groundwater resources.

In the climate change impact assessment, groundwater levels in all socioeconomic-climate scenarios were constrained to not exceed historical minimum groundwater levels. It is possible that the effects of reduced inflows into Millerton Lake, as shown in Figure 8-5, could initially cause increases in groundwater pumping; however, long-term reduction in inflows could discourage planting of annual crops and, thereby, reduce groundwater demand and pumping. Figure 8-64 suggests that the Representative Alternative may reduce unmet demand under climate change and likely reduce groundwater pumping. Therefore, there would be no change in impact significance conclusions for this topic under climate change.

Hydrology – Surface Water Supplies and Facilities Operations

The action alternatives would not impact surface water supplies and facilities in the primary study area. In the extended study area, the action alternatives could result in impacts related to the following:

- Change in water levels in the Old River near the Tracy Road Bridge (Impact SWS-3, less than significant)
- Change in water levels in the Grant Line Canal above the Grant Line Canal barrier (Impact SWS-4, less than significant)
- Change in water levels in the Middle River near the Howard Road Bridge (Impact SWS-5, less than significant)

Primary Study Area

Under climate change, runoff would occur earlier in the water year than without climate change, as shown in Figure 8-4, and reservoir elevation could be low for a longer period under drier climate change scenarios, as shown in Figure 8-14 and Figure 8-51. With the implementation of the action alternatives, changes in Millerton Lake volumes and surface water elevations would be within typical historical ranges and would not impede existing diversion facilities at Friant Dam. That is, Millerton Lake would not fall below the diversion points for the Friant-Kern and Madera Canals and the outlet to the San Joaquin River. Climate change may result in lower reservoir elevations for a longer period, as shown in Figure 8-14, but the impact on existing diversion facilities would not change and the storage in Millerton Lake would not fall below 130 TAF (Figure 8-48 and Figure 8-49). The impacts on surface water supplies and facility operations within the primary study area are not expected to differ greatly with or without climate change; therefore, there would be no change to the impact significant conclusions.

Extended Study Area

Under the action alternatives, changes in San Joaquin River flow volumes and timing would be within typical historical ranges, and Reclamation would continue to release sufficient flow to the San Joaquin River to maintain at least 5 cfs past the last diversion near Gravelly Ford, to satisfy Holding Contract diversions in Reach 1. This diversion would continue to operate and is not expected to be affected by climate change in the future.

The action alternatives would not directly change Delta operations, but instead would change Delta conditions because of indirect effects of reducing infrequent flood flows from the San Joaquin River reaching the Delta. These changed conditions could alter the quantity and timing of Jones and Banks pumping in the south Delta, as shown by the increase in X2 position and decrease in Delta exports under the Representative Alternative; although this could impact south Delta water levels, the impact would be less than significant. The impacts of water level decreases downstream from Friant Dam under the action alternatives would also be less than significant because decreases would not adversely impact agricultural users' ability to divert irrigation water. The effects of climate change could result in earlier releases of flood flows (Figure 8-4) and increase the X2 position (Figure 8-19). However, the construction of Temperance Flat RM 274 Reservoir is expected to have little change to the X2 position under climate change (Figure 8-57).

Because the impacts on surface water supplies and operations within the extended study area are not expected to differ greatly with or without climate change, there would be no change in the impact significance conclusions for this resource topic.

Hydrology – Surface Water Quality

As discussed in Chapter 15, "Hydrology – Surface Water Quality," the action alternatives could result in impacts in the primary study area related to the following:

- Temporary construction-related sediment effects the would violated water quality standards or adversely affect beneficial uses (Impact SWQ-1, less than significant)

- Temporary construction-related water temperature effects that would violate water quality standards or adversely affect beneficial uses (Impact SWQ-2, less than significant)
- Temporary construction-related metal effects that would violate water quality standards or adversely affect beneficial uses (Impact SWQ-3, less than significant)
- Long-term water quality effects that would violate water quality standards of adversely affect beneficial uses with in the primary study area and San Joaquin River (Impact SWQ-4, less than significant)
- Long-term water temperature effects that would violate water quality standards or adversely affect beneficial uses (Impact SWQ-5, less than significant and beneficial)

In the extended study area, the action alternatives could result in impacts related to the following:

- Temporary construction-related sediment effects the would violated water quality standards or adversely affect beneficial uses (Impact SWQ-1, less than significant)
- Temporary construction-related water temperature effects that would violate water quality standards or adversely affect beneficial uses (Impact SWQ-2, less than significant)
- Temporary construction-related metal effects that would violate water quality standards or adversely affect beneficial uses (Impact SWQ-3, less than significant)
- Long-term water quality effects that would violate water quality standards of adversely affect beneficial uses with in the primary study area and San Joaquin River (Impact SWQ-4, less than significant)

- Long-term water temperature effects that would violate water quality standards or adversely affect beneficial uses (Impact SWQ-5, less than significant and beneficial)

- Long-term effects on Delta salinity that would violate D-1641 salinity objectives (Impact SWQ-6 less than significant)

- Long-term effects on Delta Salinity that would violated the X2 Standard (Impact SWQ-7, less than significant)

- Long-term effects on water quality that would violate existing water quality standards or adversely affect beneficial uses in the CVP/SWP water service areas (Impact SWQ-8, less than significant)

Primary Study Area

Surface water quality effects from the action alternatives in the primary study area related to short-term construction impacts would not be affected by longer-term impacts from climate change.

After construction is complete, all action alternatives would increase the total combined volume of cold water in Millerton Lake and Temperance Flat RM 274 Reservoir, with larger available cold-water pools in action alternatives and higher carryover storage in most months.

As described previously, climate change could result in Millerton Lake receiving more inflow from precipitation than from snowmelt, as compared to the no climate change scenarios. These inflows would also occur earlier in the year (Figure 8-4). This change could result in higher releases from Millerton Lake in the winter and spring to manage the increased potential for flood events, as compared to the action alternatives without climate change, with subsequent increases in water temperature later in the year as water levels decrease. Increased surface water temperatures could result in greater eutrophication (EPA and DWR 2011). Climate change temperature increases and associated eutrophication would be offset to some degree by expected water temperature decreases under the action alternatives.

Suspended sediment levels from erosion along the shorelines of Millerton Lake and Temperance Flat RM 274 Reservoir are expected to be similar with or without climate change (see

Section 8.5.6 above). However, high turbidity could occur with climate change as storm severity increases and wildfires become more frequent (DWR 2008 as cited in EPA and DWR 2011).

Other water quality issues that could result from climate change include more frequent spikes in *E. coli* or Cryptosporidium, which typically accompany severe storms (Bates et al 2008 as cited in EPA and DWR 2011). Pollutant loads may also increase as more extreme rain events occur (DWR 2008 as cited in EPA and DWR 2011).

Significant impacts on surface water quality within the primary study area are not expected from implementation of the action alternatives. Climate change may result in significant surface water quality impacts in the primary study area, but these are not directly related to implementation of the action alternatives; consequently, there would be no changes to the impact conclusions for surface water quality in the primary study area.

Extended Study Area

The action alternatives would improve San Joaquin River release temperatures from September through December, but releases would be slightly warmer in winter than under the No Action Alternative. However, in the winter months, the temperature of released water would still be cooler than needed for anadromous fish. It is expected that the effects of climate change on water temperature downstream from Friant Dam would somewhat offset temperature benefits from increased storage in the San Joaquin River watershed under the action alternatives, as shown in Figure 8-69.

Under the action alternatives, changes in the operation of Friant Dam would not introduce new contaminants to the San Joaquin River system. However, by changing the timing and location of flows, changes in operation would change the relative concentrations of constituents in various segments of the river. Increased flows would increase dilution of constituents and result in improved water quality. Because some reaches would experience increased flows and some decreased flows at different times of the year under the action alternatives, some reaches are expected to see improvements in water quality, including salinity, while others would experience declines. These changes are expected to be less than significant. Additional changes in the timing of flow releases under climate change (earlier releases) may increase this variation; however, the magnitude is not expected to be substantially greater.

Significant impacts on surface water quality within the extended study area are not expected from implementation of the action alternatives. Climate change may result in significant surface water quality impacts in the extended study area, similar to those discussed above in the primary study area section, but these are not directly related to implementation of the action alternatives. Consequently, there would be no changes to the impact conclusions for surface water quality in the extended study area.

Land Use Planning and Agricultural Resources

As described in Chapter 17, “Land Use Planning and Agricultural Resources,” implementing any action alternative would only result impacts on land use and agricultural resources in the primary study area. These would be related to the following:

- Disruption of existing land uses (LUP-1, potentially significant and unavoidable)
- Conflict with adopted plans (LUP-2, potentially significant and unavoidable)
- Conversion of farmland to nonagricultural uses and cancellation of Williamson Act contracts (LUP-3, potentially significant and unavoidable)
- Conversion of forest land (LUP-4, potentially significant and unavoidable)

Primary Study Area

Climate change could alter agricultural practices because of its influence on a number of factors related to water demand and crop performance. Increased air temperatures may increase crop evapotranspiration, but when a crop’s optimum temperature range is exceeded growth and water demand would decrease. Higher levels of carbon dioxide can stimulate crop growth but can also reduce transpiration, resulting in lower water demand. Changes in crop growth rates and the timing of crop planting and harvesting due to higher early- and late-season temperatures could result in lower water demand for annuals but higher water demand for perennial crops, as discussed in the climate change chapter of the Modeling Appendix.

Implementing any action alternative would result in inundation of agricultural and forest lands. The effects of climate change would alter native forest composition, as discussed above (see the Biological Resources – Botanical and Wetlands section). Climate change effects on watershed evapotranspiration and crop water requirements and growth may also result in different crops being farmed in the region, or conversion of more land to other uses. It is unknown to what degree climate change may affect land uses, but it has potential to further increase impacts from land use changes associated with the action alternatives.

Extended Study Area

None of the action alternatives would impact land use planning or agricultural resources in the extended study area; therefore, there would be no change in the impact significance conclusions for this resource topic when climate change is considered.

Power and Energy

As described in Chapter 20, “Power and Energy,” the action alternatives could result in impacts in the primary study area related to the following:

- Decrease in Kerckhoff Hydroelectric Project energy generation and ancillary services (PWR-1, significant and unavoidable)
- Change in energy generation at Friant Dam powerhouses (PWR-2, beneficial)

In the extended study area, the action alternatives could result in impacts related to the following:

- Change in energy generation and use within the Friant Division of the CVP Water Service Area (PWR-3, less than significant and beneficial)
- Decrease in CVP system energy generation (PWR-4, less than significant)
- Decrease in SWP system energy generation (PWR-5, less than significant)
- Increase in CVP system pumping energy use (PWR-6, less than significant)
- Increase in SWP system pumping energy use (PWR-7, less than significant)

Primary Study Area

All action alternatives would increase the Friant Dam powerhouses' average annual generation by 16 GWh (25 percent) compared to the No Action Alternative. Higher reservoir storage volumes at Friant Dam would cause these energy generation increases. As discussed above, climate change is expected to result in earlier reservoir inflows (Figure 8-4) and likely earlier releases. Lower releases would occur in the summer with climate change, as compared to no climate change. These changes in flow timing could have an adverse impact on hydropower generation at times when demand is high.

The degree of impact from climate change is dependent on many factors and is uncertain. However, Figure 8-75 suggests that the Representative Alternative could provide a small increase in hydropower generation under different socioeconomic-climate scenarios.

Extended Study Area

Implementing the action alternatives would likely increase diversions from Millerton Lake to the Madera Canal, and likely improve energy generation at powerhouses along the Madera Canal. As shown in Figure 8-60 and Figure 8-62, deliveries to the Friant-Kern and Madera canals increase because of the construction of Temperance Flat RM 274 Reservoir in all but the wettest years. Additionally, increased diversions from Millerton Lake to the Friant-Kern and Madera canals would likely improve groundwater conditions and groundwater pumping energy use. Implementation of the action alternatives is also expected to result in benefits to CVP and SWP system energy generation.

As shown in Figure 8-46, hydropower generation will be impacted under climate change; in general, as seasonal river flows shift, hydropower may become less reliable in the future (EPA and DWR 2011). Increasing temperatures are also expected to result in increased energy demands, especially during peak demand times, i.e., summer (DWR 2008 as cited in EPA and DWR 2011).

The degree of impact from climate change on energy generation is dependent on many factors and is not known at this time. However, the effects of climate change (more energy demand and lower flows during high energy demand times) could increase impacts from the action alternatives in the extended study area.

Public Health and Hazardous Materials

As described in Chapter 21, "Public Health and Hazards," the action alternatives would only have public health and hazards impacts in the primary study area. These would be related to the following:

- Potential for exposure to hazardous materials (Impact HAZ-1, less than significant)
- Potential emission of hazardous materials within 0.25 mile of a school (Impact HAZ-2, less than significant)
- Hazards from known hazardous materials contamination site (Impact HAZ-3, less than significant)
- Interfere with evacuation routes and emergency vehicle access (Impact HAZ-4, less than significant)
- Locate electrical transmission facilities near a school (Impact HAZ-5, no impact)
- Hazards of wildland fires (Impact HAZ-6, less than significant)
- Hazards of West Nile Virus (Impact HAZ-7, less than significant)
- Hazards of Valley Fever (Impact HAZ-8, less than significant)
- Exposure to damage from acts of terrorism (Impact HAZ-9, less than significant)
- Exposure to hazards associated with abandoned mine sites (Impact HAZ-10, less than significant)
- Increase Potential for blast-related injury during construction (Impact HAZ-11, less than significant)

Primary Study Area

Most impacts identified on public health and hazards under the action alternatives are related to project construction. Therefore, climate change in the longer term would not change the effects evaluations or conclusions. Significant impacts on health and hazards within the primary study area are also not expected from implementation of the action alternatives after mitigation. Although, as stated above (see the Biological Resources – Botanical and Wetlands section), climate change has the potential to increase the frequency and intensity of wildfire, impacts from the action alternatives associated with wildfires (HAZ-6) are related to construction only, and mitigation measures would minimize these risks.

The action alternatives would not result in significant impacts from increased habitat that could contribute to the spread of and/or increase existing mosquito populations (HAZ-7). Warming temperatures, however, are likely to further increase the abundance and active period of mosquitos and could further increase the potential for negative impacts from WNV (OEHHA 2013).

Climate change effects on health and hazards would be not directly related to implementation of the action alternatives; consequently, there would be no changes to the impact conclusions for health and hazards in the primary study area.

Extended Study Area

None of the action alternatives would impact public health or hazardous materials in the extended study area; therefore, there would be no change in the impact significance conclusions for this resource topic when climate change is considered.

