3.0 Affected Environment

This section provides an overview of the physical environment and existing conditions that could be affected by the Proposed Action consistent with NEPA and CEQA guidelines. The magnitude of potential effects of the No-Action Alternative and Proposed Action, and whether the resulting effects are potentially significant, influences the level of specificity at which each resource is addressed in this section. The baseline environmental conditions assumed in this EA/IS consist of the existing physical environment as of October 2008, when the environmental process and analysis for the EA/IS was initiated. Even though this section is titled “Affected Environment” for the purposes of NEPA, it also constitutes the “Environmental Setting” required under CEQA.

3.1 Considerations for Describing the Affected Environment

The study area is broadly defined to evaluate potential environmental effects of the Proposed Action. The areas where effects may occur differ according to resource area; therefore, the geographic areas described vary by resource. Within the affected environment description for each resource, subsections are organized geographically by up to five subareas, as appropriate: the San Joaquin River upstream from Friant Dam; the San Joaquin River from Friant Dam to the confluence with the Merced River (Restoration Area), including bypasses and tributaries; the San Joaquin River downstream from the confluence with the Merced River to the Delta; the Delta; and CVP/SWP water service areas. The affected environment descriptions do not address geographic subareas in which a resource would not be affected.

Information is provided in the affected environment subsections to the extent necessary for understanding the extent of anticipated impacts, in particular any anticipated impacts that may be significant. Consequently, more detailed information is provided for resources that have greater potential for significant effects, such as hydrology/water quality and biological resources; less information is provided for other resource areas.

Information used to develop the affected environment sections included published environmental and planning documents, books, journals, articles, Web sites, field surveys, and communications with technical experts and agencies. Information developed from the Settlement or in the planning stages of the SJRRP was also used extensively.

3.1.1 NEPA Requirements

CEQ regulations for implementing NEPA specify that environmental documents must succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration. The descriptions shall be no longer than necessary to understand the effects of the alternatives. Data and analyses must be commensurate with the importance of an impact, with less important material summarized, consolidated, or simply referenced (40 CFR 1502.15).

3.1.2 CEQA Requirements

Section 15125(a) of the Guidelines for Implementing CEQA states that an environmental document must include a description of the physical environment conditions in the vicinity of a project, as they exist at the time that the Notice of Preparation (NOP) is published, or if no NOP is published, at the time the environmental analysis commences, from both a local and regional perspective. This environmental setting will normally constitute the baseline physical conditions by which the lead agency determines whether an impact is significant.

3.2 Aesthetics

The existing visual environment in the SJRRP study area is described in this section in terms of landform (topographic relief) and land cover (vegetation, water, or built environment). The overall visual quality of the study area was assessed qualitatively. The visual quality of the study area landscapes is described as “high,” “moderate,” or “low,” using the following qualitative terms:

- **Vividness** describes the presence of distinctive landscape features, such as topographic relief, geologic formations, color, or patterns that combine to form a striking or memorable visual pattern.

- **Intactness** describes the integrity of a landscape and the degree to which it is free from incongruous or out-of-place features that detract from the visual pattern.

- **Unity** describes the appearance of the landscape as a whole and the degree to which the visual elements maintain a coherent visual pattern.

Visual resources are described below for the San Joaquin River upstream from Friant Dam; the Restoration Area; and the San Joaquin River from Merced River to the Delta. There would be no project-related effects on aesthetic resources in the Delta and CVP/SWP water service areas; therefore, these geographic subareas are not discussed below.

3.2.1 San Joaquin River System Upstream from Friant Dam

The regional landform upstream from Friant Dam is characterized by relatively steep slopes and ravines, transitioning to rolling foothill terrain in the lower elevations. In the 9-mile reach of the San Joaquin River between Kerckhoff Dam and Millerton Lake, several small, ephemeral streams enter the San Joaquin River. San Joaquin River flow is diverted at Kerckhoff Dam through tunnels to the Pacific Gas and Electric Company (PG&E) Kerckhoff and Kerckhoff No. 2 powerhouses, situated on the San Joaquin River upstream from Millerton Lake.

Predominant land cover in this portion of the study area ranges from high alpine vegetation near the crest of the Sierra Nevada, through coniferous forest, mixed coniferous forest, oak woodlands and oak savannah, and grasslands in the lower elevations in the vicinity of Millerton Lake. Surface water is present in artificial impoundments, such as Millerton Lake; small natural lakes and ponds; rivers; and tributary streams. The built environment consists of roadways, small communities with low-density development, roadside businesses, diversion dams, powerhouses and associated high-voltage electrical transmission lines, and recreational facilities of the Millerton Lake State Recreation Area (SRA).

The scenic qualities of vividness, intactness, and unity in the upper reaches of the San Joaquin River watershed are generally high, especially in areas where there is limited built environment to intrude on views. The varied topography and geologic formations of the crest of the Sierra Nevada provide for striking views in the upper watershed. In the lower elevations, nearer to Millerton Lake, the human-built environment becomes more dominant and detracts from views of the natural landscape. No officially designated State scenic highways are located in or immediately adjacent to the Restoration Area.

Land cover surrounding Millerton Lake consists of grassland with scattered oak trees. The vividness of views of the lake surrounded by low-lying hills is moderate because of the increasing presence of the built environment. Millerton Lake typically fills during late spring and early summer, when San Joaquin River flows are high because of snowmelt in the upper watershed. During late winter and spring, surrounding hillsides are green and often covered with wildflowers, creating views with moderate to high vividness. Annual water allocations and release schedules typically result in drawing reservoir storage to near minimum levels by the end of September. The intactness of the views is moderate because this drawdown of the water level creates a “bathtub ring” effect that degrades the views of the lake by exposing barren shoreline during late summer and fall. Unity of the views of the lake is moderate because the degraded shoreline and recreational facilities create a sharp contrast to the surrounding natural landscape. The overall visual quality of the Millerton Lake area is moderate.

3.2.2 San Joaquin River from Friant Dam to Merced River

Visual resources of the Restoration Area are described in the following sections.

Reach 1

Observers in or adjacent to the river in Reach 1 would see a river channel and adjacent vegetated banks and bluffs with views having moderate vividness; however, the concrete structures of Friant Dam and associated diversion structures and canals, buildings, parking lots, and a fish hatchery visible above the river at the upper end of Reach 1A detract from the views. Downstream from Friant Dam, views are of naturally vegetated open space interspersed with golf courses, instream and offstream gravel operations, orchards, and row crops. Intactness of the views ranges from low in areas of gravel mining operations to moderate in areas where the riparian corridor and adjacent lands are relatively undisturbed. Unity of the views ranges from low in areas where adjacent land uses produce sharp visual contrasts (disturbed lands adjacent to natural areas) to moderate where land use types have softer edges (riparian corridor adjacent to natural or park lands). The overall visual quality in Reach 1A is low to moderate.

Observers adjacent to the river in Reach 1B would experience views with low vividness because of the lack of distinctive landscape features and the disturbed riparian corridor. Intactness of the views is somewhat degraded by the limited riparian vegetation coverage, disturbance resulting from gravel mining operations, and the contrasting managed agricultural landscape; intactness is low to moderate. Overall unity is low to moderate. The overall visual quality in Reach 1B is low.

The *San Joaquin River Parkway Plan* is a conceptual, long-range planning document intended to help preserve, enhance, and provide for enjoyment of the natural landscape of the San Joaquin River corridor (San Joaquin River Conservancy 2000). The San Joaquin River and land on both sides of the river in Reach 1 of the Restoration Area are included in the proposed parkway area.

Reach 2

The topography in Reach 2 is characterized by a sandy, meandering channel. Observers adjacent to the river in Reach 2 would experience views with low vividness because this reach lacks distinctive landscape features, including the Mendota Pool, which is sparsely vegetated. Features of the Mendota Pool include several pumps and canals to divert flows for meeting demands. Other features of this reach include the San Mateo Road crossing and the Chowchilla Bypass Bifurcation Structure, which is a major intrusive element. Therefore, intactness of this reach is considered low to moderate. Unity is low to moderate also because of intrusion of artificial structures and the contrast between the managed agricultural landscape and the meandering, sparsely vegetated stream channel in this reach. The overall visual quality in this reach is low.

Reach 3

The topography in Reach 3 is characterized by a sandy, meandering channel. This reach conveys perennial flows of Delta water released from the Mendota Pool to Sack Dam, where flows are diverted to the Arroyo Canal. The channel meanders approximately 23 miles through a predominantly agricultural area except where the City of Firebaugh borders the river’s west bank for 3 miles. One bridge crosses the river in this reach. A narrow, nearly continuous band of riparian vegetation consisting primarily of cottonwood riparian forest is present on at least one side of the channel, and several pump facilities and Arroyo Canal occur along this reach.

Observers adjacent to the river in Reach 3 would experience views with low vividness because of a lack of distinctive landscape features. Intactness of the views is low to moderate because of the presence of dams, diversion structures, and urban development, which intrude on views of the river corridor and adjacent agricultural landscape. Overall, the unity of the views is low in the vicinity of the diversion structures and moderate where the distinctive riparian corridor meanders through the more managed agricultural landscape. The overall visual quality in this reach is moderate.

Reach 4

Observers adjacent to the river in Reach 4A would experience views with low vividness because of the lack of distinctive landscape features. Intactness of the views in this reach is low because of the presence of intruding artificial structures and the degraded condition of the riparian corridor. Unity is low because of the sharp contrast between the degraded riparian area and the adjacent managed agricultural landscape. The overall visual quality in this reach is low.

Observers adjacent to the river in Reach 4B1 would experience views with low vividness because of the lack of distinctive landscape features. Intactness of the views is generally low because of the degraded condition of the riparian area. Unity is low because of the sharp contrast between the vegetation-choked river channel and wildlife refuge landscape on one side of the river and the managed agricultural landscape on the opposite side of the river. The overall visual quality in this subreach is low.

Observers adjacent to the river in Reach 4B2 would experience views with moderate vividness because of the wider floodplain with surrounding natural vegetation, and intactness is moderate because of the limited number of artificial structures that intrude on the views. Unity is moderate also because of the wider riparian corridor and adjacent areas of natural habitat. The overall visual quality in this subreach is moderate.

Reach 5

Observers adjacent to the river in Reach 5 would experience views with moderate vividness because of the views of the wider floodplain, with the meandering riparian corridors and expanses of surrounding naturally vegetated uplands. Intactness of the views is moderate because of the uninterrupted expanses of natural habitat and the limited number of artificial structures that intrude on the views. Unity of the views is moderate because the natural features of the landscape lack abrupt contrasts or changes. The overall visual quality in this reach is moderate.

Chowchilla Bypass and Tributaries

Observers in or adjacent to the bypass would experience views with low vividness because of the flat terrain and sparse vegetation, which are lacking in distinctive landscape features. The bifurcation structure, levees, and barren ground detract from the intactness of the views. Unity is low because the disparate landscape features do not form a coherent visual pattern. The overall visual quality of the bypass area is low. Visual qualities of the tributaries are similar to those of the bypass, with low vividness, low intactness, and low unity. Overall, visual qualities along these tributaries are low.

Eastside Bypass, Mariposa Bypass, and Tributaries

Observers in or adjacent to the Eastside and Mariposa bypasses would experience views with low vividness because of flat terrain and sparse vegetation lacking in distinctive landscape features. The intactness of the views is moderate because of the limited number of artificial structures that intrude on the views. Unity is low because the disparate landscape features do not form a coherent visual pattern. The overall visual quality of the bypass area is low. Visual qualities of the Eastside Bypass tributaries, including Deadman, Owens, and Bear creeks, are similar to those of the bypass, with low vividness, low intactness, and low unity. Overall, visual qualities along these tributaries are low.

3.2.3 San Joaquin River from Merced River to the Delta

Observers adjacent to the San Joaquin River in this portion of the study area would experience views with moderate vividness because of the wider floodplain with its meandering riparian corridors. Intactness of the views is moderate because of the limited number of artificial structures that intrude on the views. Unity of the views is moderate because the natural features of the landscape lack abrupt contrasts or changes. The overall visual quality in this reach is moderate. No officially designated State scenic highways are located along the San Joaquin River downstream from its confluence with the Merced River to the Delta.

3.3 Land Use/Planning and Agricultural Resources

The following sections summarize existing land uses and agricultural resources in the study area.

3.3.1 San Joaquin River Upstream from Friant Dam

California State Parks has an operating agreement with Reclamation to manage Millerton Lake as an SRA. Recreation is the primary land use along the shorelines of Millerton Lake.

3.3.2 San Joaquin River from Friant Dam to Merced River

The following subsections describe existing land uses in the Restoration Area, as well as agricultural resources, including Williamson Act lands.

Existing Land Uses

Land uses within the Restoration Area were identified and inventoried and placed into the following broad land use categories: agricultural, open space, and urban. Most of the land along the San Joaquin River downstream from Friant Dam is privately owned. Primary land uses are open space and agriculture. The acreage of open space areas (e.g., idle land, native vegetation, and aquatic environments, including open water) is shown in Table 3-1 and described after the table. Urban land uses (e.g., residential, commercial, industrial) account for only a small percentage of land use along the San Joaquin River. Table 3-1 shows the approximate acreages for each land use category along the San Joaquin River, by reach, and for the bypass areas.

Table 3-1.
Acreage of Land Uses Along the San Joaquin River in Restoration Area

River Reach	Land Use (acres)			
	Agricultural	Open Space	Urban	Total
Reach 1	9,436	4,480	1,916	15,832
Reach 2	6,068	3,009	96	9,173
Reach 3	6,150	1517	389	8,056
Reach 4	9,514	4901	24	14,439
Reach 5	821	4,615	26	5,460
Bypass Areas	10,235	9,341	47	19,623
Total	42,224	27,863	2,498	72,581
Percentage	58%	38%	4%	100%

Note: Acreage numbers have been rounded.

Agricultural land uses include a variety of different crop types and specific annual and permanent crops, although they are not separated for this analysis. These crops include, but are not limited to, the following examples:

- **Annual crops**, which comprise field crops (cotton, sweet corn, sugar beets, dry beans, and safflower); truck, nursery, and berry crops (lettuce, bell peppers, strawberries, melons, nursery products, eggplant, garlic, onions, asparagus, squash, broccoli, peas, and tomatoes); grain and hay crops (alfalfa, barley, wheat, oats, and other mixed grain and hay); and rice.
- **Vineyards**, which include a variety of grape types that may be used as table grapes or raisins or for wine.
- **Orchards**, which include citrus and subtropical crops (kiwifruit, lemons, nectarines, olives, and oranges), and deciduous fruit and nut crops (almonds, apples, sweet cherries, dried figs, peaches, persimmons, pistachios, plums, pomegranates, and walnuts).
- **Semiagricultural and incidental to agriculture**, which comprise apiary products, cattle, poultry, dairy, and wool. This category also includes other agriculture-related infrastructure, such as agricultural disposal areas, equipment maintenance areas, and storage areas.

Open space lands include the following categories, which are not separated:

- **Idle land** is cropland that is fallow but has been farmed within the past 3 years, or land that is being prepared for agricultural production. This also includes passive agriculture such as pasture (forage, irrigated, and range lands, and may include alfalfa, clover, and other native or mixed pasture plant species), and land which is not farmed because of proximity to the San Joaquin River floodplain.
- **Native vegetation** is composed of wetland/marsh, grassland, shrub/brush, and forest plant communities.
- **Aquatic environments** are lakes, reservoirs, rivers, and canals, and open water created by mining operations.

Urban land uses fall into a variety of categories, including residential, commercial/ industrial, and landscaped properties, such as golf courses, parks, and other uses. However, for purposes of this analysis, urban land uses were not separated. The following sections describe land use and ownership in the Restoration Area by reach. Figure 3-1 shows wildlife refuges, wildlife areas, ecological reserves, wildlife management areas, and state parks in the vicinity of the Restoration Area. There are approximately 195,260 acres of wildlife refuges, wildlife areas, ecological reserves, wildlife management areas, and parks (city, county, and State) in and adjacent to the Restoration Area: 2,175 acres in Reach 1; 85 acres in Reaches 2 and 3; 33,000 acres in Reach 4; and 160,000 acres in Reach 5. Uses in these public wildlife areas and parklands are described by reach in Section 3.14, “Recreation.”

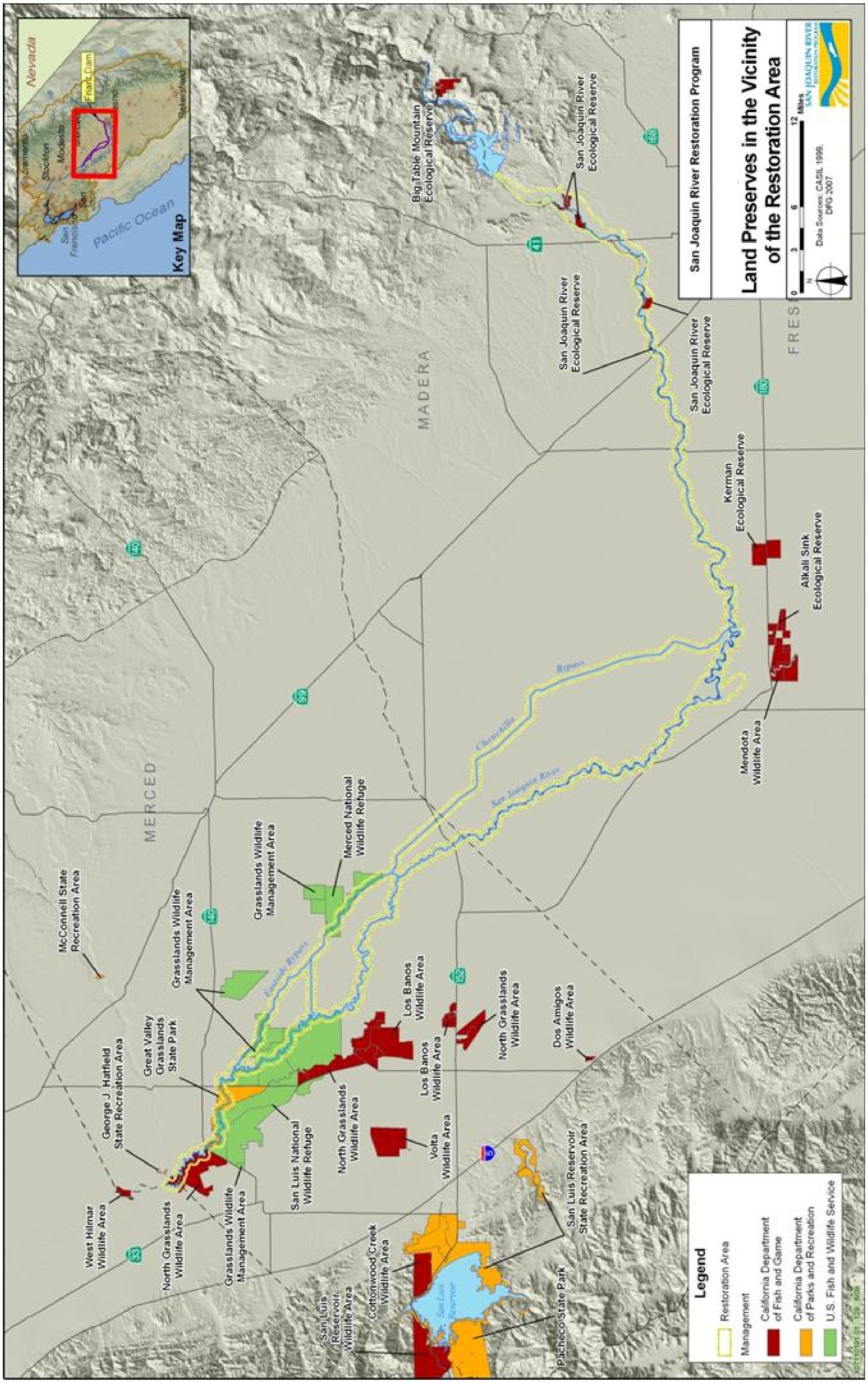


Figure 3-1.
Wildlife Refuges, Wildlife Areas, Ecological Reserves, Wildlife Management Areas, and State Parks in and adjacent to the Restoration Area

Reach 1. Reach 1 includes the City of Fresno, the town of Friant, and the unincorporated communities of Rolling Hills, Herndon, and Biola. The primary land use category of Reach 1 is agriculture (60 percent), followed by open space (28 percent) and urban land uses (12 percent). Approximately 93.8 percent of lands found in Reach 1 are privately owned.

The primary nonurban land uses along the remaining areas of Reach 1 are gravel mining, agriculture, and recreation/open space. Several active gravel quarries, and related roads and other infrastructure, are located adjacent to the river. Agricultural land uses include vineyards, annual crops, and orchards. Several recreation areas are located along Reach 1A.

Reach 2. All lands found in Reach 2 are privately owned. Similar to other reaches, the primary agricultural land uses along this reach are annual crops, vineyards, and orchards. Open space is the primary nonagricultural land use along Reach 2B, although there are no designated protected areas or recreation sites.

Reach 3. The primary land use in this reach is agriculture (76 percent). Annual crops account for most agricultural land uses in this reach. Open space is the primary nonagricultural land use, although there are no designated protected areas or recreation sites. The City of Firebaugh and associated connecting roads, located between the San Joaquin River and Helm Canal, are the only urban land uses found in Reach 3.

Reach 4. Most lands in this reach are either agricultural (66 percent) or open space (34 percent). Approximately 5 percent of land found in Reach 4 is categorized as urban. In the San Luis NWR, the Grasslands Wildlife Management Area (WMA) constitutes approximately 30 percent of the remaining wetlands in the Central Valley, a portion of which are in the Restoration Area.

Reach 5. This reach has the highest percentage of open space lands (85 percent) of the five reaches. Most of the remaining lands found in Reach 5 are categorized as agricultural (13 percent). Urban lands account for approximately 2 percent of lands in this reach. Reach 5 also has the lowest percentage of private lands (22 percent) of the five reaches. Public lands account for approximately 78 percent of lands in this reach.

There are no designated communities in this reach, and most of the lands adjacent to the San Joaquin River are considered rural and provide important open space and wildlife values to Merced County. Open space is the primary land use in this reach and is protected in the San Luis NWR, Great Valley Grasslands State Park, and George J. Hatfield SRA.

Chowchilla Bypass and Tributaries. The primary land use along the Chowchilla Bypass is agriculture; irrigated fields are located along both sides of the bypass. The bypass is also used for livestock grazing. Several roads parallel the bypass, and four roadway crossings provide access across it. Few other urban areas are located along the Chowchilla Bypass.

Eastside and Mariposa Bypasses and Tributaries. The primary land uses along the Eastside Bypass are agriculture and open space. The bypass is also used for livestock grazing. In general, irrigated crops are prevalent south of the Mariposa Bypass, whereas open space is the principal land use north of the Mariposa Bypass between the Eastside Bypass and the San Joaquin River. The Merced NWR is also located along the Eastside Bypass, south of West Sandy Mush Road between the start of the bypass and the Mariposa Bypass diversion. Several access roads parallel the Eastside Bypass south of the Mariposa Bypass, and 11 bridges provide access across the bypass. Grazing is prevalent along the Eastside and Mariposa Bypasses; exceptions are refuge-designated areas (i.e., the Lone Tree Unit of the Merced NWR).

Agricultural Resources, Including Williamson Act Lands

The State has developed processes to discourage continued conversion of agricultural land to nonagricultural uses. The use of Williamson Act contracts and Farmland Security Zones (also known as Super Williamson Act lands) enables local governments to provide private landowners with tax incentives to continue agricultural or related open space uses. Table 3-2 shows Williamson Act lands, including "Lands in Nonrenewal," which will not be continued as Williamson Act lands.

Table 3-2.
Acreage of Williamson Act Lands in the Restoration Area

River Reach	Williamson Act Lands[1] (acres)	Lands in Nonrenewal (acres)	Total (acres)
Reach 1	4,201	475	4,676
Reach 2	6,756	0	3,527
Reach 3	5,664	0	5,664
Reach 4	8,010	0	8,010
Reach 5	1,441	0	1,441
Bypasses	8,828	0	8,828
Total	34,902	475	35,377

Sources: California Department of Conservation 2004a, 2005, 2006; Madera County 2008.
Note:
[1] These acreages include Farmland Security Zone lands.

The State of California Farmland Mapping and Monitoring Program (FMMP) classifies agricultural lands. The following Important Farmland classifications are used in the FMMP (California Department of Conservation 2004b):

- **Prime Farmland** – Farmland with the best combination of physical and chemical features able to sustain long-term agricultural production. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields. Land must have been used for irrigated agricultural production at some time during the 4 years before the mapping date.

- **Farmland of Statewide Importance** – Farmland similar to Prime Farmland but with minor shortcomings, such as greater slopes or less ability to store soil moisture. Land must have been used for irrigated agricultural production at some time during the 4 years before the mapping date.

- **Unique Farmland** – Farmland of lesser quality soils used for the production of the State's leading agricultural crops. This land is usually irrigated but may include nonirrigated orchards or vineyards, as found in some climatic zones in California. Land must have been cropped at some time during the 4 years before the mapping date.

- **Farmland of Local Importance –** Land of importance to the local agricultural economy, as determined by each county's board of supervisors and a local advisory committee.

Acreages associated with the four categories of agricultural land that make up the Important Farmland classification are presented in Table 3-3.

Table 3-3.
Acreage of Agricultural Lands in the Restoration Area

River Reach	Prime Farmland	Farmland of Statewide Importance	Unique Farmland	Farmland of Local Importance
Reach 1	2,395	892	301	104
Reach 2	3,541	1,715	500	991
Reach 3	5,005	635	333	44
Reach 4	7,199	1,389	716	32
Reach 5	101	194	43	3,421
Bypasses	1,582	947	4,761	1,246
Total	19,822	5,772	6,654	2,471

Sources: California Department of Conservation 2004a, 2006

3.3.3 San Joaquin River from Merced River to the Delta

Downstream from the Restoration Area, the San Joaquin River traverses primarily agricultural land, including annual and permanent cropland. In a few locations, urban uses, including a wastewater treatment plant and small, unincorporated towns, are located adjacent to the river. Various State and county highways are located near or across the river.

3.3.4 Central Valley Project/State Water Project Water Service Areas

Discussion in this section emphasizes land uses in the CVP Friant Division because land use effects are not anticipated outside this area. Table 3-4 shows the acreages of land use by Friant Division contractor. The 28 contractors include both agricultural and municipal and industrial (M&I) contractors. Locations of the Friant Division contractors are shown in Figure 3-2.

Table 3-4.
Existing Land Uses in Friant Division

Water Users	Land Uses (acres)		
	Agricultural	Open Space	Urban
Arvin-Edison WSD	128,941	220	3,691
Chowchilla WD	85,869	0	2,250
City of Fresno Service Area[1]	85,869	0	2,250
City of Lindsay	415	0	1113
City of Orange Cove	286	0	674
Delano-Earlimart ID	56,264	0	353
Exeter ID	14,078	0	1,136
Fresno County Waterworks No. 18	251	2	0
Fresno ID[1]	187,489	64	60,336
Garfield WD	1,813	0	0
Gravelly Ford WD	8,431	0	0
International WD	724	0	0
Ivanhoe ID	10,983	0	0
Lewis Creek WD	1,297	0	0
Lindmore ID	27,483	0	214
Lindsay-Strathmore ID	15,628	0	492
Lower Tule River ID	102,159	932	185
Madera County[2]	365,436	986,084	26,014
Madera ID	123,830	1	6,882
Orange Cove ID	29,163	0	116
Porterville ID	15,842	0	1,194
Saucelito ID	19,826	0	0
Shafter-Wasco ID	36042	0	2952
Southern San Joaquin MUD	56,233	79	5,308
Stone Corral ID	6,882	0	0
Tea Pot Dome WD	3,581	0	0
Terra Bella ID	13,642	0	272
Tulare ID	69,293	0	4,220

Notes:
Table based on digitized geographic information system data. Some water user polygons overlap; therefore, acreage will be higher than actual footprint.
[1] Acreages shown for the City of Fresno Service Area and Fresno Irrigation District are inflated because more than 70,000 acres of land uses in these two service areas overlap.
[2] Land use data available for Madera County included categories not reflected in the three land use categories shown in this table. The additional acreage—from the water (6,055.25 acres), rural residential/vacant (38,952.74 acres), and not mapped (primarily the Sierra National Forest) (516,494.54 acres) categories—is included in the calculation shown for open space.
Key:
ID = irrigation district
MUD = municipal utilities district
WD = water district
WSD = water storage district

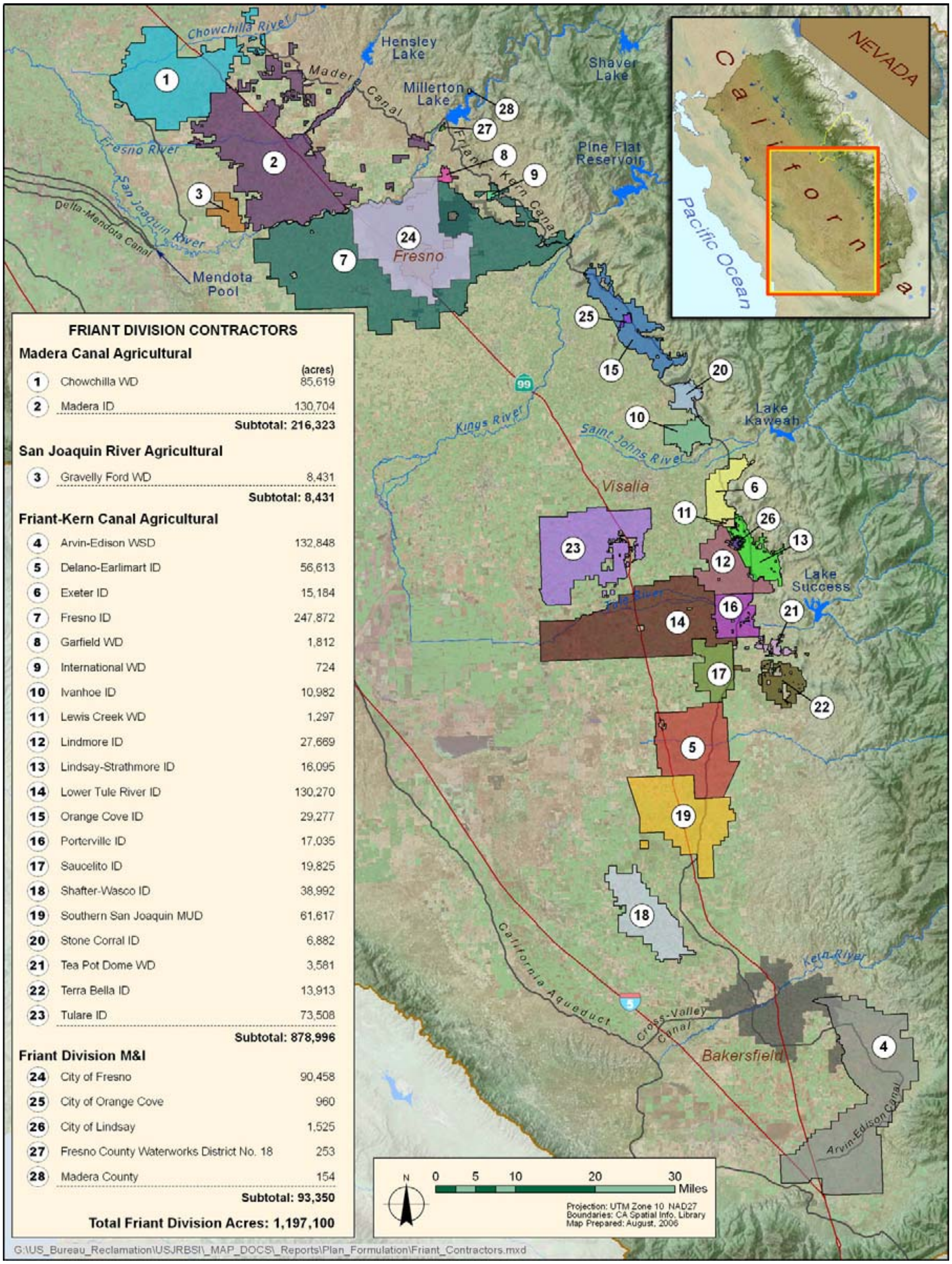


Figure 3-2.
Friant Division Long-Term Contractors

3.4 Air Quality

The study area is located in Fresno, Madera, and Merced counties, which are part of the San Joaquin Valley Air Basin (SJVAB). The SJVAB also comprises all of Kings, San Joaquin, Stanislaus, and Tulare counties and the valley portion of Kern County. Potential air quality effects from the Proposed Action (related to indirect effects associated with recreation and invasive plant treatment) are primarily focused on the study area.

Ambient concentrations of air pollutants, contaminants, and odors are determined by the amount of emissions released by sources and the atmosphere's ability to transport and dilute such emissions. Natural factors that affect transport and dilution include terrain, wind, atmospheric stability, and the presence of sunlight. Therefore, existing air quality conditions in the area are determined by such natural factors as topography, meteorology, and climate, in addition to the amount of emissions released by existing sources. The San Joaquin Valley Air Pollution Control District (SJVAPCD) develops rules, regulations, policies, and/or goals to comply with applicable air quality legislation. In that role, SJVAPCD issued *Guide for Assessing and Mitigating Air Quality Impacts* in 2002 to assist lead agencies with evaluating air quality impacts of proposed projects for purposes of meeting CEQA requirements. Providing planning assistance is one of the SJVAPCD goals for achieving attainment of the Federal and State ambient air quality standards. The SJVAPCD relies, in part, on land use designations contained in general plan documents applicable to its jurisdiction to forecast, inventory, and allocate regional emissions budgets from indirect (i.e., land-use- and development-related) sources.

3.4.1 Topography, Climate, and Meteorology

The SJVAB, which occupies the southern half of the Central Valley, is approximately 250 miles long and, on average, 35 miles wide. The SJVAB is a well-defined climatic region with distinct topographic features on three sides. The Coast Range, which has an average elevation of 3,000 feet, is located on the western border of the SJVAB. The San Emigdio Mountains, which are in turn part of the Coast Range, and the Tehachapi Mountains, which are part of the Sierra Nevada, are both located on the south side of the SJVAB. The Sierra Nevada forms the eastern border of the SJVAB. The northernmost portion of the SJVAB is San Joaquin County. No topographic feature delineates the northern edge of the basin. The SJVAB can be considered a "bowl" open only to the north.

The SJVAB is basically flat with a downward gradient in terrain to the northwest. Air flows into the SJVAB through the Carquinez Strait, the only breach in the western mountain barrier, and moves across the Delta from the San Francisco Bay Area (Bay Area). The mountains surrounding the SJVAB create a barrier to airflow, which leads to entrapment of air pollutants when meteorological conditions are unfavorable for transport and dilution. As a result, the SJVAB is highly susceptible to pollutant accumulation over time.

The inland Mediterranean climate type of the SJVAB is characterized by hot, dry summers and cool, rainy winters. The climate is a result of the topography and the strength and location of a semipermanent, subtropical high-pressure cell. During summer, the Pacific high-pressure cell is centered over the northeastern Pacific Ocean, resulting in stable meteorological conditions and a steady northwesterly wind flow. Cold ocean water upwells from below to the surface because of the northwesterly flow, producing a band of cold water off the California coast.

Daily summer high temperatures often exceed 100 degrees Fahrenheit (ºF), averaging in the low 90s in the north and high 90s in the south. In the entire SJVAB, daily summer high temperatures average 95ºF. Over the last 30 years, temperatures in the SJVAB averaged 90ºF or higher for 106 days a year, and 100ºF or higher for 40 days a year. The daily summer temperature variation can be as high as 30ºF (SJVAPCD 2002). In winter, the Pacific high-pressure cell weakens and shifts southward, resulting in wind flow offshore, the absence of upwelling, and storms. Average high temperatures in the winter are in the 50s, but lows in the 30s and 40s can occur on days with persistent fog and low cloudiness. The average daily low temperature in the winter is 45ºF (SJVAPCD 2002).

A majority of the precipitation in the SJVAB occurs as rainfall during winter storms. The rare occurrence of precipitation during summer is in the form of convective rain showers. The amount of precipitation in the SJVAB decreases from north to south primarily because the Pacific storm track often passes through the northern portion of the SJVAB, while the southern portion remains protected by the Pacific high-pressure cell. Stockton in the north receives about 20 inches of precipitation per year, Fresno in the center receives about 10 inches per year, and Bakersfield at the southern end of the valley receives less than 6 inches per year. Average annual rainfall for the entire SJVAB is approximately 9.25 inches on the valley floor (SJVAPCD 2002).