Recreation

As described in Chapter 22, "Recreation," implementing any action alternative would result in the following impacts on recreation in the primary study area related to the following:

- Permanent loss or closure of a recreation facility (Impact REC-1, less than significant)
- Permanent loss of a resource used for recreation (Impact REC-2, significant and unavoidable)
- Substantial or long-term reduction or elimination of recreation opportunities or experiences (Impact REC-3, significant and unavoidable)
- Loss of access to a locally important recreation site or area (Impact REC-4, significant and unavoidable)
- Increased use of existing neighborhood and regional parks or other recreation facilities such that substantial

physical deterioration of the facilities would occur or be accelerated (Impact REC-5, less than significant)

- Impacts associated with new or expanded recreation facilities (Impact REC-6, beneficial)

The action alternatives would result in the following impacts on recreation in the extended study area related to the following:

- Permanent loss or closure of a recreation facility (Impact REC-1, less than significant)
- Permanent loss of a resource used for recreation (Impact REC-2, less than significant)
- Substantial or long-term reduction or elimination of recreation opportunities or experiences (Impact REC-3, less than significant)
- Loss of access to a locally important recreation site or area (Impact REC-4, less than significant)
- Increased use of existing neighborhood and regional parks or other recreation facilities such that substantial physical deterioration of the facilities would occur or be accelerated (Impact REC-5, less than significant)

No impacts associated with new or expanded recreation facilities would occur in the primary or extended study areas.

Primary Study Area

Most effects on recreational resources from the action alternatives relate to inundation of such resources, which would not change when considered in the context of climate change. However, the effects of climate change on operations at Millerton Lake could potentially affect water-based recreation opportunities both at the lake and downstream. Potentially lower inflows under climate change, as shown in Figure 8-4 and Figure 8-5, could result in reservoir levels being lower or higher for longer periods of time, which could affect the availability and quality of recreation activities and experiences throughout the year. Conversely, climate change could result in warmer air temperatures, increasing demand for recreational activities associated with reservoir use.

Extended Study Area

The action alternatives would have no impact or less-than-significant impacts on recreation in the extended study area. The impact significance conclusions are not expected to change when climate change is considered.

Socioeconomics, Population, and Housing

As described in Chapter 23, “Socioeconomics, Population, and Housing,” the action alternatives could result in impacts in the primary study area related to the following:

- Temporary increases in employment and personal income resulting from construction (Impact SOC-1, less than significant and beneficial)
- Temporary increases in population and housing demand resulting from construction (Impact SOC-2, less than significant)
- Temporary increase in business income and local sales tax revenue resulting from construction (Impact SOC-3, less than significant and beneficial)
- Increases in employment and personal; income resulting from operations and maintenance (Impact SOC-4, less than significant)
- Increases in spending, employment and personal income from increased recreational visitation (SOC-5, less than significant and beneficial)
- Increases in population and housing demand resulting from operations and maintenance (SOC-6, less than significant)
- Increases in business income and local sales tax revenue associate with O&M and recreation visitation (Impact SOC-7, less than significant and beneficial)
- Decreases in property tax revenue from acquisition of privately owned land (Impact SOC-8, less than significant)

The action alternatives could result in impacts in the extended study area related to the following:

- Impacts on agricultural economics in the CVP and SWP water service areas (Impact SOC-9, less than significant and beneficial)
- Increase in population and housing demand within the CVP and SWP service areas (Impact SOC-10, less than significant)
- Increases in business income and local sales tax revenue within the CVP and SWP water service areas (Impact SOC-11, less than significant and beneficial)

Primary Study Area

Implementing any action alternative would result in construction-related and O&M-related socioeconomic (Impact SOC-1, SOC-3, SOC-4, SOC-6, SOC-7, SOC-8), population, and housing (Impact SOC-2) impacts in Fresno and Madera counties. These short-term, less than significantimpacts would not differ when considered in the context of climate change.

Extended Study Area

The action alternatives are expected to have less-than-significant but beneficial impacts on agriculture in the extended study area. As discussed above (see Land Use Planning and Agricultural Resources section), climate change is likely to affect agricultural practices; however, the specific nature (type of crops grown) and magnitude of these effects is unknown. Consequently, the potential effects of climate change on the impacts identified in the extended study area cannot be determined.

Visual Resources

As discussed in Chapter 26, “Visual Resources,” each action alternative would only impact the primary study area. These would be related to the following:

- Consistency with applicable plans (VIS-1, significant and unavoidable)
- Degradation and/or obstruction of a scenic view (VIS-2, significant and unavoidable)
- Generation of increased daytime glare and/or nighttime lighting (VIS-3, significant and unavoidable)
- Impacts on a designated scenic highway (VIS-4, no impact)

Primary Study Area

Construction and operation of the proposed Temperance Flat RM 274 Dam combined with the existing water surface of Millerton Lake would transform the riverine visual character to a reservoir, resulting in a substantial visual modification. Implementing any action alternative would stabilize the Millerton Lake water surface elevation, minimize reservoir drawdown, and reduce the exposure of barren side slopes. This reduction would enhance the visual appearance associated with the bathtub ring common to reservoirs in the western United States. Potentially lower inflows under climate change, as shown in Figure 8-4 and Figure 8-5, could result in reservoir levels being lower for longer periods of time, which could affect recreational activities. Conversely, climate change could result in warmer air temperatures, increasing demand for recreational activities associated with reservoir use.

Because the impacts on visual resources within the primary study area are not expected to differ greatly with or without climate change, there would be no change in the impact significance conclusions for this resource topic.

Extended Study Area

None of the action alternatives would have a visual impact in the extended study area; therefore, there would be no change in the impact significance conclusions for this resource topic when climate change is considered.

This page left blank intentionally.

Chapter 9
Cultural Resources

This chapter describes the affected environment for cultural resources, and potential environmental consequences and associated mitigation measures, as they pertain to implementing the alternatives. This chapter presents information on the primary study area (area of project features, the Temperance Flat Reservoir Area, and Millerton Lake below RM 274). It also discusses the extended study area (San Joaquin River from Friant Dam to the Merced River, the San Joaquin River from the Merced River to the Delta, the Delta, and the CVP and SWP water service areas).

Additional detailed description and discussion of cultural resources is presented in *Cultural Resources Analysis in Support of the EIS/EIR, Upper San Joaquin River Basin Storage Investigation, Fresno and Madera Counties, California* (Rich et al. 2014). This technical report will not be publically distributed due to the sensitive nature of the resource type and the requirement to protect these resources under the Archaeological Resources Protection Act of 1979 (16 USC 470).

Cultural resources are defined as prehistoric and historic-era archaeological sites, Traditional Cultural Properties, sites of religious and cultural significance, and architectural properties (e.g., buildings, bridges, and structures). This definition includes historic properties as defined by the National Historic Preservation Act (NHPA).

If cultural resources may be adversely affected by a Congressionally-authorized alternative, Reclamation will prepare, in coordination with affected and interested parties, agreements on the treatment of cultural resources during future planning phases. Reclamation has initiated a preliminary effort to identify archaeological resources which is used to infer potential effects on resources not yet discovered within the primary study area. These preliminary studies will help shape the Section 106 process in the event that Congress and the President authorize and fund the Investigation.

Affected Environment

This section provides a regional setting of cultural resources in the Study Area and includes sections on the prehistoric, ethnohistorical, and historical context of the primary study area. This discussion provides a general context within which the significance of cultural resources will be evaluated. Determinations of eligibility will be made during future planning phases of the project, once a preferred alternative is selected and authorized by the President and Congress.

To provide context for evaluating the potential effects that alternatives may have on cultural resources within the primary study area, archival and records searches were conducted. Information concerning potential Native American concerns within the primary study area was gathered from historic and ethnographic literature and consultation with individuals and representatives of local Native American tribes. The results of these efforts are summarized below, following a brief discussion of the regional context. The area analyzed for cultural resources comprises the primary study area, as defined in Chapter 1, “Introduction.”

Regional Setting

The following section provides a temporally organized discussion of the regional archaeological record. The study area lies at the interface of the Central Valley and the Sierra Nevada, although this lower foothill region is generally discussed with respect to the archaeology of the Sierra Nevada (Moratto 1984). As no construction activities or changes in the landscape would occur in the Delta or SWP/CVP service areas under the action alternatives, these geographic areas are not considered further in this analysis.

Prehistoric Context

Native American prehistoric occupation of the region began near the end of Pleistocene (circa 13,500 years ago) and continued until Spanish contact (in the late 1700s) (Rosenthal et al. 2007). Terminal Pleistocene (13,500 to 11,600 years ago) occupation in the region is represented by wide-ranging, mobile hunters and gatherers who periodically exploited large game. Throughout California, the prehistoric conditions of the Terminal Pleistocene are minimally represented and poorly understood.

Evidence of early Holocene (11,600 to 7,700 years ago) human settlement is only rarely encountered in the Central Valley

(Rosenthal et al. 2007). Infrequent early Holocene sites in the foothills appear to have been seasonally occupied and include a robust ground stone assemblage focused on the processing of nuts. The lack of documented Central Valley early and middle Holocene sites is due in large part to sedimentation that has buried surfaces of the time period (Rosenthal and Meyer 2004). Well-dated sites of this age in the Central Valley are typically in buried contexts. In the foothills, middle Holocene (7,700 to 3,800 years ago) sites are dominated by expedient cobble tools for various purposes including grinding, chopping, and pounding, and preserved plant remains are mainly represented by acorns and pine nuts.

By 4,500 years ago, distinctive lowland and upland adaptive patterns emerged in the region (Rosenthal et al. 2007). Throughout the late Holocene (after 3,800 years ago) the Central Valley was characterized by a complex socioeconomic strategy focused on riverine and marsh resources and extremely elaborate material culture (Moratto 1984). Notable attributes included dart points, mortars and pestles; use of acorns and pine nuts; new fishing technologies and numerous fish remains; basketry and cordage; ceramic items; diverse personal accoutrements of stone, bone and shell; and large, formal cemeteries.

Around 2,300 years ago, large populations were concentrated in major settlements along the San Joaquin River. Material culture included large dart points, mortars and pestles, milling stones, and bone spear points. Subsistence was concentrated on hunting and fishing and, based on secondary evidence, included hard seeds, with more limited use of acorns. Wide-ranging trade networks are documented and a non-egalitarian social organization and ascribed status may have emerged. With extended occupation at key settlements, large mounded villages were created. Trade items included obsidian from the Great Basin, and other items from the Central Valley and coastal southern California.

The Madera Phase (500-100 cal BP) represents the last 400 years of the prehistoric record. During this time, populations were much higher than they previously had been, and settlement patterns shifted dramatically (Moratto 1984). This new “village community pattern” included large residential sites along the Chowchilla River, with smaller residential settlements along nearby secondary drainages. Trade in brown ware pottery is well-documented. Overall, Moratto (1972, 1984) interprets this time period as a cultural florescence and sees direct continuity with Native Americans groups documented in the historic period (namely the Southern Sierra Miwok for the Chowchilla River).

Ethnohistorical Context

The San Joaquin River defines a topographic, political, and cultural frontier in the primary study area, where a variety of religious, economic, historic, and other values can be identified for Native American groups. Tribal use in this area is both historic and ongoing, and has been in flux since the post-contact-era. This ethnohistorical context attempts to capture through records analysis the variety of ways in which the primary study area has been used by numerous Native American groups.

Ethnohistorical investigations indicate that at the end of the prehistoric era and into the historic era, the primary study area was at the territorial boundary, or within a zone of overlapping use, for several Native American populations. Principal among these are various tribes of Foothill Yokuts (Spier R. 1954; Spier R. 1978a) and bands of Nim or Western Mono (Gayton, 1948; Spier R. 1978b). Other groups who may have used this area include Valley Yokutsan tribelets (Wallace 1978) and the Southern Sierra Me-Wuk (Smith 1978).

Traditionally, these four Native American groups, most easily distinguished by linguistic differences, were hunter-gatherers, focusing on locally available plant and animal resources with varied reliance on riverine resources. The primary study area appears to be more central to Foothill Yokuts territory, and Spier (1978) defines the area upstream from Friant Dam and along the lower reaches of Fine Gold Creek as being the tribal territory of the Dumna (related to the surrounding Monache tribes (Dumna 2014)). In general, Valley Yokuts populations were considered to have been complexly organized and resided in larger settlements than Foothill Yokuts groups (Kroeber 1925; Spier R. 1978a; Wallace 1978). The territories of the Nim/Western Mono and the Southern Sierra Me-Wuk were primarily at higher elevations within the Sierra Nevada. They correspondingly lived in smaller residential groups and had a more generalized subsistence strategy.

At the time of contact with European settlers, the study area was occupied by the Northern Valley Yokuts, who had lived in the region for some 4,500 years (Kroeber 1925; Latta 1949, 1977; Powers 1877; Wallace 1978). The Yokuts were hunter-gatherers who divided themselves into named tribes, each with a dialect, territory, and discrete settlements. Each tribe was politically autonomous and occupied a permanent area, usually on high ground along a major drainage course. The San Joaquin River and its main eastern tributaries formed the core of the Northern Valley Yokuts' homeland. Yokut populations at the time of European contact have been estimated to be about 41,000, with perhaps 5,000 living along the east side of the valley between the Merced and Kings rivers (Cook 1955). Overall, the primary study area was a very important and heavily used region for several Native American groups. As such, it was a contested landscape when Euro-Americans poured into the area during the latter half of the nineteenth century (Stammerjohan 1988).

Historical Context

The 200-year-long historic-era in the lower foothills began in the early 1800s with initial contact between Native Americans and Europeans (first the Spanish and then other European explorers). For some time only sporadic interaction took place between Native Californians and Europeans (Beck and Haase 1974, Clough and Secrest 1984, Hayes 2007). The first Spanish expedition into the San Joaquin Valley was led by Pedro Fages in 1772 who sought a new route between San Diego and Monterey. In the 1820s, the objective of inland expeditions had changed from scouting new mission sites to punitive forays against the San Joaquin Valley Indians, both Yokuts and Miwoks.

During the summer of 1851, gold was discovered in Coarse Gold Gulch north of the San Joaquin River. Shortly thereafter, prospectors made their way south from Coarse Gold Gulch along Fine Gold Creek and other tributaries of the San Joaquin River, as well as along the main stem itself from the mountains and down into the foothill woodlands. As a result, the native populations dropped drastically primarily due to exposure to European and Euro-American diseases brought into the area by the tremendous influx of nonnative people leading up to and during the gold rush (Wallace 1978). Today there are still several bands of Yokuts Indians living in the San Joaquin Valley, and many tribal members from Yokuts as well as Western Mono groups still gather extensively in the area for both food and materials used for traditional purposes.

In 1851, the United States chose to establish Fort Miller as a solution to conflicts with native peoples. The Fort Miller location was a couple of miles upstream from the current location of Friant Dam (old Fort Miller was subsequently inundated by Millerton Lake). This effort displaced local Native Americans (Latta 1977).

The town of Rootville became one of the early important relay points for supplies distributed to outlying mining communities on the southern fringe of the Sierra mining districts. Established in 1852, Rootville was situated near the left bank of the San Joaquin River, and just west of Fort Miller. Two years later, the name of this frontier town was changed to Millerton (Thompson 1891). Small communities such as Millerton,Texas Flat, Hildreth, and Fine Gold became local supply points in the expanding network of towns that served the surrounding mines in what became known as the Coarse Gold, Fine Gold, Temperance Flat, and Hildreth mining districts (Clark 1970).

Vast numbers of livestock were introduced into the Central Valley to feed the miners. By 1862 there were about three million cattle and nine million sheep grazing on the grasses on an open range where much of the land was unreserved public domain from the Sierra Nevada Foothills to the Coast Range. Two successive years of drought in the early 1860s, however, reduced the Central Valley to a dust bowl, and by the time normal precipitation returned to the Valley in 1864-1865, the numbers of livestock had declined markedly. Damage to the rangelands was so complete that the native grasslands never recovered (Burcham 1956).

During the 1870s, the Central Pacific Railroad, and later the Southern Pacific Railroad, spawned a network of some 50 railroad stations, of which 24 became railroad town sites. About eight of these town sites became strategic trading centers stretching from Stockton south to Bakersfield.

In 1873, the California State Legislature passed a “No Fence Law,” which established agriculture’s dominance over ranching. The need for water to irrigate the arid San Joaquin Valley became a priority for the economic development of Central Valley towns, especially those laid out along Southern Pacific’s railroad track. By the late 1880s small-scale irrigated agriculture was in the ascendancy and irrigation companies, colonies, and districts were formed to help promote agriculture, for which the first canals were completed in the 1870s. Passage of the Wright Act in 1887 provided a legal mechanism for landowners to create public irrigation districts and finance major irrigation works to divert water from the major streams flowing west from the Sierra.

The CVP was devised by the State, and ultimately built by the Federal government, to resolve California's chronic water shortage problem. Studies undertaken between 1927 and 1931 resulted in a plan calling for a vast system of canals, massive dams, and reservoirs throughout the state, including most of what became the CVP (Hundley 1992).

Reclamation designed the CVP as five fundamental units, operating as an integrated system: Shasta Dam, the Delta-Mendota Canal, Friant Dam, the Madera and Friant-Kern canals, and the Contra Costa Canal. The core of the system involved the coordinated operation of the other four units for the purpose of delivering Sacramento River water to the arid San Joaquin Valley. In 1935, Reclamation was charged with construction of the CVP, which was completed in the early 1950s (Cooper 1968, Hundley 1992).

Completed in 1942, Friant Dam was the first major engineering structure constructed for the Friant Division of the CVP. The dam controls San Joaquin River flows and provides storage for water diversions into Friant-Kern Canal and Madera Canal, which convey irrigation water to a million acres of agricultural land in Fresno, Kern, Madera, and Tulare counties in the San Joaquin Valley. Based on U.S. Geological Survey (USGS) mapping from 1945, there were only a few scattered buildings along the margins of Millerton Lake, along Fine Gold Creek and its tributaries, or along the upper San Joaquin River, despite the fact that these lands had been claimed and patented as homesteads decades earlier (California Highways and Public Works 1939, 1942; Harding 1960; Reclamation 1958).

The upper San Joaquin River watershed was also used for generation of hydroelectric power, beginning during the 1890s. In 1920 the San Joaquin Power Company (later San Joaquin Light & Power which was later absorbed by PG&E) completed Kerckhoff reservoir and powerhouse, located on the San Joaquin River, about ten miles (16 kilometers) northeast of Friant. The Kerckhoff plant was supplied with water diverted from the Kerckhoff Dam via pressure tunnel. The Kerckhoff Powerhouse supplied power to two transmission lines—one running 39 miles (63 kilometers) south to a substation at Sanger, the other running 64 miles (103 kilometers) west to Merced.

Archaeological Resources and Historical Structures

This section discusses known archaeological resources and historic structures within the primary study area.

Data Collection

Cultural resources were identified for this analysis via examination of the results of previously conducted fieldwork, as well as archival documentation. No new fieldwork was conducted to confirm the presence or absence of prehistoric or historic era archaeological sites, multi-component sites, or historic era structures, nor has any new survey evaluation work been done to assess significance of historic-era architectural resources within the primary study area.

Because this Investigation has multiple, ongoing phases, there are several stages of progress to report in regard to the sources consulted. On November 7, 2001, Reclamation initiated a records search of the Southern San Joaquin Valley Information Center (SSJVIC), California State University, Bakersfield. This entailed obtaining all State Parks site records and copies of the cover pages for archaeological reports within the action alternatives as they were defined in 2001. On February 10, 2006, a records search update was requested to identify any new sites and studies completed since 2001 within the primary study area as it was defined in the plan formulation phase of the Investigation, and included the Temperance Flat RM 274 Dam and Reservoir area (Byrd and Wee 2008). The update also included obtaining copies of all reports dealing with the primary study area.

The SSJVIC examined relevant portions of the following 7.5-minute USGS quadrangles: Friant, Millerton Lake East, Millerton Lake West, North Fork, and ONeals; Fresno and Madera Counties, California. Searches for both archaeological and non-archaeological resources were requested, and in regard to the Office of Historic Preservation's (OHP) Property Directory, the SSJVIC stipulates that this reference includes, but is not limited to, information regarding National Register of Historic Places (NRHP), California Register of Historical Resources, California Inventory of Historic Resources, California State Historic Landmarks, California State Points of Historical Interest, NRHP Index of Determined Eligible Properties, OHP's Archaeological Determinations, and OHP's Historical Property Data File.

In 2006, inquiries were also made with BLM's Bakersfield Field Office; the State Parks, Millerton Lake SRA; and the

NRHP Keeper's Office, to determine if any newly recorded sites or substantive surveys had taken place in recent years, or if any recent cultural resources investigations had been undertaken that may not have been submitted to the Information Center. Recent reports, updated site records, and information from the Squaw Leap Archaeological District paperwork were reviewed as part of this analysis. Additionally, historical research was conducted by examining various journals, government publications, historical USGS topographic maps; BLM (General Land Office) plat maps, master title plats, and mining index sheets; historical official county maps; and maps appearing in various primary and secondary sources. This research focused on localities related primarily to gold mining, mining towns, frontier military forts, homesteading, agriculture, the CVP (Friant Dam), and hydroelectric power development.

These data were again brought up to date in a records search update submitted on August 22, 2013, to identify any newly recorded sites and studies completed since 2006. Along with this update, a new search request was initiated for previously unsearched portions of the primary study area, as well as a 1/4-mile buffer zone around the unsearched portions. A new records search request to the SSJVIC was made on February 13, 2014 to encompass several additional small areas newly incorporated into the primary study area, and then again in June 2014.

Based on the combined records search results, 33 cultural resources studies have been undertaken within the primary study area. These studies consist of one overview, one historical resources report, 28 survey reports, one combined survey/testing report, and two eligibility-related documents. The boundary of each of these surveys was digitized and integrated into a GIS database. In all, 38.3 percent (2,867.9 acres) of the 7,480.9-acre area has been surveyed. The surveys were compiled during the Plan Formulation Phase of the Investigation (Byrd and Wee 2008). Additionally, there are six reports in areas adjacent to the Investigation's primary study area, including one ethnographic overview, one survey, and four excavation reports.

Only one historic-era building inventory project has been undertaken near Friant Dam (JRP 2003), but not all resources have been evaluated for eligibility. To contrast, archaeological survey has covered approximately one-third of the primary study area. Notably, few low-density prehistoric artifact scatters and no buried sites have been recorded, and historic-era sites were often not recorded. As such, archaeological inventory is not fully representative of all resources categories, and it appears that only prehistoric residential settlements and bedrock milling localities have been systematically discovered and recorded. Ultimately, only a full-coverage cultural resources survey across the primary study area will serve to securely identify the actual quantity and full breadth of archaeological and historic-era resources within the proposed Temperance Flat River Mile 274 Dam and Reservoir area.

Primary Study Area

Within the primary study area, 52 archaeological sites and seven historic-era architectural resources were identified. The archaeological sites include 41 prehistoric sites, one archaeological district (Squaw Leap Archaeological District), which encompasses multiple sites counted among the 40, six historic-era sites, and four sites with both historic-era and prehistoric components. In addition, three isolates have been recorded across the primary study area; all are historic-era stone walls. The results of this research for archaeological sites within the primary study area, as well as the historic architectural resources, are summarized in Table 9-1.

Table 9-1. Summary of Known Cultural Resources in the Primary Study Area

Category	Number of Sites
Archaeological Sites	
Prehistoric	41
Historic-era	6
Prehistoric/Historic-era	4
Archaeological District (Squaw Leap)	1
Subtotal	52
Historic Architectural Resources	
Hydroelectric	4
Roads	1
Buildings/Structures	2
Subtotal	7
Total Documented Cultural Resources	59

The 41 prehistoric sites account for 79 percent of the known archaeological sites. These include 28 bedrock milling localities, 10 residential sites (defined by the presence of midden deposits), two lithic scatter/bedrock milling localities, and one lithic scatter. Many of the residential sites have surface evidence of house pits as well as bedrock milling features, while bedrock milling sites typically contain numerous milling elements on multiple outcrops. The six historic-era archaeological sites comprise 9.5 percent of the sample, and include two mining sites, one location with two ore crushers, and a series of 13 rock cairns, some of which are located outside of the primary study area boundary. The four multi-component sites include some combination of bedrock milling loci, prehistoric or historic artifact scatters, and prehistoric or historic Native American residential evidence, and make up 9.5 percent of the sample. None of these previously recorded historic-era sites has intact standing structures.

Portions of the Squaw Leap Archaeological District are located within the primary study area. This district was determined eligible for the NRHP by the Keeper on May 5, 1980, and is on the California Register of Historic Resources. The final district boundaries included two discontiguous areas: an upland meadow area on the Madera County side of the San Joaquin River and a plateau area on the Fresno County side. The district was defined based on its ability to contribute to prehistoric research questions; it includes 20 sites, mainly bedrock milling locations, along with some residential sites. This area is currently within the BLM SJRG SRMA. As mapped, the Squaw Leap Archaeological District encompasses a total of 700 acres. The portion encompassed within the primary study area includes about 499 acres. Fourteen Squaw Leap Archaeological District sites are situated within the primary study area.

Historic-era architectural (built environment) resources include all aspects of the built environment. The site records from the Information Center records search were produced as a result of archaeological surveys, and the sample is likely biased toward archaeological sites, as opposed to the built environment. Yet some historic-era structures exist within the survey area, and this study has identified seven localities where known historical sites, buildings or structures intersect the primary study area. In general, locations of historic-era architectural resources are generally distributed throughout the primary study area; however, few resources are identified at the northeastern most portion of the primary study area, northeast of the area historically known Temperance Flat, where the rugged landscape of the river canyon restricted settlement and permanent occupation of the land.

The seven known historic-era structures include four hydroelectric resources, two structures, and one road. Hydroelectric power resources make up 57 percent of known resources in the primary study area. These four resources consist of the Kerckhoff Powerhouse and its associated resources including the Kerckhoff Dam and Tunnel, which date to the early 1920s; and the Friant Dam (and its power plant), completed in the mid-1940s. However, in a filing to FERC dated March 8, 2013, PG&E submitted a letter from the SHPO stating that the Kerckhoff Hydroelectric Project is not eligible for listing on the NRHP (FERC 2013). Buildings and structures account for 28.6 percent of all known historic resources found within the primary study area, consisting of a boat ramp and a gaging station. Only one known transportation infrastructure feature is located within the primary study area: Sky Harbour Road dates to 1965 or before. The results of this research for known archaeological sites and historic-era architectural resources within the primary study area are summarized in Table 9-1.

The only known resources within the study area that have been identified as a historic property are related to Friant Dam, one of the key water storage structures built by Reclamation as part of the CVP. As a result of a study conducted in the Millerton Lake SRA by JRP (2003), Reclamation determined Friant Dam and its contributing features (spillway, canal outlets, four gantry cranes, and three small dikes used to contain Millerton Lake) as individually eligible for the NRHP (Reclamation 2005, 2006). Further, Reclamation has also preliminarily identified Friant Dam as a contributor to a larger discontiguous Central Valley Project Historic District (Reclamation 2005, 2007).

Sensitivity analyses indicate the potential to find more historic-era resources in the primary study area. Well-preserved historic-era resources related to late-nineteenth- and early-twentieth-century homesteading and ranching would have a high potential to address important research questions. Similarly, resources related to mining activities in the Temperance Flat Mining District, because of the high concentration of mining activities dating from the 1850s through the early decades of the twentieth century, also have a high potential to address research questions related to the gold rush, mining technologies, and the ethnic and cultural groups associated with early mining in Fresno and Madera counties. Given the distribution of historic-era activities, there appears to be potentially more significant historic-era resources in the upper reaches of the primary study area, particularly in the Temperance Flat region.

No historic-era Native American villages are depicted on the General Land Office (GLO) plat maps for the portions of five townships that are located within the primary study area. A strong likelihood exists that other important Native American heritage locations are present within the primary study area, based on ethnohistoric data and initial discussions with Native Americans that have included early written communication and meetings with tribal members. The Study Area was the focus of intensive Native American occupation during historic times, with a variety of religious, economic, historic, and other values identified by Native American groups and is currently used by these groups. Sixteen groups, including those listed by the NAHC, represent Native American interests in the study area: the Big Sandy Rancheria of Western Mono Indians; Choinumni Tribe; Cold Springs Rancheria of Mono Indians; Dumna Tribal Government; the Dumna Wo-Wah Tribal Government; Dunlap Band of Mono Indians; North Fork Mono Tribe; North Fork Rancheria; Nototonme/North Valley Yokut Tribe, Inc.; Picayune Rancheria of the Chukchansi Indians; Tachi-Yokut Tribe (Santa Rosa Rancheria); Sierra Nevada Native American Coalition; Southern Sierra Miwuk Nation; Table Mountain Rancheria; Tule River Tribe; and the Traditional Choinumni Tribe.

Traditional Cultural Properties

Federal regulation defines Traditional Cultural Properties as properties that have “association with cultural practices or beliefs of a living community that (a) are rooted in that community’s history, and (b) are important in maintaining the continuing cultural identity of the community” (Parker and King 1998). Examples of Traditional Cultural Properties include: a location associated with the traditional beliefs of a Native American group about its origins, its cultural history, or the nature of the world; a location where Native American religious practitioners have historically gone, and are known or thought to go today, to perform ceremonial activities in accordance with traditional cultural rules of practice.