The winds and unstable atmospheric conditions associated with the passage of winter storms result in periods of low air pollution and excellent visibility. Precipitation and fog tend to reduce or limit some pollutant concentrations. For instance, clouds and fog block sunlight, which is required to fuel photochemical reactions that form ozone. Because carbon monoxide (CO) is partially water-soluble, precipitation and fog also tend to reduce concentrations in the atmosphere. In addition, respirable particulate matter with an aerodynamic diameter of 10 micrometers or less (PM_{10}) can be washed from the atmosphere through wet deposition processes (e.g., rain). However, between winter storms, high pressure and light winds lead to the creation of low-level temperature inversions and stable atmospheric conditions resulting in the concentration of air pollutants (e.g., CO, PM_{10}).

Summer is considered the ozone season in the SJVAB. This season is characterized by poor air movement in the mornings and by longer daylight hours, which provide a plentiful amount of sunlight to fuel photochemical reactions between reactive organic gases (ROG) and oxides of nitrogen (NO_X), resulting in ozone formation. During the summer, wind speed and direction data indicate that summer wind usually originates at the north end of the San Joaquin Valley and flows in a south-southeasterly direction through Tehachapi Pass and into the Southeast Desert Air Basin (SJVAPCD 2002).

3.4.2 Criteria Air Pollutants

Concentrations of the air pollutants ozone, CO, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), PM_{10}, fine particulate matter with an aerodynamic resistance diameter of 2.5 micrometers or less ($PM_{2.5}$), and lead are used as indicators of ambient air quality conditions. Because these are the most prevalent air pollutants known to be deleterious to human health, and because extensive documentation is available on health-effects criteria for these pollutants, they are commonly referred to as "criteria air pollutants." SJVAPCD relies, in part, on land use designations contained in general plan documents applicable to its jurisdiction to forecast, inventory, and allocate regional emissions budgets from indirect sources.

Ozone

Ozone is a photochemical oxidant, a substance whose oxygen combines chemically with another substance in the presence of sunlight, and is the primary component of smog. Ozone is not directly emitted into the air, but is formed through complex chemical reactions between precursor emissions of ROGs and NO_X in the presence of sunlight. ROGs are volatile organic compounds that are photochemically reactive. ROG emissions result primarily from incomplete combustion and the evaporation of chemical solvents and fuels. NO_X are a group of gaseous compounds of nitrogen and oxygen that results from the combustion of fuels. A highly reactive molecule, ozone readily combines with many different components of the atmosphere. Consequently, high levels of ozone tend to exist only while high ROG and NO_X levels are present to sustain the ozone formation process. Ozone located in the lower atmosphere (troposphere) is a major health and environmental concern. The adverse health effects associated with exposure to ozone pertain primarily to the respiratory system.

Ozone precursor emissions of ROGs and NO_X have decreased over the past several years in California because of more stringent motor vehicle standards and cleaner burning fuels. The ozone problem in the SJVAB ranks among the most severe in the State.

Carbon Monoxide

CO is a colorless, odorless, and poisonous gas produced by incomplete burning of carbon in fuels, primarily from mobile (transportation) sources. About 77 percent of nationwide CO emissions are from mobile sources. The other 23 percent consists of CO emissions from wood-burning stoves, incinerators, and industrial sources. Adverse health effects associated with exposure to CO concentrations include such symptoms as dizziness, headaches, and fatigue. CO exposure is especially harmful to individuals who suffer from cardiovascular and respiratory diseases (USEPA 2008).

The highest concentrations of CO are generally associated with cold, stagnant weather conditions that occur during the winter. In contrast to problems caused by ozone, which tends to be a regional pollutant, CO problems tend to be localized.

Nitrogen Dioxide

NO_2 is a brownish, highly reactive gas that is present in all urban environments. The major human-made sources of NO_2 are combustion devices, such as boilers, gas turbines, and mobile and stationary reciprocating internal combustion engines. Combustion devices emit primarily nitric oxide (NO), which reacts through oxidation in the atmosphere to form NO_2 (USEPA 2008). The combined emissions of NO and NO_2 are referred to as NO_X and reported as equivalent NO_2. Because NO_2 is formed and depleted by reactions associated with ozone, the NO_2 concentration in a particular geographical area may not be representative of the local NO_X emission sources.

Because NO_2 has relatively low solubility in water, the principal site of toxicity is in the lower respiratory tract. The severity of adverse health effects depends primarily on the concentration inhaled rather than the duration of exposure. An individual may experience a variety of acute symptoms, including coughing, difficulty with breathing, vomiting, headache, and eye irritation during or shortly after exposure. After a period of approximately 4 to 12 hours, an exposed individual may experience chemical pneumonitis or pulmonary edema with breathing abnormalities, cough, cyanosis, chest pain, and rapid heartbeat. Severe, symptomatic NO_2 intoxication after acute exposure has been linked on occasion with prolonged respiratory impairment, with such symptoms as chronic bronchitis and decreased lung functions (USEPA 2008).

Sulfur Dioxide

SO_2 is produced by such stationary sources as coal and oil combustion, steel mills, refineries, and pulp and paper mills. The major adverse health effects associated with SO_2 exposure pertain to the upper respiratory tract. SO_2 is a respiratory irritant, with constriction of the bronchioles occurring from inhalation of SO_2 at 5 parts per million (ppm) or more. On contact with the moist, mucous membranes, SO_2 produces sulfurous acid, which is a direct irritant. Concentration rather than duration of the exposure is an important determinant of respiratory effects. Exposure to high SO_2 concentrations may result in edema of the lungs or glottis and respiratory paralysis.

Particulate Matter

Respirable particulate matter with an aerodynamic diameter of 10 micrometers or less is referred to as PM_{10}. PM_{10} consists of particulate matter emitted directly into the air, such as fugitive dust, soot, and smoke from mobile and stationary sources, construction operations, fires and natural windblown dust, and particulate matter formed in the atmosphere by condensation and/or transformation of SO_2 and ROGs (USEPA 2008). Fine particulate matter ($PM_{2.5}$) is a subgroup of PM_{10}, consisting of smaller particles that have an aerodynamic diameter of 2.5 micrometers or less (ARB 2007).

Adverse health effects associated with PM_{10} depend on the specific composition of the particulate matter. Generally, adverse health effects associated with PM_{10} may result from both short-term and long-term exposure to elevated concentrations and may include breathing and respiratory symptoms, aggravation of existing respiratory and cardiovascular diseases, alterations to the immune system, carcinogenesis, and premature death (USEPA 2008). $PM_{2.5}$ poses an increased health risk because the particles can deposit deep in the lungs and may contain substances that are particularly harmful to human health.

PM_{10} emissions in the SJVAB are dominated by emissions from area-wide sources, primarily fugitive dust from vehicle travel on unpaved and paved roads, waste burning, and residential fuel combustion. $PM_{2.5}$ emissions in the SJVAB are dominated by emissions from the same area-wide sources as PM_{10} (ARB 2007).

Lead

Lead is a metal found naturally in the environment and in manufactured products. Major sources of lead emissions have historically been mobile and industrial sources. As a result of the phase-out of leaded gasoline, metal processing is currently the primary source of lead emissions. Other stationary sources are waste incinerators, utilities, and lead-acid battery manufacturers.

All areas of the State are currently designated as attainment for the State lead standard (Cal/EPA does not designate areas for the national lead standard). Although ambient lead standards are no longer violated, lead emissions from stationary sources still pose “hot spot” problems in some areas. As a result, the California Air Resources Board (ARB) identified lead as a toxic air contaminant.

Monitoring Station Data and Attainment Area Designations

Criteria air pollutant concentrations are measured at several monitoring stations in the SJVAB. Three stations are near the Restoration Area. The closest is the North Villa Avenue station in the town of Clovis, approximately 5 miles south of the Restoration Area in Fresno County. The North Villa Avenue station measures ozone, CO, PM_{10}, $PM_{2.5}$, and NO_2. The next closest is the Pump Yard station, approximately 30 miles southeast of the Restoration Area in Madera County, which measures ozone and NO_X. The third closest is the South Coffee Avenue station, approximately 15 miles northeast in Merced County, which measures ozone and NO_X. All these monitoring stations are at elevations similar to the Restoration Area.

A pollutant is designated “nonattainment” if there was at least one violation of a State standard for that pollutant in the area, and a pollutant is designated “attainment” if the State standard for that pollutant was not violated at any site in the area during a 3-year period. The category of “unclassified” is used in an area that cannot be classified on the basis of available information as meeting or not meeting standards. The SJVAB is designated as being in nonattainment for the State 1-hour ozone standard and the national 8-hour ozone standard. In addition, the SJVAB is designated as being in nonattainment for the State 24-hour and annual PM_{10} standards, and the State annual $PM_{2.5}$ standard. The basin is also in nonattainment for the national 24-hour and annual PM_{10} standards and the 24-hour and annual $PM_{2.5}$ standards.

On July 6, 2006, U.S. Environmental Protection Agency (USEPA) proposed redesignation for the SJVAB as a PM_{10} attainment area, based on attainment of the national standard in the 2003 through 2005 period. USEPA finalized approval of the attainment designation on October 17, 2006 (SJVAPCD 2008a). Although USEPA has determined that the SJVAB has attained the national PM_{10} standards, its determination does not constitute a redesignation to attainment per section 107(d)(3) of the Clean Air Act. The SJVAB will continue to be designated nonattainment until all of the Section 107(d)(3) requirements are met (SJVAPCD 2008b).

Emission Sources

With respect to the emissions of criteria air pollutants within Fresno, Madera, and Merced counties, mobile sources are the largest contributor to the estimated annual average levels of CO and NO_X, accounting for approximately 70 percent, and 79 percent, respectively, of total emissions. Area-wide sources account for approximately 44 percent, 88 percent, and 73 percent of the total county ROG, PM_{10}, and $PM_{2.5}$ emissions, respectively (ARB 2008).

3.4.3 Toxic Air Contaminants

Concentrations of toxic air contaminants, or in Federal parlance, hazardous air pollutants (HAP), are also used as indicators of ambient air quality conditions. A toxic air contaminant is defined as an air pollutant that may cause or contribute to an increase in mortality or serious illness, or that may pose a hazard to human health. Toxic air contaminants are usually present in minute quantities in the ambient air; however, their high toxicity or health risk may pose a threat to public health even at low concentrations.

According to the *California Almanac of Emissions and Air Quality* (ARB 2007), the majority of the estimated health risk from toxic air contaminants can be attributed to relatively few compounds, the most important being PM from diesel-fueled engines (diesel PM). Diesel PM differs from other toxic air contaminants in that it is not a single substance, but rather a complex mixture of hundreds of substances. Although diesel PM is emitted by diesel-fueled internal combustion engines, the composition of the emissions varies depending on engine type, operating conditions, fuel composition, lubricating oil, and whether an emission control system is present.

Unlike the other toxic air contaminants, no ambient monitoring data are available for diesel PM because no routine measurement method currently exists. However, ARB has made preliminary concentration estimates based on a PM exposure method. This method uses the ARB emissions inventory's PM_{10} database, ambient PM_{10} monitoring data, and results from several studies to estimate concentrations of diesel PM. In addition to diesel PM, toxic air contaminants for which data are available that pose the greatest existing ambient risk in California are benzene, 1,3-butadiene, acetaldehyde, carbon tetrachloride, hexavalent chromium, *para*-dichlorobenzene, formaldehyde, methylene chloride, and perchloroethylene.

Diesel PM poses the greatest health risk among these 10 toxic air contaminants. Based on receptor modeling techniques, ARB estimated the diesel PM health risk in the SJVAB in 2000 to be 390 excess cancer cases per million people. Since 1990, the health risk of diesel PM in the SJVAB has been reduced by 50 percent. Overall, levels of most toxic air contaminants have gone down since 1990 except *para*-dichlorobenzene and formaldehyde (ARB 2007).

According to the ARB Community Health Air Pollution Information System, five major existing stationary sources of toxic air contaminants are present within 3 miles of the Restoration Area (ARB 2008). Vehicles on State Routes (SR) 140, 165, 99, 41, and 152 are sources of diesel PM and other mobile source air toxics.

3.4.4 Odors

Odors are generally regarded as an annoyance rather than a health hazard. However, manifestations of a person's reaction to foul odors can range from psychological (e.g., irritation, anger, anxiety) to physiological (e.g., circulatory and respiratory effects, nausea, vomiting, headache).

The ability to detect odors varies considerably among the population and overall is quite subjective. Some individuals have the ability to smell very minute quantities of specific substances; others may not have the same sensitivity but may have sensitivities to odors of other substances. In addition, people may have different reactions to the same odor; an odor that is offensive to one person may be perfectly acceptable to another. It is important to also note that an unfamiliar odor is more easily detected and is more likely to cause complaints than a familiar one. This is because of the phenomenon known as odor fatigue, in which a person can become desensitized to almost any odor and recognition only occurs with an alteration in the intensity. Quality and intensity are two properties present in any odor.

Potential existing sources of odor include various agricultural activities in the vicinity of the Restoration Area (e.g., dairy operations, livestock operations, fertilizer use).

3.4.5 Greenhouse Gases

Certain gases in the earth's atmosphere, classified as greenhouse gases (GHG), play a critical role in determining the earth's surface temperature. Solar radiation enters the earth's atmosphere from space. A portion of the radiation is absorbed by the earth's surface, and a smaller portion of this radiation is reflected back toward space. Infrared radiation is selectively absorbed by GHGs. As a result, radiation that otherwise would have escaped back into space is instead "trapped," resulting in a warming of the atmosphere.

Prominent GHGs contributing to the greenhouse effect are carbon dioxide (CO_2), methane (CH_4), ozone, nitrous oxide (N_2O), and fluorinated compounds. Human-caused emissions of these GHGs in excess of natural ambient concentrations are responsible for intensifying the greenhouse effect and have led to a trend of unnatural warming of the earth's climate, known as global climate change or global warming (Ahrens 2003). It is extremely unlikely that global climate change of the past 50 years can be explained without the contribution from human activities (IPCC 2007).

Climate change is a global problem. GHGs are global pollutants, unlike criteria air pollutants and toxic air contaminants, which are pollutants of regional and local concern, respectively. California is the 12th to 16th largest emitter of CO_2 in the world (CEC 2006). California produced 484 million gross metric tons of CO_2 equivalent in 2004. Combustion of fossil fuel in the transportation sector was the single largest source of

California's GHG emissions in 2004, accounting for 41 percent of total GHG emissions in the State (CEC 2006). This sector was followed by the electric power sector (including both in-State and out-of-State sources) (22 percent) and the industrial sector (21 percent) (CEC 2006). Facilities (i.e., stationary, continuous sources of GHG emissions) that generate greater than 25,000 metric tons of CO_2 per year (MT CO_2/yr) are mandated to report their GHG emissions to ARB pursuant to Assembly Bill (AB) 32. In addition, the AB 32-proposed cap and trade level is 10,000 MT CO_2/yr, and the ARB preliminary draft staff proposal on GHG CEQA threshold level is 7,000 MT CO_2/yr.

3.4.6 Existing Sensitive Receptors

Sensitive receptors are considered those with increased exposure to or risk from air pollutants. Sensitive receptors in and around the Restoration Area, as well as the entire study area, include residences, churches, schools, hospitals, parks, and golf courses.

3.5 Biological Resources – Terrestrial Resources

Biological resources are discussed by the following three geographic subareas: San Joaquin River upstream from Friant Dam near Millerton Lake, San Joaquin River from Friant Dam to the Merced River, and San Joaquin River from Merced River to the Delta. Plant communities and wildlife habitat, invasive wildlife, vegetation types, common wildlife, and sensitive biological resources are discussed as they apply. Text in this section was developed through a review of scientific literature and existing data sources. Existing documents reviewed for preparation of this section include the following:

- *San Joaquin River Restoration Study Background Report*, edited by McBain and Trush, December 2002
- *Riparian Vegetation of the San Joaquin River*, prepared for Reclamation by DWR, May 2002
- *Historical Riparian Habitat Conditions of the San Joaquin River—Friant Dam to the Merced River*, prepared by Jones and Stokes Associates, Inc., for Reclamation, Fresno, California, April 1998
- *Analysis of Physical Processes and Riparian Habitat Potential of the San Joaquin River—Friant Dam to the Merced River,* prepared by Jones and Stokes Associates, Inc., for Reclamation, Fresno, California, October 1998
- *Temperance Flat Reservoir Botanical Resources Baseline Report*, prepared by EDAW, Inc., for Reclamation and DWR, September 2007

Information was also gathered and reviewed to identify and describe special-status plant and wildlife species that are known to exist, could potentially exist, or historically existed in the study area for this EA/IS. Information on special-status plant and wildlife species was compiled through a review of the following sources:

- California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants of California, 2009
- California Natural Diversity Database (CNDDB), 2008, 2009
- DFG State and Federally Listed Endangered, Threatened, and Rare Plants of California, 2008a, and Special Vascular Plants, Bryophytes, and Lichens List, 2008b
- DFG State and Federally Listed Endangered and Threatened Animals of California, 2008c, and Special Animals List, 2008d
- USFWS Federal Endangered and Threatened Species List for the region, 2009

Appendix H, Biological Resources:

- Attachment 1, Special-Status Species Reported by California Natural Diversity Database, contains a list of special-status species reported to the CNDDB for quadrangles within 1 mile of the Restoration Area
- Attachment 2, U.S. Fish and Wildlife Service List of Special-Status Species, presents a list provided by USFWS of special-status species that could be affected by activities in the area covered by the quadrangles encompassing the Restoration Area. These quadrangles include Arena, Biola, Bliss Ranch, Delta Ranch, Firebaugh, Firebaugh Northeast, Fresno North, Friant, Gravelly Ford, Greg, Gustine, Herndon, Ingomar, Jamesan, Lanes Bridge, Little Table Mountain, Madera, Mendota Dam, Millerton Lake East, Millerton Lake West, Newman, Oxalis, Poso Farm, San Luis Ranch, Sandy Mush, Santa Rita Bridge, Stevinson, Tranquility, and Turner Ranch.
- Attachment 3, Special-Status Plant and Wildlife Species with Potential to Occur in the Study Area, contains tables of special-status plants and animals known or with potential to occur in the study area.

For the purpose of this document, special-status species are plant and wildlife species that are as follows:

- Species listed, species proposed for listing, or candidates for possible future listing as threatened or endangered under the Federal ESA
- Species listed or proposed for listing by the State of California as threatened or endangered under California Endangered Species Act (CESA)
- Plant species designated as rare under the California Native Plant Protection Act (California Fish and Game Code, Section 1900 et seq.)
- Plant species considered by CNPS to be "rare, threatened, or endangered in California" (Lists 1B and 2 in CNPS 2009)
- Wildlife species considered species of special concern by DFG
- Wildlife species designated as fully protected by the California Fish and Game Code

3.5.1 San Joaquin River Upstream from Friant Dam

This section describes the plant communities and wildlife habitat, common wildlife, and sensitive biological resources known upstream from Friant Dam in the vicinity of Millerton Lake and its watershed.

Plant Communities and Wildlife Habitat

The topography of the San Joaquin River basin rises above elevation 12,000 in the upper watershed portion of the Sierra Nevada. Topography in the Millerton Lake area ranges from approximately elevation 310 at Friant Dam to above elevation 2,100 at the ridges surrounding the upper end of the reservoir. Plant communities around Millerton Lake are mostly foothill woodlands and grassland, with riparian vegetation along the shoreline. Adjacent hillsides support foothill pine-blue oak woodland with abundant grass/forb and shrub understory. Open grassland and savannah-type habitat conditions also exist in some areas. Several large basalt tables known to have vernal pools surround the canyon, well above elevation 1,600.

Upland vegetation above Millerton Lake is dominated by foothill woodland with areas of open grassland and rock outcroppings. The predominant vegetation includes foothill pine, blue oak, and interior live oak. Montane coniferous forest is found at the higher elevations upstream from Mammoth Pool. Habitat types in this area are meadow, riparian deciduous, lodgepole pine, mixed conifer, ponderosa pine, rock outcrop, and brush (USJRWPA 1982).

Common Wildlife

The Millerton Lake area hosts a diverse wildlife community, both resident and seasonal. The upper San Joaquin River area is a relatively rich wildlife region of the Sierra Nevada foothills (Reclamation and DWR 2005). Forest canopy varies considerably by slope and aspect, whereas the shrub and ground cover layer is greatly affected by cattle grazing. Wildlife in the higher elevation portions of the watershed is typical of the midelevation Sierra Nevada. Important deer winter ranges and bear habitat exist in the Temperance Flat area, in the U.S. Department of the Interior, Bureau of Land Management, San Joaquin River Gorge Management Area.

Sensitive Biological Resources

Seven special-status plant species are known to occur in the Millerton Lake/Big Bend region. Hartweg’s pseudobahia, Federally listed as endangered and found in grasslands, is reported present. Species that are Federally listed as threatened include San Joaquin Valley Orcutt grass and fleshy owl’s-clover, which are species associated with vernal pools. Tree anemone is an extremely localized species endemic to chaparral and woodland in the region, and is State-listed as threatened. Bogg’s Lake hedge-hyssop, State-listed as an endangered species, is found in vernal pools and lake margins. Several populations of Madera leptosiphon, on CNPS List 1B, are recorded along the shores of Millerton Lake, with one known population near Big Bend. Suitable conditions for this species probably exist in other parts of the study area, also. Blue elderberry, a shrub often associated with riparian habitat, occurs in the watershed from Big Bend upstream to Horseshoe Bend. Elderberry shrubs, including blue elderberry, are host plants for the valley elderberry longhorn beetle, Federally listed as threatened.

Several special-status wildlife species are known to occur in the Millerton Lake/Big Bend region (Reclamation and DWR 2005). These species include California red-legged frog, western pond turtle, western spadefoot toad, northern harrier, prairie falcon, bald eagle, valley elderberry longhorn beetle, and western (California) mastiff bat.

3.5.2 San Joaquin River from Friant Dam to Merced River

This section describes the plant communities and wildlife habitat, invasive wildlife, vegetation types, and sensitive biological resources known to occur in or adjacent to the Restoration Area.

Plant Communities and Wildlife Habitat

Plant communities and common wildlife species found in the Restoration Area are described in this section. Table 3-5 lists, in acres, plant communities and land cover in the various reaches of the Restoration Area mapped in 2002 by DWR. Other data sources were used to characterize and evaluate environmental consequences for areas not mapped by DWR. The following discussion summarizes these plant communities and land cover, including riparian forest, scrub, emergent wetlands, grassland and pasture, alkali sink, agriculture, open water, riverwash, disturbed areas, invasive plants, and urban.

Riparian Forest. Riparian forest has been classified (Table 3-5) into four major types based on the dominant species: cottonwood riparian forest, willow riparian forest, mixed riparian forest, and valley oak riparian forest. In areas where canopy cover was less than 30 percent, the community was mapped as “low density” (DWR 2002). 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, red-shouldered hawk, Swainson’s hawk, and white-tailed kite. These trees also provide nesting habitat for cavity-nesting species, such as downy woodpecker, wood duck, northern flicker, ash-throated flycatcher, oak titmouse, tree swallow, and white-breasted nuthatch. Riparian forests and associated wetlands produce populations of insects that feed on foliage and stems during the growing season. These insects, in turn, are prey for migratory and resident birds, including Pacific-slope flycatcher, western wood-pewee, olive-sided flycatcher, warbling vireo, orange-crowned warbler, yellow warbler, Bullock’s oriole, and spotted towhee. Mammal species using riparian forests include coyote, raccoon, desert cottontail, and striped skunk.

Scrub. Several types of scrub habitat were mapped in the Restoration Area, including willow scrub, riparian scrub, and elderberry savannah (DWR 2002). Typical bird species found in riparian scrub habitat include western wood-pewee, black phoebe, yellow-billed magpie, bushtit, Bewick’s wren, lazuli bunting, blue grosbeak, and American goldfinch. Mammal species using scrub habitats are similar to those described for riparian forest habitats above.

Table 3-5.
Plant Communities and Land Cover in the Restoration Area

Vegetation Type		Reaches and Bypasses (acres)									
		Reach									Bypasses
		1A	1B	2A	2B	3	4A	4B1	4B2	5	
Riparian Forest	Cottonwood Riparian Forest	166	79	30	48	429	16	18	14	29	0
	Cottonwood Riparian Forest LD[1]	27	114	41	1	23	4	2	2	0	0
	Willow Riparian Forest	198	119	43	110	116	68	177	330	506	2
	Willow Riparian Forest LD[1]	28	0	4	6	8	14	88	100	249	0
	Mixed Riparian Forest	439	260	0	0	0	6	0	0	0	0
	Mixed Riparian Forest LD[1]	65	19	2	0	0	0	0	0	1	0
	Valley Oak Riparian Forest	265	0	0	0	0	0	16	7	35	0
Scrub	Willow Scrub	214	113	76	38	188	38	101	18	70	0
	Willow Scrub LD[1]	73	32	124	15	41	10	0	13	10	0
	Riparian Scrub	53	48	209	67	56	61	55	3	71	20
	Elderberry Savannah	2	0	3	63	0	0	0	0	0	0
Emergent Wetlands		204	5	11	64	8	41	164	139	217	0
Grassland and Pasture		1,513	286	470	227	157	201	620	2,131	2,955	1
Alkali Sink		0	0	0	0	0	0	0	0	2	0
Agriculture		1,450	2,821	2,569	1,858	4,669	2,775	3,768	111	580	18
Open Water		1,307	220	327	279	341	113	140	123	440	5
Riverwash[2]		34	47	170	3	22	68	3	0	6	0
Disturbed Areas		1,998	335	181	243	654	401	452	183	110	1
Invasive Plants	Nonnative Tree	54	22	9	0	0	0	0	0	12	0
	Giant Reed (Arundo)	3	4	6	0	0	0	0	0	0	0
Urban		158	0	0	0	332	0	0	0	0	0
No Data[3]		2,412	642	255	1,622	1011	780	909	157	41	19,576
Total		**10,655**	**5,166**	**4,530**	**4,644**	**8,058**	**4,595**	**6,513**	**331**	**5,333**	**19,622**
Ratio of Natural Habitat Per River Mile		**194.2 acres/ mile**	**48.0 acres/ mile**	**79 acres/mile**		**47.5 acres/ mile**	**14.8 acres/ mile**	**512.8 acres/mile**		**508.0 acres/ mile**	**Unknown**

Source: DWR 2002

Notes:

[1] Canopy covers less than 30 percent.

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

Key:

LD = low density

Emergent Wetlands. 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 such as tules and cattails. More ephemeral wetlands, especially 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, arrowgrass, smartweed, Mexican rush, horseweed, willow herb, saltgrass, sunflower, and curly dock. Many bird species are known to use emergent wetlands, including song sparrow, common yellowthroat, marsh wren, and red-winged blackbird. Mammal species that use this habitat include California vole, common muskrat, and Norway rat. Pacific chorus frog and western terrestrial garter snake are commonly present in this habitat.

Grassland and Pasture. Grassland and pasture is an herb- and grass-dominated plant community. Generally, sites with grassland or pasture are well drained and flood only occasionally under present-day hydrologic conditions. Most areas of grassland or pasture are above the frequently flooded zone of the San Joaquin River. The grassland and pasture vegetation type 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, foxtail fescue, and Mediterranean barley) and herbs (red-stemmed filaree and horseweed). Typical bird species associated with grasslands include northern harrier, ring-necked pheasant, mourning dove, burrowing owl, horned lark, loggerhead shrike, and savannah sparrow. Mammal species that use grasslands include deer mouse, California vole, California ground squirrel, Botta’s pocket gopher, American badger, and coyote. Common reptile species associated with grasslands in the San Joaquin Valley include California toad, western fence lizard, western racer, and gopher snake.

Alkali Sink. Alkali sinks are shallow seasonally flooded areas or playas that are dominated by salt-tolerant wetland plants. Soils typically are fine textured with an impermeable caliche layer or clay pan. Salt encrustations are often deposited on the surface as the playa dries. Alkali sinks support valley sink scrub, which is a low-growing open to dense succulent shrubland community dominated by alkali-tolerant members of the goosefoot family, especially iodine bush and seablites. An herbaceous understory usually is lacking, but sparse cover of annual grasses, such as Mediterranean barley and red brome, may be present. Alkali sinks flood seasonally, but do not flood every year and respond to local thunderstorms. Wildlife species typically associated with alkali sink habitat include species of common and listed kangaroo rats, Nelson’s antelope squirrel, kit fox, coyote, side-blotched lizard, and BNLL.

Agriculture. Agricultural lands in the Restoration Area can provide food and cover for wildlife species, but the value of the habitat varies greatly among crop types and agricultural practices. 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 is removed. Species that use orchards and vineyards, such as ground squirrel, American crow, Brewer's blackbird, and European starling, often are considered agricultural pests.

Open Water. Open water is characterized by permanent or semipermanent ponded or flowing water. Open water may be the result of constructed impoundments or naturally occurring water bodies. Open water areas provide habitat for pond turtle, Pacific chorus frog, and bullfrog. Both submerged and floating aquatic vegetation are used as basking or foraging habitat and provide cover for aquatic wildlife species. Deeper open water areas without vegetation provide habitat for species that forage for fish, crayfish, or other aquatic organisms, such as river otter.

Riverwash. 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. Woody and herbaceous plant cover is low. Numerous herbaceous species occur in riverwash areas; however, most are relatively uncommon. The most abundant species are foxtail fescue, Bermuda grass, red-stemmed filaree, willow herb, and lupine species. Riverwash provides nesting habitat for shorebirds, such as killdeer, black-necked stilt, and American avocet. Other species, such as mallard or western pond turtle, may use riverwash habitats for roosting or resting.

Disturbed Areas. 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 may provide habitat for birds such as white-crowned sparrow, western meadowlark, and American goldfinch. These habitats also are expected to support some common mammals, such as California ground squirrel, deer mouse, and desert cottontail.

Invasive Plants. Invasive plants are species that are not native to the region, persist without human assistance, and have serious impacts on their nonnative environment (Simberloff et al. 1997, 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 California Invasive Plant Council (CalIPC) maintains a list of species that have been designated as invasive in California. Prevalent species and their associated CalIPC category and California Department of Food and Agriculture (CDFA) rating are identified in Table 3-6. The term "noxious weed" is used by government agencies for nonnative plants that have been defined as pests by law or regulation (CDFA 2007). 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 seed and fruit that provide food webs for aquatic and terrestrial riparian fish and wildlife.

**Table 3-6.
Prevalent Invasive Species Identified by
Federal and State Agencies in the Restoration Area**

Species	California Invasive Plant Council Inventory Category[1]	California Department of Food and Agriculture Rating[2]	U.S. Department of Agriculture Noxious Weed Status
Terrestrial Riparian Species			
Red sesbania (*Sesbania punicea*)	High, Red Alert	Q	–
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*)	High	–	–
Aquatic Species			
Water hyacinth (*Eichornia crassipes*)	High	C	–
Water milfoil (*Myriophyllum aquaticum*)	High	C	–
Parrot's feather (*Myriophyllum aquaticum*)	High, Red Alert	–	–
Curly-leaf pondweed (*Potamogeton crispus*)	Moderate	–	–
Sponge plant (*Limnobium spongia*)	–	Q	–

Sources: DWR in preparation, California Invasive Plant Council 2006, CDFA 2007, USDA 2006

Notes:

[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 Ratings:

- B – Eradication, containment, control, or other holding action at the discretion of the Commissioner.
- C – State-endorsed holding action and eradication only when found in a nursery; action to retard spread outside nurseries at the discretion of the Commissioner.
- Q – Temporary rating for eradication, containment, rejection, or other holding action at the State-county level, outside nurseries pending determination of a permanent rating.
- -- Not applicable

A comprehensive survey of riparian vegetation on the San Joaquin River identified several invasive species in the Restoration Area (DWR 2002). The invasive species were mapped separately from the riparian vegetation and land cover, with the exception of large stands of invasive trees (blue gum, salt cedar, and tree-of heaven) and giant reed (nonwoody) that could be identified on aerial photos. The invasive species included in the "invasives" geographic information system (GIS) layer are red sesbania, giant reed, blue gum, tree-of-heaven, pampas grass, and edible fig. A number of other invasive nonnative species are present, but their occurrence was not systematically mapped. These species include Himalayan blackberry, white mulberry, castor bean, Lombardy poplar, and tamarisk (DWR 2002).

Additional invasive plants have been identified through meetings with local stakeholders and SJRRP agency personnel. These species include nonnative trees (Chinese tallow, Catalpa, Russian olive, Chinaberry, and tree tobacco), emergent and submergent aquatic plants (sponge plant, water hyacinth, curly leaf pond weed, parrot feather, milfoil, and water primrose), and herbaceous weeds (thistles (bull, star, and milk), watergrass, bermuda grass, and other common nonnative grasses and forbs that compete with native riparian species for shoreline and low floodplain establishment and growth sites).
Blue gum is the most widespread and abundant invasive species in the Restoration Area, mapped by DWR (2002) in all reaches except Reaches 3 and 4 and the bypasses (see reach descriptions below), and encompasses more than 100 acres (Table 3-7). Giant reed is also widespread, mapped in all reaches except Reach 4 and the bypasses, and encompasses about 35 acres. 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 and was already abundant in Reach 1 in 2000. In 2008, red sesbania was also widespread in Reach 2A and was observed at two locations along the Eastside Bypass (Stefani, pers. comm., 2008). The recent and rapid spread of red sesbania is a particular concern to the SJRRP because it has successfully colonized both disturbed bar soil and substrate (banks of aggregate mining pits, sand and gravel bars, and other exposed surfaces), as well as encroached into the occupied understory of existing dense riparian vegetation, and formed monocultures along the low-flow shoreline.

Table 3-7.
Acreage of Invasive Species Mapped in the Restoration Area in 1998 and 2000

Species	Reach 1		Reach 2		Reach 3		Reach 4		Reach 5		Total	
	Number of Locations	Acres	Number of Locations	Acres	Number of Locations	Acres	Number of Locations	Acres	Number of Locations	Acres	Number of Locations	Acres
Blue gum	68	117.75	4	7.05	–	–	–	–	3	12.29	75	105.09
Giant reed	59	23.37	47	17.46	3	0.22	–	–	1	0.26	110	34.35
Red sesbania	32	17.24	–	–	–	–	–	–	–	–	32	17.24
Tree-of-heaven	5	3.44	1	0.49	–	–	–	–	–	–	6	3.43
Edible fig	5	1.04	2	0.14	–	–	–	–	–	–	7	1.18
Lombardy poplar	–	–	–	–	–	–	–	–	1	1.62	1	1.62
Salt cedar	–	–	1	0.16	1	0.07	1	0.05	–	–	3	0.28
White mulberry	–	–	–	–	1	0.09	–	–		–	1	0.09
Castor bean	–	–	–	–	–	–	1	0.07	–	–	1	0.07
Pampas grass	1	0.03	–	–	–	–	–	–	–	–	1	0.03
Total invasives	171	162.87	55	25.30	5	0.38	2	0.12	5	14.17	238	163.54
Total Survey Area		15,821		9,174		8,058		11,439		5,333		49,825

Source: DWR 2002
Note:
Bypasses not included in area surveyed.
Key:
— Not Applicable

Also, based on recent information from stakeholders, water hyacinth is present in Reaches 2, 3, and 4, and a small population of Chinese tallow is present in Reach 1. In 2008, Chinese tallow was also observed in Reach 3 (Stefani, pers. comm., 2008). Low-flow channels choked with a mix of floating and submergent aquatic weeds severely decrease flow capacity, lower dissolved oxygen (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).

Overall, as mapped in 2000 by DWR (2002), Reach 1 contained the greatest acreage of invasive woody species, with more than 162 acres of invasive plants documented, and also the greatest diversity of invasive species, with seven documented invasive woody species. Reach 2 had the second largest acreage of invasive species, with over 25 acres mapped, while Reaches 3 and 4 contained few invasive plants. Reach 5 had 14 acres of invasive plants, mostly consisting of three large blue gum stands (DWR 2002).

Before 2008, the Chowchilla, Eastside, and Mariposa bypasses were not surveyed or mapped, and no other references with comparable data were found for these portions of the Restoration Area. In 2008, observations of red sesbania were recorded in the Eastside Bypass during that year's survey effort (Stefani, pers. comm., 2008).

Invasive Wildlife

The introduction of nonnative wildlife species can be detrimental to native species assemblages. Nonnative wildlife species distribution and abundance in the Restoration Area is unknown but likely includes American bullfrog, crayfish, and red-eared sliders, which are common in most of California's waterways. Several invasive invertebrate species, such as Asian clam and Chinese mitten crab, are known to occur within the study area. Each of these is discussed briefly below.

The Asian clam is present in rivers and streams throughout California. The species is most abundant in well-oxygenated, clear waters but is found both in stream and lake habitats. Clay and fine- to coarse-grained sand are preferred substrates, although Asian clams may be found in lower numbers on almost any substrate (USGS 2001). Asian clams have been documented in tributary rivers to the San Joaquin River, including the Merced River. The clam is thought to affect ecosystem processes by limiting suspended algal biomass within tributaries, thereby reducing export of suspended algae into mainstem rivers (Stillwater Sciences 2007).

The mitten crab is catadromous – adults reproduce in saltwater and the offspring migrate to freshwater to rear. The ecological impact of a large mitten crab population is not well understood. Although juveniles primarily consume vegetation, they do prey on animals, especially invertebrates, as they grow. Chinese mitten crabs have been found in the Delta and eastern San Joaquin County (Escalon-Bellota Weir on the Calaveras River and Little Johns Creek near Farmington), and south to the San Luis NWR near Gustine (DFG 1998). In the last decade, there have been several unconfirmed reports of the Chinese mitten crab from the lower Stanislaus and Merced rivers, but no official collections have been documented from this area; in addition, no crabs were reported from these areas during 2007 (Stillwater Sciences 2007).

Vegetation Types

Vegetation types in the Restoration Area are described here by reach based on a combination of on-the-ground vegetation sampling and interpretation of recent aerial photographs (DWR 2002). The area and distribution of vegetation by type are based on studies by DWR during 2000 (DWR 2002) and GIS data (DWR 2002) (Table 3-7).

Reach 1A. 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 (2002), all eight classifications of riparian communities (cottonwood, willow, mixed, and oak riparian forest; willow and riparian scrub and elderberry savannah; and emergent wetlands) are present in this reach. Approximately half of the total number of plant taxa recorded were native. However, the largest areas occupied by invasive tree species (blue gum and tree-of-heaven) were recorded in Reach 1A. Giant reed and red sesbania were also recorded primarily in Reach 1A (DWR 2002).

Reach 1B. Reach 1B has one of the lowest ratios of natural vegetation per river mile – in 14 miles of channel, little over 1 square mile of natural habitat is present (Table 3-7). Woody riparian vegetation is prevalent and occurs mainly in narrow strips immediately adjacent to the river channel. Willow scrub is more abundant (13 percent) than in Reach 1A (7 percent) (DWR 2002). 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 and Trush 2002). Blue gum, giant reed, red sesbania, and tree-of-heaven were prevalent in Reach 1B. Red sesbania was mapped downstream to Highway 99 in 2000, but likely is currently more abundant downstream given its potential to spread rapidly (DWR 2002).

Reach 2A. Riparian vegetation in the upper 10 miles of this reach (Reach 2A) is sparse or absent because the river is usually dry and the shallow groundwater is overdrafted (McBain and 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 savannah mapped in the Restoration Area occurs on the left bank near the Chowchilla Bypass Bifurcation Structure, at the junction of Reaches 2A and 2B (DWR 2002). Invasive species recorded in Reach 2A in 2000 included large stands of blue gum and tree-of-heaven (9 acres) and giant reed (6 acres) (DWR 2002).

Reach 2B. The lower few miles of Reach 2B support narrow, patchy, but nearly continuous vegetation, because this area is continuously watered by the backwater of the Mendota Pool. The riparian zone is very narrowly confined to a thin strip 10 to 30 feet wide bordering the channel. The herbaceous understory, however, is very rich in native species and a high portion of the total vegetative cover is native plants. Invasive species were not mapped in Reach 2B by DWR (2002). The margins of the 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 and Trush 2002); however, the narrow width of the riparian corridor results in a very low ratio of native vegetation per river mile (DWR 2002). In Reach 3, cottonwood riparian forest is the most abundant native vegetation type, followed by willow scrub, willow riparian forest, and riparian scrub. Small amounts (less than 0.5 acre each) of giant reed and nonnative trees were mapped in Reach 3 (DWR 2002).

Reach 4A. Reach 4A is sparsely vegetated, with a very 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 ponds 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 Restoration Area.

Reach 4B. Reach 4B upstream from the Mariposa Bypass (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. As described in Section 2, Reach 4B1 no longer conveys flows. The channel in Reach 4B1 is poorly defined and filled with dense vegetation and, in some cases, is plugged with fill material. Because of the wider floodplain and available groundwater, and 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). No significant stands of nonnative trees or giant reed were found in Reach 4 (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 and 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). Less than 0.5 acres of giant reed were mapped in Reach 5, but larger stands of nonnative trees were recorded (DWR 2002).

Chowchilla Bypass. The Chowchilla Bypass is grazed by livestock and mostly covered with nonnative annual grassland, although scattered cottonwoods and elderberry shrubs are present. A narrow band of emergent marsh dominated by tules and cattails may grow along the banks of the Chowchilla Bypass.

Mariposa Bypass. Vegetation in the Mariposa Bypass is similar to that along the Chowchilla Bypass. Upland vegetation is grassland and ruderal vegetation (i.e., the nonnative herbaceous vegetation of disturbed lands). Isolated trees and small patches of tree-dominated riparian vegetation are present, as are narrow bands of riparian scrub along some channel banks.

Eastside Bypass. Vegetation in the lower 10 miles of the Eastside Bypass is similar to that along the Chowchilla Bypass. Upland vegetation is grassland and ruderal vegetation. The reach between the Sand Slough Control Structure and Merced NWR (approximately 4.5 miles) supports a number of duck ponds. The next 2.2 miles of the bypass are located in the Merced NWR, which encompasses over 10,000 acres of wetlands, native grasslands, vernal pools, and riparian habitat, and hosts the largest wintering populations of lesser sandhill cranes and Ross' geese along the Pacific Flyway. Farther downstream, the Eastside Bypass passes through the Grasslands WMA, an area of private lands with conservation easements held by USFWS, and through the East Bear Creek Unit of the San Luis NWR Complex. Patchy riparian trees and shrubs occur along the banks of the

Eastside Bypass in these areas. Side channels and sloughs (e.g., Duck, Deep, and Bravel sloughs) are present along the lower Eastside Bypass, some of which support remnant patches of riparian vegetation.

Sensitive Biological Resources

Sensitive biological resources are discussed below for each reach of the Restoration Area. Special-status species, recovery areas, designated critical habitat, and sensitive natural communities are discussed as they apply for each reach of the Restoration Area.

Reach 1A. The riparian vegetation and elderberry savannah along Reach 1A support documented occurrences of the valley elderberry longhorn beetle. Vernal pools and grasslands on the bluffs adjacent to Reach 1A are known to support several special-status animals and plants, but these areas are not in the Restoration Area. Known great egret, great blue heron, and cormorant rookery sites are present in Reach 1A at the following locations: the base of Friant Dam, in the DFG Rank Island Ecological Reserve, and in the DFG Milburn Ecological Reserve. Rookeries at the base of Friant Dam and in Rank Island Ecological Reserve support great blue heron and great egret nests. The rookery in the Milburn Ecological Reserve supports nests of all three species. A spotted bat was collected from the San Joaquin Fish Hatchery in the 1970s, and there is a 1990s observation record of San Joaquin kit fox just west of Friant Dam (CNDDB 2009). High above the alluvial plain of the river corridor in Reach 1A, just outside the Restoration Area, are terraces that support vernal pool grasslands and emergent wetlands. Numerous occurrences of special-status animal and plant species are documented in these habitats, including California tiger salamander, vernal pool fairy shrimp, western spadefoot toad, hairy Orcutt grass, Sanford’s arrowhead, San Joaquin Valley Orcutt grass, spiny-sepaled button-celery, and succulent owl’s clover.

Reach 1B. No special-status plants or animals have been identified in Reach 1B (CNDDB 2008), largely because of the minimal amount of remnant native habitats along this stretch of the river. Nonetheless, it is likely that raptors and grassland-affiliated species use the remnant habitats in this reach.

Reach 2A. The only special-status species mapped by CNDDB (2007) as occurring in Reach 2A is Swainson’s hawk. An occurrence of heartscale is documented in the grasslands on the terraces above the alluvial plain, and outside the identified Restoration Area in this reach. These species are both associated with grassland habitats and, in the case of Swainson’s hawk, agricultural areas. It is likely that other grassland- and scrub-affiliated species use the limited remnant habitats in this reach, and valley elderberry longhorn beetle could potentially occur in the elderberry savannah. Elderberry shrubs have been documented along the river within this reach. Open water habitat may attract migratory ducks, such as mallards, gadwalls, and ruddy ducks. Emergent vegetation provides limited habitat for marsh-dwelling species, such as rails, herons, and various songbirds.

Reach 2B. Occurrences of Swainson’s hawk are recorded throughout Reach 2B; the CNDDB (2007) indicates that numerous nesting sites are present in the riparian forest, and foraging opportunities exist in the agricultural fields and grasslands along this reach.

Silvery legless lizard has been documented in the riparian scrub located at the Chowchilla Bypass Bifurcation Structure. In the marshy backwater area of the Mendota Pool that extends into Reach 2B, several special-status species are documented, including records from the mid-1970s of giant garter snake and western pond turtle and a 1948 record of Sanford's arrowhead (CNDDB 2007). Western yellow-billed cuckoo has been documented in the riparian and willow scrub habitats around the Mendota Pool in the 1950s (CNDDB 2007). Bank swallows, which use habitats along banks or bluffs usually adjacent to water, have been documented in the vicinity of the Mendota Pool. Several other species have been documented at Mendota Wildlife Area (WA), outside the Restoration Area, including Lost Hills crownscale, giant garter snake, BNLL, burrowing owl, western mastiff bat, Nelson's antelope squirrel, and San Joaquin Kit fox.

Reach 3. Giant garter snake, western pond turtle, western yellow-billed cuckoo, and San Joaquin pocket mouse are documented as occurring in suitable habitats in Reach 3. Occurrences of Swainson's hawk are recorded throughout this reach, where this hawk forages in the grassland and agricultural areas, and nests in the riparian forest along the river. Several occurrences of San Joaquin kit fox from the 1990s have been documented in the grasslands immediately east and west but outside the Restoration Area along this reach of the river. Lesser saltscale and Munz' tidy-tips, both associated with alkaline scrub and grassland habitats, are documented in the higher terraces above the alluvial plain and just outside the Restoration Area along this reach.

Reach 4. Occurrences of Swainson's hawk are recorded throughout Reach 4, where this hawk forages in the grassland and agricultural areas, and nests in the riparian forest along the river. The San Luis NWR and Grasslands WMA in Reach 4B support marsh and emergent wetlands, native grasslands, alkali sink, riparian forests, and vernal pool habitats; the Grassland WMA supports the largest remaining block of contiguous wetlands in the Central Valley. Numerous documented occurrences of special-status species affiliated with these habitats have been documented throughout this subreach. Species include Delta button-celery, American badger, California tiger salamander, Conservancy fairy shrimp, giant garter snake, northern harrier, San Joaquin kit fox, vernal pool fairy shrimp, vernal pool tadpole shrimp, western pond turtle, and western spadefoot toad.

Reach 5. Occurrences of Swainson's hawk are recorded throughout Reach 5, where this hawk forages in the grassland and agricultural areas, and nests in the riparian forest along the river. Just north of the San Joaquin River and Bear Creek confluence, the river crosses through Great Valley Grasslands State Park and then again traverses through the San Luis NWR. The State Park and San Luis NWR support marsh and emergent wetlands, alkali sacaton grasslands, alkali sink, riparian forest, and vernal pool habitats. Numerous occurrences of special-status species affiliated with these habitats are documented in the State Park and San Luis NWR, including Delta button-celery American badger, California tiger salamander, Conservancy fairy shrimp, longhorn fairy shrimp, San Joaquin kit fox, tricolored blackbird, vernal pool tadpole shrimp, western pond turtle, and western spadefoot toad. The State Park and NWR also support occurrences of other rare and endangered species, although these are not documented in the Restoration Area itself; these species include alkali milk-vetch, brittlescale, heartscale, Hispid bird's-beak, lesser saltscale, prostrate navarretia, vernal pool smallscale, and Wright's trichocoronis. Farther along this reach, the river traverses the North Grasslands WA, which contains over 7,000 acres of wetlands, riparian habitat, and uplands, and provides habitat for Swainson's hawk and greater sandhill crane. The West Hilmar WA is located to the north and contains 340 acres of oaks, cottonwoods, and grasslands providing habitat for great blue heron and great egret.

Chowchilla Bypass. Heartscale and subtle orache, both grassland-associated species, are documented in the Chowchilla Bypass. BNLL, which prefers open habitats and washes, is also known to occur in the Chowchilla Bypass. Large elderberry shrubs at the bifurcation structure, particularly where Lone Willow Slough comes onto the levee right-of-way, have potential to support valley elderberry longhorn beetle. Burrowing owls have been observed occupying burrows near the bifurcation structure, and the scattered cottonwoods along the Chowchilla Bypass provide nest sites for Swainson's hawk. Bald eagles are also known to nest along the Chowchilla Bypass. The *Recovery Plan for Upland Species of the San Joaquin Valley, California*, has identified the Chowchilla and Eastside bypasses and natural lands along them as a movement corridor for San Joaquin kit fox. The plan includes as one of its recovery actions for San Joaquin kit fox "maintenance and enhancement of the Chowchilla or Eastside Bypasses and natural lands along the corridor through acquisition, easement, or safe harbor initiatives" (USFWS 1998).

Eastside Bypass. Where the Eastside Bypass traverses through the Grassland WMA, San Luis NWR, and Merced NWR, which support marsh and perched wetlands, sand dunes, riparian forests, native grasslands, and vernal pool habitats, there are several documented occurrences of special-status species affiliated with these habitats. These species include Delta button-celery, Wright's trichocoronis, California tiger salamander, Conservancy fairy shrimp, San Joaquin kit fox, Swainson's hawk, tricolored blackbird, vernal pool fairy shrimp, and vernal pool tadpole shrimp. The Merced NWR also supports habitat for Colusa grass. Other special-status species, including brittlescale, heartscale, Sanford's arrowhead, vernal pool smallscale, and American badger, are documented in the vicinity but outside the Restoration Area. Critical habitat for Hoover's spurge, Colusa grass, vernal pool tadpole shrimp, vernal pool fairy shrimp, and Conservancy fairy shrimp has been designated within and adjacent to the Restoration Area along the Eastside Bypass.

Mariposa Bypass. The Mariposa Bypass supports several occurrences of Delta button-celery. Critical habitat for Hoover's spurge, Colusa grass, vernal pool tadpole shrimp, vernal pool fairy shrimp, and Conservancy fairy shrimp has been designated within and adjacent to the Restoration Area along the Mariposa Bypass.

3.5.3 San Joaquin River from Merced River to the Delta

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.

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.

Special-status species in this reach include plant species that occur in the river floodplain, such as Delta button-celery, and marsh plants, such as Sanford’s arrowhead, a CNPS List 1B species. Special-status animals 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, Federally listed and State-listed as endangered, and riparian woodrat, Federally listed as endangered, are found along the lower San Joaquin River (CNDDB 2008).

3.6 Biological Resources – Fish

Fish in the San Joaquin River upstream from Friant Dam, San Joaquin River downstream from the Merced confluence (Restoration Area), and in the Delta have the potential to be affected by implementation of WY 2010 Interim Flows. Fisheries resources in each geographic subarea are briefly described below.

3.6.1 San Joaquin River Upstream from Friant Dam

Most of the commonly occurring species in Millerton Lake are introduced game or forage species. Principal game species include spotted bass, largemouth bass, smallmouth bass (collectively referred to as black bass), bluegill, black crappie, and striped bass. The principal forage species for most of the game fishes is threadfin shad. Several native nongame species have been collected from the reservoir, including Sacramento sucker, Sacramento pikeminnow, Sacramento blackfish, hitch, hardhead, and white sturgeon. Currently, Kern brook lamprey are not considered to occur within Millerton Lake.

Millerton Lake is dominated by black bass species, which spawn in shallow edge waters in depths anywhere from 3 to 9 feet deep. Spotted bass begin spawning in Millerton Lake as early as late March, peaking in late May and early June (Wang 1986). Largemouth bass begin spawning in Millerton Lake in March and may spawn through June (Mitchell 1982). If reservoir elevations fluctuate during the spawning and incubation period in spring, the young are at risk of increased mortality. Under current reservoir operations, Millerton Lake water levels change by a foot or more per day almost 50 percent of days, and change by 2 feet or more about 10 percent of days.

American shad, introduced into Millerton Lake in the 1950s, have marginal value as a sport fish in Millerton Lake, but are highly sought after as a sport fish by anglers in some regions of California and other states. American shad are also an important prey item for adult striped bass (California Striped Bass Association 2006). The Millerton Lake population of American shad is the only known successfully spawning, landlocked population.

3.6.2 San Joaquin River from Friant Dam to Merced River

Of the native fish species historically present in the San Joaquin River, at least eight are now uncommon, rare, or extinct, and nonnative warm-water fish species have become dominant. Nonnative species appear better adapted to current, disturbed habitat conditions than native assemblages. However, habitat conditions in Reach 1 (slightly higher gradient, cooler water temperatures, and higher water velocities) seem to have restricted many introduced species from colonizing this reach. Fish species currently known to occur in the Restoration Area are shown in Table 3-8.

Table 3-8.
Fish Species Identified or Presumed to Occur in the San Joaquin River

Common Name	Native or Introduced	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Downstream
Pacific lamprey	Native	X	X	X	X	X	X
Kern brook lamprey	Native	X					
Smallmouth bass	Introduced					X	
Sacramento pikeminnow	Native					X	X
Carp	Introduced	X	X			X	X
Goldfish	Introduced	X	X			X	X
Golden shiner	Introduced	X	X			X	X
Red shiner	Introduced		X			X	X
Hitch	Native					X	X
Fathead minnow	Introduced					X	X
Blackfish	Native					X	X
Sacramento splittail	Native					X	X
Sacramento sucker	Native	X	X			X	X
Black bullhead	Introduced					X	X
Brown bullhead	Introduced	X				X	X
Channel catfish	Introduced	X				X	X
White catfish	Introduced					X	X
Rainbow trout	Native	X					
Central Valley steelhead	Native						X
Threespine stickleback	Native	X					
Sculpin spp.	Native	X				X	X
Mosquitofish	Introduced	X	X			X	X
Black crappie	Introduced	X				X	X
White crappie	Introduced					X	X
Bluegill	Introduced	X	X			X	X
Green sunfish	Introduced	X	X			X	X
Redear sunfish	Introduced	X	X			X	X
Largemouth bass	Introduced	X	X			X	X
Spotted bass	Introduced	X	X			X	X
Bigscale logperch	Introduced					X	X
Tule perch	Native					X	X
Threadfin shad	Introduced		X			X	X
Striped bass	Introduced					X	X
Inland silverside	Introduced					X	X
Fall-run Chinook salmon	Native						X
Hardhead	Native	X	X				X
California roach	Native					X	X
White sturgeon	Native						X

Sources: DFG 1991, 2007, Saiki 1984, Brown and Moyle 1993, Yoshiyama et al. 1998.

In general, species diversity increases downstream, while species composition shifts from native species to nonnative species (DFG 2007). Much of Reach 2 is typically dry; thus, fish populations are confined to the upper part of Reach 2 upstream from Gravelly Ford, and to the Mendota Pool in the lower part of Reach 2, with restricted fish migration between these habitats. Because Reach 4 is dry much of the time, only a single fish species – inland silverside – has been documented in Reach 4 in the past 25 years (Saiki 1984, DFG 2007). Reach 5 has perennial flow. The occurrence of fish in the Restoration Area bypasses depends on the routing of flood flows through the bypass system. When water is present, fish of all life stages may enter the bypasses from upstream diversion points such as the Chowchilla Bypass Bifurcation Structure and Sand Slough Control Structure. Information on fish species that may use temporary aquatic habitat in the bypasses is not available. However, it is assumed that any species present near the diversion points would be routed into the bypasses along with flood flows.

3.6.3 San Joaquin River from Merced River to the Delta

The lower San Joaquin River downstream from Reach 5 provides physical habitat similar to Reach 5. Flows are substantially increased by input from the Merced, Tuolumne, Stanislaus, and Calaveras rivers. Water management in the San Joaquin River focuses on diversion of water out of streams and rivers into canals for agricultural use, with some of the applied water returned as agricultural drainage (Brown and May 2006). Fish species presently inhabiting the San Joaquin River from the confluence with the Merced River to the Delta are listed in Table 3-8.

Fall-run Chinook salmon inhabit the Merced, Tuolumne, and Stanislaus rivers, supported in part by hatchery stock in the Merced River. The average annual spawning escapement (1952 through 2005) for the three major San Joaquin River tributaries was an estimated 19,100 adults. Since 1952, fall-run Chinook salmon populations in the San Joaquin basin have fluctuated widely, with a distinct periodicity that generally corresponds to periods of drought and wet conditions. Recent escapement estimates in 2006 and 2007 indicate another period of severe declines, presumably unrelated to drought, with a near-record low escapement in 2007 (DFG 2008d). Steelhead are still present in low numbers in the Stanislaus, Tuolumne, and possibly the Merced river systems below the major dams (McEwan 2001, Zimmerman et al. 2008), but escapement estimates are not available.

Brown and May (2006) summarized presence/absence of fish species in the San Joaquin River downstream from the Merced River confluence. Native species include Sacramento sucker, Sacramento pikeminnow, Sacramento splittail, tule perch, prickly sculpin, Sacramento blackfish, and hardhead (Brown and May 2006) (Table 3-8). In addition, California roach, threespine stickleback, lamprey, and hitch likely occur, although they were not detected during the springtime monitoring efforts summarized by Brown and May (2006).

3.6.4 Sacramento-San Joaquin Delta

The historical Delta consisted of low-lying islands and marshes that flooded during high spring flows. More than 95 percent of the original tidal marshes have been leveed and filled, resulting in substantial losses of high-quality aquatic habitat (USGS 2007). The current Delta consists of islands, generally below sea level, surrounded by levees to keep out water. Freshwater inflow into the Delta has been substantially reduced by water diversions, mostly to support agriculture but with an increasing shift to M&I uses. Dredging and other physical changes have altered water flow patterns and salinity (USGS 2007). Nonnative species are changing the Delta's ecology by altering its food webs. All of these changes have had substantial effects on the Delta's biological resources, including marked declines in the abundance of many native fish and invertebrate species (Greiner et al. 2007).

The Delta supports freshwater fishes, anadromous fishes, estuarine fish, nursery grounds for marine fish, and freshwater species that can tolerate high salinities (Moyle 2002). Key native species that occur in the Delta include delta smelt, longfin smelt, Chinook salmon, steelhead, green and white sturgeon, splittail, and starry flounder. Species identified in Table 3-9 will be evaluated for effects from the WY 2010 Interim Flows.

Table 3-9.
Delta Fish Species Evaluated for WY 2010 Interim Flows

Species	Status
Delta smelt	Federally listed as threatened, State-listed as threatened
Longfin smelt	Proposed Federally listed as threatened, proposed State-listed as threatened
Green sturgeon	Federally listed as threatened
Central Valley late fall-run/ fall-run Chinook salmon	Federal species of concern, State species of special concern
Sacramento River winter-run Chinook salmon	Federally listed as endangered, State-listed as endangered
Central Valley spring-run Chinook salmon	Federally listed as threatened, State-listed as threatened
Central Valley steelhead	Federally listed as threatened
Sacramento splittail	State species of special concern

Key:
WY = Water Year

3.7 Cultural Resources

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).

Historic resources for this analysis were identified solely through archival documentation. No fieldwork was used to confirm the presence or absence of sites, nor has any new survey evaluation work been done to assess significance of existing historic-period resources within the Restoration Area. Historic-era resources identified through formal recordation on site records, California Department of Parks and Recreation (DPR) 523 property inventory forms, or through other State or local landmark inventory programs, are referred to in this analysis as "known" or "previously recorded" resources. To develop the sensitivity assessments, archival research and historic mapping were undertaken. The actual presence or integrity of historic-era architectural resources identified only through archival research and historic mapping is unknown, and these are referred to in this study as "identified resources."

3.7.1 San Joaquin River Upstream from Friant Dam

Surveys of the Millerton Lake SRA have identified 19 sites that lie below the maximum water level and above the low water level of Millerton Lake (Byrd and Wee 2008, Theodoratus and Crain 1962). All 19 prehistoric sites, including 13 bedrock milling sites, 4 residential sites, and 1 lithic scatter. The most notable of these is MAD-98, which was excavated by Hines (1988).

These sites are currently seasonally inundated by Millerton Lake. If the existing pattern of lake fluctuations changes, it may be appropriate to assess potential changes to site impacts. Significantly lower lake levels may increase exposure of existing sites or expose unrecorded sites that are currently fully inundated by Millerton Lake. At present, only two known sites (MAD-8 and FRE-71) are fully inundated by the lake. Both are large prehistoric residential sites recorded by Hewes in the 1930s (1941). Unrecorded sites may also exist.

3.7.2 San Joaquin River from Friant Dam to Merced River

Known cultural resources within the Restoration Area include several places of importance to the various Yokuts Tribes in particular. Some of the sites are close to the river. Major areas of resource concentrations appear to be in Firebaugh, Friant, the lower river from Fremont Ford to the Stanislaus County border, Herndon, Lanes Bridge, various current and former river alignments in the Sanjon de Santa Rita, and a number of sloughs and river locales north of San Luis Island. Cultural resource archival records are relatively limited within the Restoration Area. Based largely on the Central California and San Joaquin Valley information centers records search results, 213 cultural resources studies have been documented. Archaeological surveys have inventoried 12 percent of the Restoration Area, as shown in Table 3-10.

Table 3-10.
Summary of Cultural Resources Results by Reach

Reach	1	2	3	4	5	Bypasses	Total
Acreage	47,883	23,667	23,600	43,821	17,678	12,750	169,399
Archaeological Survey (%)	24.6	5.1	1.6	9.7	8.3	11.7	12.2
Recorded Archaeological Sites (resources with trinomials)							
Historic-Era	15	1	0	2	0	0	18
Prehistoric	42	7	0	12	18	5	84
Prehistoric/Historic-Era	5	0	0	2	0	0	7
Total	62	8	0	16	18	5	109
Recorded Historic-Era Architecture							
Primary Number Only	20	0	1	1	3	0	25
Caltrans Bridge Inventory	4	0	0	0	1	0	5
Partially Documented	10	0	0	0	0	0	10
Archaeological Sites with Architecture [1]	3	1	0	2	0	0	6
From Fresno County Historic Places List[4]	–	–	–	–	0	0	10
Total	37	1	1	3	4	0	56
Potential Prehistoric Surface Site Distribution[3]							
Using Survey Results by Reach	171	59	522	82	156	17	536
Buried Prehistoric Site Potential							
Very Low-Low (%)	31	41	14	41	38	73	35
Moderate (%)	0	0	6	20	4	22	8
Very High-High (%)	57	54	78	37	55	3	51
Potentially Sensitive Historic-Era Archaeological Sites							
Number	139	20	23	26	6	0	214
%	65	9.3	10.7	12.1	2.8	0	99.9
Potential Historic-Era Architectural Resources							
Number	841	90	101	94	121	14	1,242
By Weighted Value	942	123	141	138	121	13	–

Notes:
[1] Also counted in archaeological site numbers.
[2] Average density for Reaches 2 and 4 (2.2) used to generate this value.
[3] Conservative estimate–higher densities indicated by landform age data.
[4] Locations uncertain.
Key:
– = Not available

A total of 109 archaeological sites have been recorded within the Restoration Area. This includes 84 prehistoric sites, 18 historic-era sites, and 7 sites with both prehistoric and historic-era components. Most are concentrated in Reach 1 (57 percent) where inventory efforts have been the most rigorous, while Reach 3 lacks documented sites (with only 2 percent surveyed).

The 91 prehistoric sites and components include 35 major residential sites, 11 residential sites, 28 bedrock milling localities, 11 artifact scatters, 3 artifact scatters with bedrock milling, 2 lithic scatters, and 1 site with a single house pit. Many of the major residential sites have mounds (n=7), house pit depressions on the surface (n=21), and human remains (n=17). Human remains have also been noted at six other sites.

The 25 historic-era archaeological sites include 8 refuse deposits, 7 structural remains, 4 structural remains with refuse deposits, 4 water-related resources (2 check dams, 1 ditch, and 1 canal with refuse), and 2 railroad grades. Those with structural remains include residential and commercial buildings, Dickerson's Ferry, and ranches.

A total of 56 historic-era architectural resources were variously documented within the Restoration Area. These include 32 residential and commercial buildings, 7 bridges, 6 canals, 3 ferries, 2 dams, and 6 miscellaneous (1 rookery, 2 forts, 1 point, 1 pueblo, and 1 railroad grade). Most are concentrated in Reach 1 where inventory efforts have been the most rigorous.

Sensitivity Assessments

Distinct approaches to assessing sensitivity were applied to prehistoric archaeological sites, historic-era archaeological sites, and historic-era architectural resources.

Prehistoric Sites. Prehistoric surface site densities are relatively low and highly patterned by landform, based on the results of archaeological surveys. Middle Holocene landforms have the highest site density (20 per 1,000 acres), followed by Early Holocene and Latest Holocene-Modern landforms (4 sites per 1,000 acres), while Late Holocene and Pleistocene-and-Earlier landforms have much lower densities (2 to 3 sites per 1,000 acres). Landform age distribution also varies greatly throughout the Restoration Area; for example, Middle Holocene landforms are concentrated in Reach 4. Based on survey results, site densities are highest in Reach 5, and lowest in the bypass system. It is anticipated that full inventory would document between 500 and 800 surface sites. Over half of the Restoration Area appears to have a high to very high potential for buried sites. This is because large portions are covered by Latest Holocene-Modern (36 percent) and Late Holocene (15 percent) landforms. These results suggest that the low surface site densities in the Restoration Area may be largely due to alluviation that has buried much of the archaeological record (notably sites dating from the Latest Pleistocene through the Middle Holocene). Hence, differential sensitivity for encountering surface and buried prehistoric sites is contextual within this large study area, but landform age appears to be the most appropriate tool for assessing localized sensitivity.

Historic-Era Sites. Owing to the minimal number of recorded sites, the historic-era sensitivity analysis included known sites and potential archaeological sites based on documentary research. Of 1,024 potential archaeological resources, 214 are assessed as potentially sensitive historical archaeological properties. These include 92 that predate 1915, 119 agricultural properties dating from 1915 to 1950, 2 1930s labor camps, and a Japanese Assembly Center. The remaining 810 potential site locations, all dating after 1915, were considered unlikely to contain significant information. Overall, agricultural properties (64 percent) dominate the potentially sensitive sites, followed by residences

(22 percent), and towns and settlements (10 percent). Most of these are concentrated in Reach 1 (65 percent). Reaches 2 through 4 contain from 9 percent to 12 percent of these potential resources, Reach 5 has less than 3 percent, and the Eastside Bypass has none.

Historic-Era Architecture. The number of “identified resources” outweighs the “known resources” by a factor of approximately 22:1, with identified resources numbering 1,242 and previously recorded resources totaling 56. In large part, this great discrepancy is explained by the limited number of historic-era property survey reports undertaken within the 169,398-acre Restoration Area. The 1,242 localities with potential historic-era architecture are dominated by buildings and structures, followed by transportation infrastructure and water-related engineering features (comprising 93 percent). Homestead patents comprise 5 percent, with the remaining 2 percent including mining, recreation, private land grants in the prestatehood era, and miscellaneous elements, such as cemeteries, land colonies, and historic settlements. The sensitivity assessment used a qualitative ranking by assigning a numerical value to each potential resource based on three main variables: (1) estimated construction, (2) assumed presence or absence at the end of the historic period, and (3) known historic association. Reach 1 has the highest sensitivity; Reaches 2, 3, 4, and 5 have appreciably less potential by a factor of about 7:1; and the Eastside Bypass has a ratio of 70:1.

Potential Resources Eligible for Inclusion in National Register

Five previously recorded resources have been determined eligible for the National Register of Historic Places. All are architectural resources: Mendota Dam (P-10-03200), Merced River Bridge (P-24-00724), Madera Canal (P-20-02308), Friant-Kern Canal, and Friant Dam. While the latter three resources contribute to the overall proposed CVP multiple property listing currently being undertaken by Reclamation, the Friant-Kern Canal and Friant Dam have also been found individually eligible for listing on the National Register. No individual archaeological sites are currently listed on the National Register, although one site, MER-415, has been determined eligible.

Salient research domains useful for assessing the significance and eligibility for nomination were identified separately for prehistoric and historic-era archaeological sites. For surface prehistoric sites, residential sites have the highest likelihood for being evaluated as eligible for inclusion on the National Register. Most of these sites are Late Holocene in age, and most of the archaeological record dating between 4,000 and 12,000 years ago lies buried by later alluvium. In contrast to surface sites, a more varied range of buried sites is more likely to be evaluated as eligible for the National Register because they would fill important data gaps in understanding the region’s prehistory.

Agriculture sites (64 percent) and residences and towns (32 percent) dominate the potentially eligible historic-era archaeological sites. Most of the former date to between 1915 and 1950, while potentially eligible residences and towns all predate 1915. Although these property types were given greater weight, all potential types of archaeological properties were discussed with respect to their ability to address significant research questions and the appropriate data sets to do so.

3.8 Geology and Soils

Because of the regional-scale nature of earth resources, the geology and soils characteristics addressed in this section are described in a regional context, referring to geologic provinces, physiographic regions, or other large-scale areas, as appropriate.

3.8.1 Geology and Seismicity

The various geologic processes active in California over millions of years have created many geologically different areas, called provinces. The upper San Joaquin River lies in the Sierra Nevada Province, and the Restoration Area and lower San Joaquin River are in the Central Valley Province.

The Sierra Nevada Province encompasses the Sierra Nevada mountains, and comprises primarily intrusive rocks, including granite and granodiorite, with some metamorphosed granite and granite gneiss. The province is a tilted fault block nearly 400 miles long, with a high, steep multiple-scarp east face and a gently sloping west face that dips beneath the Central Valley Province (CGS 2002a).

The Central Valley Province encompasses the Central Valley, an alluvial plain about 50 miles wide and 400 miles long in the central part of California, stretching from just south of Bakersfield to Redding, California. The San Joaquin River and its tributaries flow out of the Sierra Nevada Province into the Central Valley, depositing sediments on the alluvial fans, riverbeds, floodplains, and historical wetlands of the Central Valley Province. The Central Valley Province is characterized by alluvial deposits and continental and marine sediments deposited almost continually since the Jurassic Period (CGS 2002b). The most recent surficial alluvial deposits are mined for aggregate, as discussed below (CGS 2002a).

Both the Sierra and Central Valley geologic provinces continue to be subject to minor tectonic activity (occurring within the past 1.6 million years). Active and inactive faults are recognized on both the north and south sides of the San Joaquin Valley. Earthquake groundshaking hazard potential is low in most of the San Joaquin Valley and Sierra Nevada foothills (CSSC 2003). The San Joaquin Valley is not a high-risk liquefaction area because of its generally low earthquake and groundshaking hazard risk; however, some liquefaction risk exists throughout the valley in areas where unconsolidated sediments and a high water table coincide, such as near rivers and in wetland areas (Mintier and Associates 2007).

3.8.2 Land Subsidence

Four types of land subsidence occur in the San Joaquin Valley: aquifer-system compaction due to groundwater level decline, near-surface hydrocompaction, subsidence due to fluid withdrawal from oil and gas fields, and subsidence caused by deep-seated tectonic movements (Ireland et al. 1982). Groundwater level decline has been one of the primary causes of land subsidence in the San Joaquin Valley because of compaction of aquifer sediments as a result of overdraft of the confined aquifer (Ireland 1986).

3.8.3 Salts

The accumulation of salts in the soils of the San Joaquin Valley is due to a combination of the regional geology, high water table, intensive irrigation practices, and importation of water from the Delta that is high in salinity and is applied to lands in the region. The Corcoran Clay and other clay layers contribute to a naturally high water table in the valley, concentrating salts in the root zone by evaporation through the soil. Farmers actively leach these salts from the soil into drainage water with irrigation and subsurface drainage practices. Drainage water with high concentrations of salts may be reused for irrigation (with or without treatment), accumulate in groundwater, or be discharged to evaporation ponds or tributaries to the San Joaquin River. The salinization caused by concentrations of naturally occurring soil salts is exacerbated by the use of more saline Delta water, imported via the DMC and the California Aqueduct, as a major source of irrigation water.

Additionally, naturally occurring trace elements in soils may be mobilized and concentrated along with salts. Soils throughout the San Joaquin Valley typically contain some selenium (see Figure 3-3), and soils on the west side of the valley are particularly selenium-rich. These soils have developed on alluvial deposits comprising eroded material from the Coast Range, where selenium is found in marine deposits. Selenium can pose a hazard to fish and wildlife when it becomes highly concentrated in surface waters.