The records search at the Information Center revealed that no Traditional Cultural Properties have been formally recorded in the primary study area. However, there is a possibility that Traditional Cultural Properties, and/or viewsheds associated with Traditional Cultural Properties, exist within the primary study area. Should Congress authorize and fund implementation of an action alternative, additional information about Traditional Cultural Properties in the primary study area will be sought by Reclamation.

Indian Sacred Sites

Executive Order No. 13007 defines a sacred site as "any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site." Reclamation will continue to provide updates about the project to tribal members and solicit input from the tribes on known resources within the Study Area that may be affected by the action alternatives.

Executive Order 13007 pertains only to Federally recognized tribes and Federally managed lands. For groups that are not formally recognized, sacred areas may be listed in the Sacred Lands files of the California Native American Heritage Commission. This commission has reviewed its files and identified sacred lands within the study area. Their locations are confidential.

Environmental Consequences and Mitigation Measures

This section describes potential environmental consequences on cultural resources that could result from the No Action Alternative and from implementing any of the action alternatives. It also describes the methods of environmental evaluation, assumptions, and specific criteria that were used to determine the significance of impacts on cultural resources. It then discusses the potential impacts and proposes mitigation where appropriate. The potential impacts on cultural resources and associated mitigation measures are summarized in Table 9-2.

Table 9-2. Summary of Impacts and Mitigation Measures for Cultural Resources

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
CUL-1: Disturbance or Destruction of Known or Previously Undiscovered Prehistoric Resources Due to Construction, Inundation, and Project Operation	Primary Study Area	No Action Alternative	LTS	None Required	LTS
		Alternative Plan 1	S	CUL-1:Precautions for Limiting Post-Construction Vandalism to Cultural Resources	SU
		Alternative Plan 2	S		SU
		Alternative Plan 3	S		SU
		Alternative Plan 4	S		SU
		Alternative Plan 5	S		SU
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
CUL-2: Disturbance or Destruction of Known or Previously Undiscovered Historic-Era Resources Due to Construction, Inundation, and Project Operation	Primary Study Area	No Action Alternative	LTS	None Required	LTS
		Alternative Plan 1	S	CUL 2: Implement Mitigation Measure CUL-1, Precautions for Limiting Post-Construction Vandalism to Cultural Resources	SU
		Alternative Plan 2	S		SU
		Alternative Plan 3	S		SU
		Alternative Plan 4	S		SU
		Alternative Plan 5	S		SU
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI

Table 9-2. Summary of Impacts and Mitigation Measures for Cultural Resources (contd.)

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
CUL-3: Construction and Management of Project Components That would Cause a Substantial Adverse Change in the Significance of a Historical and/or Unique Archaeological Resource, Historic Property, or Historic District	Primary Study Area	No Action Alternative	LTS	None Required	LTS
		Alternative Plan 1	S	CUL 3: Implement Mitigation Measure CUL-1, Precautions for Limiting Post-Construction Vandalism to Cultural Resources	SU
		Alternative Plan 2	S		SU
		Alternative Plan 3	S		SU
		Alternative Plan 4	S		SU
		Alternative Plan 5	S		SU
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI
CUL-4 Destruction or Damage to Traditional Cultural Properties	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	CUL 4: Implement Mitigation Measure CUL-1, Precautions for Limiting Post-Construction Vandalism to Cultural Resources	SU
		Alternative Plan 2	S		SU
		Alternative Plan 3	S		SU
		Alternative Plan 4	S		SU
		Alternative Plan 5	S		SU
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI

Table 9-2. Summary of Impacts and Mitigation Measures for Cultural Resources (contd.)

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
CUL-5 Destruction or Damage to Indian Sacred Sites	Primary Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	S	CUL 5: Implement Mitigation Measure CUL-1, Precautions for Limiting Post-Construction Vandalism to Cultural Resources	SU
		Alternative Plan 2	S		SU
		Alternative Plan 3	S		SU
		Alternative Plan 4	S		SU
		Alternative Plan 5	S		SU
	Extended Study Area	No Action Alternative	NI	None Required	NI
		Alternative Plan 1	NI		NI
		Alternative Plan 2	NI		NI
		Alternative Plan 3	NI		NI
		Alternative Plan 4	NI		NI
		Alternative Plan 5	NI		NI

Key:
LTS = less than significant
NI = no impact
S = significant
SU = significant and unavoidable

The environmental setting for this chapter includes only the primary study area, which includes the proposed Temperance Flat River Mile 274 Dam and Reservoir and is defined as the San Joaquin River upstream from Friant Dam to Kerckhoff Dam, including Millerton Lake and the area that would be inundated by the reservoir, which encompasses the proposed temporary and permanent facilities upstream from Friant Dam, such as the dam and appurtenant structures, power generation features including transmission facilities, and other construction areas. Together these areas comprise the focus of this cultural resources analysis. No potential impacts to cultural resources are expected in the extended study area as no construction or other physical disturbance would occur there. Therefore, the extended study area is not discussed further in this section.

Impact Assessment Methods and Assumptions

The standard Section 106 process of the NHPA follows a series of steps that are described in the 36 CFR Part 800 regulations that implement the NHPA. These steps are as follows:

- Initiate Section 106 Process, 36 CFR Part 800.3
- Identify Historic Properties, 36 CFR Part 800.4
- Assess Adverse Effects, 36 CFR Part 800.5
- Resolve Adverse Effects, 36 CFR Part 800.6

"Adverse Effects" are defined below. In the event that historic properties within the APE for an undertaking would be subject to adverse effects, the lead Federal agency would consider ways to minimize or mitigate ("resolve") such effects, in consultation with the SHPO and other signatories and consulting parties. This often requires a memorandum of agreement or programmatic agreement among the consulting parties (Part 800.6).

Section 106 regulations allow Federal agencies to conduct "nondestructive project planning activities before completing compliance with Section 106" (36 CFR Part 800.1[c]), and the regulations encourage Federal agencies to consider a broad range of alternatives during the planning process for the undertaking. Reclamation will not have a specific undertaking until such time as Congress makes a decision regarding whether to authorize a project that would involve constructing a new dam and appropriates funding for this purpose.

Reclamation conducted a record and literature search of the primary study area to assess which portions of the primary study area have been previously inventoried, and to identify all previously recorded cultural resources. Methods used to document existing information on the cultural resources included archival records searches (that identified previously recorded sites, site records, and Native American ethnographic studies), agency consultation, and Native American consultations. Information on archaeological sites and historical structures was obtained for sites within the primary study area that may be affected by the action alternatives. Sensitivity analyses, discussed in sections below, were also conducted for prehistoric and historic-era resources to address data gaps using methods tailored to each data set. Native American issues and resource locations within the primary study area were discussed during meetings with local Native American groups and individuals.

Included in the analysis was an assessment of the effects of inundation and drawdown on cultural resources located within the pool of a reservoir. Previous reservoir studies have shown that the greatest impacts occur in the zone of inundation and drawdown (fluctuation zone), where cultural resources are repeatedly exposed to scouring, wave action, wet/dry cycles, and de-vegetation. This means that the most significant impacts will occur during the early years of inundation, and if reservoir operations change and causing an increase in reservoir fluctuation.

Archaeological and Historic-Era Structural Resources

Although the records search revealed that significant portions of the primary study area were surveyed previously, the frequency and distribution of recorded sites within the primary study area only give a limited and incomplete picture of the actual number of resources. This is because only a very small percentage of the primary study area has been systematically inventoried for cultural resources to contemporary standards. To estimate site densities for the primary study area as a whole, sensitivity analyses were undertaken. Separate sensitivity analyses for prehistoric and historic-era sites were conducted to predict where unrecorded sites should be concentrated within unsurveyed areas. The resulting site-density predictions provide the most accurate estimate of site sensitivity available at present. The following discussion presents the methods and approach taken.

Research conducted for the Investigation was designed to identify the types of cultural resources known to be present in the primary study area. However, the frequency and distribution of formally recorded resources give only a limited and incomplete picture of the actual number of resources.

Therefore, a comparative sensitivity analysis was conducted to take both documented and likely but undocumented resources (including archaeological sites and historic-era structures) into account that may be affected by the action alternatives. The sensitivity analysis was restricted to the primary study area.

Separate sensitivity analyses using methods tailored to each data set were conducted for prehistoric and historic-era sites to estimate the total number of cultural resources present (see Rich et al. (2014) for methodological details and specific data). The prehistoric sensitivity analysis used a weights-of-evidence quantitative analysis to predict the overall density and distribution of sites. In contrast, the historic-era sensitivity study gathered archival data (mainly maps) within the primary study area to make predictions regarding the number and type of potential unrecorded historic-era resources (both structures and sites). Results of the prehistoric and historic-era sensitivity analyses were integrated to provide quantitative estimates of the total number of cultural resources likely documented after full inventory. These estimates are for planning purposes only; additional pedestrian surveys would be needed if one of the action alternatives were to be authorized by Congress for implementation.

Traditional Cultural Properties and Sacred Sites and Areas

A qualitative evaluation of the potential to affect traditional cultural properties or sacred sites or areas was conducted based on the results of record searches at the Information Center and California Native American Heritage Commission. Tribal consultation for the Investigation is pending.

Criteria for Determining Significance of Effects

An environmental document prepared to comply with NEPA must consider the context and intensity of the environmental effects that would be caused by, or result from, the proposed action. An environmental document prepared to comply with CEQA must identify the potentially significant environmental effects of a proposed project. A “[s]ignificant effect on the environment” means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project (State CEQA Guidelines, Section 15382). CEQA also requires that the environmental document propose feasible measures to avoid or substantially reduce significant environmental effects (State and CEQA Guidelines, Section 15126.4(a).

Federal Criteria

Under Federal regulation, the Protection of Historic Properties (36 CFR Section 800(a)(1)), which defines the Section 106 process mandating Federal agencies to undergo a review process for all federally funded and permitted projects that will impact sites listed on, or eligible for listing on, the NRHP, states:

> *"An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative."*

Examples of adverse effects (36 CFR Section 800(a)(2)) include the following:

- Physical destruction, damage, or alteration, including moving the property from its historic location
- Isolation from, or alteration of, the setting
- Introduction of intrusive elements
- Neglect leading to deterioration or destruction
- Transfer, sale, or lease from Federal ownership

State Criteria

California regulations require that effects to cultural resources be considered only for resources meeting the criteria for eligibility to the California Register of Historical Resources, outlined in Section 5024.1 of the California Public Resources Code. Demolition, replacement, substantial alteration, or relocation of an eligible resource are actions that could change those elements of the resource which make it eligible. The following eligibility criteria were developed using guidance provided by the State CEQA Guidelines, which considers the context and intensity of the environmental effects as required under NEPA. Under the State CEQA Guidelines, impacts on cultural resources may be considered significant if an action alternative would result in any of the following:

- Cause a substantial adverse change in the significance of a historical resource, as defined in Guidelines Section 15064.5
- Cause a substantial adverse change in the significance of an archaeological resource pursuant to Guidelines Section 15064.5
- Disturb human remains, including those interred outside formal cemeteries

According to the above criteria, the project would be considered to have a significant impact on cultural resources if it would result in any of the following:

- Substantial adverse change in the significance of a historical resource
- Substantial adverse change in the significance of a unique archaeological resource
- Disturbance of any human remains, including those interred outside of formal cemeteries
- Elimination of important examples of the major periods of California history or prehistory

Under CEQA an impact to a cultural resource can be reduced to a less-than-significant level through mitigation. Statements of impact significance are relative to both existing conditions (January 2014) and future conditions (Year 2030), unless stated otherwise. Only those elements of a resource which contribute to its eligibility need to be considered; effects to noncontributing elements are less than significant.

Topics Eliminated from Further Consideration

As no construction activities or changes in the landscape would occur in extended study area under the action alternatives, this geographic area is not considered further in this analysis.

Direct and Indirect Effects

This section describes the environmental consequences of the alternatives, and proposed mitigation measures for any impacts determined to be significant or potentially significant.

Impact CUL-1: Disturbance or Destruction of Known or Previously Undiscovered Prehistoric Resources Due to Construction, Inundation, and Project Operation

Primary Study Area

No Action Alternative Dam construction, infrastructure, reservoir area inundation, and construction activities adjacent to the area of project impacts would not occur under the No Action Alternative. Therefore, no additional prehistoric cultural resources and archaeological sites would be impacted, and conditions would be the same as they currently exist.

The condition of known and previously undiscovered prehistoric cultural resources and archaeological sites within the existing Millerton Lake fluctuation zone will continue to be impacted by fluctuations in the water level under the No Action Alternative. As stated above, dam construction, infrastructure and facilities relocation, and additional reservoir area inundation would not occur under the No Action Alternative. No new impacts on cultural resources related to construction or inundation are expected.

This impact would be **less than significant** under the No Action Alternative.

Action Alternatives Known or previously undiscovered prehistoric-era cultural resources potentially impacted by action alternatives include those within the San Joaquin River upstream from Friant Dam to Kerckhoff Dam, including Millerton Lake and the area that would be inundated by the proposed Temperance Flat RM 274 Dam and Reservoir, as well as areas that could be directly affected by construction-related activities. Operation and maintenance of the Temperance Flat RM 274 Dam and Reservoir would damage or destroy known prehistoric resources, and could damage or destroy previously undiscovered prehistoric cultural resources through increased erosion in the zone of inundation and drawdown (fluctuation zone), where cultural resources are repeatedly exposed to scouring, wave action, wet/dry cycles, and de-vegetation. Additionally, construction and management of project components could disturb human remains, including those interred outside of formal cemeteries. Implementation of the action alternatives would have a direct impact on cultural resources.

The construction schedule for the project as described in detail in the Engineering Summary Appendix, approximates a three-phase, up to 10-year period of construction for the 200 TAF reservoir and dam, as well as appurtenant structures, and includes drawdown of Millerton Lake. Temporary construction actions for the action alternatives include: the movement of borrow area materials; mass excavation for a dam foundation, power generation, and other construction areas; and staging for construction materials and equipment.

When filled, prehistoric-era cultural resources in Temperance Flat RM 274 Dam and Reservoir fluctuation zone would be subject to the erosive processes of periodic fluctuations in water level. Operation and maintenance of the Temperance Flat RM 274 Dam and Reservoir and power generation features would damage or destroy known prehistoric resources, and could damage or destroy previously undiscovered prehistoric cultural resources through exposure in the fluctuation zone, through increased recreation access (recreation facilities, roads, utilities, trails, etc.), and by enhanced access to exposed resources in the fluctuation zone by visitors to the recreation area. Additionally, while the action alternatives would not change modify Friant Dam, they would increase the carryover pool in Millerton Lake and hence increase the elevation of the low water level, increasing the duration that cultural resources are inundated.