To address the ongoing problem of salinization of soils and water in the Valley, the SWRCB, the Central Valley Regional Water Quality Control Board (RWQCB), and the multifaceted stakeholder group named the Central Valley Salinity Coalition, have teamed to lead efforts to identify and manage salt sources and processes causing salt loading in the San Joaquin Valley. Through the program CV-SALTS, this diverse group is devising a collaborative basin planning effort aimed at developing and implementing a comprehensive salinity and nitrate management strategy. Reclamation has also agreed to participate in salinity control efforts in the lower San Joaquin River watershed, as described in its Management Agency Agreement with the Central Valley RWQCB.

Total maximum daily loads (TMDL), which define a maximum acceptable level of loading of a particular constituent in surface water, exist or are currently being developed for salts in the San Joaquin River and several tributaries. More information on salt-related TMDLs, as well as a more detailed description of the water quality conditions in the study area, are presented in Section 3.11, Hydrology and Water Quality.

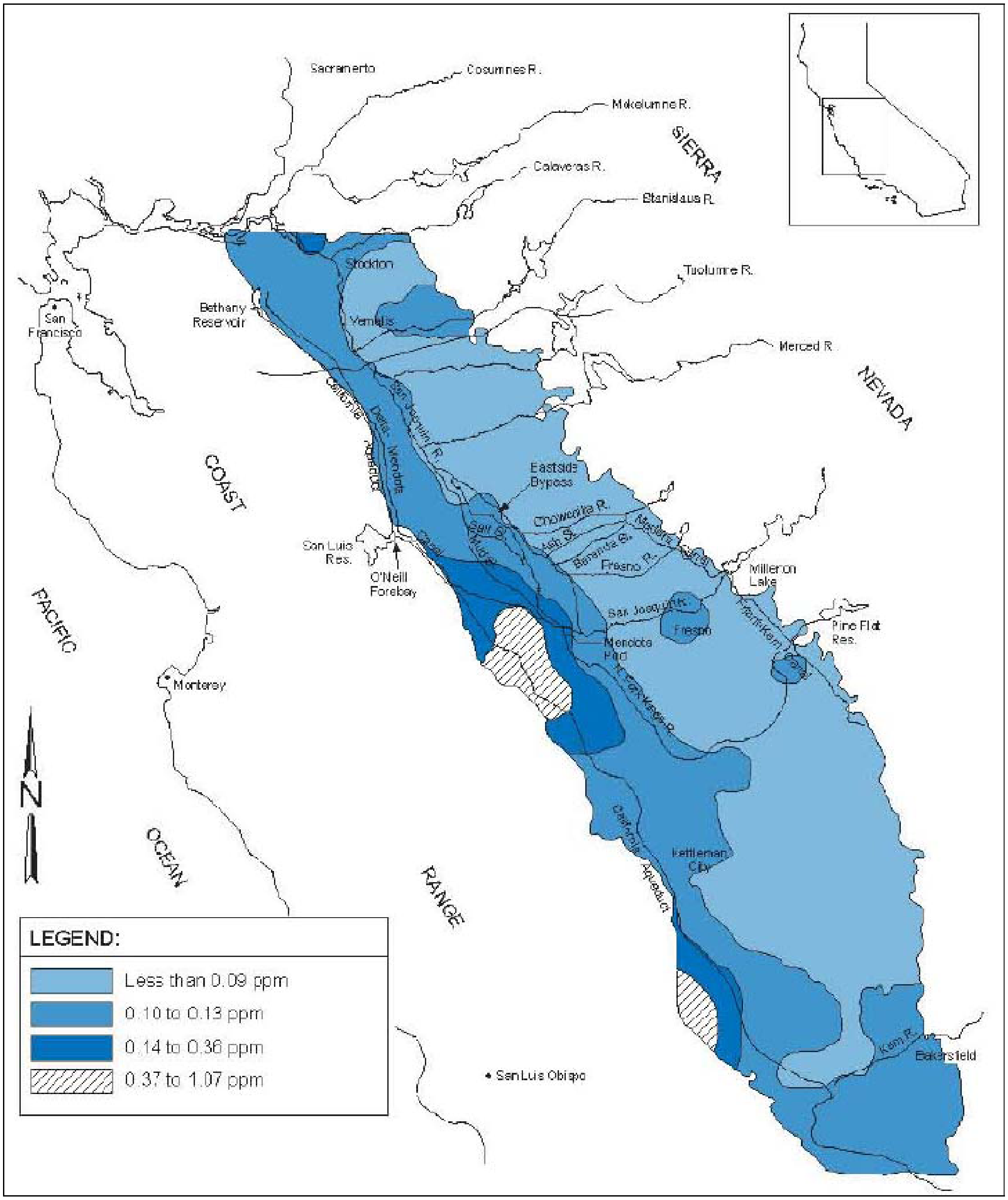


Figure 3-3.
Selenium Concentrations in Top 12 Inches of Soil in San Joaquin Valley

3.8.4 San Joaquin River from Friant Dam to Merced River

The following subsections describe geology and soils in the Restoration Area in more detail. Geology, seismicity and neotectonics, soils, erosion and sedimentation, and geomorphology are discussed as they apply to each reach of the Restoration Area and the bypasses.

Reach 1

At Friant Dam, the San Joaquin River leaves its narrow canyon in the Sierra Nevada mountains. After exiting the mountains, the river is confined by bluffs 50 to 100 feet high as a result of the river incising the Pleistocene alluvial fan. Within the bottomland between the bluffs, the river has also cut through more recently formed (Holocene) old alluvial fans, the remnants of which now make up terraces 15 to 30 feet high bounding the river. These confining features extend as far as Gravelly Ford.

Reach 1 has the steepest slopes in the Restoration Area. The reach has a coarse sediment substrate consisting of gravels and cobbles, which are prime salmonid spawning material. Since the construction of Friant Dam, the lower watershed has been cut off from the upper watershed, its major source of sediment. Remaining sediment sources to the lower watershed include (1) lateral erosion of terraces, (2) vertical incision of the riverbed itself, and (3) two small tributaries entering the reach directly, Cottonwood and Little Dry creeks. However, reduction in the original high-flow regime after emplacement of Friant Dam has reduced the ability of the river to recruit coarse terrace and bed sediment. Friant Dam (and other upstream dams) has not only severed the lower watershed from its source of coarse sediment, but also has cut off its main source of fine sediment. Fine sands and silts do not generally deposit in the active channel, but do deposit on the floodplain and are necessary for riparian vegetation regeneration. Without such fine sediment, riparian regeneration is impaired.

Soil in Reach 1 is dominated by sandy loam and sand, with minor amounts of loam, clay loam, and clay. Table 3-11 contains the calculated areas in acres for each generalized soil texture. Further National Resource Conservation Service (NRCS) data (Soil Survey Staff 2008) indicate that Reach 1 soils have moderate erosion potential. The exception is the bluffs of the San Joaquin River, which have steep slopes and are subject to high erosion potential.

Table 3-11.
Acreages of Soil Textures in Reaches and Bypasses

Reach	Subreach	Acreage of Soil Texture					Total Acreage
		Clay/Clay Loam	Loam	Sand	Sandy Loam	Variable[1]	
1	1A	103	96	1,541	6,193	2,732	10,663
	1B		24	902	3,629	610	5,165
	Reach 1 Total	103	119	2,443	9,822	3,341	15,828
2	2A		525	540	2,684	780	4,530
	2B	517	1,274	129	2,065	658	4,644
	Reach 2 Total	517	1,799	669	4,750	1,438	9,173
3	3	885	1,279	209	5,096	588	8,056
4	4A	624	713	254	2,602	402	4,595
	4B1	3,211	1,192	539	870	701	6,513
	4B2	1,338	509	82	418	983	3,331
	Reach 4 Total	5,173	2,415	875	3,890	2,086	14,439
5	5	2,583	317	341	756	1,464	5,460
Bypasses	(all subreaches)	4,896	7,937	672	3,980	2,137	19,623
Total All Reaches		19,950	18,198	9,198	46,755	17,920	112,020

Source: Soil Survey Staff 2008
Note:
[1] The category "variable" includes soils of undifferentiated texture and areas that were not mapped by the National Resource Conservation Service (i.e., covered by water during the mapping period).

Reach 2

Along the downstream end of Reach 1B, river terraces gradually merge with the floodplain, and by Gravelly Ford, bluffs and terraces no longer confine the river. The lack of confining features and the reduced gradient in Reach 2 both cause the channel to change to sand-bedded, meandering morphology. Meanders are moderate in Reach 2A and become more sinuous in Reach 2B as the river runs up against the prograding alluvial fans of the Coast Range drainages. The presence of the large-scale sloughs that typify the lower river reaches begins at the boundary of Reaches 2A and 2B.

Because of lack of through flows, most sediment is routed through the Chowchilla Bypass and very little sediment currently moves through Reach 2B. Instead, most sediment is routed with flows into the bypass, or accumulates at the entrance to the bypass. Historically, when flows through Reach 2 were more consistent, sediment supply decreased gradually from Reach 1B through Reach 2 the sediment was deposited on the floodplains.

Lack of vegetation and the sandy substrate cause the riverbed to be easily eroded when flows do pass through the reach. Bed mobility probably occurs at most baseflows, and bed scour is likely at flows of a few thousands cfs. As a result of this erosion, channel avulsion and migration can still occur between the project levees. Local landowners perform some sand mining in the levees, leaving pits 10 to 15 feet deep. However, the pits appear to fill after a single flood control release from Friant Dam. Reclamation and DWR are unaware of any Conditional Use Permits for mining activities in Reach 2A or in Eastside Bypass Reach 2.

Soil in Reaches 2A and 2B is dominated by sandy loam and sand, with sand becoming less common and loam more common with distance downstream. Additionally, loam, clay loam, and clay dominate the area of Fresno Slough and the Mendota Pool. Table 3-11 contains the calculated areas in acres for each generalized soil texture in Reaches 2A and 2B. NRCS data (Soil Survey Staff 2008) indicate that most Reach 2 soils have a moderate erosion potential.

Reach 3

Reach 3 is characterized by a meandering, sand-bedded channel, with a meander pattern that is less consistent than the meanders of Reach 2B. The river gradient decreases in Reach 3 relative to Reach 2 (Mussetter 2000a). Man-made structures, including canal embankments and project and nonproject levees, confine the river on both banks and prevent most overbank flows, channel migration, and avulsion. Confining canals are slightly set back from the channel between Mendota and Firebaugh, but downstream from Firebaugh, the channel is tightly bounded by canals that follow the meander of the river. These canals not only restrict the river channel but they also cut off the river from its historic floodplain.

Historic high-flow cut-off channels and meanders have also been separated from the main river channel by canals and levees. Many of these presently convey agricultural return flows and, during rain events, runoff. Examples of these in Reach 3 include Lone Willow Slough, which originates near the Chowchilla Bypass Bifurcation Structure and terminates just over a mile upstream from the Arroyo Canal diversion, and Button Willow Slough, a tributary to Lone Willow Slough.

Construction and operation of the Chowchilla Bypass system has effectively separated Reach 3 from most upstream sediment supply. Much of the sediment that is transported through Reach 2 is then temporarily caught behind Mendota Dam at the head of Reach 3. However, periodic pulling of boards on the dam and occasional draining of the Mendota Pool for inspection allow high flows to eventually carry this sediment into Reach 3. The Chowchilla Bypass Bifurcation Structure itself causes significant backwater effects, resulting in sediment build-up in the river channel just downstream from the structure.

Soil in Reach 3 is dominated by sandy loam, with minor amounts of loam, clay loam, clay, and sand. Table 3-11 contains the calculated areas in acres for each generalized soil texture in Reach 3.

Reach 4

Similar to Reach 3, Reach 4 begins as a meandering, sand-bedded channel with a gradient also similar to that of Reach 3 (Mussetter 2000a). However, in the upstream part of Reach 4, river morphology changes from the moderately confined configuration of Reaches 2 and 3 to the extensive flood basin geometry that characterizes Reaches 4 and 5. Beginning in Reach 4, the channel becomes confined by smaller riparian levees rather than by the bankfull channel and floodplains. Many large anabranching sloughs originate in Reach 4; these sloughs probably conveyed summer and winter baseflows in the past.

The river sediment load is typically low by the time flows arrive at Reach 4. The lack of extensive floodplains and a lower frequency of exposed sand bars within the channel indicate that Reach 4 was historically subject to sediment deprivation relative to upstream reaches. Since the construction of, and diversion of the majority of river flows into, the Chowchilla Bypass in Reach 2, sediment starvation of Reach 4 has increased.

At the boundary between Reaches 4A and 4B1, current operations of the Sand Slough Control Structure divert all flows into the Eastside Bypass. With flows, the entire sediment load of the river is conveyed into the bypass, entirely cutting off the sediment supply from the main river channel to Reach 4B1.

Downstream from the Sand Slough Control Structure, the Mariposa Bypass directs flow and sediment from Reach 4A and the bypass system into Reach 4B. Downstream from the Mariposa Bypass, Reach 4B receives further sediment influx from flow in the Chowchilla and Eastside bypasses and agricultural return flows.

Soil in the upstream half of Reach 4A is dominated by sandy loam, but further downstream, the river channel is characterized by more loam, clay loam, and clay. Soil in Reach 4B comprises mainly clay loam, clay, and some loam, with minor amounts of sandier soils. Lack of flows through this reach has likely prevented channel scour from removing these fine sediments. Table 3-11 contains the calculated areas in acres for each generalized soil texture in Reaches 4A and 4B. NRCS data (Soil Survey Staff 2008) indicate that overall, Reach 4 soils have moderate erosion potential.

Reach 5

The extensive flood basin morphology of Reach 4 continues into Reach 5, with little change in stream gradient. Historically, natural riparian levees provided moderate control of flows, although project and nonproject levees confine the river today. Anabranching channels that historically conveyed summer and winter baseflows continue to be common in this reach. Salt Slough and Mud Slough, tributaries that originate in the farmlands south of Reach 4, join the river in Reach 5. At the downstream end of Reach 5, the alluvial fan of the Merced River provides base level control of the river channel. Downstream from Reach 5, river geometry returns to a floodplain rather than flood basin morphology because of sediment supply from the Merced River.

Soil in Reach 5 is dominated by clay loam and clay, with minor amounts of coarser soils. Table 3-11 contains the calculated areas in acres for each generalized soil texture in Reach 5. NRCS data (Soil Survey Staff 2008) indicate that overall, Reach 5 soils have moderate erosion potential.

Chowchilla Bypass, Eastside Bypass, and Mariposa Bypass

The bypass system has been constructed in the San Joaquin River floodplain and is composed of man-made channels and converted sloughs. A low-flow channel exists in much of the bypass system; however, it is best defined in the Mariposa Bypass, where the high groundwater table maintains more frequent base flows. This aggradation has affected the conveyance capacity of the bypass system (USACE 1993).

Soil in the bypass system is dominated by loam, clay loam, and clay, with some sandy loam and minor amounts of sand. Table 3-11 contains the calculated area in acres for each generalized soil texture in the bypass system. NRCS data (Soil Survey Staff 2008) indicate that overall, soils in the bypass system have moderate erosion potential.

3.9 Mineral Resources

Because of the regional-scale nature of earth resources, the mineral characteristics addressed in this section are described in a regional context.

3.9.1 Mineral Production

In 2006, California ranked third in the Nation in nonfuel mineral production. In that year, California yielded $4.6 billion in nonfuel minerals, totaling 7 percent of the Nation's entire production (Kohler 2006). The value and quantity produced of the most economically important products in the State are summarized in Table 3-12. Of these products, construction sand and gravel are the most widely mined resources in the vicinity of the San Joaquin River. Historically, gold was also extracted from the riverbed, as described below.

Table 3-12.
California Nonfuel Mineral Production in 2006

Product	Quantity (short tons)	Value ($ millions)
Construction sand and gravel	178,605,000	1,500
Portland cement	12,899,200	1,250
Boron minerals	674,700	731.8
Crushed stone	58,728,000	481.7
Other[1]	NA	395.6
Masonry cement	771,700	87.8
Industrial sand and gravel	2,260,100	62.2
Clays	1,334,000	46.1
Gold	1.11	19.6
Dimension stone	47,400	11.2
Gemstones	NA	1.1
Total	NA	**4,587**

Source: Kohler 2006
Note:
[1] Other includes diatomite, feldspar, gypsum, iron ore, lime, magnesium compounds, perlite, pumice and pumicite, salt, soda ash, silver, talc, sodium sulfate, and zeolites.
Key:
NA = Not available

Sand, Gravel and other Rock Products

In 2006, California was the Nation's largest producer of construction sand and gravel ($1.5 billion) and Portland cement ($1.25 billion) (Kohler 2006). California also produced significant quantities of crushed stone ($481 million), industrial sand and gravel ($62.2 million), masonry cement ($87.8 million), and dimension stone ($11.2 million) (Table 3-12). Together, the market value of these products totals $3.4 billion, almost 75 percent of the total value of State nonfuel mineral production. The San Joaquin River below Friant Dam is a significant source of sand and gravel in the State, and mining occurs at multiple locations on the floodplain and river terraces (Reclamation 1997, Mussetter 2000b).

Gold

Historically, gold was mined from quartz veins in the Mother Lode of the northern Sierra Nevada as well as from placer deposits in loosely consolidated alluvial sediments throughout the Sierra Nevada foothills. The San Joaquin River above Friant Dam was subject to some degree of placer mining from 1848 to 1880, followed by dredge mining from 1880 to the 1960s (Mussetter 2000b). These activities significantly reworked the riverine environments, redistributing sediments and altering channel forms. However, the San Joaquin River was not as affected by dredge mining as the more northerly Sierra Nevada drainages where gold was more plentiful (McBain and Trush 2002). Gold extraction does not currently occur on any part of the San Joaquin River.

3.9.2 San Joaquin River from Friant Dam to Merced River

The following subsections describe the minerals of the Restoration Area in more detail. Mining is discussed for Reach 1 and Reach 2 of the Restoration Area and the bypasses.

Reach 1

Reach 1A is the most substantially aggregate mining part of Reach 1. From Friant Dam to Skaggs Bridge (Highway 145), at least nine large pits ranging in size from 2.8 to 67.3 acres have been captured by the river (McBain and Trush 2002). More than 60 separate pits have been identified within this reach. Table 3-13 shows the total area of mining pits and percentage capture by the river between Friant Dam and Skaggs Bridge. Local channel degradation throughout Reach 1 can most likely be attributed to this mining in combination with the cutoff of sediment supply from the upper watershed (McBain and Trush 2002).

Table 3-13.
Aggregate Mining Areas in Reach 1 Between Friant Dam and Skaggs Bridge

Reach	Total Area of Mining Pits (acres)	Area of Pits Captured by River (acres)	Percentage of Pits Captured
Reach 1A from Friant Dam to State Route 41	494.5	7.5	1.5
Reach 1A from State Route 41 to State Route 99	784.4	155.4	19.8
Reach 1B from State Route 99 to Skaggs Bridge (Highway 145)	76.2	26.8	35.1
Totals	1,355.1	189.7	56.4

Source: McBain and Trush 2002

Substantial aggregate mining in the San Joaquin River and its tributaries has significantly decreased coarse sediment replenishment. In Reach 1A, an estimated 1,562,000 cubic yards of aggregate were removed from the active channel of the San Joaquin River between 1939 and 1989, and another 3,103,000 cubic yards were removed from the floodplain and terraces. In Reach 1B during the same time period, an estimated 107,000 cubic yards of aggregate were removed from the active river channel and 72,000 cubic yards were extracted from the floodplain and terraces (McBain and Trush 2002).

This total quantity of aggregate is in fact much greater than the amount of coarse sediment thought to have been delivered from the upper watershed under unimpaired (pre-Friant Dam) conditions (between 26,000 and 48,600 cubic yards/year). Given this sediment transport rate, in the absence of Friant Dam, the river would have transported approximately 1,865,000 cubic yards of material into Reach 1 in the 50-year period from 1939 through 1989. The aggregate removed from the active river channel in Reach 1A alone during this same time period (1,562,000 cubic yards) nearly equals this amount. Local channel degradation throughout Reach 1 can mostly likely be attributed to this mining in combination with the cutoff of sediment supply from the upper watershed (McBain and Trush 2002).

Reach 2

Local landowners perform some sand mining in the levees, leaving pits 10 to 15 feet deep. However, the pits appear to fill after a single flood control release from Friant Dam. Reclamation and DWR are unaware of any Conditional Use Permits for mining activities in Reach 2.

Chowchilla Bypass, Eastside Bypass, and Mariposa Bypass

A sediment detention basin is located in the Chowchilla Bypass downstream from the bifurcation structure. The 250,000-cubic yard basin captures incoming sediment, particularly sand, to prevent it from filling the bypass channels further downstream. As part of their operations and maintenance, the Lower San Joaquin Levee District (LSJLD) contracts with private companies to excavate this sand to maintain basin capacity. LSJLD generates revenue from sand removal activities. Sand scoured from Eastside Bypass Reach 1 is deposited in Eastside Bypass Reach 3.

3.10 Hazards and Hazardous Materials

Hazards and hazardous materials are described in terms of anthropogenic hazards, West Nile virus (WNV), Valley Fever, school safety, oil and gas wells, wildland fire, and aircraft safety.

3.10.1 Anthropogenic Hazards

The following subsections describe anthropogenic hazards in the study area, which are primarily limited to the Restoration Area and downstream.

San Joaquin River from Friant Dam to Merced River

Anthropogenic sources of hazardous materials and waste may exist in both the agricultural and urbanized portions of the Restoration Area. Contaminated sites generally are the result of unregulated spills of hazardous materials, such as gasoline or industrial chemicals, which result in unacceptable levels of toxic substances in soil or water that pose risks to human health and safety. Contamination also may result from ongoing land uses that generate substantial amounts of hazardous wastes, such as mines and landfills.

Hazardous waste sites listed below were compiled from the Department of Toxic Substances Control's Cortese List, SWRCB's Geotracker (2008), and USEPA's Enviromapper databases.

Areas currently or historically used for agricultural purposes, such as a large portion of the study area, are likely to have received pesticide, herbicide, and fertilizer applications. Therefore, it should be assumed that all geographic areas discussed below are potentially contaminated with residual agricultural chemicals.

Reach 1. In addition to two sites for which remediation has been completed, two additional sites in Reach 1 are known to contain hazardous materials and are considered to have "open" SWRCB cleanup status. Palm Bluffs Corporate, located at 7690 Palm Avenue, Fresno, is listed as a land disposal site. Southern Pacific Transportation Company, located at 17390 Friant Road, Friant, is listed for potential chromium and other metals contamination.

Reach 2. One site in Reach 2 is listed in the above-mentioned databases. Mendota Landfill is considered by SWRCB to have open cleanup status, and potential volatile organic compound contamination.

Reach 3. The SWRCB lists eight sites for which remediation has been completed. Four leaking underground storage tank (LUST) sites are known in Firebaugh, in the vicinity of Reach 3.

Reaches 4 and 5. No sites listed in the above-mentioned databases are located in Reaches 4 and 5.

Chowchilla Bypass and Tributaries. No sites listed in the above-mentioned databases are located in the Chowchilla Bypass or tributary of the Restoration Area.

Eastside Bypass, Mariposa Bypass, and Tributaries. No sites listed in the above-mentioned databases are located in the Eastside and Mariposa bypasses or tributaries of the Restoration Area.

San Joaquin River from Merced River to the Delta

Anthropogenic hazards may occur on the west side of the San Joaquin River below the Merced River confluence but are not known to contaminate the river.

3.10.2 West Nile Virus

All mosquito species are potential vectors of organisms that can cause disease to pets, domestic animals, wildlife, and humans. Public concern regarding WNV, a disease transmitted to humans, has increased since the virus was first detected in the United States in 1999. A mosquito acquires WNV by feeding on a bird with the virus in its blood. Although most people infected with WNV experience no symptoms, approximately 20 percent will develop West Nile Fever. West Nile Fever symptoms, which may last from a few days to several weeks, include fever, fatigue, body aches, headache, skin rash on the trunk of the body, and swollen lymph glands. Approximately 1 in 150 persons who are exposed to WNV, usually those over the age of 50 or considered to be immunocompromised, will develop severe West Nile Disease. Severe West Nile Disease symptoms include West Nile encephalitis (inflammation of the brain), West Nile meningitis (inflammation of the membrane around the brain and spinal cord), and West Nile poliomyelitis (inflammation of the brain and surrounding membrane).

All counties in the Restoration Area or downstream to the Delta have reported cases of WNV (CDPH et al. 2009). Mosquito habitat for all of the life cycles of the species is located in this geographic region within several miles of wetted portions of the San Joaquin River, bypasses, and tributaries.

3.10.3 Valley Fever

Valley Fever is an infection, usually targeting the lungs, which results from inhalation of the fungus *Coccidioidomycosis*. *Coccidioidomycosis* spores live in soil and generally are limited to areas of the southwestern United States, Mexico, and parts of Central and South America. It can be contracted only from inhaling spores; it cannot be passed from an infected person to an uninfected person. In California, it is most commonly found in the Central Valley. Spores can enter the air when earthmoving activities, including natural disasters such as earthquakes or excavation activities, disturb spore-bearing soil. Approximately 60 percent of exposed people experience symptoms. Infection can cause flu-like symptoms, and if it is disseminated to organs other than the lungs, Valley Fever can lead to severe pneumonia, meningitis, and death (CDC 2008).

The Centers for Disease Control and Prevention(CDC) considers Valley Fever to be endemic in California. Because this disease is considered to be particularly prevalent in California’s Central Valley, it is likely that *Coccidioidomycosis* is present in the Restoration Area and other portions of the study area, and could be disturbed and become airborne during any earthmoving activities.

3.10.4 School Safety

School-aged children are considered to be particularly sensitive to adverse effects resulting from exposure to hazardous materials, substances, or waste. Public Resources Code Section 21151.4 requires that lead agencies evaluate projects proposed within a quarter-mile of a school to determine whether release of hazardous air emissions or hazardous substances, resulting from implementing the Proposed Action, would pose a human health or safety hazard. Fourteen schools are located within a quarter-mile of Reaches 1 and 3 of the Restoration Area. No schools are located within a quarter-mile of Reaches 2, 4, or 5; the bypasses; or the San Joaquin River below the Merced River confluence to the Delta. Schools located within the Restoration Area are listed in Table 3-14.

Table 3-14.
Schools Located Within the Restoration Area

Reach 1	Schools Within a Quarter-Mile of Reach
Reach 1	Alview Elementary School
	Friant Elementary School
	Liddell Elementary School
	River Bluff Elementary School
	Valley Oak Elementary School
Reach 3	El Puente High School
	Firebaugh Head Start
	Firebaugh High School
	Firebaugh Middle School
	Firebaugh Migrant Head Start
	Hazel M. Bailey Primary School
	Mills Intermediate School
	St. Joseph High School
	St. Joseph School

Note:
[1] No schools are located within a quarter-mile of Reaches 2, 4, 5, or the bypasses

3.10.5 Oil and Gas Wells

Oil or gas wells are abandoned when production ends at a well or when it is determined to be a dryhole (e.g., no existing oil or gas). Proper abandonment procedures involve plugging the well by placing cement in the well bore or casing at certain intervals, as specified in California laws and regulations. The plug is intended to seal the well bore or casing and prevent fluid from migrating between underground rock layers. Health and safety hazards may occur if earthmoving activities disrupt active, idle, or abandoned wells. Disruption could potentially result in soil and groundwater contamination, oil and methane seeps, fire hazards, and air quality degradation (DOGGR 2007, 2008).

The California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR) has inventoried abandoned wells located in the Restoration Area (DOGGR 2008). In addition to wells identified by DOGGR, confidential wells (e.g., exploratory wells) may be located along the reaches in the Restoration Area. Wells are granted confidentiality for up to 2 years. Confidential wells and other wells not listed may be found during site surveying for earthmoving activities. Table 3-15 shows the number of known abandoned oil and gas wells within the Restoration Area.

Table 3-15.
Known Abandoned Oil and Gas Wells Within Restoration Area

River and Bypass Reaches	Number of Known Abandoned Oil and Gas Wells
San Joaquin River – Reach 1	1
San Joaquin River – Reach 2	9
San Joaquin River – Reach 3	4
San Joaquin River – Reach 4	6
San Joaquin River – Reach 5	0
Fresno Slough/James Bypass	9
Chowchilla Bypass and Tributaries	8
Eastside Bypass, Mariposa Bypass, and Tributaries	1

Source: CDC 2008

3.10.6 Wildland Fire

Wildland fires pose a hazard to both persons and property in many areas of California. The severity of wildland fires is influenced primarily by vegetation, topography, and weather (temperature, humidity, and wind). The California Department of Forestry and Fire Protection (CALFIRE) developed a fire hazard severity scale that considers vegetation, climate, and slope to evaluate the level of wildfire hazard in all State Responsibility Areas. The designation of State Responsibility Areas and Local Responsibility Areas is used to identify responsibility for providing basic wildland fire protection assistance, and to identify three levels of fire hazard severity zones (moderate, high, and very high) to indicate the severity of fire hazard in a particular geographic area (CALFIRE 2009).

Reaches 2 through 5, all bypasses and tributaries, and the lower San Joaquin River are located in a Local Responsibility Area and a moderate or an unzoned Fire Hazard Severity Zone.

3.10.7 Aircraft Safety

Collisions between aircraft and wildlife can compromise the safety of passengers and flight crews. Damage to an aircraft resulting from a wildlife collision can range from a small dent in the wing to catastrophic engine failure, destruction of the aircraft, and potential loss of life. Airports within 2 nautical miles of a project area may be affected by land use changes that attract wildlife that can cause hazards. Natural or constructed areas found in the Restoration Area, such as poorly drained locations, wetlands, odor-causing rotting organic matter (putrescible waste), detention/retention ponds, disposal operations, wastewater treatment plants, and agricultural or aquaculture activities can provide wildlife habitat.

According to the Federal Aviation Administration (FAA) (FAA 2007), the following groups of species, found in the Restoration Area, are hazardous to airport operations: waterfowl, wading birds, and shorebirds; gulls; sparrows, larks, and finches; raptors; swallows; blackbirds and starlings; corvids; and columbids.

Airports within 2 miles of each river and bypass reaches are shown in Table 3-16.

Table 3-16.
Airports Within 2 Miles of River and Bypass Reaches

River and Bypass Reaches	Airports Located Within 2 Miles
Reach 1	Arnold Ranch Sierra Sky Park
Reach 2	Mendota Airport
Reach 3	Firebaugh Airport
Reach 4	Triangle T Ranch Willis Ranch
Reach 5	Gustline Stevinson Strip
Fresno Slough/James Bypass	Mendota Airport
Chowchilla Bypass and Tributaries	Emmett Field Red Top Triangle T Ranch
Eastside Bypass, Mariposa Bypass, and Tributaries	None
San Joaquin River from Merced River to the Delta	Ahlem Farms Westley Yandell Ranch

Source: FAA 2007

3.11 Hydrology and Water Quality

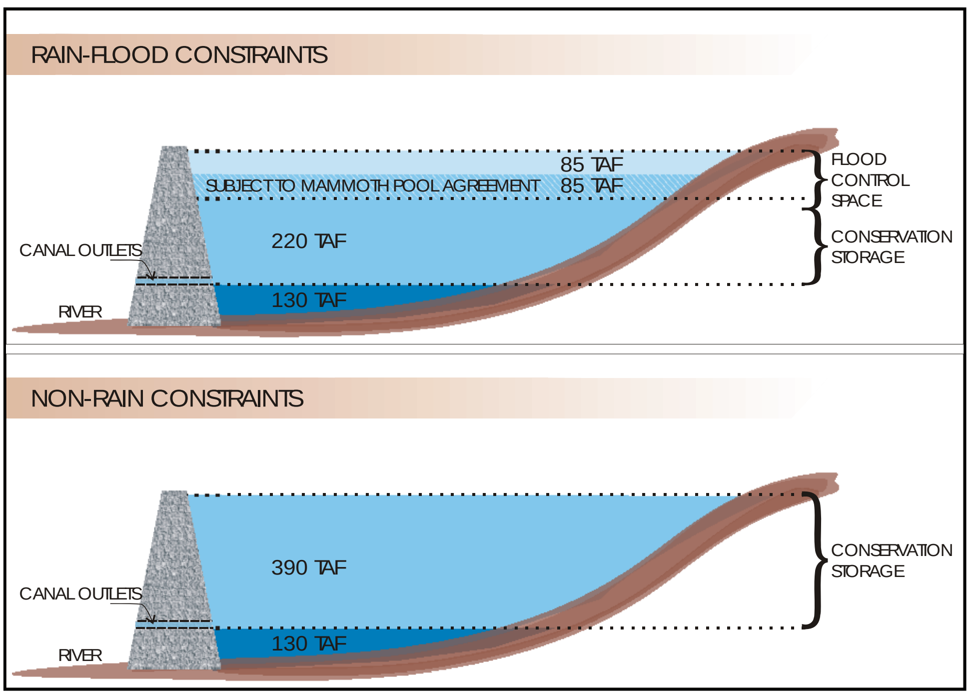
Hydrology and water quality conditions in the study area include surface water supplies and facilities operations, surface water quality, and groundwater. These conditions are described below for the geographic subareas, as appropriate.

3.11.1 Surface Water Supplies and Facilities Operations

All major rivers in the Central Valley have been developed by construction of dams and conveyance facilities for water supply, flood management, and hydropower generation. Flows in the San Joaquin River are affected by water projects on the river's tributaries, imports to the river from other regions, diversions from the river, return flows, and Millerton Lake. Surface water supplies and facilities operations are described in the following subsections for all five geographic subareas.

San Joaquin River Upstream from Friant Dam

Millerton Lake has a volume of 524 TAF and a surface area of 4,905 acres at the top of active storage. Figure 3-4 shows an active conservation space of 390 TAF, with up to 170 TAF for flood management space in Millerton Lake from October through March. The mean annual unimpaired runoff to Millerton Lake is 1,812 TAF, with a range of 362 to 4,642 TAF.



Source: Reclamation 2003
Key: TAF = thousand acre-feet

Figure 3-4.
Schematic of Millerton Lake Storage Requirements

Millerton Lake is operated as an annual reservoir – all water supplies available in a given year are allocated, with the expectation of delivery. Median reservoir water level ranges from elevation (North American Vertical Datum of 1988 (NAVD 1988)) 564 in late spring to elevation (NAVD 1988) 497 in late summer. Water deliveries, principally for irrigation, are made through outlet works to the Friant-Kern and Madera canals, completed in 1949 and 1944, respectively. A river outlet works is located within the lower portion of the dam. Additional physical data pertaining to Friant Dam and Millerton Lake are presented in Table 3-17.

Table 3-17.
Pertinent Physical Data – Friant Dam and Millerton Lake

Friant Dam and Millerton Lake Flows			
Average annual unimpaired runoff (1901–2008)	1,811,681 acre-feet	Average daily inflow	2,500 cfs
Minimum average daily inflow (Oct. 10, 1977)	0 cfs	Maximum average daily inflow (Dec. 23, 1955)	61,700 cfs
Maximum instantaneous inflow (Dec. 23, 1955)	97,000 cfs	*Spillway design flood*	
Minimum average daily outflow (Oct. 20, 1940)	5.5 cfs	Peak inflow	197,000 cfs
Maximum average daily outflow (June 6, 1969)	12,400 cfs	Peak outflow	158,500 cfs
Friant Dam and Millerton Lake Characteristics[1]			
Friant Dam (concrete gravity)		**Millerton Lake**	
Elevation, top of parapet	587.6 feet above msl	*Elevations*	
Freeboard above spillway flood pool	3.25 feet	Minimum operating level[2]	468.7 feet above msl
Elevation, crown of roadway	583.8 feet above msl	Top of active storage capacity	580.6 feet above msl
Maximum height, foundation to crown of roadway	319 feet	Spillway flood pool	587.6 feet above msl
Crest Length		*Area*	
Left abutment, nonoverflow section	1,478 feet	Minimum operating level	2,108 acres
Overflow river section	332 feet	Top of active storage capacity	4,905 acres
Right abutment, nonoverflow section	1,678 feet	Spillway flood pool	5,085 acres
Total length	3,488 feet	*Storage capacity*	
Width of crest at elevation 581.25	20.0 feet	Minimum operating level[2]	130,740 acre-feet
Total concrete in dam and appurtenances	2,135,000 cubic yards	Top of active storage capacity	524,250 acre-feet
		Spillway flood pool	559,300 acre-feet
		Drainage area	1,638 square miles
Spillway (gated ogee)		**Outlets**	
Crest length		*River outlets (110-inch-dia. w/ 96-inch hollow jet valves)*	
Gross	332 feet	Number and elevation	4 @ 382.6 feet above msl
Net	300 feet	Capacity at minimum pool	12,400 cfs
Crest elevation	562.6 feet above msl	Capacity at top of active storage	16,400 cfs
Discharge capacity (height = 18.0 feet)	83,160 cfs	*Diversion outlets, Madera Canal (91-inch-dia. w/ 86-inch needle valve)*	
Crest gates (1 drum and 2 Obermeyer)		Number and elevation	2 @ 448.6 feet above msl
Number and size	3 @ 100 feet by 18 feet	*Diversion outlets, Friant-Kern Canal (110-inch-dia. w/ 96-inch hollow jet valve)*	
Top elevation when lowered	562.6 feet above msl	Number and elevation	4 @ 466.6 feet above msl
Top elevation when raised	580.6 feet above msl		
Friant-Kern Canal		**Madera Canal**	
Length	152 miles	Length	36 miles
Operating capacity below Friant Dam	5,000 cfs	Capacity below Friant Dam	1,250 cfs
Operating capacity at terminus of canal	2,000 cfs	Capacity at Chowchilla River	625 cfs

Source: USACE 1955 (revised 1980), with elevations revised to NAVD 1988; CDEC gage records.
Notes:
[1] Elevations are given in North American Vertical Datum (NAVD) of 1988.
[2] Minimum operating level generally corresponds with elevation of Friant-Kern Canal outlets.
Key:
cfs = cubic feet per second
Dec. = December
dia. = diameter
msl = mean sea level
Oct. = October

San Joaquin River from Friant Dam to Merced River

This section describes water operations within the Restoration Area for nine distinct river reaches and subreaches, and several flood bypasses. Average historical flows in the San Joaquin River within the Restoration Area, are described below.