The surveys to date in the primary study area indicate that prehistoric resources exist within the zone of construction and may be subject to the construction, operation, and maintenance impacts associated with the action alternatives. The 40 prehistoric sites account for 80 percent of the known archaeological sites. These include 27 bedrock milling localities, 10 residential sites (defined by the presence of midden deposits), two lithic scatter/bedrock milling localities, and one lithic scatter. Many of the residential sites have surface evidence of house pits as well as bedrock milling features, while bedrock milling sites typically contain numerous milling elements on multiple outcrops. These results are summarized in Table 9-1.

Sensitivity analyses indicate the potential to find more archaeological sites in the primary study area. The prehistoric site sensitivity analysis suggests sites should be found on older soils, relatively low slopes, and close to water.

It is not possible at this stage of the Investigation to determine how many known or previously undiscovered historic-era resources may be determined eligible for listing under NHPA, or how many of the eligible resources could sustain adverse impacts from the action alternatives. Reclamation would comply with the Federal NHPA Section 106 process to avoid, minimize, or mitigate adverse impacts. As described in Chapter 2, "Alternatives," Reclamation could enter into a Programmatic Agreement with the Advisory Council on Historic Preservation (if it chooses to participate), the SHPO, and other consulting parties that would identify how the Section 106 process would be completed for the authorized project. The Programmatic Agreement could include alternative methods for compliance or phased identification efforts/phased finding of effects efforts, as agreed upon with the consulting parties. As part of a Programmatic Agreement, Reclamation would work with the consulting parties to determine the need to provide a full evaluation of archaeological sites and recovery of data at any eligible sites that would be adversely affected by the action alternatives. Other potential outcomes of consultation are to protect sites left in place and provide for interpretation and curation of archaeological artifacts.

This impact would be **significant** under the action alternatives**.** Mitigation for this impact is proposed below in the Mitigation Measures section.

Impact CUL-2: Disturbance or Destruction of Known or Previously Undiscovered Historic-Era Resources Due to Construction, Inundation, and Project Operation

Primary Study Area

No Action Alternative Temperance Flat RM 274 Dam construction, infrastructure, reservoir area inundation, and construction activities adjacent to the area of project impacts would not occur under the No Action Alternative. Therefore, no additional historic-era cultural resources and archaeological sites would be impacted, and conditions would be the same as they currently exist.

The condition of known and previously undiscovered historic-era cultural resources and archaeological sites within the existing Millerton Lake fluctuation zone will continue to be impacted by fluctuations in the water level under the No Action Alternative. As stated above, dam construction, infrastructure and facilities relocation, and additional reservoir area inundation would not occur under the No Action Alternative. No new impacts on cultural resources related to construction or inundation are expected.

This impact would be **less than significant** under the No Action Alternative.

Action Alternatives Known or previously undiscovered historic-era cultural resources potentially impacted by the action alternatives include those within the San Joaquin River upstream from Friant Dam to Kerckhoff Dam, including Millerton Lake and the area that would be inundated by the proposed Temperance Flat RM 274 Dam and Reservoir, as well as areas that could be directly affected by construction-related activities. Operation and maintenance of the reservoir would damage or destroy known historic-era resources, and could damage or destroy previously undiscovered historic-era cultural resources due to increased erosion in the zone of inundation and drawdown (fluctuation zone), where cultural resources are repeatedly exposed to scouring, wave action, wet/dry cycles, and de-vegetation. Implementation of action alternatives would have a direct impact on historic-era cultural resources.

When filled, the reservoir fluctuation zone of Temperance Flat RM 274 Reservoir would be subject to the erosive processes of periodic fluctuations in water level. The action alternatives would not change the size of Millerton Lake, but would increase the carryover pool and hence increase the elevation of the low water level. Operation and maintenance of Temperance Flat RM 274 Dam and Reservoir could damage or destroy known and previously undiscovered historic-era cultural resources through exposure in the fluctuation zone, through increased recreation access through new recreation facilities, roads, utilities, trails, etc., and enhanced recreation access to resources in the fluctuation zone.

The survey of known historic-era archaeological resources categorizes the resources as sites, multi-component sites, and structures. Known historic-era sites comprise 8 percent of the survey sample of total archaeological resources, and include two mining sites, one location with two ore crushers, and a series of rock cairns, some of which fall are located outside of the primary study area. None of these previously recorded historic-era sites has intact standing structures. The five multi-component sites include some combination of bedrock milling loci, prehistoric or historic artifact scatters, and prehistoric or historic Native American residential evidence, and make up 10 percent of the sample. No historic-era Native American villages are depicted on the GLO plat maps for the portions of five townships that are located fall within the primary study area.

As described previously, sensitivity analyses indicate the potential to find more historic-era resources in the primary study area. It is not possible at this stage to determine how many known or previously undiscovered historic-era resources may be determined eligible for listing under NHPA, or how many of the eligible resources could sustain adverse impacts from the action alternatives. Adverse effects would be avoided, minimized, or mitigated through the environmental commitments within the project design, in compliance with NHPA Section 106 procedures, and, when warranted through project redesign as discussed in this chapter and Chapter 28, “Other NEPA and CEQA Considerations.”

Reclamation would comply with the Federal NHPA Section 106 process to avoid, minimize, or mitigate adverse impacts to the extent feasible. As described in Chapter 2, “Alternatives,” Reclamation could enter into a Programmatic Agreement with the Advisory Council on Historic Preservation (if it chooses to participate), the SHPO, and other consulting parties that would identify how the Section 106 process would be completed for the authorized project. The Programmatic Agreement could include alternative methods for compliance or phased identification efforts/phased finding of effects efforts, as agreed upon with the consulting parties. As part of a Programmatic Agreement, Reclamation would ensure the evaluation and recovery of data or documentation at any eligible historic-era sites that would be adversely affected by the action alternatives.

This impact would be **significant.** Mitigation for this impact is proposed below in the Mitigation Measures section.

Impact CUL-3: Construction and Management of Project Components That would Cause a Substantial Adverse Change in the Significance of a Historical and/or Unique Archaeological Resource, Historic Property, or Historic District

Primary Study Area

No Action Alternative Temperance Flat RM 274 Dam construction, infrastructure, reservoir area inundation, and construction activities adjacent to the area of project impacts would not occur under the No Action Alternative. Therefore, no additional historic-era cultural resources and archaeological sites would be impacted, and conditions would remain as they currently exist.

The condition of known and previously undiscovered historic-era cultural resources and archaeological sites within the existing Millerton Lake fluctuation zone will continue to be impacted by fluctuations in the water level under the No Action Alternative. As stated above, dam construction, infrastructure and facilities relocation, and additional reservoir area inundation would not occur under the No Action Alternative; therefore, no new impacts on cultural resources related to construction or inundation are expected.

This impact would be **less than significant** under the No Action Alternative.

Action Alternatives As described previously, portions of the Squaw Leap Archaeological District are located within the primary study area. Fourteen Squaw Leap Archaeological District sites are located within the primary study area. As mapped, components of the Squaw Leap Archaeological District that would be impacted by action alternatives total about 499 acres.

The only known resources within the primary study area that have been identified as a historic property under Section 106 are related to Friant Dam. As described previously, Friant Dam is a contributor to a larger discontiguous Central Valley Project Historic District (Reclamation 2005, 2007) and it along with its contributing features (spillway, canal outlets, four gantry cranes, and three small dikes used to contain Millerton Lake) are also individually eligible for the NRHP (Reclamation 2005, 2006).

Reclamation would comply with the Federal NHPA Section 106 process to avoid, minimize, or mitigate adverse impacts to less than significant levels. As described in Chapter 2, “Alternatives,” Reclamation could enter into a Programmatic Agreement with the Advisory Council on Historic Preservation (if it chooses to participate), the SHPO, and other consulting parties that would identify how the Section 106 process would be completed for the authorized project. The Programmatic Agreement could include alternative methods for compliance or phased identification efforts/phased finding of effects efforts, as agreed upon with the consulting parties. As part of a Programmatic Agreement, Reclamation would ensure the appropriate evaluation, recovery of data and/or recordation at any eligible sites that would be adversely affected by the action alternatives. However, unique archaeological sites can be difficult to mitigate under traditional methods.

This impact would be **significant.** Mitigation for this impact is proposed below in the Mitigation Measures section.

Impact CUL-4: Destruction or Damage to Traditional Cultural Properties

Primary Study Area

No Action Alternative Temperance Flat RM 274 Dam construction, infrastructure, reservoir area inundation, and construction activities adjacent to the area of project impacts would not occur under the No Action Alternative. No traditional cultural properties would be impacted, and conditions would remain as they currently exist.

There would be **no impact** under the No Action Alternative.

Action Alternatives No traditional cultural properties are known to exist in the primary study area, however the potential for undocumented traditional cultural properties does exist. It is not possible to know the number of resources present, how many would be determined eligible, and how many of the eligible resources would be adversely impacted from the action alternatives since only a small fraction of the area has been inventoried. However, since the action alternatives include inundation and ground-disturbing activities, potential exists for significant adverse impacts to occur to traditional cultural properties.

As described in Chapter 2, “Alternatives,” the action alternatives include measures to minimize or avoid impacts to these resources to less than significant levels. Reclamation would follow the process in the implementing regulations at 36

CFR Part 800 to identify historic properties (including traditional cultural properties, as appropriate), assess effects, and resolve adverse effects through the consultation process. Consulting parties for the National Historic Preservation Act Section 106 process would include the SHPO, the Advisory Council on Historic Preservation (if it choose to participate), other Federal agencies where applicable, tribal representatives, and other interested parties (including non-Federally recognized Native Americans, members of the public, and other State or local agencies) to develop methods to avoid, minimize, or mitigate adverse effects. Any human remains, funerary objects, sacred objects, or objects of cultural patrimony that were removed from federally managed or tribal lands during any project activities would be treated consistent with the Native American Graves Protection and Repatriation Act. If human remains were removed from non-federally managed lands, they would be subject to the PRC regarding the treatment of human remains outside a dedicated cemetery.

This impact would be **significant.** Mitigation for this impact is proposed below in the Mitigation Measures section.

Impact CUL-5: Destruction or Damage to Indian Sacred Sites

Primary Study Area

No Action Alternative Temperance Flat RM 274 Dam construction, infrastructure, reservoir area inundation, and construction activities adjacent to the area of project impacts would not occur under the No Action Alternative. No Indian Sacred Sites would be impacted, and conditions would remain as they currently exist.

There would be **no impact** under the No Action Alternative.

Action Alternatives Documented sacred areas are located in the primary study area, and undocumented sacred areas or sacred sites may also be present in the primary study area. It is not possible to know the number of resources present, how many would be determined eligible, and how many of the eligible resources would be adversely impacted from these alternatives since only a small fraction of the area has been inventoried. However, since the action alternatives include inundation and ground-disturbing activities, potential exists for significant adverse impacts to occur to sacred sites and sacred areas.

As described in Chapter 2, “Alternatives,” the action alternatives include measures to minimize or avoid impacts to these resources. Reclamation would follow the process in the implementing Executive Order 13007 (May 24, 1996). Where appropriate, Reclamation would maintain the confidentiality of sacred sites. Reclamation would provide reasonable notice of proposed actions that may restrict future access to or ceremonial use of, or adversely affect the physical integrity of, sacred sites. Reclamation would comply with the April 29, 1994, executive memorandum, “Government-to-Government Relations with Native American Tribal Governments.” Any human remains, funerary objects, sacred objects, or objects of cultural patrimony that were removed from federally managed lands during any project activities would be treated consistent with the Native American Graves Protection and Repatriation Act. If human remains were removed from non-federally managed lands, they would be subject to the PRC regarding the treatment of human remains outside a dedicated cemetery.

This impact would be **significant** under the action alternatives**.** Mitigation for this impact is proposed below in the Mitigation Measures section.

Mitigation Measures

This section discusses mitigation measures for each significant impact described in the environmental consequences section, as presented in Table 9-2.

Impacts CUL-1, CUL-2, CUL-3, CUL-4, and CUL-5 within the primary study area would be significant for all action alternatives. Mitigation Measure CUL-1, described below, is proposed for Impacts CUL-1, CUL-2, CUL-3, CUL-4, and CUL-5.

Mitigation Measure CUL-1: Precautions for Limiting Post-Construction Vandalism to Cultural Resources

Impacts on some sites from increased access and vandalism will be minimized by implementing a Cultural Resources Management Plan. To ensure the long-term protection of these sites, the plan will provide guidelines to prevent impacts on historic properties, such as restrictions for use in areas of sensitivity, and a long-term monitoring program to ensure that cultural resources are protected in the future.

Implementing Mitigation Measure CUL-1 would aid in reducing adverse effects and vandalism to prehistoric resources. However, this mitigation measure would not be sufficient to reduce Impact CUL-1 to a less-than-significant level. As a result, Impact CUL-1 would remain **significant and unavoidable** under the action alternatives.

Mitigation Measure CUL-2: Implement Mitigation Measure CUL-1, Precautions for Limiting Post-Construction Vandalism to Cultural Resources

Implementing Mitigation Measure CUL-2 would aid in reducing adverse effects and vandalism to historic-era resources. However, this mitigation measure would not be sufficient to reduce CUL-2 to a less-than-significant level. As a result, Impact CUL-2 would remain **significant and unavoidable** under the action alternatives.

Mitigation Measure CUL-3: Implement Mitigation Measure CUL-1, Precautions for Limiting Post-Construction Vandalism to Cultural Resources

Implementing Mitigation Measure CUL-3 would aid in reducing adverse effects and vandalism to a historical and/or unique archaeological resource, historic property, or historic district. However, this mitigation measure would not be sufficient to reduce CUL-3 to a less-than-significant level. As a result, Impact CUL-3 would remain **significant and unavoidable** under the action alternatives.

Mitigation Measure CUL-4: Implement Mitigation Measure CUL-1, Precautions for Limiting Post-Construction Vandalism to Cultural Resources

Implementing Mitigation Measure CUL-4 would aid in reducing adverse effects and vandalism to traditional cultural properties. However, this mitigation measure would not be sufficient to reduce CUL-4 to a less-than-significant level. As a result, Impact CUL-4 would remain **significant and unavoidable** under the action alternatives.

Mitigation Measure CUL-5: Implement Mitigation Measure CUL-1, Precautions for Limiting Post-Construction Vandalism to Cultural Resources

Implementing Mitigation Measure CUL-5 would aid in reducing adverse effects and vandalism to Indian sacred sites. However, this mitigation measure would not be sufficient to reduce CUL-5 to a less-than-significant level. As a result, Impact CUL-5 would remain **significant and unavoidable** under the action alternatives.