Reach 1. San Joaquin River releases are made at Friant Dam to comply with Holding Contract requirements along Reach 1. Streamflow of at least 5 cfs must be maintained past the last diversion before Gravelly Ford, with no requirements for streamflow into Reach 2. The design channel capacity of Reach 1 is 8,000 cfs. Sand and aggregate mining pits in the channel and floodplain in Reach 1 are hydrologically connected to Reach 1, and can attenuate flow and increase evaporation. Agricultural return flows in Reach 1 are minor. Reach 1 is divided into Reach 1A and Reach 1B.

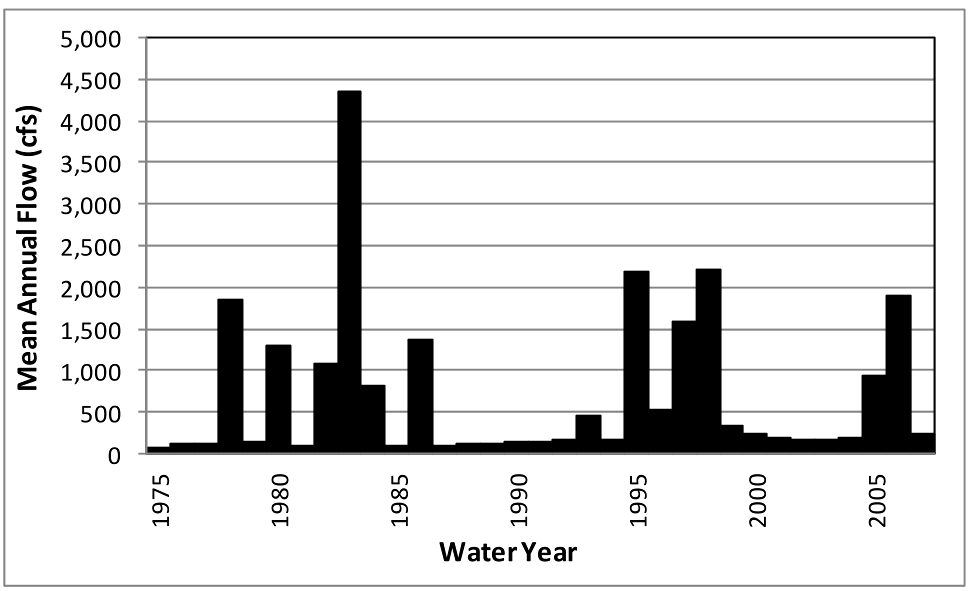
Flows within Reach 1A are predominantly influenced by releases from Friant Dam along with diversions and seepage losses. Mining pits in Reach 1 are primarily located in Reach 1A. Cottonwood Creek and Little Dry Creek, two intermittent streams, join the San Joaquin River in Reach 1A. Since 1949, Reclamation has made annual releases of about 117 TAF from Friant Dam to the San Joaquin River to comply with Holding Contract requirements upstream from Gravelly Ford. Additional river flows occur during years when releases are made to the San Joaquin River for flood management purposes. Nonflood releases made from Friant Dam for water diversions are typically below 150 cfs. Four streamflow gages are located within or near Reach 1A. Table 3-18 lists the gages located in or near this reach, along with the gages' period of record, mean annual streamflow, and maximum daily average flow. Figures 3-5, 3-6, 3-7, and 3-8 show historical mean annual flows at the gages. Tables 3-19, 3-20, 3-21, and 3-22 show monthly mean flows at the gages. Ninety water diversions are located along this reach, not all of which are active on a regular basis.

Flows within Reach 1B are predominantly influenced by inflow from Reach 1A, diversions, and seepage losses. Table 3-23 lists the gages located in or near this reach segment, along with periods of record and mean and maximum daily mean streamflow. Figures 3-9, 3-10, and 3-11 show mean annual flows at the gages. Tables 3-24, 3-25, and 3-26 show historical mean monthly flows at the gages. Fifteen water diversions are located along this reach.

Table 3-18.
Streamflow Gages in Reach 1A

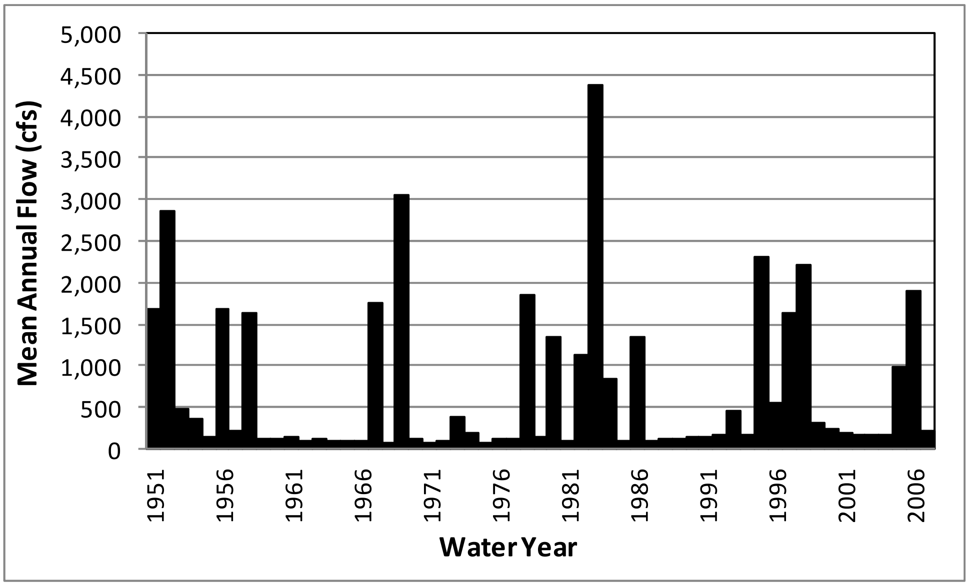
Gage Name	USGS Gage Station No. or CDEC ID	MP	Drainage Area (square miles)	Period of Record[1]	Mean Annual Streamflow (cfs)	Maximum Daily Mean Streamflow (cfs) (date measured)
San Joaquin River release from Friant Dam	MIL	267.6	1,640	1974 – 2007	707	25,556 (January 4, 1997)
San Joaquin River below Friant Dam	11251000	266.0	1,676	1950 – present[2]	703	36,800 (January 3, 1997)
Cottonwood Creek near Friant Dam	CTK	NA	35.6	1974 – 2007	7	783 (January 27, 1983)
Little Dry Creek near Friant Dam	LDC	NA	57.9	1974 – 2007	22	2,457 (March 11, 1995)

Source: CDEC 2008; USGS 2008
Notes:
[1] Calendar years.
[2] Period of record coincides with start of diversions from Friant Dam (1950).
Key:
CDEC = California Data Exchange Center
cfs = cubic feet per second
ID = identification
MP = milepost
NA = not applicable/not available
No. = number
USGS = U.S. Geological Survey



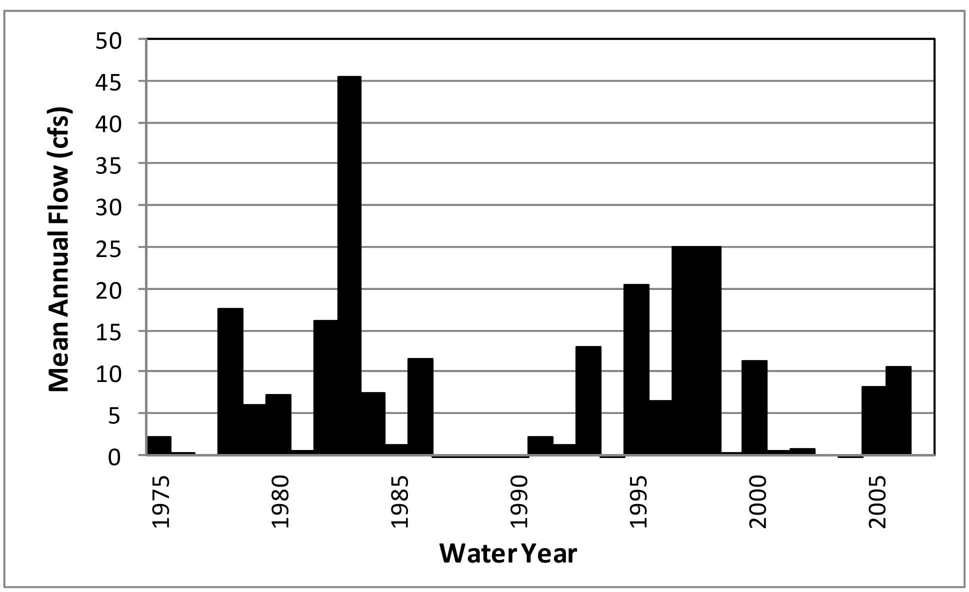
Source: CDEC 2008, Gage ID MIL

Figure 3-5.
Historical Mean Annual Flow for Friant Dam Releases



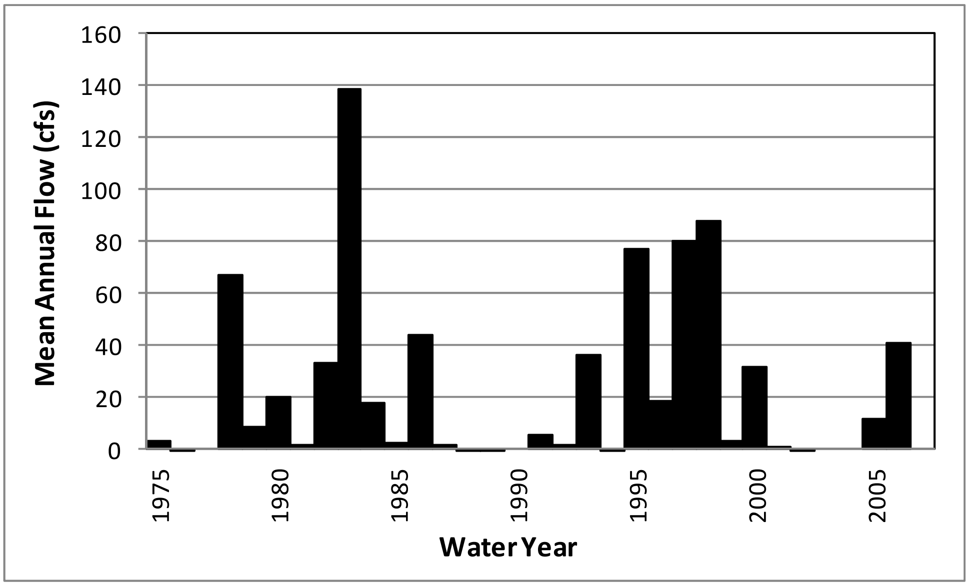
Source: USGS 2008, Gage ID 11251000

Figure 3-6.
Historical Mean Annual Flow for San Joaquin River Flow Below Friant Dam



Source: CDEC 2008, Gage ID CTK

Figure 3-7.
Historical Mean Annual Flow for Cottonwood Creek near Friant Dam



Source: CDEC 2008, Gage ID LDC

Figure 3-8.
Historical Mean Annual Flow for Little Dry Creek near Friant Dam

Table 3-19.
Historical Mean Monthly Flows for Friant Dam Releases

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	187	199	306	635	823	1,078	1,599	1,423	1,162	731	258	254
Wet	146	277	600	1,609	2648	3,379	4,453	3,402	2,720	1,971	371	402
Normal-Wet	321	301	444	682	281	410	269	349	281	239	195	173
Normal-Dry	152	116	92	81	86	89	132	156	191	207	202	196
Dry	128	101	83	67	77	105	145	167	200	225	222	195
Critical-High	86	68	51	62	52	107	109	171	172	171	160	132
Critical-Low	99	83	96	69	84	112	153	128	175	191	193	150

Source: CDEC 2008, Gage ID MIL
Note:
[1] Period of record Water Years 1975 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Table 3-20.
Historical Mean Monthly Flows for San Joaquin River Below Friant Dam

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	198	167	284	590	883	965	1,478	1,495	1,240	588	260	223
Wet	157	228	533	1,618	2,882	3,266	4,601	4,532	3,641	1,602	399	369
Normal-Wet	283	209	448	613	507	394	509	370	442	340	264	152
Normal-Dry	224	140	107	102	148	132	170	216	178	178	179	192
Dry	107	86	66	54	69	92	123	138	173	199	197	165
Critical-High	108	69	118	107	61	112	131	159	167	175	161	120
Critical-Low	90	69	97	68	92	107	151	115	177	194	195	150

Source: USGS 2008, Gage ID 11251000
Note:
[1] Period of record Water Years 1951 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Table 3-21.
Historical Mean Monthly Flows for Cottonwood Creek near Friant Dam

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	0	0	4	17	26	28	11	2	0	0	0	0
Wet	0	0	11	54	73	74	26	5	1	0	0	0
Normal-Wet	0	0	4	5	22	21	5	0	0	0	0	0
Normal-Dry	0	0	0	1	1	5	1	0	0	0	0	0
Dry	0	0	0	0	2	1	0	0	0	0	0	0
Critical-High	0	0	0	0	1	2	0	0	0	0	0	0
Critical-Low	0	0	0	0	0	0	0	0	0	0	0	0

Source: CDEC 2008, Gage ID CTK
Note:
[1] Period of record Water Years 1975 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Table 3-22.
Historical Mean Monthly Flows for Little Dry Creek near Friant Dam

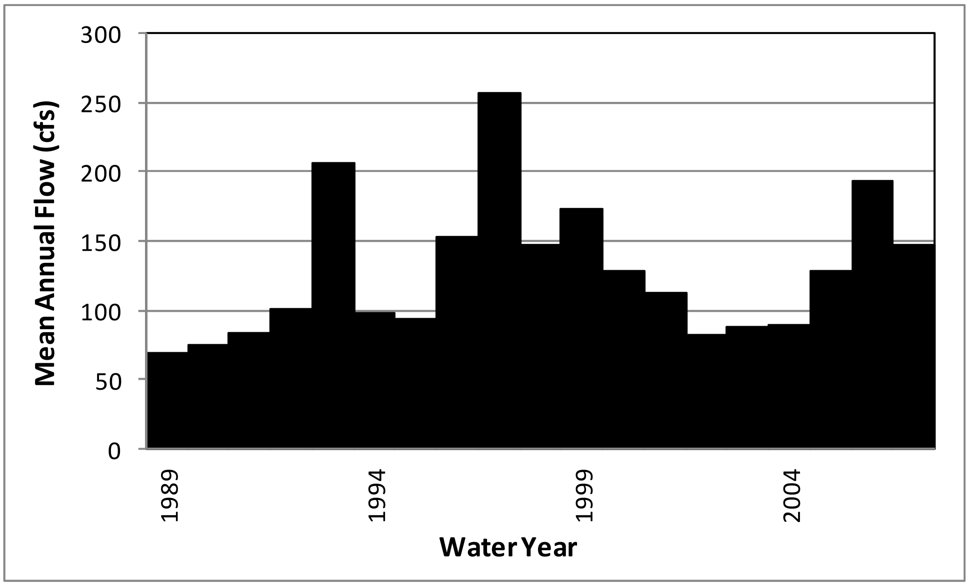
Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	0	1	12	43	84	84	39	7	2	0	0	0
Wet	0	2	31	143	249	252	87	20	6	0	0	0
Normal-Wet	0	2	17	7	65	44	10	1	0	0	0	0
Normal-Dry	0	0	1	1	3	13	2	0	0	0	0	0
Dry	0	0	0	0	6	3	1	0	0	0	0	0
Critical-High	0	0	0	0	2	1	0	0	0	0	0	0
Critical-Low	0	0	0	0	0	0	0	0	0	0	0	0

Source: CDEC 2008, Gage ID LDC
Note:
[1] Period of record Water Years 1975 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Table 3-23.
Streamflow Gages in Reach 1B

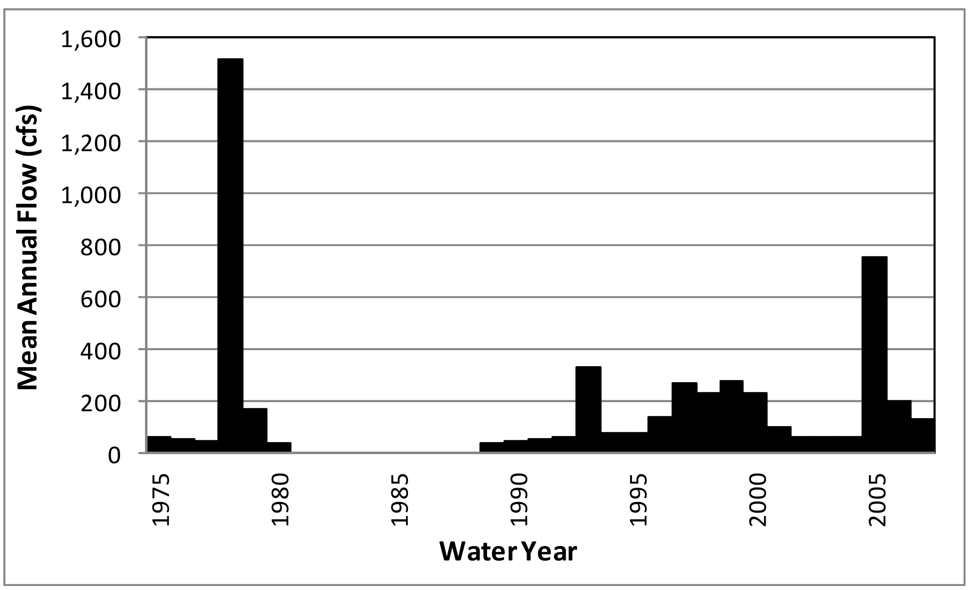
Gage Name	USGS Gage Station No. or CDEC ID	MP	Drainage Area (square miles)	Period of Record[1]	Mean Streamflow (cfs)	Maximum Daily Mean Streamflow (cfs) (date measured)
San Joaquin River at Donny Bridge	DNB	240.7	NA	1988 – 2007	122	7,900 (December 30, 1996)
San Joaquin River at Skaggs Bridge	NA[2]	232.1	NA	1974 – 2007	215	7,900 (December 30, 1996)
San Joaquin River near Biola	11253000	NA	1,811	1952 – 1961	514	7,860 (April 7, 1958)

Source: CDEC 2008; USGS 2008; Reclamation 2007
Notes:
[1] Calendar year.
[2] Data obtained from Reclamation (Reclamation 2007)
Key:
CDEC = California Data Exchange Center
cfs = cubic feet per second
ID = identification
MP = milepost
NA = not applicable/not available
No. = number
USGS = U.S. Geological Survey



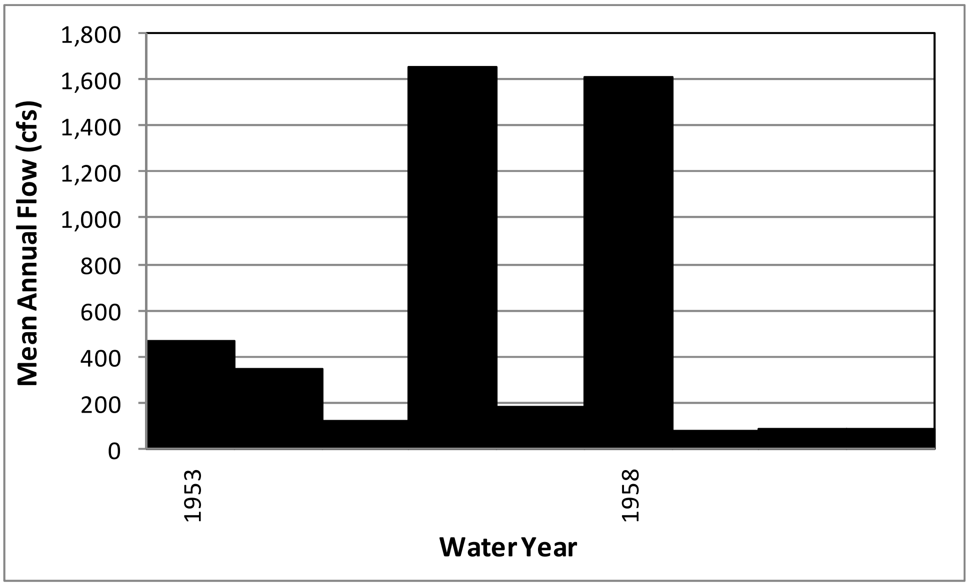
Source: CDEC 2008, Gage ID DNB

Figure 3-9.
Historical Mean Annual Flow for San Joaquin River at Donny Bridge



Source: Reclamation 2007, Gage ID not available

Figure 3-10.
Historical Mean Annual Flow for San Joaquin River at Skaggs Bridge



Source: USGS 2008, Gage ID 11253000

Figure 3-11.
Historical Mean Annual Flow for San Joaquin River near Biola

Table 3-24.
Historical Mean Monthly Flows for San Joaquin River at Donny Bridge

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	111	85	118	115	132	129	92	98	156	149	140	138
Wet	127	94	285	256	182	505	Data not available	187	202	173	199	158
Normal-Wet	90	70	57	53	308	72	98	75	269	192	129	115
Normal-Dry	100	84	75	72	70	91	80	81	96	95	99	119
Dry	81	67	63	51	64	77	86	97	115	131	133	125
Critical-High	Data not available											
Critical-Low	Data not available											

Source: CDEC 2008, Gage ID DNB
Note:
[1] Period of record Water Years 1989 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Table 3-25.
Historical Mean Monthly Flows for San Joaquin River at Skaggs Bridge

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	97	73	106	110	228	379	460	479	379	143	132	123
Wet	87	67	225	242	1,100	2,278	2,158	2,177	1,357	189	252	201
Normal -Wet	130	99	128	104	322	359	127	106	192	150	125	100
Normal -Dry	85	69	54	45	42	72	59	58	70	64	71	92
Dry	60	38	36	33	44	51	58	72	81	87	92	89
Critical-High	49	48	39	33	51	46	52	70	67	52	55	49
Critical-Low	44	40	42	44	31	36	52	34	51	47	57	45

Source: Reclamation 2007
Note:
[1] Period of record Water Years 1975 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Table 3-26.
Historical Mean Monthly Flows for San Joaquin River near Biola

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	289	176	333	711	601	495	1,099	1,198	813	148	128	194
Wet	80	68	903	2,687	2,056	1,547	4,205	4,331	3,152	280	139	187
Normal-Wet	Data not available											
Normal-Dry	455	262	193	175	232	238	261	386	167	118	139	241
Dry	72	74	49	23	54	89	97	92	108	123	119	108
Critical-High	89	59	175	132	54	81	84	97	70	64	58	52
Critical-Low	Data not available											

Source: USGS 2008, Gage ID 11253000
Note:
[1] Period of record Water Years 1953 – 1961; some years may be missing data.
Key:
cfs = cubic feet per second

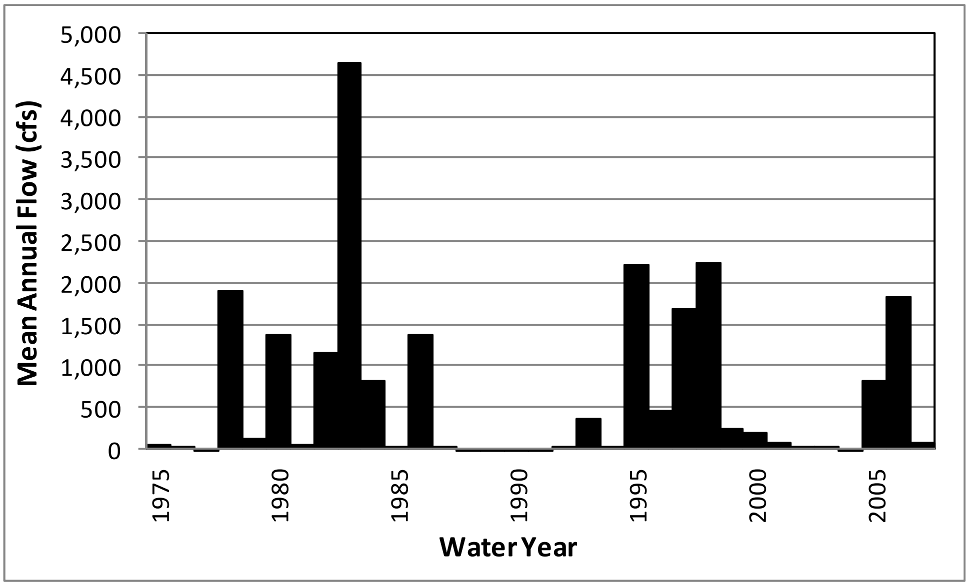
Reach 2. Reach 2 is typically dry; flows reach the Mendota Pool from Reach 2B or from Fresno Slough only during periods of flood management flow releases. Flood flows in both the San Joaquin and Kings rivers were experienced at Mendota Pool in 1997, 2001, 2005, 2006, and 2007. At all other times, the DMC is the primary source of water to the Mendota Pool. The Mendota Pool delivers water to the San Joaquin River Exchange Contractors Water Authority, other CVP contractors, wildlife refuges and management areas, and State water authorities. The Mendota Pool provides no long-term storage for water supply operations or flood control. Reach 2 is divided into Reach 2A and Reach 2B.

Reach 2A is typified by the accumulation of sand caused in part by backwater effects of the Chowchilla Bypass Bifurcation Structure and by a lower gradient relative to Reach 1. Gravelly Ford, as its name implies, and Reach 2A have high percolation losses, such that the reach is dry under normal conditions. Under steady-state conditions, flow does not reach the Chowchilla Bypass Bifurcation Structure when discharge at Gravelly Ford is less than 75 cfs (McBain and Trush 2002). Reach 2A has a design channel capacity of 8,000 cfs to accommodate controlled releases from Friant Dam. Agricultural return flows within this reach are minor. Table 3-27 lists the gage located in this reach segment, along with the period of record, mean annual and maximum daily mean streamflow. Figure 3-12 shows historical mean annual flow at the gage for the period of record shown in Table 3-27. Table 3-28 shows historical mean monthly flow at the gage. Nine water diversions are located along this reach. One major road crossing in this reach could affect flow stage.

Table 3-27.
Streamflow Gage in Reach 2A

Gage Name	USGS Gage Station No. or CDEC ID	MP	Drainage Area (square miles)	Period of Record	Mean Annual Streamflow (cfs)	Maximum Daily Mean Streamflow (cfs) (date measured)
San Joaquin River at Gravelly Ford	GRF	236.9	NA	1974 – 2007	652	37,843 (January 4, 1997)

Source: CDEC 2008
Key:
CDEC = California Data Exchange Center
cfs = cubic feet per second
ID = identification
MP = milepost
NA = not applicable/not available
No. = number
USGS = U.S. Geological Survey



Source: CDEC 2008, Gage ID GRF

**Figure 3-12.
Historical Mean Annual Flow for San Joaquin River at Gravelly Ford**

**Table 3-28.
Historical Mean Monthly Flows for San Joaquin River at Gravelly Ford**

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	100	109	236	672	880	1,153	1,560	1,340	1,028	633	138	139
Wet	40	174	532	1,887	2,945	3,726	4,568	3,417	2,601	2,053	376	380
Normal-Wet	295	215	370	630	314	512	251	305	151	92	82	62
Normal-Dry	55	33	24	21	23	35	21	21	30	20	20	32
Dry	29	13	12	9	15	16	18	18	19	9	17	20
Critical-High	29	23	20	16	30	23	28	39	36	21	22	17
Critical-Low	17	21	13	20	13	5	2	3	3	1	6	5

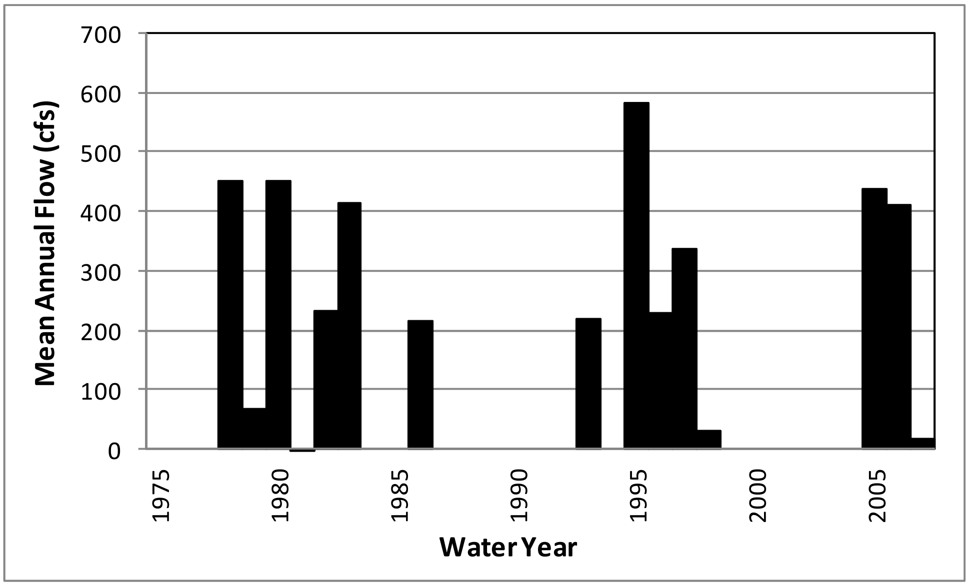
Source: CDEC 2008, Gage ID GRF
Note:
[1] Period of record Water Years 1975 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Reach 2B is a sandy channel extending into for Mendota Pool. The design channel capacity of this reach is 2,500 cfs, but significant seepage has been observed at flows above 1,300 cfs (RMC 2007). Agricultural return flows within this reach are minor. Reach 2B ends at Mendota Dam, and Mendota Pool backwater extends up a portion of this reach. Table 3-29 shows the gage located in this reach segment, along with the period of record and historical mean annual and maximum daily mean streamflow. Figure 3-13 shows historical mean annual flow at the gage for the period of record shown in Table 3-29, and demonstrates the dry conditions within Reach 2B. Table 3-30 shows historical mean monthly flow at the gage. Thirty-one water diversions are located along this reach. One major road crossing in this reach could affect flow stage.

Table 3-29.
Streamflow Gages in Reach 2B

Gage Name	USGS Gage Station No. or CDEC ID	MP	Drainage Area (square miles)	Period of Record	Mean Annual Streamflow (cfs)	Maximum Daily Mean Streamflow (cfs) (date measured)
San Joaquin River below Chowchilla Bypass Bifurcation Structure	SJB	217.8	NA	1974 – 1986, 1988 – 1997, 2005 – 2007	159	2,660 (May 23, 1978)

Source: CDEC 2008
Key:
CDEC = California Data Exchange Center
cfs = cubic feet per second
ID = identification
MP = milepost
NA = not applicable/not available
No. = number
USGS = U.S. Geological Survey



Source: CDEC 2008, Gage ID SJB

Figure 3-13.
Historical Mean Annual Flow for San Joaquin River Below Chowchilla Bypass Bifurcation Structure

Table 3-30.
Historical Mean Monthly Flows for San Joaquin River Below Chowchilla Bypass Bifurcation Structure

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	11	4	6	81	164	285	328	348	327	230	60	54
Wet	9	2	17	205	439	675	638	690	686	589	174	153
Normal-Wet	15	5	0	18	140	396	257	157	55	0	0	0
Normal-Dry	5	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Critical-High	0	0	0	0	0	0	0	0	0	0	0	0
Critical-Low	0	0	0	0	0	0	0	0	0	0	0	0

Source: CDEC 2008, Gage ID SJB
Note:
[1] Period of record Water Years 1975 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

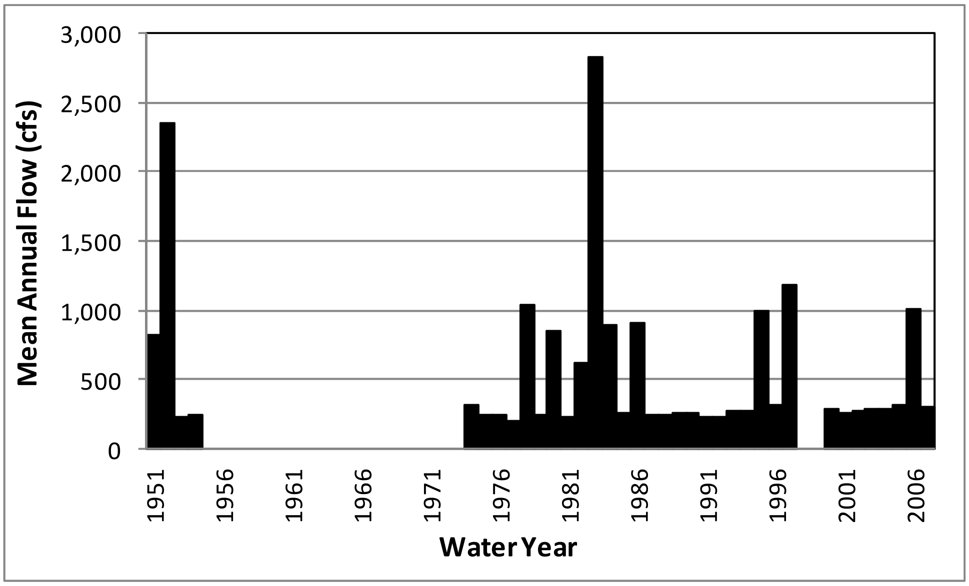
Reach 3. The design capacity of Reach 3 is 4,500 cfs (exterior levees). DWR has estimated the capacity of interior levees in this reach to be 1,300 cfs with 3 feet of freeboard. The RMC has reported that Reach 3 conveys up to 800 cfs of water for irrigation diversions at Sack Dam, and that higher flows (less than 4,500 cfs) can cause seepage and levee stability problems in this reach (2007). No operational storage for water supply exists within this reach. Flows within this reach predominantly consist of water conveyed by the DMC and released from the Mendota Pool for diversion. Under typical conditions, most water reaching Sack Dam is diverted to the Arroyo Canal. Flows greater than required for diversions (such as during upstream flood releases) spill over Sack Dam into the San Joaquin River downstream into Reach 4A. Table 3-31 lists the gage located in this reach, along with the period of record and annual mean and maximum daily mean streamflow. Figure 3-14 shows the historical mean annual flow at the gage for the period of record shown in Table 3-31. Table 3-32 shows the historical mean monthly flow at the gage. Seven water diversions are located along this reach. One major road crossing in this reach could affect flow stage.

Table 3-31.
Streamflow Gage in Reach 3

Gage Name	USGS Gage Station No. or CDEC ID	MP	Drainage Area (square miles)	Period of Record	Mean Annual Streamflow (cfs)	Maximum Daily Mean Streamflow (cfs) (date measured)
San Joaquin River near Mendota	11254000	217.8	3,940	1950 – 1954, 1974 – present[1]	545	8,770 (May 29, 1952)

Source: USGS 2008
Note:
[1] Period of record coincides with start of diversions from Friant Dam (1950).