Chapter 10
Environmental Justice

This chapter describes the affected environment for environmental justice, as well as potential environmental consequences and associated mitigation measures, as they pertain to implementing the alternatives. This chapter presents information on the primary study area (area of project features, the Temperance Flat Reservoir Area, and Millerton Lake below RM 274). It also discusses the extended study area (San Joaquin River from Friant Dam to the Merced River, the San Joaquin River from the Merced River to the Delta, the Delta, and the CVP and SWP water service areas). Chapter 23, "Socioeconomics, Population, and Housing," analyzes impacts on social and economic characteristics and the non-environmental justice issues related to population, employment, and housing.

An analysis of Federal actions that have the potential to result in disproportionately high and adverse impacts on minority and low-income populations is required under Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 Federal Register [FR] 7629).

Affected Environment

The affected environment discussion for environmental justice addresses race, ethnic origin, and economic status of affected groups. For purposes of this analysis, the definitions of minority individuals and minority and low-income populations are provided in the CEQ's Guidance for Agencies on Key Terms in Executive Order 12898 (CEQ 1997).

The CEQ defines minority individuals as persons from any of the following U.S. Census categories for race: Black/African American, Asian, Native Hawaiian or Other Pacific Islander, and American Indian or Alaska Native. Additionally, for the purposes of this analysis, minority individuals also include all other nonwhite racial categories that were added in the most recent census, such as "some other race" and "two or more races." The CEQ also mandates that persons identified through the U.S. Census as ethnically Hispanic, regardless of race, should be included in minority counts (CEQ 1997).

A minority population is present within a study area under either of the following conditions (CEQ 1997):

- The minority population percentage of the affected area is meaningfully greater than the minority population percentage of the general population.

- The minority population percentage of the affected area exceeds 50 percent.

Low-income populations are identified based upon poverty thresholds provided by the U.S. Census Bureau and are identified in one of the following ways (CEQ 1997):

- The population percentage below the poverty level is meaningfully greater than that of the population percentage in the general population.

- The population percentage below the poverty level in the affected area exceeds 50 percent.

Significant concentrations of minority or low-income individuals are sometimes referred to as environmental justice populations. Historically, minority and low-income populations have suffered a greater share of adverse environmental and health impacts related to industry and development relative to the benefits.

Primary Study Area

The primary study area can be described in terms of U.S. Census Bureau Census Tract 64.05 in Fresno County and Census Tract 1.02 in Madera County, which together include the area of project features, the Temperance Flat Reservoir Area, and Millerton Lake below RM 274.

For the purposes of this analysis, the environmental justice population was determined to be areas that could be subject to construction- or operation-related impacts associated with implementing any of the alternatives, including Census Tracts 64.05 and 1.02; the Auberry Census-Designated Place (CDP) in Census Tract 64.05; and Fresno Census-County Division (CCD), which includes the cities of Fresno and Clovis, the community of Friant, and other unincorporated areas south and east of the San Joaquin River, southwest of the Friant-Kern

Canal, west of the community of Sanger, and north of the community of Fowler (Figure 10-1). CDPs and CCDs are locations identified by the U.S. Census Bureau for statistical purposes. CDPs are delineated to provide data for settled concentrations of population that are identifiable by name but, like the community of Auberry, are not legally incorporated, whereas CCDs are designed to represent community areas focused on employment centers, such as the Fresno CCD. Data compiled for Fresno and Madera counties and the nearby cities of Clovis, Fresno, and Madera allow for a comparison of primary study area characteristics to a larger reference area.

Minority Populations

Table 10-1 presents racial and ethnic characteristics for the primary study area which consists of the potentially affected Census Tracts and Auberry CDP and potentially affected areas outside of the primary study area, which consist of Census Tracts 55.15, 55.25, and 10; the Friant CDP; the Fresno CCD; the nearby cities of Clovis, Fresno, and Madera; Fresno and Madera counties; and the State as a whole. These data are from the 2010 decennial census because the decennial census is the most recently completed dataset that can be used to show racial and ethnic heritage data at the Census Tract level.

Outside of the primary study area, the Friant CDP had the highest proportion of residents identified as White (85.1 percent), while the City of Fresno had the lowest proportion of White residents (49.6 percent) in 2010. In general, the Fresno CCD had a higher proportion of African American and Asian populations than the surrounding communities and the State. The Hispanic population represented the largest non-White population, ranging from 12.4 percent in the Friant CDP to 76.7 percent in the City of Madera. With the exception of the City of Clovis, the percentage of people outside of the primary study area who are of Hispanic origin was higher, with the exception of the city of Clovis than the State average (37.6 percent). The proportions of residents who identified themselves as American Indian, Pacific Islander, and “two or more races” is generally consistent with the State for many of the cities and counties in this study area. However, the proportions of residents who identified themselves as “some other race” are higher in the study area than in the State as a whole.

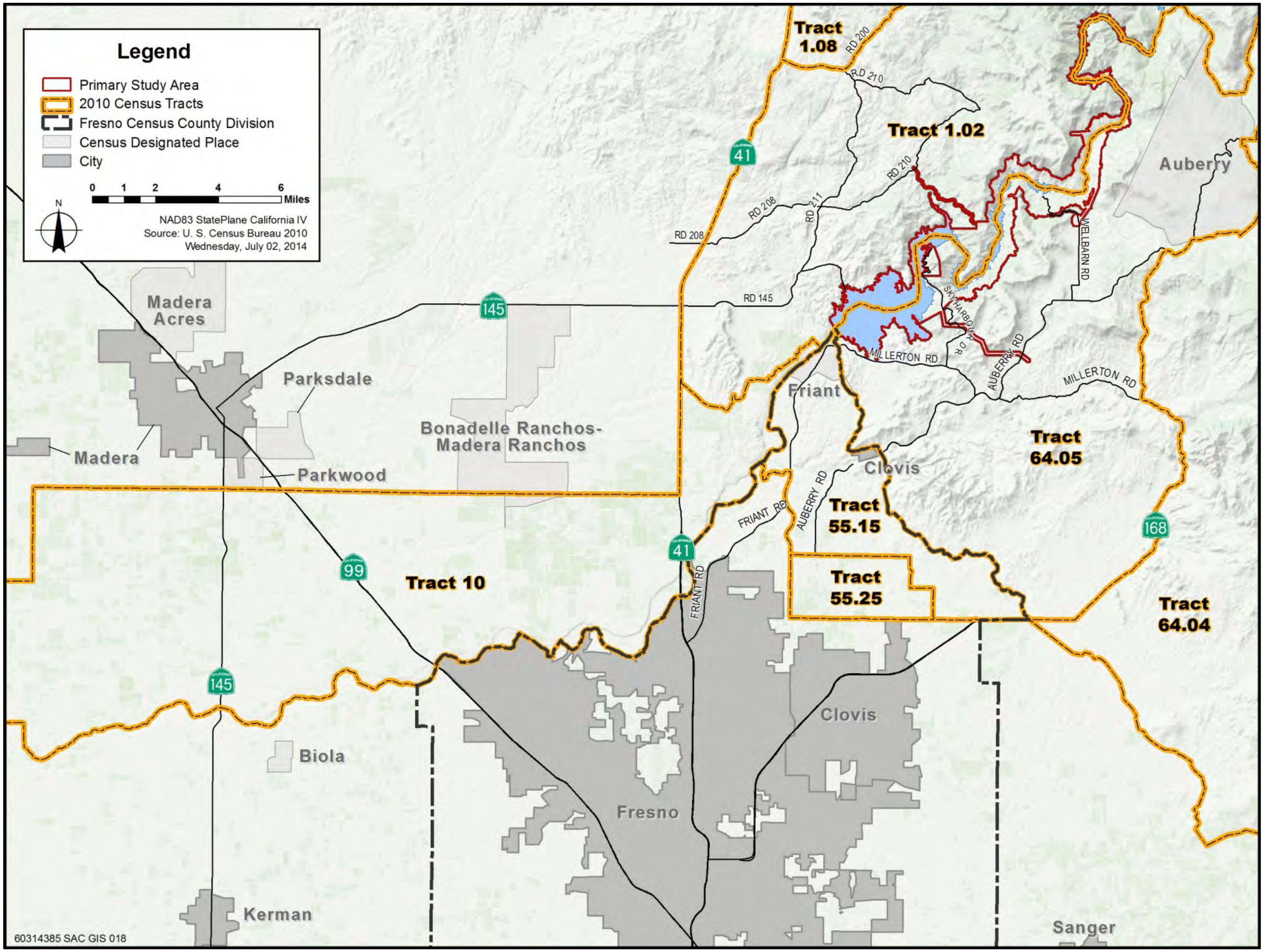


Figure 10-1. Census Tracts in the Primary Study Area

Table 10-1. Racial Composition and Ethnicity in the Primary Study Area, Fresno and Merced Counties, Nearby Cities, and State of California, 2010 (Percent of Total)

Geographic Area	White	Black/ African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Some Other Race	Two or More Races	Hispanic (Any Race)
Census Tract 64.05[1]	87.4	0.4	3.1	1.6	0.1	3.2	4.2	12.1
Census Tract 1.02[2]	80.8	0.8	10.0	0.8	0.1	2.2	5.3	10.2
Fresno County	55.4	5.3	1.9	9.6	0.2	23.3	4.5	50.3
Census Tract 55.15	79.0	1.6	1.6	8.5	0	4.5	4.8	14.4
Census Tract 55.25	81.7	1.6	1.1	8.4	0	3.1	4.2	15.8
Auberry CDP[3]	86.4	0.4	4.4	1.0	0.1	2.9	4.7	13.0
Friant CDP	85.1	0.8	2.8	1.4	0	2.2	7.9	12.4
City of Clovis	70.9	2.7	1.4	10.7	0.2	9.3	4.8	25.6
City of Fresno	49.6	8.3	1.7	12.6	0.2	22.6	5.0	46.9
Fresno CCD	54.2	6.9	1.7	12.0	0.2	20.2	4.8	43.1
Madera County	62.6	3.7	2.7	1.9	0.2	24.8	4.2	53.7
Census Tract 10	66.1	1.2	1.8	2.6	0.1	24.9	3.4	53.8
City of Madera	49.9	3.4	3.4	2.2	0.1	38.8	4.4	76.7
State of California	57.6	6.2	1.0	13.0	1.0	17.0	4.9	37.6

Source: U.S. Census Bureau 2010

Notes:

[1] Census Tract 64.05 is located within the Fresno County portion of the primary study area.

[2] Census Tract1.02 is located within the Madera County portion of the primary study area.

[3] The Auberry CDP is located within Census Tract 64.05.

Key:

CCD = Census-County Division

CDP = Census-Designated Place

Within the primary study area, the population of individuals identifying themselves as White in Census Tracts 64.05 and 1.02 and the Auberry CDP, which is located in Census Tract 64.05 (87.4 percent, 80.8 percent, and 86.4 percent, respectively), and American Indian in these areas (3.1 percent, 10.0 percent, and 4.4 percent, respectively) was greater than that in Fresno and Madera counties; the nearby cities; and the State as a whole. Although not greater than 50 percent, the population percentages of Native Americans in Census Tract 64.05, the Auberry CDP, and Census Tract 1.02 are be considered meaningfully greater than for the State as a whole. The African American population and Asian population were substantially less than those in the surrounding communities and in the State as a whole.

People identifying themselves as Hispanic represented the largest non-White group in Census Tracts 64.05 and 1.02 and the Auberry CDP, accounting for approximately 12.1 percent, 10.2 percent, and 13.0 percent, respectively, of the total population. However, this percentage is substantially lower than the average county (54 percent) and city (50 percent) populations and the State population (37.6 percent) identified as Hispanic.

As described in Chapter 9, “Cultural Resources,” a strong likelihood exists that important Native American heritage locations are present within the primary study area. The Study Area was the focus of intensive Native American occupation during historic times, with a variety of religious, economic, historic, and other values identified by Native American groups and is currently used by these groups.

Low-Income Populations

Persons living with income below the poverty level are identified as “low-income” populations, according to the annual statistical poverty thresholds established by the U.S. Census Bureau. Income thresholds that vary by family size and composition to determine which families are living in poverty. Poverty thresholds do not vary geographically but are updated annually for inflation using the Consumer Price Index. According to the U.S. Census Bureau, the poverty threshold in 2011 was $11,484 for an individual and $22,891 for a family of four (U.S. Census Bureau 2011a).

Table 10-2 presents the median household income, per capita income, and proportion of individuals living below the poverty threshold for the potentially affected Census Tracts and

Auberry CDP within the primary study area and potentially affected areas outside of the primary study area, which consist of Census Tracts 55.15, 55.25, and 10; the Friant CDP; the nearby cities of Clovis, Fresno, and Madera; the Fresno CCD; Fresno and Madera counties; and the State of California as a whole. Data in Table 10-2 were obtained from the U.S. Census Bureau 2007–2011 American Community Survey (ACS). Estimates from the ACS are all "period" estimates that represent data collected over a period of time (as opposed to "point-in-time" estimates, such as the decennial census, that approximate the characteristics of an area on a specific date). The primary advantage of using multiyear estimates in this analysis of low-income populations is the increased statistical reliability of the data for less populated areas and small population subgroups.

Table 10-2. Median Household Income and Poverty Levels in the Primary Study Area, Fresno and Merced Counties, Nearby Cities, and State of California, 2011

Geographic Area	Median Household Income	Per Capita Income	Percent of Population Below Poverty Level
Census Tract 64.05[1]	$73,750	$34,854	3.9
Census Tract 1.02[2]	$51,339	$27,547	12.9
Fresno County	$46,903	$20,638	23.4
Census Tract 55.15	$108,681	$56,702	2.0
Census Tract 55.25	$79,420	$38,443	6.2
Auberry CDP[3]	$70,096	$31,289	3.4
Friant CDP	$24,152	$23,924	7.3
City of Clovis	$65,300	$27,749	10.4
City of Fresno	$43,440	$19,978	25.9
Fresno CCD	$47,875	$22,063	22.6
Madera County	$47,724	$18,817	19.8
Census Tract 10	$21,904	$8,484	22.1
City of Madera	$41,991	$14,685	26.1
State of California	$60,632	$29,674	14.4

Source: U.S. Census Bureau 2011b

Notes:

Values are presented in 2011 dollars.

[1] Census Tract 64.05 is located within the Fresno County portion of the primary study area.

[2] Census Tract 1.02 is located within the Madera County portion of the primary study area.

[3] The Auberry CDP is located within Census Tract 64.05.

Key:

CCD = Census-County Division

CDP = Census-Designated Place

As shown in Table 10-2, the median household income (2011 dollars) for both counties and the majority of the nearby communities outside of the primary study area is less than the statewide median household income ($60,632). The Friant CDP registered the highest median household income, approximately $108,681. Census Tract 10 recorded the lowest median household income ($41,991), which averaged $19,000 less than the State's average and lowest per capita income ($14,685).

The population percentage in counties and nearby communities outside of the primary study area below the poverty level does not exceed 50 percent and is not meaningfully greater than the percentage of the population in the State and is not twice as great as those of the State. The percentage of populations of Fresno and Madera Counties at income levels below the poverty threshold (23.4 percent and 19.8 percent, respectively) were higher than the statewide average of 14.4 percent. The City of Fresno had the highest poverty rate (25.9 percent) in the area, and Census Tracts 55.15 and 55.25 (2.0 percent and 6.2 percent, respectively), the Friant CDP (7.3 percent), and Clovis (10.4 percent) had proportions below the statewide poverty threshold.

It should be noted that Fresno and Madera counties and the cities of Fresno and Madera exhibit relatively high proportions of low-income residents, although the proportion does not exceed 28.8 percent, suggesting that there are clusters of low-income residents present in each of these urban centers. Overall, the distribution of employment for the low-income populations in both counties and cities by industry is similar. A greater percentage of residents were employed in agricultural, forestry, and mining industries, with Madera County and City of Madera having the highest percentage (17.9 percent and 27.8 percent, respectively), when compared to the primary study area (U.S. Census Bureau 2011b).

Within the primary study area, Census Tract 64.05 and the Auberry CDP had median household incomes ($73,750 and $70,096, respectively) that were substantially greater than the statewide median household income ($60,632), and the per capita income of Census Tract 64.05 and the Auberry CDP ($34,854 and $31,289, respectively) were greater than the statewide per capita income ($29,674). Census Tract 1.02 had a median household income ($51,339) and per capita income ($27,547) that were less than the State's average but greater than the median household income and per capita income of Fresno and Madera counties and the cities of Fresno and Madera in 2010. The population below poverty threshold in the Census Tracts 64.05 and 1.02 (3.9 percent and 12.9 percent, respectively) and the Auberry CDP (3.4 percent) was lower than both counties and nearby cities, with the exception of Clovis, and lower than the State as a whole (14.4 percent).

Census Tracts 64.05 and 1.02 consist of smaller rural communities that provide tourism and recreational services to the Millerton Lake area. These Census Tracts exhibit a lower proportion of low-income residents than Fresno and Madera counties and the cities of Fresno, Clovis, and Madera. Within Census Tracts 64.05 and 1.02, the percentage of workers employed in the arts, entertainment, and accommodations industry (10.3 percent and 20.1 percent, respectively) was greater than that in the surrounding urban areas (U.S. Census Bureau 2011b).

Extended Study Area

The portion of the San Joaquin River extending from Friant Dam to the confluence with the Merced River is now subject to changed instream flows associated with implementing the SJRRP. Interim and Restoration flows have not resulted in a physical change that substantially affected minority and low-income populations (SJRRP 2009).

All of the action alternatives would deliver some portion of the new water supply from Temperance Flat RM 274 Reservoir to the Friant Division of the CVP and SWP water users. Alternative Plans 2, 3, 4, and 5 would also deliver additional water supply to CVP SOD contractors. These deliveries would be dispersed over the 36 counties that are served by the CVP and SWP and would be less discernible to a single jurisdiction. Implementing any of the action alternatives would improve surface water supply reliability to agricultural producers in the CVP and SWP water service areas. About 30 percent to 60 percent of the water made available for delivery would be conveyed directly to Friant Division water contractors, depending on the alternative plan implemented. Therefore, increased surface water reliability would provide the greatest benefit to agricultural water users in the six counties within the Friant Division water service area (i.e., Fresno, Kern, Kings, Madera, Merced, and Tulare counties). This description of the environmental justice setting focuses on this six-county area. Environmental justice demographic data are also provided for the State of California to provide a basis for comparison of the six-county area to a larger reference area.

Minority Populations

Table 10-3 presents racial and ethnic characteristics for the six counties within the Friant Division of the CVP water service area and for the State of California. These data are from the most recent decennial census completed in 2010 that provided racial and ethnic heritage data at the countywide and statewide level.

Table 10-3. Racial Composition and Ethnicity in the Six-County Friant Division Water Service Area and State of California, 2010 (Percent of Total Population)

Geographic Area	White	Black/ African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Some Other Race	Two or More Races	Hispanic (Any Race)
Fresno County	55.4	5.3	1.9	9.6	0.2	23.3	4.5	50.3
Kern County	59.5	5.8	1.5	4.2	0.1	24.3	4.5	49.2
Kings County	54.3	7.2	1.7	3.7	0.2	28.1	4.9	50.9
Madera County	62.6	3.7	2.7	1.9	0.2	24.8	4.2	53.7
Merced County	58.0	3.9	1.4	7.4	0.2	24.5	4.7	54.9
Tulare County	60.1	1.6	1.6	3.4	0.1	29.0	4.2	60.6
State of California	57.6	6.2	1.0	13.0	1.0	17.0	4.9	37.6

Source: U.S. Census Bureau 2010

Most of the people in this six-county area are White, but the proportion of population identified as White varies substantially between counties. The White population of Madera County (62.6 percent) in 2010 was the highest proportion of any county in the area, while Kings County had the lowest proportion of White residents (54.3 percent). Kings County (7.2 percent) registered a higher percentage of African Americans than the State as a whole (6.2 percent). The American Indian populations in all six counties were higher than the State's population (1.0 percent), and the Asian populations in all six counties were less than the State's population (13.0 percent). The proportions of residents responding as being Pacific Islander are generally consistent with the statewide levels. The proportions of residents responding as "some other race" in all six counties were also substantially higher than the statewide levels (17.0 percent). In all of the counties, the Hispanic population represented the largest non-White population, ranging from 49.2 percent in Kern County to 60.6 percent in Tulare County. No other sizeable variations in minority populations were observed between State and county levels.

Low-Income Populations

Table 10-4 presents the median household income and per capita income in 2011 dollars, and the proportion of individuals living below the poverty threshold for the six-county area. The median household income and per capita income were less than the State ($60,632 and $29,674, respectively), and the poverty level was greater than the statewide average (14.4 percent) for all six counties. Fresno County had the highest median and per capita income ($49,903 and $20,638, respectively), and Tulare County had the lowest median and per capita income ($43,550 and $17,986, respectively). The percentage of populations at income levels below the poverty threshold ranged from 19.3 percent in Kings County to 23.8 percent in Tulare County.

Table 10-4. Median Household Income and Poverty Levels in the Friant Division, and State of California, 2011

Geographic Area	Median Household Income	Per Capita Income	Percent of Population Below Poverty Level
Fresno County	$49,903	$20,638	23.4
Kern County	$48,021	$20,167	21.4
Kings County	$48,838	$18,296	19.3
Madera County	$47,724	$18,817	19.8
Merced County	$43,945	$18,304	23.0
Tulare County	$43,550	$17,986	23.8
State of California	$60,632	$29,674	14.4

Source: U.S. Census Bureau 2011b
Note:
Values presented in 2011 dollars.

Environmental Consequences and Mitigation Measures

This section describes the methods of environmental evaluation, assumptions, and specific criteria that were used to determine whether implementing any of the alternatives might cause disproportionately high and adverse human health or environmental impacts on minority or low-income populations. Where the action alternatives would have identical or nearly identical impacts regardless of which action alternative is implemented, the action alternatives are described together. Where impacts would differ, the action alternatives are described separately. The potential impacts are summarized in Table 10-5.

Table 10-5. Summary of Impacts and Mitigation Measures for Environmental Justice

Impact	Study Area	Alternative	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
ENJ-1: Disproportionately High and Adverse Impacts on Minority and Low Income Populations	Primary Study Area	No Action Alternative	NDHA	None Required	NDHA
		Alternative Plan 1	DHA	ENJ-1: Implement Mitigation Measure CUL-1, Precautions for Limiting Post-Construction Vandalism to Cultural Resources	DHA
		Alternative Plan 2	DHA		DHA
		Alternative Plan 3	DHA		DHA
		Alternative Plan 4	DHA		DHA
		Alternative Plan 5	DHA		DHA
	Extended Study Area	No Action Alternative	NDHA	None Required	NDHA
		Alternative Plan 1	NDHA		NDHA
		Alternative Plan 2	NDHA		NDHA
		Alternative Plan 3	NDHA		NDHA
		Alternative Plan 4	NDHA		NDHA
		Alternative Plan 5	NDHA		NDHA

Key:
DHA = disproportionately high and adverse
NDHA = not disproportionately high and adverse

Methods and Assumptions

For the purposes of this environmental justice analysis, racial and ethnic characteristics were obtained from the U.S. Census Bureau 2010 decennial census, and income characteristics and poverty status were obtained from the U.S. Census Bureau 2007–2011 ACS. As discussed above, the environmental justice population was determined to be areas that could be subject to construction- or operation-related impacts associated with implementing any of the action alternatives, including Census Tract 64.05, Census Tract 1.02, and the Auberry CDP in the primary study area. Potentially affected areas outside of the primary study area, consisting of Census Tract 55.15, Census Tract 55.25, Census Tract 10, the Friant CDP, and the Fresno CCD, were also analyzed. Finally, the nearby cities of Clovis, Fresno, and Madera, and the entire Fresno and Madera county areas, were also evaluated. Environmental justice demographic data are also presented for the entire state to provide a basis for comparison to a larger reference area.

According to CEQ and EPA guidelines, the first step in conducting an environmental justice analysis is to define minority and low-income populations (CEQ 1997). Based on these guidelines, a meaningfully greater minority population is present if it meets one of the following criteria:

- The minority population of the affected area exceeds 50 percent.
- The proportion of the minority population residing in the affected area is meaningfully greater than the proportion of the minority population in the general population or other appropriate unit of geographic analysis.
- The proportion of population in the primary study area whose income is below the poverty level, as defined by the U.S. Census Bureau, exceeds 50 percent.
- The proportion of people living in households below the poverty threshold is meaningfully greater than the proportion of the general population or other appropriate unit of geographic analysis who live below the poverty level.

The second step of an environmental justice analysis requires that a determination be made as to whether a “high and adverse" impact would occur. The CEQ guidance indicates that when determining whether the impacts are high and adverse, agencies are to consider whether the risks or rates of impact "are significant (as that term is defined by the NEPA lead agency) or above generally accepted norms."

The final step requires a determination as to whether the impact on the minority or low-income population would be "disproportionately high and adverse." Although there are no published guidelines defining the term "disproportionately high and adverse," CEQ includes a nonquantitative definition stating that an impact is disproportionate if it appreciably exceeds the risk to the general population. If an impact remains significant after all mitigation is implemented, then the impact is included in the environmental justice analysis, and the equity of the impact across the affected population is determined. For impacts determined to be less than significant or less than significant with implementation of mitigation, no additional evaluation is needed because those effects would not result in disproportionate effects on minority and low-income populations.

Criteria for Determining Significance of Impacts

An environmental document prepared to comply with NEPA must consider the context and intensity of the environmental impacts that would be caused by, or result from, implementing the No Action Alternative and other alternatives. Under NEPA, the severity and context of an impact must be characterized. To make a finding that disproportionately high and adverse impacts would likely fall on a minority or low-income population, the following three conditions must be met simultaneously:

- A minority or low-income population must reside in the affected area.
- A high and adverse impact on the natural or physical environment must exist.
- The impact on the minority or low-income population must be disproportionately high and adverse.

The EPA's environmental justice guidance states that "impacts that may affect a cultural, historical, or protected (e.g., treaty) resource of value to an Indian Tribe or a minority population, even when the population is not concentrated in the vicinity" should be considered in an environmental justice analysis (EPA

1998). A qualitative evaluation of the potential to affect traditional cultural properties or sacred sites or areas was conducted based on the results of record searches at the Information Center and California NAHC (see Chapter 9, “Cultural Resources”). Sixteen groups, including those listed by the NAHC, represent Native American interests in the Study Area: the Big Sandy Rancheria of Western Mono Indians; Choinumni Tribe; Cold Springs Rancheria of Mono Indians; Dumna Tribal Government; the Dumna Wo-Wah Tribal Government; Dunlap Band of Mono Indians; North Fork Mono Tribe; North Fork Rancheria; Nototonme/North Valley Yokut Tribe, Inc.; Picayune Rancheria of the Chukchansi Indians; Tachi-Yokut Tribe (Santa Rosa Rancheria); Sierra Nevada Native American Coalition; Southern Sierra Miwuk Nation; Table Mountain Rancheria; Tule River Tribe; and the Traditional Choinumni Tribe. Tribal consultation for the Investigation is pending.

Topics Eliminated from Further Consideration

No topics related to environmental justice that are included in the significance criteria listed above were eliminated from further consideration. All relevant topics are analyzed below.

Direct and Indirect Effects

This section describes the environmental consequences of implementing any of the alternatives. Where the action alternatives would have identical or nearly identical impacts regardless of which action alternative is implemented, the action alternatives are described together. Where impacts would differ, the action alternatives are described separately.

Impact ENJ-1: Disproportionately High and Adverse Impacts on Minority and Low-Income Populations

Primary Study Area

No Action Alternative Under the No Action Alternative, none of the action alternatives would be constructed, and there would be no physical changes to the environment. Existing facilities in the primary study area would continue to be operated similar to current conditions.

No disproportionately high and adverse impacts on minority or low-income populations in the primary study area would occur.

Action Alternatives As shown in Table 10-1, no minority or low-income populations in Census Tract 64.05, the Auberry

CDP in Fresno County, or Census Tract 1.02 in Madera County are greater than 50 percent of the total population or proportionally larger than in either county or the State. Although not greater than 50 percent, the population percentages of Native Americans in Census Tract 64.05, the Auberry CDP, and Census Tract 1.02 are be considered meaningfully greater than for the State as a whole, as shown in Table 10-1. The Hispanic population within Fresno and Madera counties is greater than the 50 percent threshold and is substantially greater than the average State population identified as Hispanic (37.6 percent), as shown in Table 10-1.

The percentage of the population below the poverty level in Census Tract 64.05 (3.9 percent), the Auberry CDP (3.4 percent), and Census Tract 1.02 (12.9 percent) does not exceed 50 percent and is not considered meaningfully greater than the percentage of the population in the State that is living in poverty (28.8 percent), as shown in Table 10-2. Similarly, none of the population outside of the primary study area exceeds 50 percent of the population in the State living in poverty and therefore is not considered meaningfully greater, as shown in Table 10-2.