Key:
CDEC = California Data Exchange Center
cfs = cubic feet per second
ID = identification
MP = milepost
NA = not applicable/not available
No. = number
USGS = U.S. Geological Survey



Source: USGS 2008, Gage ID 11254000

Figure 3-14.
Historical Mean Annual Flow for San Joaquin River near Mendota

Table 3-32.
Historical Mean Monthly Flows for San Joaquin River near Mendota

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	203	221	306	444	661	732	920	979	839	613	439	275
Wet	160	234	488	1,019	1,770	2,274	2,646	2,534	1,820	939	483	311
Normal-Wet	292	530	746	654	495	278	223	364	463	497	433	274
Normal-Dry	175	101	67	86	208	190	240	328	491	522	406	247
Dry	218	115	61	56	175	230	209	245	445	526	445	275
Critical-High	133	67	1	87	146	157	231	345	479	486	459	312
Critical-Low	188	58	4	27	126	219	141	141	341	507	412	214

Source: USGS 2008, Gage ID 11254000
Note:
[1] Period of record Water Years 1951 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

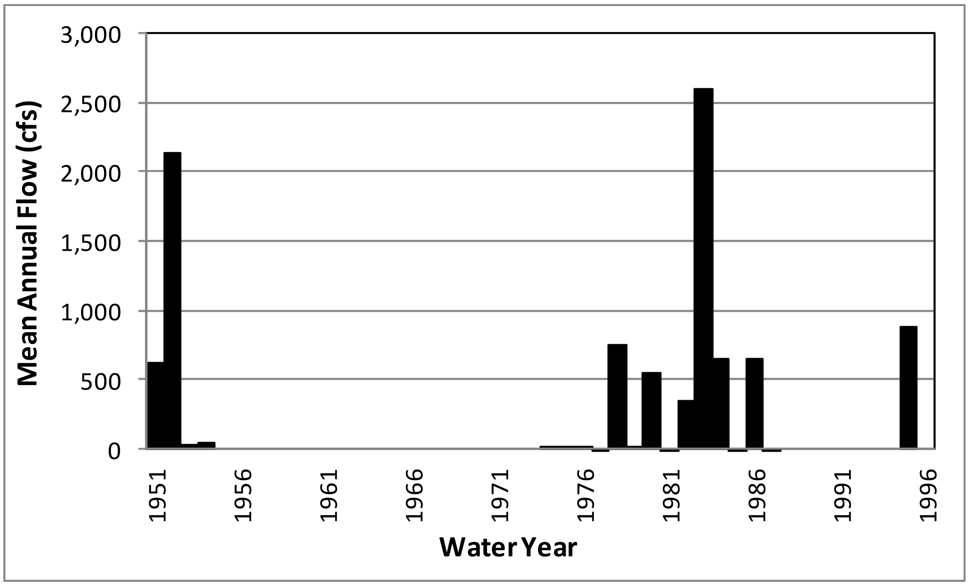
Reach 4. No operational storage for water supply exists within this reach. Reach 4 is divided into Reach 4A, Reach 4B1, and Reach 4B2.

Estimated flow capacity in Reach 4A is approximately 4,500 cfs, beginning at Sack Dam and extending to the Sand Slough Control Structure. Most water reaching Sack Dam is diverted to the Arroyo Canal; however, the channel below Sack Dam has flow during the agricultural season (agricultural return flows) and during upstream flood releases. Table 3-33 lists the gages located in Reach 4A, along with the period of record and annual mean and maximum daily mean streamflows. Figures 3-15 and 3-16 show the historical mean annual flows at the gages for the period of record shown in Table 3-33. Tables 3-34 and 3-35 show the historical mean monthly flows at the gages. Four water diversions are located along this reach. No road crossings would affect flow stage in Reach 4A.

Table 3-33.
Streamflow Gages in Reach 4A

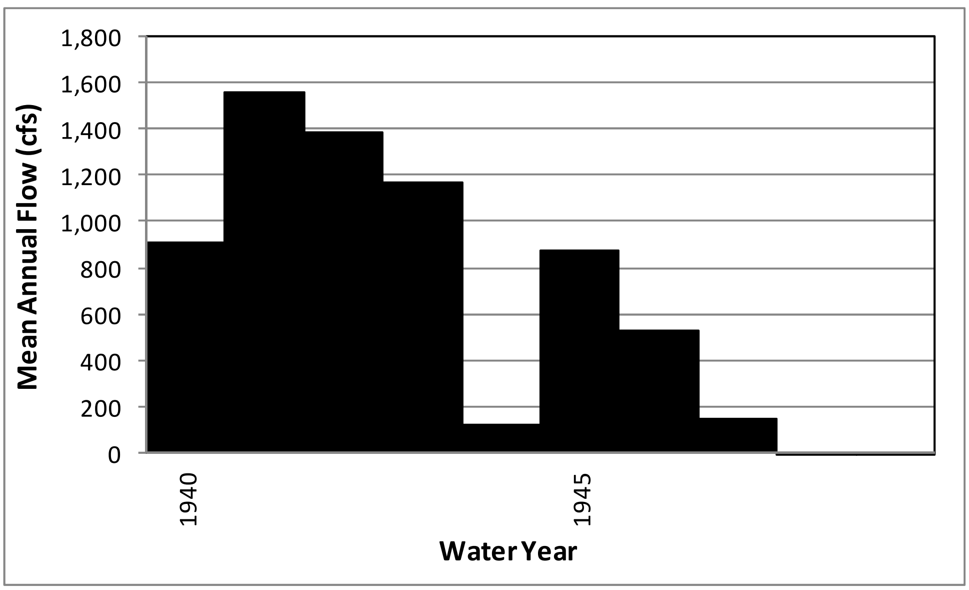
Gage Name	USGS Gage Station No. or CDEC ID	MP	Drainage Area (square miles)	Period of Record	Mean Annual Streamflow (cfs)	Maximum Daily Mean Streamflow (cfs) (date measured)
San Joaquin River near Dos Palos	11256000	NA	4,669	1950 – 1954, 1974 – 1987, 1995[1]	478	8,170 (June 5, 1952)
San Joaquin River near El Nido	11260000	NA	6,443	1939 – 1949[2]	705	3,700 (June 22, 1942)

Source: USGS 2008
Notes:
[1] Period of record coincides with start of diversions from Friant Dam (1950).
[2] Period of record occurs during Friant Dam construction and filling.
Key:
CDEC = California Data Exchange Center
cfs = cubic feet per second
ID = identification
MP = milepost
NA = not applicable/not available
No. = number
USGS = U.S. Geological Survey



Source: USGS 2008, Gage ID 112560000

Figure 3-15.
Historical Mean Annual Flow for San Joaquin River near Dos Palos



Source: USGS 2008, Gage ID 11260000

Figure 3-16.
Historical Mean Annual Flow for San Joaquin River near El Nido

Table 3-34.
Historical Mean Monthly Flows for San Joaquin River near Dos Palos

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	49	202	458	556	794	943	1,064	1,007	562	187	22	29
Wet	6	182	610	751	1,642	2,515	2879	2,726	1,512	469	45	68
Normal-Wet	154	501	873	995	585	55	4	3	6	6	7	3
Normal-Dry	5	4	52	62	154	6	8	7	8	6	6	7
Dry	0	0	0	41	23	15	3	8	10	Data not available		
Critical-High	58	6	6	51	1	2	1	3	7	12	8	0
Critical-Low	0	13	0	0	2	3	2	1	9	9	9	6

Source: USGS 2008, Gage ID 112560000
Note:
[1] Period of record Water Years 1951 – 1996; some years may be missing data.
Key:
cfs = cubic feet per second

Table 3-35.
Historical Mean Monthly Flows for San Joaquin River near El Nido

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	27	106	399	934	1,248	1,112	1,201	1,538	1,489	473	17	13
Wet	0	0	630	1,842	2,521	2,805	2,600	3,096	3,429	1,779	26	8
Normal-Wet	54	199	594	1,303	1,840	1,540	1,629	2117	1,947	482	24	20
Normal-Dry	1	16	97	247	204	153	20	54	79	22	2	3
Dry	Data not available											
Critical-High	Data not available											
Critical-Low	Data not available											

Source: USGS 2008, Gage ID 11260000
Note:
[1] Period of record Water Years 1940 – 1949; some years may be missing data.
Key:
cfs = cubic feet per second

Reach 4B1 has a design capacity of 1,500 cfs, and the Sand Slough Control Structure is designed to maintain this design discharge; however, the current conveyance capacity of Reach 4B1 is unknown and could be as low as zero in some locations. Actual operations keep the gates of the San Joaquin River headgates closed, diverting all flow from Reach 4B1 to the Eastside Bypass via Sand Slough over the last few decades (McBain and Trush 2002). Reach 4B1, therefore, is dry until downstream agricultural return flows contribute to its baseflow. Four road crossings in Reach 4B1 have the potential to affect flow stage.

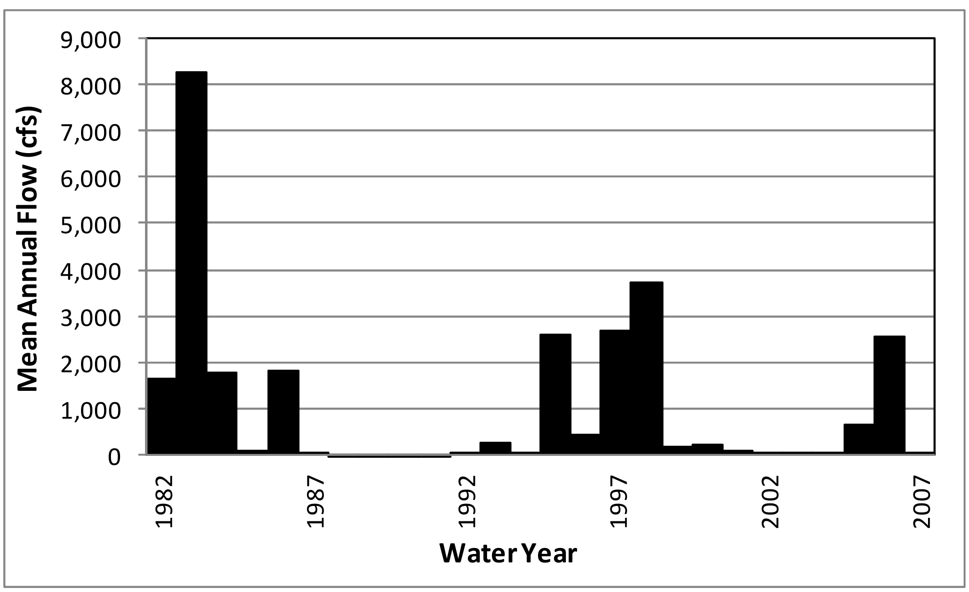
The design channel capacity of Reach 4B2 is 10,000 cfs. The channel carries tributary and flood flows from the Mariposa Bypass. No operational storage for water supply exists within this reach. Two water diversions are located along this reach. No road crossings affect flow stage in Reach 4B2.

Reach 5. The design capacity of Reach 5 is 26,000 cfs; no significant capacity constraints have been identified in this reach. Reach 5 receives flow from Reach 4B2 and the Eastside Bypass. Agricultural and WMA return flows also enter Reach 5 via Mud and Salt sloughs, which drain the west side of the San Joaquin Valley. Table 3-36 lists the gages located in or near this reach, along with the periods of record and annual mean and maximum daily mean streamflows. Figures 3-17, 3-18, 3-19, and 3-20 show the historical mean annual flows at the gages for the periods of record shown in Table 3-36. Tables 3-37, 3-38, 3-39, and 3-40 show the historical mean monthly flows at the gages. Four water diversions are located in this reach. Three major road crossing within this reach could affect flow stage.

Table 3-36.
Streamflow Gages in Reach 5

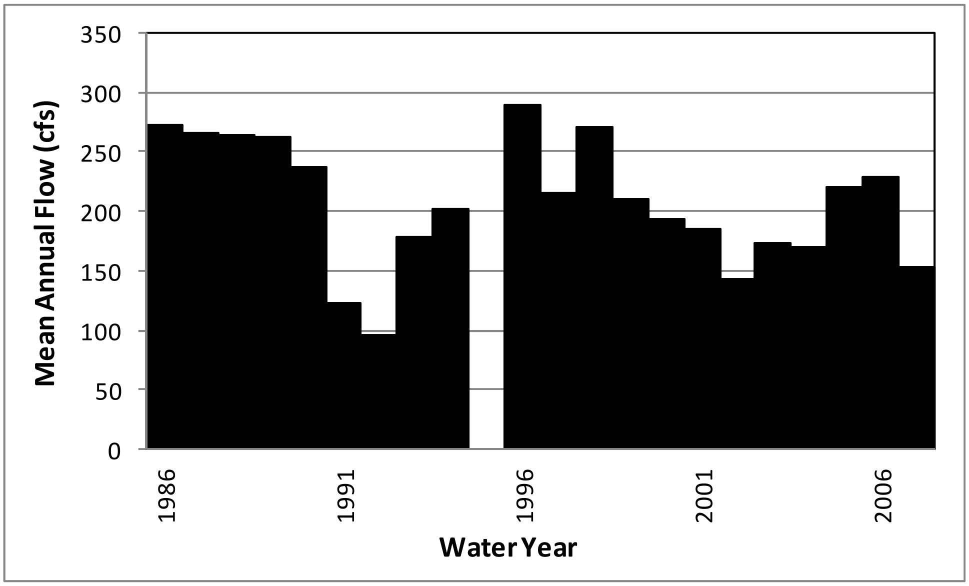
Gage Name	USGS Gage Station No. or CDEC ID	MP	Drainage Area (square miles)	Period of Record	Mean Annual Streamflow (cfs)	Maximum Daily Mean Streamflow (cfs) (date measured)
San Joaquin River near Stevinson	SJS	118.2	NA	1981 – present	1,042	23,900 (January 28, 1997)
Salt Slough at Highway 165 near Stevinson	11261100	NA	NA	1985 – present	206	810 (February 20, 1986)
San Joaquin River at Fremont Ford Bridge	11261500	118.2	7,619	1950 – 1971, 1985 – 1989, 2001 – present[1]	640	22,500 (April 8, 2006)
Mud Slough near Gustine	11262900	NA	NA	1985 – present	101	1,060 (February 9, 1998)

Source: CDEC 2008; USGS 2008
Note:
[1] Period of record coincides with start of diversions from Friant Dam (1950).
Key:
CDEC = California Data Exchange Center
cfs = cubic feet per second
ID = identification
MP = milepost
NA = not applicable/not available
No. = number
USGS = U.S. Geological Survey



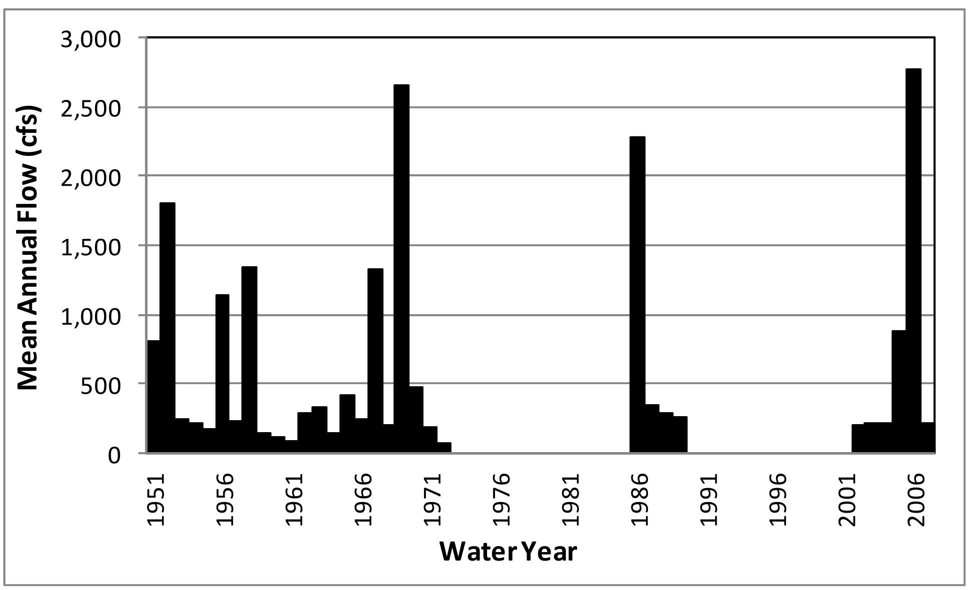
Source: CDEC 2008, Gage ID SJS

Figure 3-17.
Historical Mean Annual Flow for San Joaquin River near Stevinson



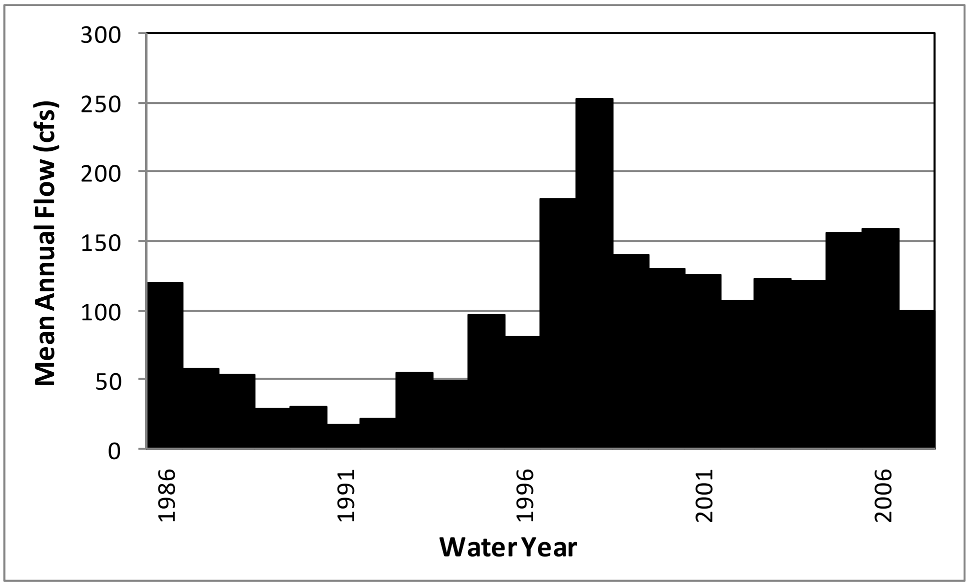
Source: USGS 2008, Gage ID 11261100

Figure 3-18.
Historical Mean Annual Flow for Salt Slough at Highway 165 near Stevinson



Source: USGS 2008, Gage ID 11261500

Figure 3-19.
Historical Mean Annual Flow for San Joaquin River at Fremont Ford Bridge



Source: USGS 2008, Gage ID 11262900

Figure 3-20.
Historical Mean Annual Flow for Mud Slough near Gustine

Table 3-37.
Historical Mean Monthly Flows for San Joaquin near Stevinson

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	188	229	705	1619	1,768	1,985	2,344	1,764	1,213	671	83	148
Wet	109	326	1,593	4,269	5,745	6,423	6,716	4,783	3,307	2,314	229	448
Normal-Wet	670	654	1,301	1,699	654	678	148	289	70	46	55	78
Normal-Dry	60	23	32	90	95	177	42	22	21	12	13	30
Dry	59	22	20	46	157	66	27	19	13	8	7	10
Critical-High	Data not available											
Critical-Low	Data not available											

Source: CDEC 2008, Gage ID SJS
Note:
[1] Period of record Water Years 1982 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Table 3-38.
Historical Mean Monthly Flows for Salt Slough at Highway 165 near Stevinson

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	146	173	146	181	284	356	241	199	197	213	215	142
Wet	117	141	124	208	364	362	291	239	234	264	292	185
Normal-Wet	159	178	184	186	336	403	226	179	186	211	216	137
Normal-Dry	147	155	120	147	212	320	210	163	178	184	180	109
Dry	167	206	155	148	242	352	241	212	212	227	230	170
Critical-High	Data not available											
Critical-Low	Data not available											

Source: USGS 2008, Gage ID 11261100
Note:
[1] Period of record Water Years 1986 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Table 3-39.
Historical Mean Monthly Flows for San Joaquin River at Fremont Ford Bridge

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	132	161	306	769	1,098	1,152	1,483	1,171	979	292	193	195
Wet	99	99	375	1,586	3,309	4,029	4,188	3,245	2,879	706	313	388
Normal-Wet	55	211	696	832	1213	512	523	274	210	156	157	160
Normal-Dry	149	159	180	503	422	371	236	243	207	147	144	137
Dry	211	170	174	199	267	316	241	249	219	183	203	182
Critical-High	24	36	60	131	139	95	125	144	103	66	80	66
Critical-Low	Data not available											

Source: USGS 2008, Gage ID 11261500
Note:
[1] Period of record Water Years 1951 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Table 3-40.
Historical Mean Monthly Flows for Mud Slough near Gustine

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
All Years	88	107	120	166	205	187	85	58	56	53	46	36
Wet	61	90	140	288	358	308	146	81	73	69	54	37
Normal-Wet	122	141	161	158	256	204	81	75	71	54	53	50
Normal-Dry	96	110	101	107	124	138	55	46	43	56	48	39
Dry	35	51	49	62	91	82	38	19	28	25	26	7
Critical-High	Data not available											
Critical-Low	Data not available											

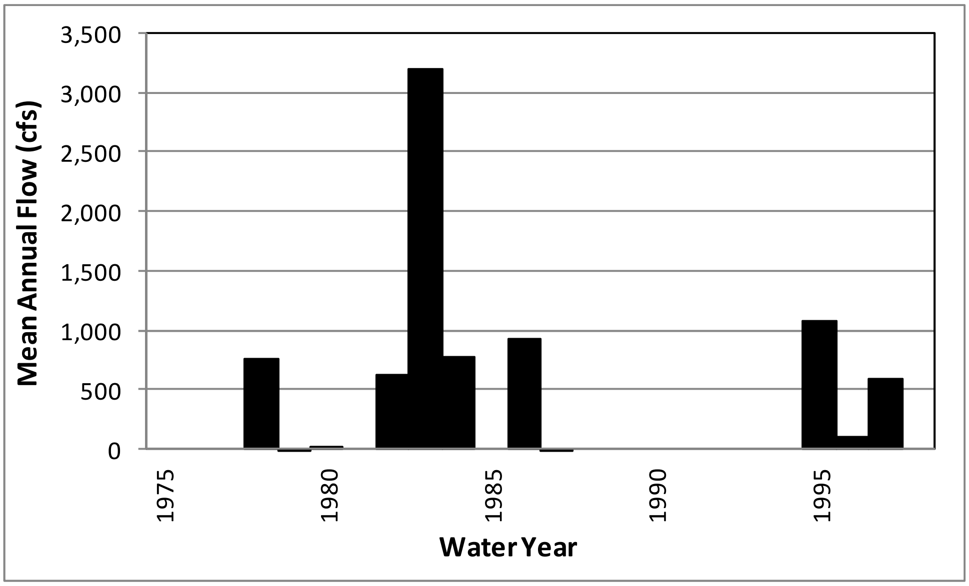
Source: USGS 2008, Gage ID 11262900
Note:
[1] Period of record Water Years 1986 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Fresno Slough/James Bypass. Under current operational requirements, Kings River flood flows can enter the Mendota Pool via the Fresno Slough/James Bypass. Flows from the Kings River are regulated by Pine Flat Dam. If combined Fresno Slough/James Bypass and San Joaquin River flows would exceed the 4,500 cfs channel capacity downstream from the Mendota Pool, then the San Joaquin River flows can be incrementally diverted to the Chowchilla Bypass to allow for Fresno Slough/James Bypass flows. (More details can be found in Section 3.11.4, Flood Management.) Reclamation supplements natural flow from the Fresno Slough/James Bypass and San Joaquin River into the Mendota Pool with deliveries from the DMC to satisfy water supply contracts. Flows from the Kings River are regulated by the Pine Flat Dam operator, Kings River Water Conservation District. Table 3-41 lists the gage located at the head of this bypass, along with the period of record and annual mean and maximum daily mean streamflow. Figure 3-21 shows mean annual flow at the gage for the period of record shown in Table 3-41. Table 3-42 shows the historical mean monthly flow at the gage.

Table 3-41.
Streamflow Gage at Fresno Slough/James Bypass

Gage Name	USGS Gage Station No. or CDEC ID	MP	Drainage Area (square miles)	Period of Record	Mean Annual Streamflow (cfs)	Maximum Daily Mean Streamflow (cfs) (date measured)
Fresno Slough/ James Bypass near San Joaquin	11253500	NA	NA	1974 – 1987, 1995 – 1997	495	5,355 (March 3, 1983)

Source: USGS 2008
Key:
CDEC = California Data Exchange Center
cfs = cubic feet per second
ID = identification
MP= milepost
NA = not applicable/not available
No. = number
USGS = U.S. Geological Survey



Source: USGS 2008, Gage ID 11253500

Figure 3-21.
Historical Mean Annual Flow for Fresno Slough/James Bypass near San Joaquin River

Table 3-42.
Historical Mean Monthly Flows for Fresno Slough/James Bypass near San Joaquin River

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
All Years	108	244	371	584	597	764	11,57	1261	653	330	74	54
Wet	0	220	533	901	1,283	1,620	2,478	2,524	1,396	707	159	117
Normal-Wet	431	591	550	752	6	31	4	313	5	1	0	0
Normal-Dry	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	11	22	Data not available							
Critical-High	0	0	0	0	0	0	0	0	0	0	0	0
Critical-Low	0	0	0	0	0	0	0	0	0	0	0	0

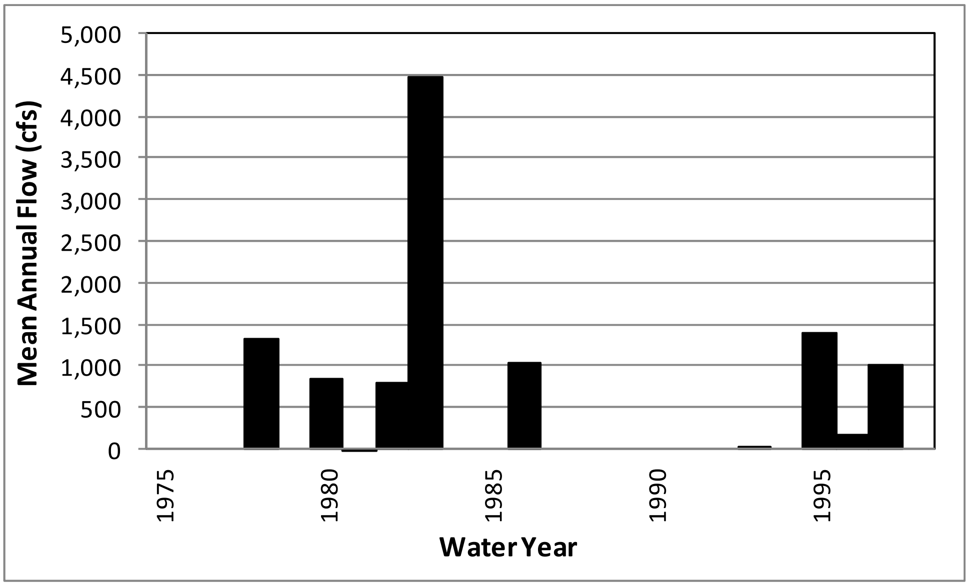
Source: USGS 2008, Gage ID 11253500
Note:
[1] Period of record Water Years 1975 – 1998; some years may be missing data.
Key:
cfs = cubic feet per second

Chowchilla Bypass and Tributaries. The Chowchilla Bypass Bifurcation Structure at the head of Reach 2B regulates the flow split between the San Joaquin River and Chowchilla Bypass. The structure is operated according to flows in the San Joaquin River, flows from the Kings River system via Fresno Slough, and water demands in the Mendota Pool. The design channel capacity of the bypass is 5,500 cfs from the bifurcation structure to its confluence with the Eastside Bypass and the Fresno River. Table 3-43 lists the gage located at the head of this bypass, along with the period of record and annual mean and maximum daily mean streamflow. Figure 3-22 shows the historical mean annual flow at the gage for the period of record shown in Table 3-43. Table 3-44 shows the historical mean monthly flow at the gage.

Table 3-43.
Streamflow Gage at Chowchilla Bypass at Head

Gage Name	USGS Gage Station No. or CDEC ID	MP	Drainage Area (square miles)	Period of Record	Mean Annual Streamflow (cfs)	Maximum Daily Mean Streamflow (cfs) (date measured)
Chowchilla Bypass at Head	CBP	216.0	NA	1974 – 1986, 1988 – 1997	462	9,430 (February 19, 1986)

Source: CDEC 2008
Key:
CDEC = California Data Exchange Center
cfs = cubic feet per second
ID = identification
MP = milepost
NA = not applicable/not available
No. = number
USGS = U.S. Geological Survey



Source: CDEC 2008, Gage ID CBP

Figure 3-22.
Historical Mean Annual Flow for Chowchilla Bypass at Head

Table 3-44.
Historical Mean Monthly Flows for Chowchilla Bypass at Head

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	0	0	22	533	821	1,214	1,339	957	487	335	29	40
Wet	0	0	57	1,400	2,151	3,073	3,682	2,490	1,339	920	80	111
Normal-Wet	0	0	0	0	35	302	0	282	0	0	0	0
Normal-Dry	2	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Critical-High	0	0	0	0	0	0	0	0	0	0	0	0
Critical-Low	0	0	0	0	0	0	0	0	0	0	0	0

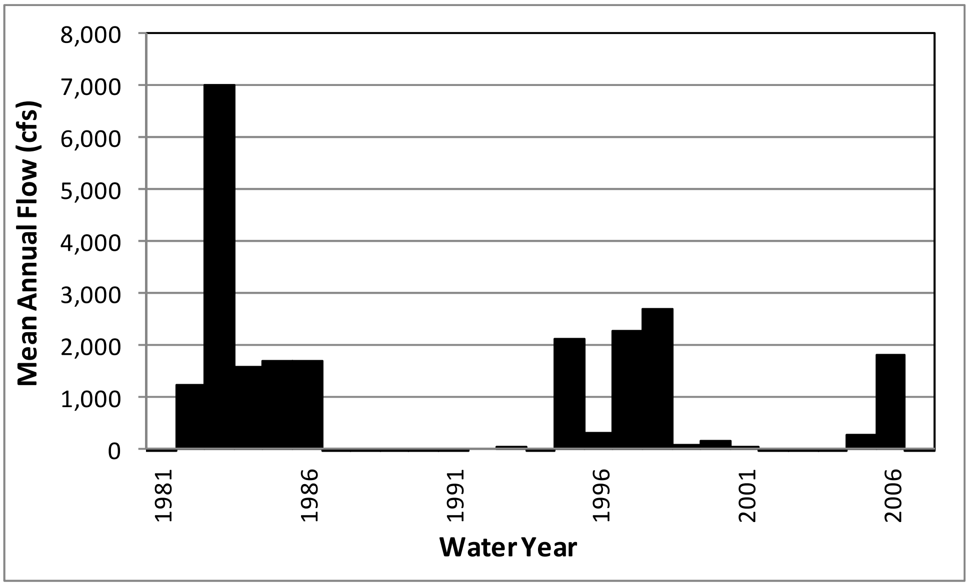
Source: CDEC 2008, Gage ID CBP
Note:
[1] Period of record Water Years 1975 – 1998; some years may be missing data.
Key:
cfs = cubic feet per second

Eastside Bypass, Mariposa Bypass, and Tributaries. The three Eastside Bypass reaches have a design channel capacity of 10,000 cfs, 16,500 cfs, and 13,500 cfs, respectively. The design channel capacity in Eastside Bypass Reach 1 increases to 12,000 cfs and 17,000 cfs as it intercepts Berenda and Ash Slough. The design channel capacity in Eastside Bypass Reach 3 increases to 18,500 cfs at the confluence of Bear Creek. Flow within Eastside Bypass Reach 3 is controlled by the Eastside Bypass Bifurcation Structure. Actual channel capacities may be less because of subsidence of the Eastside Bypass levees. Flow within the Mariposa Bypass is controlled by the Mariposa Bypass Bifurcation Structure, which diverts water from the Eastside Bypass back to Reach 4 of the San Joaquin River. Table 3-45 lists the gages located in or near the Eastside Bypass, along with the periods of record and annual mean and maximum daily mean streamflows. Figures 3-33, 3-34, and 3-35 show mean annual flows at the gages for the periods of record shown in Table 3-45. Tables 3-46, 3-47, and 3-48 show the historical mean monthly flows at the gages.

Table 3-45.
Streamflow Gages in Eastside Bypass

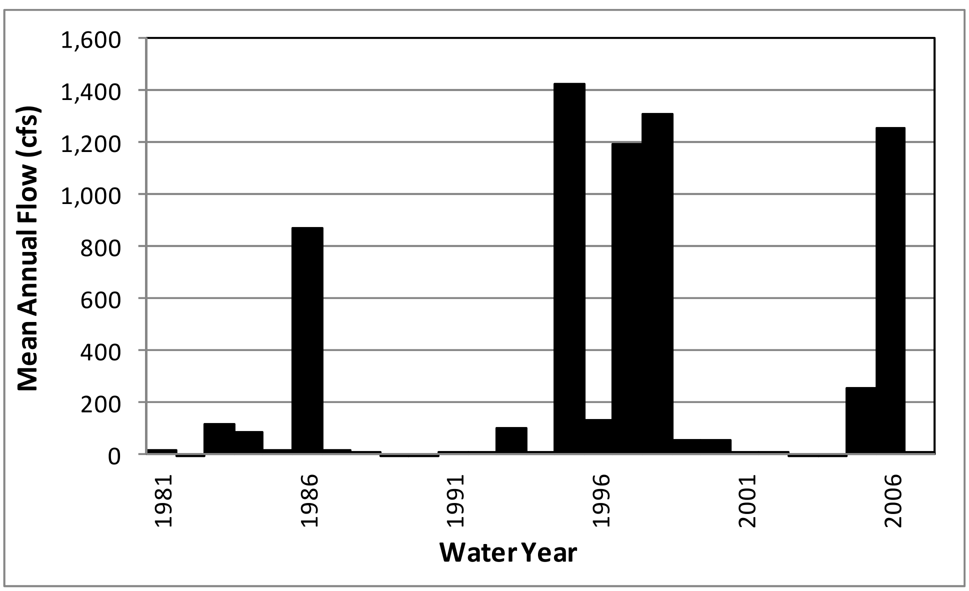
Gage Name	CDEC ID or DWR Station No.	Drainage Area (square miles)	Period of Record	Mean Annual Streamflow (cfs)	Maximum Daily Mean Streamflow (cfs) (date measured)
Eastside Bypass near El Nido	ELN	NA	1980 – 2007	840	20,400 (January 27, 1997)
Eastside Bypass below Mariposa Bypass	EBM	NA	1980 – 2007	257	11,400 (January 27, 1997)
Bear Creek below Eastside Bypass	B05516	NA	1980 – 2007	81	4,170 (April 6, 2006)

Key: *Source: CDEC 2008; Reclamation 2008*
CDEC = California Data Exchange Center
cfs = cubic feet per second
DWR = California Department of Water Resources
ID = identification
NA = not applicable/not available
No. = number



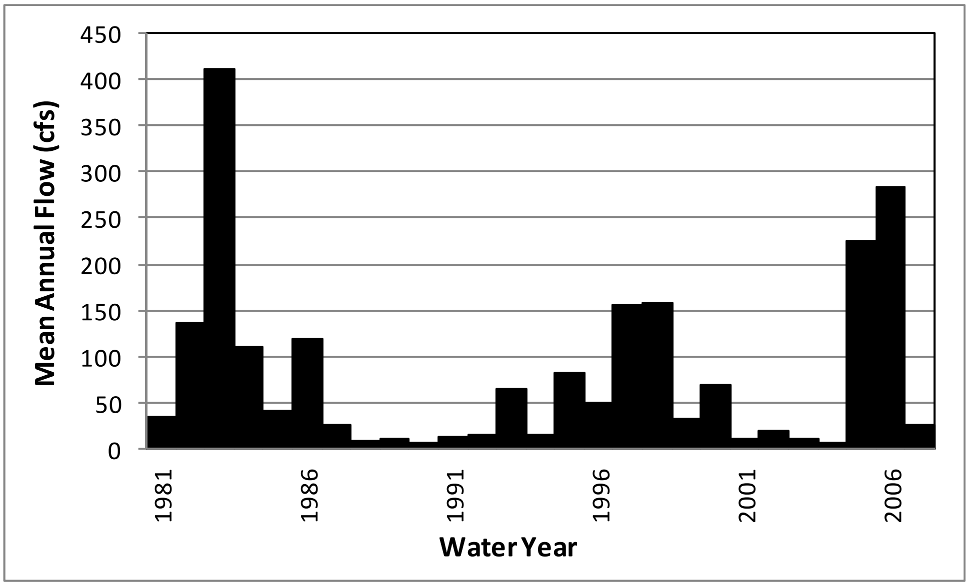
Source: CDEC 2008, Gage ID ELN

Figure 3-23.
Historical Mean Annual Flow for Eastside Bypass near El Nido



Source: CDEC 2008, Gage ID EBM

Figure 3-24.
Historical Mean Annual Flow for Eastside Bypass Below Mariposa Bypass



Source: Reclamation 2008, Gage ID B05516

Figure 3-25.
Historical Mean Annual Flow for Bear Creek Below Eastside Bypass

Table 3-46.
Historical Mean Monthly Flows for Eastside Bypass near El Nido

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	110	198	559	1,108	1,331	1,711	2,122	1,521	1,002	512	32	58
Wet	1	280	1,282	3,173	4,582	4,844	6,008	4,129	2,846	1,922	113	219
Normal-Wet	572	656	1191	1477	118	723	14	263	2	0	1	1
Normal-Dry	7	9	13	23	464	1,230	967	119	111	5	7	3
Dry	12	8	11	23	4	0	1	0	0	0	0	0
Critical-High	Data not available											
Critical-Low	Data not available											

Source: CDEC 2008, Gage ID ELN
Note:
[1] Period of record Water Years 1981 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Table 3-47.
Historical Mean Monthly Flows for Eastside Bypass Below Mariposa Bypass

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	23	16	50	338	424	376	634	602	410	206	17	10
Wet	22	27	102	1,217	1,427	1,262	1,539	1,331	906	727	51	20
Normal-Wet	58	36	98	23	191	131	22	157	22	19	20	20
Normal-Dry	14	3	8	21	9	46	3	1	1	0	0	0
Dry	10	4	9	21	45	1	3	2	1	1	1	1
Critical-High	Data not available											
Critical-Low	Data not available											

Source: CDEC 2008, Gage ID EBM
Note:
[1] Period of record Water Years 1981 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Table 3-48.
Historical Mean Monthly Flows for Bear Creek Below Eastside Bypass

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	50	23	57	186	172	184	121	43	29	22	25	47
Wet	59	39	108	434	416	390	159	75	56	40	52	122
Normal-Wet	51	27	86	48	167	88	50	33	40	28	21	27
Normal-Dry	44	7	12	29	22	70	10	8	4	1	2	20
Dry	49	6	3	9	58	21	7	5	3	1	2	13
Critical-High	Data not available											
Critical-Low	Data not available											

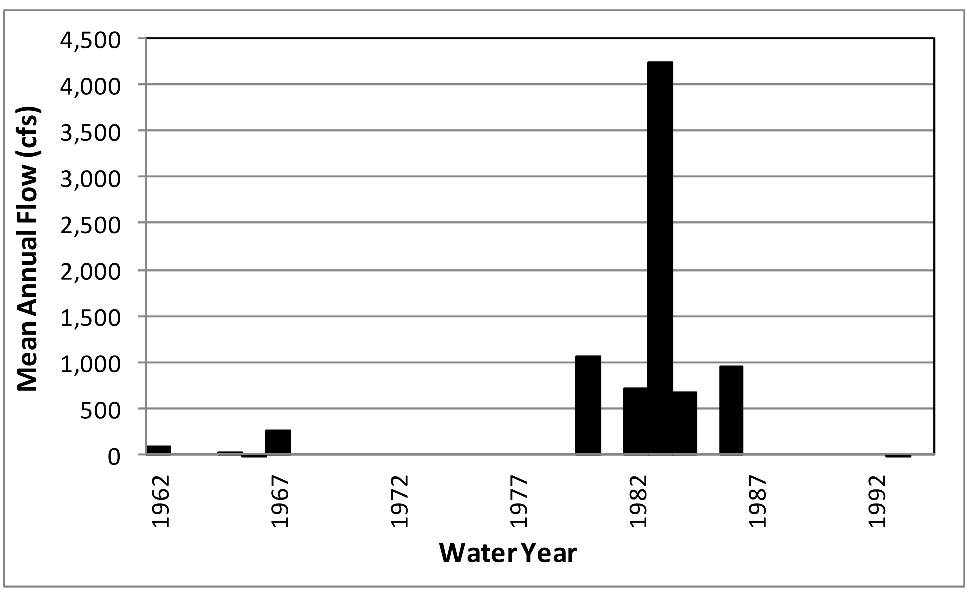
Source: Reclamation 2008, DWR Gage ID B05516
Note:
[1] Period of record Water Years 1981 – 2007; some years may be missing data.
Key:
cfs = cubic feet per second

Table 3-49 lists the gage located in the Mariposa Bypass, along with the period of record and annual mean and maximum daily mean streamflow. Figure 3-26 shows the historical mean annual flow at the gage for the period of record shown in Table 3-49. Table 3-50 shows the historical mean monthly flow at the gage.

Table 3-49.
Streamflow Gage in Mariposa Bypass near Crane Ranch

Gage Name	DWR Station No.	Drainage Area (square miles)	Period of Record	Mean Streamflow (cfs)	Maximum Daily Mean Streamflow (cfs) (date measured)
Mariposa Bypass near Crane Ranch	B00420	NA	1980 – 1994	456	9,960 (March 3, 1983)

Source: Reclamation 2008
Key:
cfs = cubic feet per second
DWR = Department of Water Resources
NA = not applicable/not available
No. = number



Source: Reclamation 2008, Gage ID B00420

Figure 3-26.
Historical Mean Annual Flow for Mariposa Bypass near Crane Ranch

Table 3-50.
Historical Mean Monthly Flows for Mariposa Bypass near Crane Ranch

Year Type	Mean Monthly Flow (cfs)[1]											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
All Years	66	147	410	598	720	1,076	958	556	422	285	28	44
Wet	0	315	893	1,525	2,044	3,050	2,871	1,574	1,196	911	90	141
Normal-Wet	496	472	671	1,038	1	0	6	0	0	0	0	0
Normal-Dry	0	0	0	1	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Critical-High	Data not available											
Critical-Low	Data not available											

Source: Reclamation 2008, Gage ID. B00420
Note:
[1] Period of record Water Years 1962 – 1994; some years may be missing data.
Key:
cfs = cubic feet per second

San Joaquin River from Merced River to the Delta

Flows in the San Joaquin River below the Merced River confluence to the Delta are controlled in large part by releases from reservoirs located on tributary systems, including the Merced, Tuolumne, and Stanislaus rivers, to satisfy contract deliveries and instream flow requirements. Average historical flows in the San Joaquin River near Newman, located just downstream from the Merced River confluence, are shown in Table 3-18. Flows are also controlled in part by operational agreements such as VAMP.

VAMP is an experimental-management program, under the jurisdiction of the SWRCB (per D-1641). VAMP was established as a 12-year program to protect juvenile Chinook salmon emigrating through the San Joaquin River and Delta, and to evaluate how Chinook salmon survival rates change in response to alterations in San Joaquin River flows and exports at CVP and SWP facilities in the south Delta when the Head of Old River Barrier is installed.

VAMP includes a 31-day pulse flow period in April and May of up to 110 TAF, depending on the flow conditions. Water needed to create the pulse flow is obtained by Reclamation through performance-based agreements that require the release of water or reduction of delivery from reservoirs on the Merced, Tuolumne, and Stanislaus rivers and from the Exchange Contractors at Mendota Pool, to meet the target flow requirements. Under the San Joaquin River Agreement, SJRGA coordinates operations to meet VAMP requirements. Reclamation and DWR compensate SJRGA to make water supplies available for instream flows, as needed, up to prescribed limits. Releases from major reservoirs on the tributaries are made in response to multiple operational objectives that would not be affected by WY 2010 Interim Flows, including flood management, downstream diversions, instream fisheries flows, and instream water quality flows. These operational objectives are in addition to VAMP.

The major reservoirs on the tributary rivers are all operated for local requirements, including flood control and water supply. The operation of these reservoirs to meet these demands includes rules that are based on reservoir storage at any given time. For example, flood control rules typically specify required releases during periods of high inflows as a reservoir fills. If the reservoir has a different storage at the start of the high inflow period, it will capture a different volume of the high inflow and will reach the flood control storage limit at a different time, changing the releases from the reservoir.

Sacramento-San Joaquin Delta

Both the CVP and the SWP use Delta channels to convey water released from the upstream Sacramento River basin reservoirs to their pumping stations in the south Delta for export south of the Delta. These pumping facilities are large enough to impact local flow patterns in the Delta channels and cause changes to stages and salinities. The Jones Pumping Plant has a nominal and permitted pumping capacity of 4,600 cfs. Harvey O. Banks Pumping Plant (Banks Pumping Plant) has a nominal installed pumping capacity of 10,300 cfs. However, flow diverted from the Delta into Clifton Court Forebay is limited by permit to 6,680 cfs during much of the year. A number of agreements exist between the CVP and SWP operators (Reclamation and DWR, respectively) regarding how they will jointly operate to meet both their own goals and needs, and to meet shared responsibilities for in-basin flow and water quality requirements in the Delta. Both entities export water from the Delta for project use in areas to the south. The rates of export are operationally conditioned by the 2008 USFWS and 2009 NMFS Biological Opinions (BO) for the long-term coordinated operations for the CVP and SWP.

Central Valley Project/State Water Project Water Service Areas

The following sections describe storage and diversion facilities for CVP and SWP water service areas.

Central Valley Project Friant Division Water Service Area and Facilities. Friant Division facilities include Friant Dam and Millerton Lake, and the Madera and Friant-Kern canals, which convey water north and south, respectively, to agricultural and urban water contractors. These facilities are described in the San Joaquin River Upstream from Friant Dam section, above. Historically, the Friant Division has delivered an average of about 1,300 TAF of water annually. Figure 3-2 shows the locations and acreage of the 28 Friant Division long-term contractors.

The area supplied by the Friant Division remains in a state of groundwater overdraft today. Reclamation employs a two-class system of water allocation to support conjunctive water management and take advantage of water during wetter years:

- Class 1 supplies, which are based on a firm water supply, are generally assigned to M&I and agricultural water users who have limited access to quality groundwater. During project operations, the first 800 TAF of annual water supply are delivered as Class 1 water.
- Class 2 water is a supplemental supply and is delivered directly for agricultural use or for groundwater recharge, generally in areas that experience groundwater overdraft. Class 2 contractors typically have access to good quality groundwater supplies and can use groundwater during periods of surface water deficiency. Many Class 2 contractors are in areas with high groundwater recharge capability and operate dedicated groundwater recharge facilities. Total Class 2 contracts equal 1.4 million acre-feet (MAF).

In addition to Class 1 and Class 2 water deliveries, Reclamation delivers water (called Section 215 water) made possible as a result of a water supply not otherwise storable for project purposes or frequent and otherwise unmanaged flood flows of short duration under the authority of Section 215 of the Reclamation Reform Act of 1988.Delivery of Section 215 water has enabled San Joaquin Valley groundwater replenishment at levels higher than otherwise could be supported with Class 1 and Class 2 contract deliveries.

Central Valley Project Water Service Areas and Facilities. Reclamation operates several other reservoirs with a combined storage capacity of about 12 MAF. The DMC, completed in 1951, carries water from the Jones Pumping Plant in the Delta along the west side of the San Joaquin Valley for irrigation supply, for use by Delta Division, San Luis Unit, and San Felipe Unit contractors, and to replace San Joaquin River water stored at Friant Dam and diverted into the Friant-Kern and Madera canals. The DMC is about 117 miles long and ends at the Mendota Pool. The initial diversion capacity is 4,600 cfs, which decreases to 3,211 cfs at the terminus.

The CVP provides water to Settlement Contractors in the Sacramento Valley, Exchange Contractors in the San Joaquin Valley, agricultural and M&I water service contractors in both the Sacramento and San Joaquin valleys, and wildlife refuges both north and south of the Delta. Through an Exchange Contract, Reclamation provides a substitute water supply to the Exchange Contractors, including CCID, Columbia Canal Company, SLCC, and the Firebaugh Canal Water District, in exchange for the use of waters of the San Joaquin River within the Friant Division. The four entities of the Exchange Contractors each have separate conveyance and delivery systems, operated independently. The Exchange Contractors, along with eight additional water right contractors, have conveyance and delivery systems that generally divert water from the DMC or Mendota Pool, convey water to customer delivery turnouts, and at times discharge to tributaries of the San Joaquin River.

State Water Project Water Service Areas and Facilities. San Luis Reservoir, with a total capacity of about 2.0 MAF, is shared at 0.97 MAF for the CVP and 1.1 MAF for the SWP. The O'Neill Forebay serves as a regulating reservoir for San Luis Reservoir; the William R. Gianelli Pumping-Generating Plant (Gianelli Pumping-Generating Plant), also a joint CVP/SWP facility, can pump flows from the O'Neill Forebay into San Luis

Reservoir, and also make releases from San Luis Reservoir to the O'Neill Forebay for diversion to either the DMC or the California Aqueduct. The SWP operates under long-term contracts with public water agencies throughout California. These agencies, in turn, deliver water to wholesalers or retailers, or deliver it directly to agricultural and M&I water users (DWR 1999).

3.11.2 Surface Water Quality

Surface water quality monitoring programs are currently being conducted by Reclamation, USGS, DFG, DWR, and the Central Valley RWQCB in the Restoration Area. In particular, the Central Valley RWQCB, in conjunction with the Westside San Joaquin River Watershed Coalition, monitors for pesticides and other agricultural contaminants within the affected reaches on a monthly basis. The USEPA maintains a database of existing surface water quality monitoring programs in the San Joaquin River watershed through the San Joaquin River Monitoring and Assessment Strategy Web site. surface water quality monitoring programs and data sources (USEPA 2008) are listed in Table 3-51. Table 3-52 lists existing surface water quality monitoring stations identified to support the SJRRP. Most of the surface water quality monitoring stations were chosen because they are established monitoring sites, funded by other projects, have sufficient historical data, and are likely to continue operation for at least 10 more years

Table 3-51.
Current Surface Water Quality Monitoring Programs in the Restoration Area

Water Quality Monitoring Program	Lead Agencies	Period of Record	Parameters	Frequency
IEP Environmental Monitoring Program	DWR	1971–present	Biological community, basic parameters, sediments, clarity (turbidity, Secchi depth), nutrients, organics, toxicity	Continuous, monthly, quarterly
Subsurface Agricultural Drainage Monitoring Program	Central Valley RWQCB	2000–present	Basic parameters, ions & minerals, trace elements & metals	Weekly
San Joaquin-Tulare Basins National Water Quality Assessment Program	USGS	1991–present	Basic parameters, nutrients, organics, pesticides, sediments	Biweekly
Central Valley Project Baseline Water Quality Monitoring Program	Reclamation	1998–present	Trace metals, ions & minerals, nutrients	Quarterly
DFG Water Quality Sampling	DFG	2003–present	Basic parameters	Hourly
Grasslands Bypass Project	Reclamation, Central Valley RWQCB	1996–present	Basic parameters, ions & minerals, nutrients, trace elements & metals	Weekly, monthly
San Joaquin District – Surface Water Monitoring Sites	DWR	1959–present	Basic parameters, nutrients, trace elements & metals	Monthly
San Joaquin River Real-Time Water Quality Management Program	Reclamation, DWR	1996–present	EC, DO, temperature	Hourly
Surface Water Ambient Monitoring Program	Central Valley RWQCB	1999–present	Basic parameters, organics, bacteria, pathogens	Weekly, bimonthly, semiannually
Reclamation Flow Data	Reclamation	1944–present	Basic parameters	Daily

Table 3-51.
Current Water Quality Monitoring Programs in the Restoration Area (contd.)

Water Quality Monitoring Program	Lead Agencies	Period of Record	Parameters	Frequency
Irrigated Lands Program	Westside San Joaquin River Watershed Coalition, Central Valley RWQCB	2004–present	Basic parameters, sediments, clarity (turbidity), pesticides, macroinvertebrates, ultraviolet absorbance, hardness, ions & minerals, organics, nutrients	Monthly, bimonthly
Municipal Water Quality Investigations	DWR	1982–present	DBPs, basic parameters, ions & minerals, nutrients, pathogens, arsenic	Monthly (May to October), weekly (November to April)

Key:
Basic parameters = dissolved oxygen (DO), pH, electrical conductivity (EC), water temperature
Biological community = benthic macroinvertebrates, phytoplankton, and zooplankton
Clarity = Secchi depth, turbidity
DBPs = disinfection by-products
DFG = California Department of Fish and Game
DWR = California Department of Water Resources
IEP = Interagency Ecological Program
Ions & minerals = calcium, magnesium, potassium, sodium, chloride, fluoride, silica, sulfate, iron, manganese, boron, and arsenic
Nutrients = nitrogen, phosphorus
Organics = total organic carbon (TOC), dissolved organic carbon (DOC)
Pathogens = fecal coliforms, total coliforms, *E. Coli*
Reclamation = U.S. Department of the Interior, Bureau of Reclamation
RWQCB = Regional Water Quality Control Board
Sediments = total suspended solids (TSS), total dissolved solids (TDS)
Trace elements & metals = molybdenum, selenium, mercury, thallium, copper, and zinc
USGS = U.S. Geological Survey

Table 3-52.
Surface Water Quality Monitoring Stations Identified to Support SJRRP

Location	Responsible Agency	Parameters	Frequency	Remarks
Friant Dam (Millerton Lake)	Reclamation (SCCAO)	Physical [1]	Continuous	Multiple parameter sonde*
San Joaquin River below Friant Dam	Reclamation (SCCAO)	Physical [1]	Continuous	Multiple parameter sonde
	Reclamation (MP157)	Short list* [2] Baseline [3]	Daily composite* Quarterly	Autosampler* Grab sample
San Joaquin River at Gravelly Ford	Reclamation (SCCAO)	Temperature	Continuous	Multiple parameter sonde*
San Joaquin River below bifurcation	Reclamation (SCCAO)	Temperature	Continuous	Multiple parameter sonde*
San Joaquin River near Mendota	Reclamation (SCCAO)	Physical [1]	Continuous	Multiple parameter sonde
	Reclamation (MP157)	Short list* [2] Baseline* [3]	Daily composite* Quarterly*	Autosampler* Grab sample*
San Joaquin River below Sack Dam	TBD	Physical* [1]	Continuous*	Multiple parameter sonde*
San Joaquin River at top of Reach 4B	TBD	Conductivity* Temperature* Dissolved oxygen* Turbidity*	Continuous*	Recommend using established site at Fremont Ford
San Joaquin River at Fremont Ford Bridge	USGS	Physical [1]	Continuous	Multiple parameter sonde
	Central Valley RWQCB	Selenium Boron Nutrients [4] Others [5]	Weekly	Grassland Bypass Project Station H
San Joaquin River at Hills Ferry	TBD	Physical* [1]	Continuous*	Multiple parameter sonde
	SLDMWA	Selenium Boron	Weekly	Grassland Bypass Project Station H
	Reclamation (MP157)	Short list* [2] Baseline* [3]	Daily composite* Quarterly	Autosampler* Grab sample*

Table 3-52.
Water Quality Monitoring Stations Identified to Support the SJRRP (contd.)

Location	Responsible Agency	Parameters	Frequency	Remarks
San Joaquin River near Crows Landing	USGS	Physical [1]	Continuous	Grassland Bypass Project Station N
	Central Valley RWQCB	Selenium Boron	Daily composite	Autosampler*
		Nutrients [4] Others [5]	Weekly	Grab sample

Notes:
* New equipment or sampling for the San Joaquin River Restoration Program water quality monitoring plan.
[1] Real-time measurements of electrical conductivity (salinity), temperature, pH, dissolved oxygen, turbidity, and chlorophyll; calibration, as needed.
[2] Short list of constituents for lab analysis – to be determined (e.g., selenium, boron).
[3] Central Valley Project Baseline Water Quality Monitoring Program; full Title 22 organic and inorganic compounds, plus bacterial.
[4] Parameters included in the Nutrient Series are nitrate, ammonia, total Kjeldahl nitrogen, total phosphate, and ortho phosphate, required by the Waste Discharge Permit for Grassland Bypass Project. Nutrient Series sampling period increases to every other week during irrigation season (March through August).
[5] Other constituents include bacteria, trace elements, total organic carbon, and other minerals.

Key:
Central Valley RWQCB = Central Valley Regional Water Quality Control Board
MP157 = Reclamation Mid-Pacific Region, Environmental Monitoring Branch
Reclamation = U.S. Department of the Interior, Bureau of Reclamation
SCCAO = Reclamation, South Central California Area Office
SJRRP = San Joaquin River Restoration Program
SLDMWA = San Luis & Delta-Mendota Water Authority
TBD = to be determined
USGS = U.S. Geological Survey

The following sections describe the affected environment for surface water quality within the five geographic subareas of the EA/IS study area.

The Central Valley RWQCB, through the Surface Water Quality Monitoring Program (SWAMP), monitors water quality at numerous sites in the San Joaquin River basin. Eight sites are located on the San Joaquin River, downstream from major inflows, and numerous sites are located on San Joaquin River tributaries. San Joaquin River SWAMP sites located near and downstream from the San Joaquin River confluence with Merced River include the following:

- San Joaquin River at Hills Ferry (Site Code STC 512), located 30 yards upstream from Merced River
- San Joaquin River at Crows Landing (Site Code STC504)
- San Joaquin River at Patterson (Site Code STC507)
- San Joaquin River at Maze Boulevard (Site Code STC510
- San Joaquin River at Airport Way (Site Code STC501)

The San Joaquin River SWAMP sites serve as long-term trend monitoring stations. Sites are monitored weekly, monthly, or quarterly (depending on the constituent and available funding), and monitoring data collected through the program include data obtained during high flow events. All of the sites have data covering at least several of the flood flows that occurred during 1997, 2001, 2005, 2006, and 2007. The suite of parameters monitored at each site varies, and includes a subset of the following: water temperature, electrical conductivity (EC), pH, dissolved oxygen, boron, selenium, total suspended solids (TSS), turbidity, bacteria, nutrients, biological oxygen demand, metals, and minerals.

San Joaquin River SWAMP water quality data collected by the Central Valley RWQCB suggest that EC, total organic carbon, turbidity, and TSS were influenced by storm events, especially EC during the first storm runoff (RWQCB 2009). Concentrations of these constituents spiked during storm events, likely because of increased runoff across agricultural lands, and then decreased, but remained at elevated levels, during the irrigation season.

San Joaquin River Upstream from Friant Dam

Water upstream from Friant Dam is generally “soft” with low mineral and nutrient concentrations due to the insolubility of granitic soils in the watershed and the river’s granite substrate. As the San Joaquin River and tributary streams flow from the Sierra Nevada foothills across the eastern valley floor, their mineral concentration increases. Sediment is captured behind the many impoundments in this geographic subarea.

Most of Millerton Lake becomes thermally stratified during spring and summer. Complete mixing of the water column likely occurs during winter. Dissolved oxygen concentrations in Millerton Lake are generally high during most of the year, with lowest concentrations typically exhibited during November at depths greater than 175 feet.

San Joaquin River from Friant Dam to Merced River

Water quality in various segments of the San Joaquin River below Friant Dam is degraded because of low flow, and discharges from agricultural areas, wildlife refuges, and wastewater treatment plants. The following subsections describe surface water quality conditions within San Joaquin River reaches in the Restoration Area. The *Water Quality Control Plan* for the Sacramento and San Joaquin river basins (Basin Plan), adopted by the Central Valley RWQCB in 1998, is the regulatory reference for meeting Federal and State water quality requirements, and lists existing and potential beneficial uses of the San Joaquin River. The current Basin Plan review is anticipated to provide regulatory guidance for TMDL standards at locations along the San Joaquin River.

Water quality in Reach 1 is influenced by releases from Friant Dam, with minor contributions from agricultural and urban return flows. Water quality data collected at San Joaquin River below Friant demonstrate the generally high quality of water released at Friant Dam from Millerton Lake to Reach 1. Temperatures of San Joaquin River water releases to Reach 1 depend on the cold-water volume available at Millerton Lake (Reclamation 2007).

During the irrigation season, water released at Mendota Dam to Reach 3 generally has higher concentrations of total dissolved solids (TDS) than water in the upper reaches of the San Joaquin River. Increased EC and TSS concentrations demonstrate the effect of Delta contributions to San Joaquin River flow. Water temperatures below Mendota Dam depend on water temperatures of inflow from the DMC and, occasionally, the Kings River system via James Bypass (Reclamation 2007).

Water quality criteria applicable to some beneficial uses are not currently met within Reaches 3 and 4. Proposed Clean Water Act Section 303(d) listings for these reaches include boron, EC, and some pesticides. TMDL and Basin Plan amendments are currently in place for diazinon and chloropyrifos runoff into the San Joaquin River. TMDLs and Basin Plan amendments are currently being developed for selenium, salt and boron, and pesticides. Water temperature conditions in Reach 4A depend on inflow water temperatures during flood flows from Reach 3 (Reclamation 2007).

Reach 5 typically has the poorest water quality of any reach of the river. Reach 5 and its tributaries (Bear Creek and Mud and Salt sloughs) do not meet water quality criteria applicable to some designated beneficial uses, as shown in Table 3-53. In addition to TMDLs and Basin Plan amendments currently in place or being developed for Reaches 3 and 4, TMDLs were developed to address selenium in Salt Slough and the Grasslands Drainage Area.

Water quality data collected at Salt Slough, Mud Slough, and San Joaquin River sites within Reach 5 demonstrate the effects of irrigation runoff contributions from eastside tributaries. San Joaquin River water temperatures within Reach 5 are influenced greatly by the water temperature of Salt Slough inflow, which contributes the majority of streamflow in the reach (Reclamation 2007).

Table 3-53.
Proposed 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments, San Joaquin River System, Reach 5, and Tributaries

Segment	Pollutant/Stressor	Potential Source
San Joaquin River, Bear Creek to Mud Slough (Reach 5)	Boron	Agriculture
	DDT	Agriculture
	Electrical conductivity	Agriculture
	Group A pesticides	Agriculture
	Mercury	Agriculture
	Unknown toxicity	Source unknown
San Joaquin River, Mud Slough to Merced River (Reach 5)	Boron	Agriculture
	DDT	Agriculture
	Electrical conductivity	Agriculture
	Group A pesticides	Agriculture
	Mercury	Agriculture
	Unknown toxicity	Source unknown
Bear Creek	Mercury	Resource extraction
Mud Slough	Boron	Agriculture
	Electrical conductivity	Agriculture
	Pesticides	Agriculture
	Unknown toxicity	Source unknown
Salt Slough	Boron	Agriculture
	Chlorpyrifos	Agriculture
	Diazinon	Agriculture
	Electrical conductivity	Agriculture
	Unknown toxicity	Agriculture

Key:
DDT = dichlorodiphenyl-trichloroethane

San Joaquin River from Merced River to the Delta

Below its confluence with the Merced River, San Joaquin River water quality generally improves at successive confluences with rivers draining the Sierra Nevada, particularly at confluences with the Merced, Tuolumne, and Stanislaus rivers. In the relatively long reach between the Merced and Tuolumne rivers, mineral concentrations tend to increase because of inflows of agricultural drainage water, other wastewaters, and effluent groundwater (DWR 1965). TDS in the San Joaquin River near Vernalis has historically ranged from 52 milligrams per liter (mg/L) at high flows to 1,220 mg/L from 1951 to 1962 (DWR 1965).

Water quality impairments identified by the Central Valley RWQCB for the San Joaquin River from Merced River to the Delta, and recommended to SWRCB during 2006 for listing on the Federal Clean Water Act Section 303(d) list, are provided in Table 3-54. In addition to these water quality impairments, a TMDL and Basin Plan amendment for organic enrichment/low dissolved oxygen in the Stockton Deepwater Ship Channel portion of the San Joaquin River were also identified.

Table 3-54.
Proposed 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments, San Joaquin River System from Merced River to Delta

Segment	Pollutant/Stressor	Potential Source	Affected Area/Reach Length
San Joaquin River, Merced River to Tuolumne River	Boron	Agriculture	29 miles
	DDT	Agriculture	
	Electrical conductivity	Agriculture	
	Group A pesticides	Agriculture	
	Mercury	Resource Extraction	
	Unknown toxicity	Agriculture	
San Joaquin River, Tuolumne River to Stanislaus River	Boron	Agriculture	8.4 miles
	DDT	Agriculture	
	Electrical conductivity	Agriculture	
	Group A pesticides	Agriculture	
	Mercury	Resource Extraction	
	Unknown toxicity	Agriculture	
San Joaquin River, Stanislaus River to Delta	Boron	Agriculture	3 miles
	DDT	Agriculture	
	Electrical conductivity	Agriculture	
	Group A pesticides	Agriculture	
	Mercury	Resource Extraction	
	Toxaphene	Source unknown	
	Unknown toxicity	Agriculture	

Key: DDT = dichlorodiphenyl-trichloroethane

Sacramento-San Joaquin Delta

Water quality in the Delta is highly variable temporally and spatially and is a function of complex circulation patterns that are affected by Delta inflows, pumping for local Delta agricultural operations and regional exports, operation of flow control structures, and tidal action. The existing water quality problems of the Delta system may be categorized as the presence of toxic materials, eutrophication and associated fluctuations in dissolved oxygen, presence of suspended sediments and turbidity, salinity, and presence of bacteria.

Delta waterways within the area under Central Valley RWQCB jurisdiction are listed as impaired on the USEPA 303(d) list for dissolved oxygen, EC, dichlorodiphenyl-trichloroethane (DDT), mercury, Group A pesticides, diazinon and chlorpyrifos, and unknown toxicity (Central Valley RWQCB 2007). The Delta is also listed as impaired for mercury, chlordane, selenium, DDT, dioxin compounds, polychlorinated biphenyl (PCB) compounds, dieldrin, diazinon, exotic species, and furan compounds (San Francisco Bay RWQCB 2003).

The north Delta tends to have better water quality primarily because of inflow from the Sacramento River. The quality of water in the west Delta is strongly influenced by tidal exchange with San Francisco Bay; during low-flow periods, seawater intrusion increases salinity. In the south Delta, water quality tends to be poorer because of the combination of inflows of poorer water quality from the San Joaquin River, discharges from Delta islands, and effects of diversions that can sometimes increase seawater intrusion from San Francisco Bay.

The Sacramento and San Joaquin rivers contribute approximately 61 percent and 33 percent, respectively, to tributary inflow TDS concentrations within the Delta. TDS concentrations are relatively low in the Sacramento River, but because of its large volumetric contribution, the river provides the majority of the TDS load supplied by tributary inflow to the Delta (DWR 2001). Although actual flow from the San Joaquin River is lower than from the Sacramento River, TDS concentrations in San Joaquin River water average approximately 7 times those in the Sacramento River. As mentioned, the influence of this relatively poor San Joaquin River water quality is greatest in the south Delta channels and in CVP and SWP exports. Water temperature in the Delta is only slightly influenced by water management activities (i.e., dam releases) (Reclamation and DWR 2005).

Delta exports contain elevated concentrations of disinfection byproduct precursors (e.g., dissolved organic carbon (DOC)), and the presence of bromide increases the potential for formation of brominated compounds in treated drinking water. Organic carbon in the Delta originates from runoff from agricultural and urban land, drainage water pumped from Delta islands that have soils with high organic matter, runoff and drainage from wetlands, wastewater discharges, and primary production in Delta waters. Delta agricultural drainage can also contain high levels of nutrients, suspended solids, organic carbon, minerals (salinity), and trace chemicals such as organophosphate, carbamate, and organochlorine pesticides.

Central Valley Project/State Water Project Water Service Areas

Water delivered to Friant Division contractors via the Friant-Kern and Madera canals from Millerton Lake is representative of water quality conditions in Millerton Lake and the upper San Joaquin River watershed, generally soft with low mineral and nutrient concentrations. Surface water quality in the other CVP water service areas is affected by fluctuations of water quality in the Delta, which in turn are influenced by climate, water quality in the San Joaquin River, local agricultural diversions and drainage water, and the Sacramento River. Water quality concerns of particular importance are those related to salinity and drinking water quality. Surface water quality conditions within SWP water service areas and at SWP facilities are similar to the conditions described above for other CVP water service areas and facilities. Constituents that affect drinking water quality are more of a concern within the SWP water service area because of high demand for municipal water supplies for SWP contractors.

3.11.3 Groundwater

This section discusses hydrogeology, groundwater storage and production, groundwater levels, land subsidence, and seepage and waterlogging within the San Joaquin Valley Groundwater Basin. The San Joaquin Valley Groundwater Basin (see Figure 3-27) comprises the San Joaquin River Hydrologic Region and the Tulare Lake Hydrologic Region. The San Joaquin River Hydrologic Region consists of basins draining into the San Joaquin River system, from the Cosumnes River basin on the north through the southern boundary of the San Joaquin River watershed (DWR 1999). The Tulare Lake Hydrologic Region is a closed drainage basin at the south end of the San Joaquin Valley, south of the San Joaquin River watershed, encompassing basins draining to the Kern Lakebed, Tulare Lakebed, and Buena Vista Lakebed (DWR 1999).

The San Joaquin Valley Groundwater Basin is composed of 16 subbasins: 9 in the San Joaquin Hydrologic Region and 7 in the Tulare Lake Hydrologic Region. The San Joaquin Hydrologic Region is heavily groundwater-reliant, with groundwater making up approximately 30 percent of the annual supply for agricultural and urban uses (DWR 2003). Groundwater in this region accounts for 5 percent of the State’s total agricultural and urban water use (DWR 1998). The Tulare Lake Hydrologic Region has also been historically heavily reliant on groundwater supplies. Groundwater use in this region has historically accounted for 41 percent of the total annual water supply and for 35 percent of all groundwater use in the State. Groundwater use in this region represents approximately 10 percent of the State’s total agricultural and urban water use (DWR 1998).

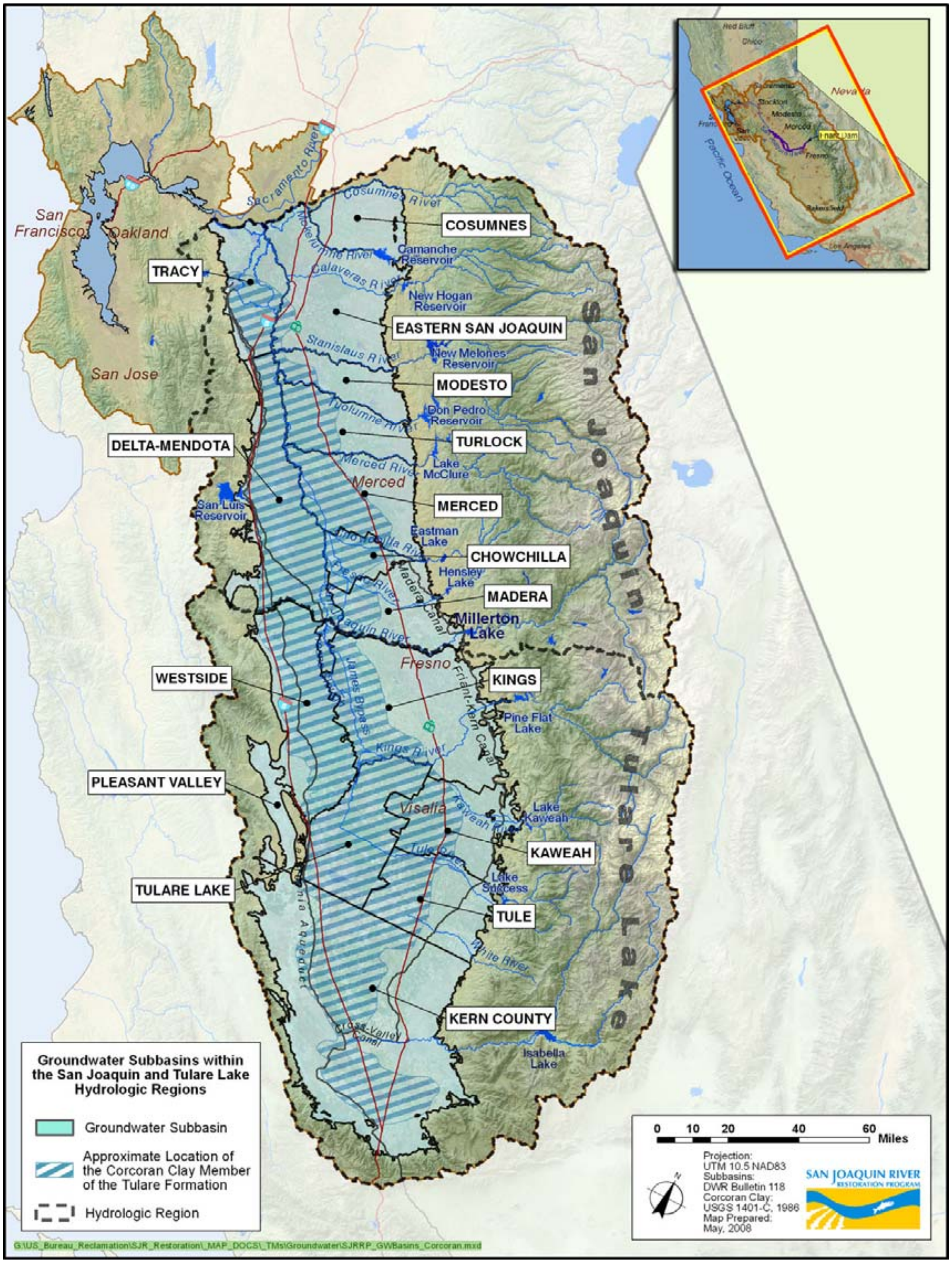


Figure 3-27.
Groundwater Subbasins of the San Joaquin and Tulare Lake Hydrologic Regions

Hydrogeology

The San Joaquin Valley is located in an asymmetric structural trough in the Central Valley of California. The San Joaquin Valley has accumulated up to 6 vertical miles of sediment, including marine and continental rocks and deposits (Page 1986). The eastern side of the valley is underlain by granitic and metamorphic rocks that slope gently from the outcrops of the Sierra Nevada. The western side and part of the eastern side of the valley are underlain by a mafic and ultramafic complex that is also part of the Sierra Nevada. The continental and marine rocks deposited in the San Joaquin Valley range in thickness from tens of feet to more than 2,000 feet (Page 1986). Although these sediments contain freshwater, the depth of the unit prevents it from being considered an important source of water (Page 1986).