It should be noted that Fresno and Madera counties and the cities of Fresno and Madera exhibit relatively high proportions of low-income residents, although the proportion does not exceed 28.8 percent, suggesting that there are clusters of low-income residents present in each of these urban centers. A Cumulative Environmental Vulnerability Assessment (CEVA) was prepared for the eight counties that comprise the San Joaquin Valley. The CEVA considers the combined single, multiple, routine, and accidental release of hazardous materials and air quality emissions and produces spatial analysis that identifies the places that are subject to both the highest concentrations of cumulative environmental hazards and the fewest social and economic resources to prevent, reduce, or adapt to these conditions. The CEVA determined that substantial overlap between environmental hazards and social vulnerability that occurs in many rural areas throughout the San Joaquin Valley where minority and low-income communities reside in the vicinity of agricultural fields, regional transportation corridors, and non-agricultural industries such as power plants and waste disposal facilities. In the primary study area, areas within and adjacent to the Fresno CCD are shown to be areas with high vulnerability levels (Ganlin and London 2012).

Implementing any of the action alternatives could cause disproportionately high and adverse impacts on minority and low-income populations because the population percentages of American Indian in the primary study area is meaningfully greater than for the State; the Hispanic population in areas adjacent to the primary study area is greater than 50 percent of the total population and the State as a whole; and there are likely clusters of low-income populations within this area.

After consideration of actions, operations, and features to avoid, mitigate, and/or compensate for adverse impacts, implementing any of the action alternatives would likely result in significant and unavoidable or potentially significant and unavoidable direct and indirect impacts on local air quality and GHG emissions, aquatic resources, botanical resources, terrestrial biological resources, geology and soils, land use planning and agricultural resources, noise and vibration, power and energy, public health and hazards, recreational opportunities, and visual resources. The following discussion summarizes significant and unavoidable impacts identified in these resource chapters and discusses the potential for those impacts to result in disproportionately high and adverse effects on minority populations in the primary study area.

As discussed in Chapter 4, “Air Quality and Greenhouse Gas Emissions,” implementing the action alternatives would result in generation of criteria air pollutant (PM_{10}) and precursor emissions (ROG and NO_X) due to construction (Impact AQ-1, significant and unavoidable) and generation of GHG emissions due to construction activities, recreation visitation, energy consumption, and loss of CO_2 sequestration from vegetation clearing (Impact AQ-4, significant and unavoidable). Construction would cause temporary air quality impacts, and these short-term impacts would be localized to the inundation areas. Long-term air quality impacts would occur throughout the primary study area and affect the primary study area’s population equally, regardless of race, ethnicity, or income level.

Chapter 5, “Biological Resources – Fisheries and Aquatic Resources,” Chapter 6, “Biological Resources – Botanical and Wetlands,” and Chapter 7, “Biological Resources – Wildlife,” addressed impacts on fish species, riparian habitat and sensitive natural communities, and special-status wildlife species. Implementing the action alternatives would result in the loss of riverine habitat for lotic fish species (Impact FSH-1, significant and unavoidable); loss of existing spawning habitat of

American shad and spawning habitat of striped bass (Impact FSH-9, significant and unavoidable); change in water temperature conditions supporting juvenile salmon and steelhead migration (Impact FSH-11, significant and unavoidable); effects on Delta fish habitat from changes in water temperature and DO concentrations (Impact FSH-18, potentially significant and unavoidable); loss of riparian habitat and other sensitive natural communities (Impact BOT-2, significant and unavoidable); and substantial impact on special-status raptors (Impact WLD-3, significant and unavoidable). There are no minority or low-income populations in the area that subsist on aquatic, botanical, and terrestrial biological resources; therefore, there would not be a disproportionately high and adverse human health or environmental effect on minority populations and low-income populations, including tribal populations.

Chapter 9, "Cultural Resources," states implementing the action alternatives would result in significant and unavoidable impacts from disturbance or destruction of known or previously undiscovered prehistoric resources due to construction, inundation, and project operation (Impact CUL-1, significant and unavoidable); disturbance or destruction of known or previously undiscovered historic-era resources due to construction, inundation, and project operation (Impact CUL-2, significant and unavoidable); destruction or damage to traditional cultural properties (Impact CUL-4, significant and unavoidable); and or destruction or damage to Indian sacred sites (Impact CUL-5, significant and unavoidable). The primary study area contains historic-era archaeological resources, including two mining sites, one location with two ore crushers, and a series of rock cairns, and multi-component sites, including some combination of bedrock milling loci, prehistoric or historic artifact scatters, and prehistoric or historic Native American residential evidence. No traditional cultural properties are known to exist in the primary study area; however, the potential for undocumented traditional cultural properties does exist. Documented sacred areas are located in the primary study area, and undocumented sacred areas or sacred sites may also be present in the primary study area.

Reclamation would follow the process in the implementing regulations at 36 CFR Part 800 to identify historic properties (including traditional cultural properties, sacred sites, and sacred areas, as appropriate), assess effects, and resolve adverse effects through the consultation process. Consulting parties for the National Historic Preservation Act Section 106 process would include the SHPO, the Advisory Council on Historic Preservation (if it chooses to participate), other Federal agencies where applicable, tribal representatives, and other interested parties (including non-Federally recognized Native Americans, members of the public, and other State or local agencies) to develop methods to avoid, minimize, or mitigate adverse effects. In addition, to ensure the long-term protection of these sites, a Cultural Resources Management Plan will provide guidelines to avoid, minimize, or mitigate impacts on historic properties and a long-term monitoring program to ensure that cultural resources are protected in the future, and the plan would aid in reducing adverse effects and vandalism to prehistoric resources. Implementation of mitigation measures would not reduce this impact to a less-than-significant level and the impact would remain significant and unavoidable. Therefore, destruction or damage to prehistoric resources, traditional cultural properties, or Indian sacred sites would result in a disproportionately high and adverse effect on Native American populations. Implementing the action alternatives would cause a substantial adverse change in the significance of a historical and/or unique archaeological resource, historic property, or historic district (Impact CUL-3, significant and unavoidable). The only known resources within the primary study area that have been identified as historic properties under Section 106 are related to Friant Dam. Impacts on Friant Dam would not affect any one minority population; therefore, no impacts on environmental justice populations would occur.

As discussed in Chapter 11, “Geology and Soils,” alteration of fluvial geomorphology could adversely affect aquatic habitat in the reservoir by creating new delta deposits (Impact GEO-2, potentially significant and unavoidable) and could cause substantial soil erosion or loss of topsoil due to construction and operations (Impact GEO-4, potentially significant and unavoidable). Impacts associated with geology and soils would not result in impacts on environmental justice populations.

As discussed in Chapter 17, “Land Use Planning and Agricultural Resources,” implementing the action alternatives could result in physical disruptions of existing land uses resulting from inundation affecting existing San Joaquin River crossings, trails, and roads (Impact LUP-1, potentially significant and unavoidable). These potential disruptions in land uses would occur in the immediate vicinity of the inundation area. None of these changes would affect minority populations in Census Tracts 64.05 and 1.02 and the Auberry CDP.

Conversion of farmland to nonagricultural uses and cancellation of Williamson Act Contracts (Impact LUP-3, potentially significant and unavoidable) would not directly affect minority populations. Indirectly, conversion of farmland could result in impacts associated with agricultural-related employment and income. Active agricultural land uses occur in the primary study area and grazing activities do not employ substantial numbers of workers; therefore, loss of grazing lands would not result in impacts on environmental justice populations.

The conversion of forestlands (Impact LUP-4, potentially significant and unavoidable) would not directly affect minority populations. Indirectly, conversion of forestland could result in impacts associated with timber harvest-related employment and income. Timber harvesting in the primary study area does not employ substantial numbers of workers; therefore, loss of forestlands would not result in impacts on environmental justice populations.

Implementing the action alternatives would result in potential conflicts with adopted land use plans, goals, and policies of affected jurisdictions, including the BLM Bakersfield Proposed RMP, Millerton Lake RMP and General Plan, and Big Table Mountain Ecological Reserve (Impact LUP-2, potentially significant and unavoidable); the Fresno County and Madera County general plan objectives and guidelines to protect natural communities (Impact WLD-10, significant and unavoidable); and with guidelines for visual resources in the BLM Bakersfield Proposed RMP (Impact VIS-1, significant and unavoidable). However, inconsistencies between adopted or proposed land use plans, goals, policies are related to land use regulations and not to a physical environmental consequence of project implementation. Therefore, no impacts on environmental justice populations would occur.

As discussed in Chapter 18, “Noise and Vibration,” exposure of sensitive receptors to noise generated by facility construction (Impact NOI-1, significant and unavoidable) and short-term exposure of sensitive receptors to construction-related traffic noise due to increases in traffic noise would occur within the primary study area (Impact NOI-3, significant and unavoidable). Long-term increases in traffic noise due to increases in daily traffic would result from improved conditions at Millerton Lake and additional recreational opportunities (Impact NOI-5, significant and unavoidable). These impacts would occur throughout the primary study area and affect the primary study area's population equally, regardless of race, ethnicity, or income level.

Implementing the action alternatives would result in a decrease in Kerckhoff Hydroelectric Project energy generation and ancillary services (Impact PWR-1, significant and unavoidable). As discussed in Chapter 20, "Power and Energy," electricity generated by the Kerckhoff Hydroelectric Project provides electrical supplies to cities and communities throughout the upper San Joaquin River Basin; therefore, impacts associated with a decrease in energy generation would affect the population equally, regardless of race, ethnicity, or income level.

As discussed in Chapter 22, "Recreation," implementing the action alternatives would result in the permanent loss of recreational opportunities associated with the Millerton Lake Cave System (Impact REC-2, significant and unavoidable), substantial or long-term reduction or elimination of recreation opportunities or experiences (Impact REC-3, significant and unavoidable), and the temporary loss of access to the Temperance Flat boat-in campground or SRA Temperance Flat and Big Bend areas during construction (Impact REC-4, significant and unavoidable). Various races, ethnicities, and income levels participate in recreational opportunities in the primary study area; therefore, these impacts would affect recreationists equally.

Implementing the action alternative would degrade and/or obstruct a scenic view (Impact VIS-2, significant and unavoidable), and increase daytime glare and/or nighttime lighting (Impact VIS-3, significant and unavoidable). As discussed in Chapter 26, "Visual Resources," changes in views and increased glare and nighttime lighting would affect recreational users, including motorists, hikers, campground users, and watercraft users and motorists, residents and nearby workers near Auberry Road and other local roads. These impacts would affect the primary study area's population equally, regardless of race, ethnicity, or income level.

As discussed in Chapter 23, "Socioeconomics, Population, and Housing," substantial employment and personal income in Fresno and Madera counties would be generated from construction- and operations-related activities and increased recreation visitation. These new jobs are expected to provide employment opportunities to many workers, particularly unemployed workers, and spending related to increases in personal income would result in new local economic activity in Fresno and Madera counties.

In addition, implementing any of the action alternatives would also result in a substantial increase in business income and local sales tax revenue in Fresno and Madera counties from spending of personal income and expenditures and purchases. Increased revenues could be reinvested into existing businesses, invested in new ventures or diversification, translated into increased salaries and wages for employees, and/or used in other ways. These increased employment and income opportunities would likely benefit minority and low-income populations in the region.

Disproportionately high and adverse impacts on minority or low-income populations in the primary study area could occur under the action alternatives. Mitigation for this impact is proposed below in the Mitigation Measures section.

Extended Study Area

No Action Alternative   Under the No Action Alternative, no changes in water supply delivery or flood storage operations for Friant Dam would occur, and there would be no substantial changes from existing conditions.

No disproportionately high and adverse impacts on minority or low-income populations in the CVP and SWP water service areas would occur.

Action Alternatives   The Friant Division of the CVP, other CVP SOD contractors, and SWP contractors are considered as beneficiaries in the action alternatives. Each action alternative would deliver some portion of the new water supply from Temperance Flat RM 274 Reservoir to the Friant Division of the CVP and SWP water users. Alternative Plans 2, 3, 4, and 5 would also deliver new supply to CVP SOD contractors.

No significant and unavoidable impacts were identified to occur in the CVP and SWP water service areas that could cause disproportionately high and adverse impacts on minority and low-income populations. Therefore, none of the action alternatives would have environmental impacts in the CVP and SWP water service areas that would disproportionately affect minority or low-income populations.

Improved surface water reliability expected to result from implementing any of the action alternatives would result in less crop idling, thereby increasing agricultural production and net income. Within the CVP and SWP water service areas, the increased surface water reliability would provide the greatest economic benefits to agricultural water users in the six counties within the Friant Division of the CVP water service area (i.e., Fresno, Kern, Kings, Madera, Merced, and Tulare counties).

Agricultural water users in the CVP and SWP water service areas outside of the Friant Division of the CVP would also benefit from increased surface water reliability; however, these economic impacts would be dispersed over the 36 counties that are served by the CVP and SWP and would be less discernible to a single jurisdiction. There would be beneficial impacts on the population at large in the water service areas that cannot be reduced to discrete benefits for any particular segment of the population, but it is likely that minority and low-income populations in the CVP and SWP water service areas would benefit from increased employment and income opportunities.

As discussed in Chapter 23, "Socioeconomics, Population, and Housing," agriculture-related income and spending would represent new local economic activity and provide employment opportunities to many workers, particularly unemployed workers in the CVP and SWP water service areas. In addition, implementing any of the action alternatives would also result in a substantial increase in business income and local sales tax revenue in the CVP and SWP water service areas from spending of personal income and expenditures and purchases. Increased revenues and profits could be reinvested into existing businesses, invested in new ventures or diversification, translated into increased salaries and wages for employees, or used in other ways. Therefore, these increased employment and income opportunities would likely benefit minority and low-income populations in the Friant Division and CVP and SWP water service areas outside of the Friant Division water service area.

No disproportionately high and adverse impacts on minority or low-income populations in the CVP and SWP water service areas would occur under the action alternatives. Mitigation for this impact is not needed and thus not proposed.

Mitigation Measures

As shown in Table 10-5, implementing the action alternatives would result in disproportionate high and adverse effects on environmental justice populations (i.e., Native Americans) in the primary study area (Impact ENJ-1). Mitigation Measure ENJ-1, described below, is proposed for Impact ENJ-1.

No disproportionately high and adverse impact on minority or low-income populations would occur within the extended study area, as presented in Table 10-5. No further mitigation is proposed.

Mitigation Measure ENJ-1: Implement Mitigation Measure CUL-1, Precautions for Limiting Post-Construction Vandalism to Cultural Resources

Chapter 9, "Cultural Resources," states implementation of the action alternatives would result in significant impacts from destruction or damage to traditional cultural properties or Indian sacred sites. Implementation of Mitigation Measure CUL-1 would reduce this impact but not to a less-than-significant level, and the impact would remain significant and unavoidable. Therefore, destruction or damage to traditional cultural properties or Indian sacred sites, Impact ENJ-1, would result in a disproportionately high and adverse effect on Native American populations under the action alternatives. No further mitigation is proposed.