On a regional scale, the E-clay, a thick zone of clay deposited as part of a sequence of lacustrine and marsh deposits underlying Tulare Lake, divides the groundwater system into two major aquifers: a confined aquifer beneath the E-clay and a semiconfined aquifer above the E-clay (Mitten et al. 1970, Williamson et al. 1989). The E-clay is considered equivalent to the Corcoran Clay member of the Tulare Formation, and is found ranging from zero to 160 feet thick and between 80 feet deep near Chowchilla, to 400 feet below the land surface to the southwest (Mitten et al. 1970).

Groundwater Storage and Production

Usable storage capacities for the San Joaquin River and Tulare Lake hydrologic regions are estimated to be 24 and 28 MAF, respectively, in DWR *Bulletin 160-93* (1994). DWR *Bulletin 160-93* defined perennial yield as "…the amount of groundwater that can be extracted without lowering groundwater levels over the long-term" (1994). Perennial yields of the San Joaquin River and Tulare Lake hydrologic regions are estimated to be 3.3 and 4.6 MAF, respectively (DWR 1994). The estimated perennial yield is directly dependent on the amount of recharge received by the groundwater basin, which can change over time. In 2000, approximately 33 percent of the water supply in the San Joaquin River and Tulare Lake hydrologic regions was provided by groundwater (DWR 2005).

Although a comprehensive assessment of overdraft in California's subbasins has not been completed since 1980, the *California Plan Update* reports that three of the subbasins in the San Joaquin River Hydrologic Region and five subbasins in the Tulare Lake Hydrologic Region are in a critical condition of overdraft. These subbasins include Chowchilla, Eastern San Joaquin, and Madera, in the San Joaquin Hydrologic Region, and Kings, Tulare Lake, Kern County, Kaweah, and Tule in the Tulare Lake Hydrologic Region (DWR 2005). Typical production in the subbasins in the San Joaquin River and Tulare Lake hydrologic region is shown in Tables 3-55 and 3-56 (DWR 1998, 2003).

Table 3-55.
Typical Groundwater Production in the San Joaquin River Hydrologic Region

Subbasin	Extraction (TAF/year)
Madera	570
Merced	560
Delta-Mendota	510
Turlock	450
Chowchilla	260
Modesto	230

Key:
TAF/year = thousand acre-feet per year

Table 3-56.
Typical Groundwater Production in the Tulare Lake Hydrologic Region

Subbasin	Extraction (TAF/year)
Kings	1,790
Kern County	1,400
Kaweah	760
Tulare Lake	670
Tule	660
Westside	210
Pleasant Valley	100

Key:
TAF/year = thousand acre-feet per year

Groundwater Levels

During the drought of the late 1980s and early 1990s (1987–1992), there were substantial deficiencies in surface water deliveries to water districts in the San Joaquin Valley Basin, resulting in increased groundwater pumping of the confined and semiconfined units of the aquifer system (McBain and Trush 2002, Reclamation 1997). A regional response to the drought was evident in the San Joaquin Valley Basin, with water levels in the central and eastern parts declining by 20 to 30 feet (Westlands Water District 1995). Following the drought, groundwater depression areas were present in the San Joaquin River Hydrologic Region in Merced and Madera counties, where groundwater was less than 50 feet above msl. The groundwater levels declined on the eastern side of the San Joaquin River Hydrologic Region until 1995 (DWR 2003).

Groundwater levels in the San Joaquin River Hydrologic Region began to recover in some of the subbasins in 1994 and continued through 2000 to water levels near 1970 predrought levels (DWR 2003). Figure 3-28 presents the most recent (2005) groundwater level conditions in the San Joaquin River and Tulare Lake hydrologic regions (DWR 2008). These groundwater contours, developed by DWR, illustrate groundwater elevations in the unconfined and semiconfined aquifers of the San Joaquin Valley. The groundwater elevations indicate that the San Joaquin Valley Groundwater Basin has generally recovered from the previous drought (1987–1992).

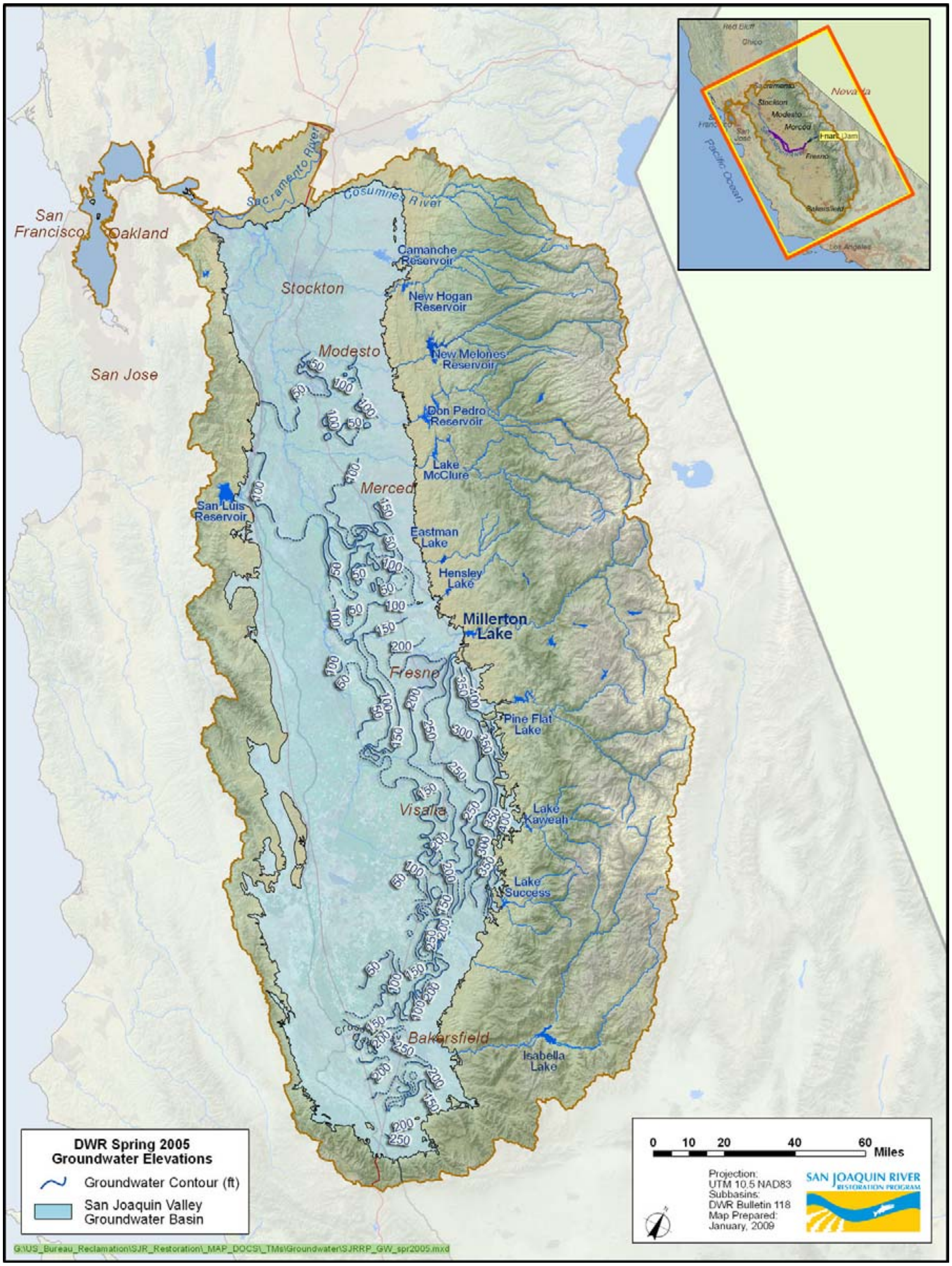


Figure 3-28.
Groundwater Elevations in Spring 2005

Groundwater Quality

Groundwater quality in the San Joaquin River and Tulare Lake hydrologic regions varies considerably. In general, groundwater quality is suitable for most urban and agricultural uses (DWR 2003). Primary constituents of concern include TDS, boron, chloride, nitrates, arsenic, selenium, dibromochloropropane (DBCP), and radon. Future site-specific projects relating to SJRRP implementation may require a more detailed assessment of local groundwater quality issues. USGS Groundwater Ambient Monitoring (GAMA) program data are currently available for the Southeast San Joaquin Valley and the Kern County Subbasin in the Tulare Lake Hydrologic Region (Burton and Belitz 2008; Shelton et al. 2008). The southeast San Joaquin Valley study area includes portions of Fresno, Tulare, and King counties, which in turn include the Kings, Kaweah, Tulare Lake, and Tule subbasins (Burton and Belitz 2008).

Seepage and Waterlogging

Seepage and waterlogging of crops in the lower reaches of the San Joaquin River has been an issue historically. High periodic streamflows and local flooding, combined with high groundwater levels in the San Joaquin River, and in the vicinity of its confluence with major tributaries, have resulted in seepage-induced waterlogging damage to low-lying farmland (Reclamation 1997). During flood-flow events, lateral seepage and structural stability issues with existing project and nonproject levees have been identified (RMC 2003, 2007).

McBain and Trush (2002) identified and classified different reaches of the San Joaquin River as “gaining” or “losing” reaches:

- **Reach 1 –** Outside the irrigation season, a minimum flow of 105 cfs is needed in Reach 1 at the Friant gaging station to obtain measurable flow at the Gravelly Ford gage, which suggests that this is a losing reach with a minimum loss of 105 cfs potentially due to seepage, pumping from the river, and vegetative consumptive use. During the summer and fall irrigation seasons, flow losses were estimated to increase to approximately 130 to 250 cfs when riparian diversions increased.

- **Reach 2 –** A minimum flow of 75 cfs is needed at the Gravelly Ford gage to have a measurable flow at the Chowchilla Bypass Bifurcation Structure gage, which suggests that this is a losing reach with a minimum seepage loss is 75 cfs outside the irrigation season, when riparian diversions are not in use. Reach 2A has historically had lower groundwater levels, increasing the potential for vertical seepage or infiltration losses within this reach between Gravelly Ford and the Mendota Pool (RMC 2003, 2005).

- **Reach 3 –** Downstream from Mendota Dam, seepage has been reported to occur in agricultural fields adjacent to the San Joaquin River near the town of Firebaugh (Steele 2008). Reach 3 of the San Joaquin River has been characterized as both a losing and gaining reach (McBain and Trush 2002). Shallow groundwater has contributed to lateral seepage resulting in waterlogging of the crop root-zones (RMC 2003, 2005).

- **Reach 4 –** A portion of Reach 4B, from the Mariposa Bypass downstream, was identified as potentially being a gaining reach. Observations of seepage along Reach 4A of the San Joaquin River have been reported between Sack Dam and Highway 152 (SJRRP 2007a). An *Opportunities and Constraints Analysis Report and Refuge Flow Delivery Study* (Moss 2002) presented a description of river conditions and seepage along Reach 4 using observations of landowners. In particular, riparian landowners along Reach 4A between Sack Dam and Highway 152, reported seepage problems on adjacent lands downstream from Sack Dam at flows in excess of 600 cfs (Moss 2002). Specific comments about Reach 4A raised concern regarding irrigation canals and drainage facilities. Shallow groundwater has contributed to lateral seepage resulting in waterlogging of the crop root-zones (RMC 2003, 2005).

- **Reach 5 –** Under current operating conditions, Reach 5 is identified as a gaining reach. Seepage has been reported to create waterlogging and/or salt problems on adjacent lands between the Sand Slough Control Structure and the San Luis NWR *in Reach 5 of the San Joaquin River (Moss 2002). Shallow groundwater has co*ntributed to lateral seepage resulting in waterlogging of the crop root-zones (RMC 2003, 2005).

3.11.4 Flood Management

The following is a description of flood management structures in the study area.

San Joaquin River Upstream from Friant Dam. Friant Dam serves dual purposes of storage for irrigation and flood control. Physical data pertaining to Friant Dam and Millerton Lake are presented in Table 3-17. Friant Dam is the principal flood storage facility on the San Joaquin River, with a dedicated flood management pool of up to 170 TAF dur**in**g the October through March flood season. Under present operating rules, up to 85 TAF of the flood control storage required in Millerton Lake may be provided by an equal amount of space in Mammoth Pool. The dam is operated to maintain combined releases to the San Joaquin River at or below a flow objective of 8,000 cfs. Several flood events in the past few decades resulted in flows greater than 8,000 cfs downstream from Friant Dam and, in some cases, flood damages resulted.

San Joaquin River from Friant Dam to Merced River. Flood control structures and facilities within the Restoration Area include several flood bypasses and bypass structures, as follows:

- **Chowchilla Bypass and Chowchilla Bypass Bifurcation Structure** – As a component of the Lower San Joaquin River and Tributaries Project, the Chowchilla Bypass begins at the Chowchilla Bypass Bifurcation Structure in the San Joaquin River and runs northwest, parallel to the San Joaquin River, intercepting the Fresno River where the Chowchilla Bypass ends and essentially becomes the Eastside Bypass. The design channel capacity of the Chowchilla Bypass is 5,500 cfs. The bypass is constructed in highly permeable soils, and much of the initial flood flows infiltrate and recharge groundwater.

- **Eastside Bypass and Eastside Bypass Bifurcation Structure –** The Eastside Bypass extends from. the confluence of the Fresno River and the Chowchilla Bypass to its confluence with the San Joaquin River at the head of San Joaquin River Reach 5. The Eastside Bypass is subdivided into three reaches. Eastside Bypass Reach 1, with a design channel capacity ranging from 10,000 cfs to 17,000 cfs, extends from the Fresno River to the downstream end of the Sand Slough Bypass, and receives flows from, Berenda Slough, Ash Slough, and the Chowchilla River. Eastside Bypass Reach 2, with a design channel capacity of 16,500 cfs, extends from the Sand Slough Bypass confluence to the Mariposa Bypass Bifurcation Structure at the head of the Mariposa Bypass and the Eastside Bypass Bifurcation Structure. Eastside Bypass Reach 3, with a design channel capacity of 13,500 cfs at the Eastside Bypass Bifurcation Structure, and 18,500 cfs at its confluence with Bear Creek, extends from the Eastside Bypass Bifurcation Structure to the head of the San Joaquin River Reach 5, and receives flows from Deadman, Owens, and Bear creeks. The gated Eastside Bypass Bifurcation Structure works in coordination with the Mariposa Bypass Bifurcation Structure to direct flows to either Eastside Bypass Reach 3 or to the Mariposa Bypass. The channel capacities described above are design capacities; current capacities may be reduced because of subsidence of Eastside Bypass levees. Eastside Bypass Reach 3 ultimately joins with Bear Creek to return flows to the San Joaquin River.

- **Mariposa Bypass and Mariposa Bypass Bifurcation Structure –** The Mariposa Bypass Bifurcation Structure controls the proportion of flood flows that continue down the Eastside Bypass or leave through the Mariposa Bypass back into San Joaquin River Reach 4B. The Mariposa Bypass delivers flow back into the San Joaquin River from the Eastside Bypass at the head of Reach 4B2. Of 14 bays on the Mariposa Bypass Bifurcation Structure, 8 are gated. The operating rule for the Mariposa Bypass is to divert all flows to the San Joaquin River when the Eastside Bypass discharges reach 8,500 cfs, and higher flows remain in the Eastside Bypass, eventually discharging back into the San Joaquin River at the Bear Creek Confluence at the end of San Joaquin River Reach 4B2. However, actual operations have deviated from this rule; flows from 2,000 cfs to 3,000 cfs have historically remained in the Eastside Bypass, and approximately one-quarter to one-third of the additional flows are released to the Mariposa Bypass. Flood flows not diverted to the San Joaquin River via the Mariposa Bypass continue down the Eastside Bypass and are returned to the San Joaquin River via Bravel Slough and Bear Creek. Bravel Slough reenters the San Joaquin River at Mile Post 136 and is the ending point of the bypass system.

- **Sand Slough Control Structure/San Joaquin River Headgates –** The Sand Slough Control Structure, located in the short connection between the San Joaquin River at Mile Post 168.5 and the Eastside Bypass, between Eastside Bypass Reaches 1 and 2, is an uncontrolled weir working in coordination with the San Joaquin River Headgates to control the flow split between the mainstem San Joaquin River and Eastside Bypass. The Sand Slough Control Structure diverts flows from the San Joaquin River to the Eastside Bypass. The San Joaquin River

Headgates allow flows from San Joaquin River Reach 4A into Reach 4B. While there are no documented operating rules for the San Joaquin River Headgate structure during low flows, the headgates have not been opened for many years, including during the 1997 flood.

- **Mendota Dam –** Mendota Dam is located at the confluence of the San Joaquin River and Fresno Slough. Fresno Slough connects the Kings River to the San Joaquin River, and delivers water to the south from Mendota Pool during irrigation season, and delivers water to the Mendota Pool and San Joaquin River from the Kings River when the Kings River is flooding. If the flashboards are not pulled before a high flow from the San Joaquin River or Fresno Slough, the increased water surface elevations cause seepage problems on upstream and adjacent properties.

- **Sack Dam –** Sack Dam is operated in conjunction with Mendota Dam to deliver flows to Arroyo Canal for irrigation. Flood flows conveyed from the Mendota Pool are passed over Sack Dam.

Structures on Major San Joaquin River Tributaries – Each major tributary to the San Joaquin River has existing flood control facilities, which are described below:

- **Hidden Dam and Hensley Lake**. Hidden Dam on the Fresno River has a gross pool of 90 TAF and a flood management reservation of 65 TAF.

- **Buchanan Dam and H. V. Eastman Lake**. Buchanan Dam on the Chowchilla River has a gross pool of 150 TAF, a 45 TAF flood management reservation, and a combined downstream objective release of 7,000 cfs via Ash (5,000 cfs) and Berenda (2,000 cfs) sloughs.

- **Redbank and Fancher Creeks Flood Control Project**. The Redbank and Fancher Creeks Flood Control Project provides flood protection to the Fresno-Clovis Metropolitan area and nearby agricultural land.

- **Los Banos Detention Dam**. Los Banos Detention Dam on Los Banos Creek has a storage capacity of 34,600 acre-feet and a flood management reservation of 14,000 acre-feet to control flows to a maximum of 1,000 cfs. (USACE 1999).

- **Merced County Streams Group Project**. This project consists of five dry dams (Bear, Burns, Owens, Mariposa, and Castle), located in the foothills east of Merced on tributaries of the San Joaquin River; these dams provide flood protection to the City of Merced.

San Joaquin River from Merced River to the Delta. Flood management facilities on major tributaries that affect flood conditions in the San Joaquin River from the Merced River to the Delta include New Exchequer Dam and Lake McClure on the Merced River; Don Pedro Dam Lake on the Tuolumne River; and New Melones Dam and Lake on the Stanislaus River.

- **New Exchequer Dam and Lake McClure –** New Exchequer Dam on the Merced River has a top of active storage capacity of 1,024 TAF at Lake McClure, a maximum flood management reservation of 350 TAF, and a downstream objective release of 6,000 cfs or less in the Merced River at Stevinson.
- **Don Pedro Dam and Lake –** The new Don Pedro Dam on the Tuolumne River has a top of active storage capacity of 2,030 TAF at the lake, a maximum flood management reservation of 340 TAF, and a downstream objective release of 9,000 cfs or less in the Tuolumne River below Dry Creek.
- **New Melones Dam and Lake. –** New Melones Dam on the Stanislaus River has a top of active storage capacity of 2,420 TAF at the lake, and a maximum flood management reservation of 450 TAF, and a downstream objective release of 8,000 cfs or less at Orange Blossom Bridge in the Stanislaus River.

Project Levees

There are two classes of levees and dikes in the San Joaquin River study area: (1) those associated with the San Joaquin River Flood Control Project (project levees), and (2) those constructed by individual landowners to protect site-specific properties, and thus not associated with the San Joaquin River Flood Control Project (nonproject levees).

San Joaquin River from Friant Dam to Merced River. The San Joaquin River Flood Control Project consists of a parallel conveyance system: (1) a leveed bypass system in the San Joaquin Valley, and (2) a leveed flow conveyance system in the San Joaquin River. The mainstem San Joaquin River levee system within the study area is composed of approximately 192 miles of project levees (see Figure 3-29) and various nonproject levees located upstream from the Merced River confluence. Project levees are levees constructed as part of the San Joaquin River Flood Control Project by USACE, and occur in Reach 2A downstream from Gravelly Ford, and extend downstream to the Chowchilla Bypass Bifurcation Structure. A small section of project levees extends into Reach 4A upstream from Sand Slough. Project levees begin again in Reaches 4B and 5 at the Mariposa Bypass confluence downstream from the Merced River confluence.

The State has constructed a bypass system consisting of levees and channel improvements. These improvements were coordinated with the Federal Government for effectiveness of the Federal portion of the projects. The bypass system consists primarily of man-made channels (Eastside, Chowchilla, and Mariposa bypasses), which divert and carry flood flows from the San Joaquin River at Gravelly Ford, along with inflows from other eastside tributaries, downstream to the mainstem just above the Merced River. The system consists of about 193 miles of new levees, several control structures, and other appurtenant facilities, and about 80 miles of surfacing on existing levees. Construction of the original State system started in 1959 and was completed in 1966. O&M of the completed State upstream bypass features of the project is accomplished by the LSJLD.

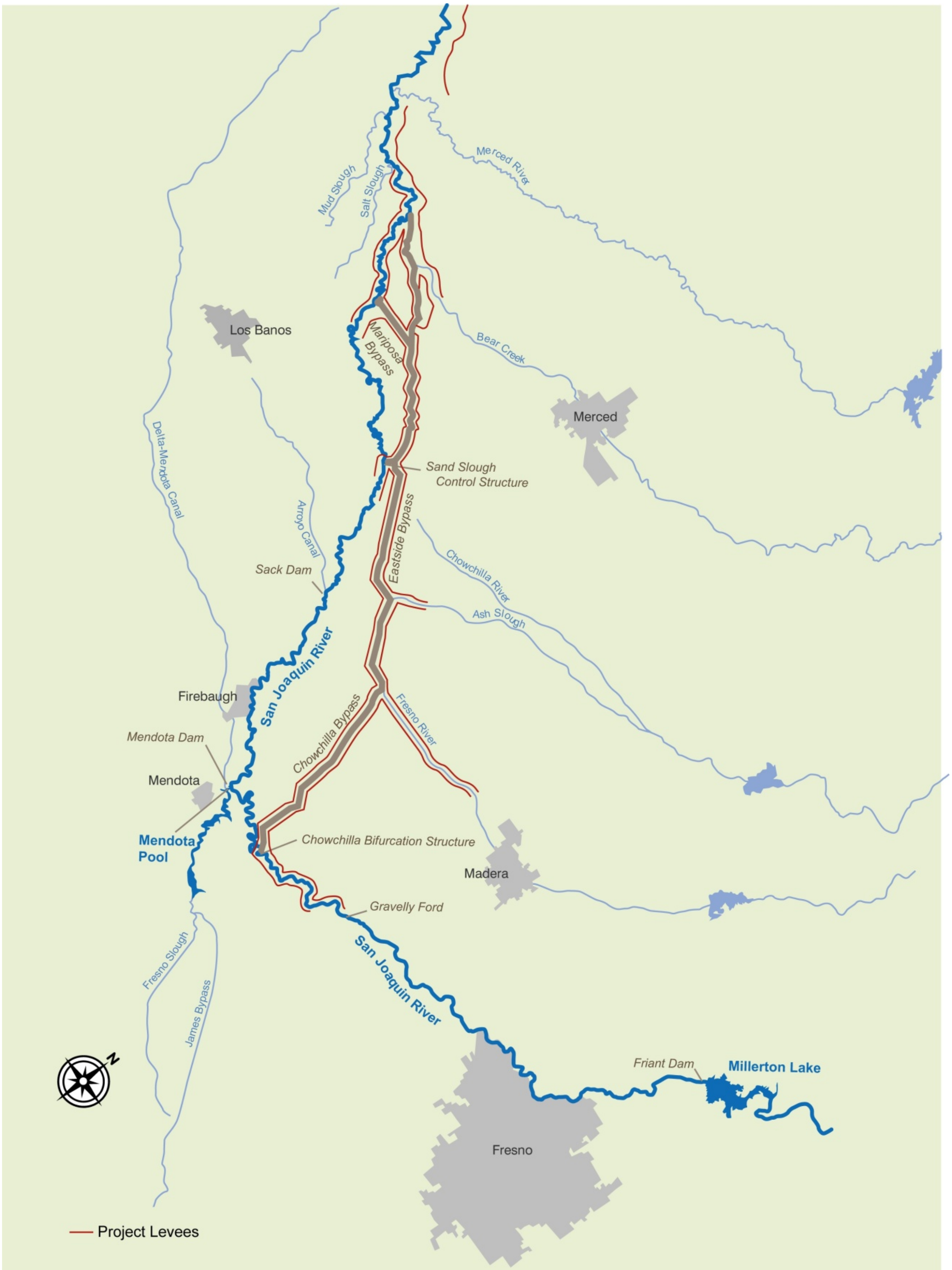


Figure 3-29.
Project Levees Along San Joaquin River from Friant Dam to Merced River Confluence

Design capacity was authorized as the amount of water that can pass through a given reach with a levee freeboard of 3 feet within the historical San Joaquin River and 4 feet of freeboard along the bypasses, except along the left side of the Eastside Bypass, which has 3 feet of design freeboard. Project design channel capacities were probably estimated to be similar to flows that produced little or no significant damage during the planning, design, construction, and initial operation phases of water resource facilities in the San Joaquin River system. However, over time, river stages in various reaches of the river have increased, and flood, seepage, and erosion damage has increased. Although some channel clearing work has been accomplished by USACE, Reclamation, and others, an adequate maintenance program has been difficult to sustain.

The intended design capacities for the various San Joaquin River reaches are illustrated in Table 3-57, which also summarizes USACE design flow capacities and modeled objective flow capacities for various reaches throughout the San Joaquin flood control system (McBain and Trush 2002).

Table 3-57.
Design Channel Capacities

Reach	Flow (cfs)
Reaches 1 and 2A	8,000
Chowchilla Bypass	5,500
Mariposa Bypass	8,500
Eastside Bypass	10,000 – 18,500
Kings River North	4,750
Reach 2B	2,500
Reaches 3 and 4A	4,500
Reach 4B1	1,500
Reaches 4B2 and 5	10,000 – 26,000
Merced River to Tuolumne River	45,000
Tuolumne River to Stanislaus River	46,000
Stanislaus River to Paradise Dam (at head of Paradise Cut)	52,000
Paradise Dam to Old River[1]	37,000
Old River to Stockton Deep Water Ship Channel	22,000

Source: California Resources Agency 1976.
Note:
[1] Diversion capacity of Paradise Cut is 15,000 cfs.
Key:
cfs = cubic feet per second

San Joaquin River from Merced River to the Delta. From about 1956 to 1972, USACE constructed the Lower San Joaquin River and Tributaries project from the Delta upstream to the Merced River, under authorization of the 1944 Flood Control Act. Additional modifications to the project were completed in the mid-1980s. The Federally constructed portion of the project consists of about 100 miles of intermittent levees along the San Joaquin River, Paradise Cut, Old River, and the lower Stanislaus River. The levees vary in height from about 15 feet at the downstream end to an average of 6 to 8 feet over much of the project. The project levees, along with the upstream flow regulation, were designed to contain floods varying from once in 60 years at the lower end of the project to about once in 100 years at the upper limits. Local levees are located along many reaches of the river in the gaps between the project levees.

Nonproject Levees

Nonproject levees are typically associated with levees and dikes constructed by early flood control districts and adjacent landowners between the Chowchilla Bypass Bifurcation Structure and the Mariposa Bypass confluence. Canal embankments bordering both sides of the San Joaquin River between Mendota Dam and approximately 2 miles upstream from the Sand Slough Control Structure effectively form a set of nonproject levees that have significantly reduced the width of the floodplain, primarily on the river. The existing channel capacity in this reach is approximately 4,500 cfs, but flows of this magnitude can cause seepage and levee stability problems (RMC 2007). In addition, local landowners have constructed other low-elevation berms within the reach, creating a narrower floodplain. Information on and dimensions of estimated channel capacities for locally constructed levees are difficult to obtain and, in some cases, currently unavailable.

Flood Management Operations and Conditions

USACE has established flood management objective flows for the San Joaquin River tributaries, bypasses, and flood management operations of reservoirs within the river system. Objective flows are generally considered to be safe carrying capacities, but some flood damages to adjacent land developments do occur when objective flows are passed. Design capacity is defined by USACE as the amount of water that can pass through reaches of the San Joaquin River with a levee freeboard of 3 feet. Design capacity was intended to provide protection against a 50-year storm (McBain and Trush 2002); intended design capacities are illustrated in Table 3-58.

The three mainstem tributaries of the lower San Joaquin River downstream from the Restoration Area include the Merced, Tuolumne, and Stanislaus rivers. Table 3-59 shows USACE objective flows for the San Joaquin River and its tributaries for use in flood control operations of the reservoirs within the system. Design capacity was authorized as the amount of water that can pass through a reach with a levee freeboard of 3 feet within the historical San Joaquin River, and 4 feet along the bypasses (USACE 1999).

Table 3-58.
Comparison of Objective Flow Capacity with Design Channel Capacities for San Joaquin River Flood Control Project

San Joaquin River Reach	Reach	USACE Design Capacity with 3-foot Freeboard (cfs)	Estimated Hydraulic Capacity with No Freeboard (top of levee) (cfs)
Friant Dam to Gravelly Ford	1	8,000	16,000
Gravelly Ford to the Chowchilla Bifurcation Structure	2A	8,000	Approximately 16,000
Chowchilla Bifurcation Structure to Mendota Dam	2B	2,500	Approximately 4,500
Mendota Dam to Sand Slough	3, 4A	4,500	6,000 to 8,000
Sand Slough to Mariposa Bypass Confluence	4B1	1,500	400 to 1,500
Mariposa Bypass confluence to Eastside Bypass Confluence	4B2	10,000	Exceeds 10,000
Eastside Bypass confluence to Merced River Confluence	5	26,000	Exceeds 26,000

Source: McBain and Trush 2002
Key:
cfs = cubic feet per second
USACE = U.S. Army Corps of Engineers

Table 3-59.
Comparison of Objective Flow Capacity
San Joaquin River Flood Control Project Below Merced River

San Joaquin River Reach	USACE Design Capacity with 3-foot Freeboard (cfs)
Merced River to Tuolumne River	45,000
Tuolumne River to Stanislaus River	46,000
Stanislaus River to Paradise Dam (at head of Paradise Cut)	52,000
Paradise Dam to Old River	37,000
Old River to Stockton Deep Water Ship Channel	22,000

Source: California Resources Agency 1976
Key:
cfs = cubic feet per second
USACE = U.S. Army Corps of Engineers

3.12 Noise

Noise is generally defined as sound that is loud, disagreeable, unexpected, or unwanted. Sound is characterized by two parameters: amplitude (loudness) and frequency (tone). Amplitude is the size of a sound wave. The frequency of a wave refers to the rate at which particles vibrate when a wave passes through a medium. Directly measuring sound pressure fluctuations would require a very large and cumbersome range of numbers. To have a more useable numbering system, the logarithmic decibel (dB) scale is commonly used. The normal range of human hearing extends from about 10 dB to about 140 dB.

This section describes the existing noise (and vibration) environment in the only areas potentially affected by the Proposed Action and the No-Action Alternatives: the Restoration Area and the San Joaquin River from the Merced River to the Delta.

3.12.1 San Joaquin River from Friant Dam to the Merced River

The existing noise (and vibration) environment in and surrounding the Restoration Area is influenced by transportation noise, agricultural activities, mining operations, urban uses, light industrial uses, commercial uses, and recreational uses. Sources of noise and sensitive receivers in the Restoration Area are described below.

Reach 1

The existing noise environment in and around Reach 1 is dominated by urban land uses (Reach 1A) and agricultural land uses (Reach 1B). Existing noise-sensitive land uses within Reach 1 include residential uses, churches, schools, hospitals, parks, and golf courses. The nearest residential receiver located in Reach 1 is approximately 100 feet from the centerline of the Restoration Area, and residential receivers are present within 1,000 feet of the centerline. The nearest church, school, and hospital are located 2,500 feet, 2,875 feet, and 3,500 feet, respectively, from the centerline of the Restoration Area.

Reach 2

The existing noise environment in and around Reach 2 is dominated by agricultural land uses (Reach 2A), but it is also influenced by urban land uses (Reach 2B). Urban use noise in Reach 2 emanates from the City of Mendota, an industrial use to the south, and the Mendota Municipal Airport. The nearest noise-sensitive receiver (residential) in Reach 2A is located 740 feet from the centerline of the Restoration Area. No other noise-sensitive land uses are present in Reach 2A. Reach 2B has a handful of sensitive receivers (residential) in close proximity to the Restoration Area; the nearest is located 460 feet from the centerline.

Reach 3

The existing noise environment in and around Reach 3 is primarily dominated by agricultural land uses. Urban land use noise in Reach 3 emanates from the City of Firebaugh, industrial uses located along the river and south of the City, and the Firebaugh Municipal Airport. The nearest noise-sensitive receiver (residential) in Reach 3 is located 200 feet from the centerline of the Restoration Area. The nearest church and school are located 570 feet and 300 feet, respectively, from the centerline of the Restoration Area.

Reaches 4 and 5

The existing noise environment in and around Reaches 4 and 5 is primarily dominated by agricultural land uses. Only three noise-sensitive receivers (residential) in Reaches 4 and 5 are located within 500 feet of the Restoration Area centerline. No other noise-sensitive land uses are present in Reaches 4 and 5.

Chowchilla Bypass, Eastside Bypass, Mariposa Bypass, and Tributaries

The existing noise environment in and around the Chowchilla, Eastside, and Mariposa bypass areas is primarily dominated by agricultural land uses. Noise-sensitive land uses near the Restoration Area are residences and a school. The nearest residential use is located 380 feet from the Restoration Area centerline. The school is located 4,400 feet from the Restoration Area centerline.

3.12.2 San Joaquin River from Merced River to the Delta

The existing noise environment in and around the San Joaquin River from the Merced River to the Delta area is primarily dominated by agricultural land uses. Traffic noise emanating from rural roads also contributes to the existing noise environment relative to the proximity of the roads to the San Joaquin River. Noise-sensitive land uses near the lower San Joaquin River area are residences and churches. The nearest residential use is located 200 feet from the river's centerline. The nearest church is located 2,700 feet from the river's centerline. The noise policies and standards that apply to this section of the San Joaquin River are Merced County (2000) and Stanislaus County (1994) general plans and ordinances.

3.13 Population and Housing

This section addresses population and housing for the three-county Restoration Area and the five-county Friant Division Water Contractors Service Areas (Friant Division Service Area), which are the portions of the study area that may experience population effects from the Proposed Action. Topics closely related to population and housing are described below in Section 3.17, Socioeconomics.

3.13.1 San Joaquin River from Friant Dam to Merced River

The following subsections describe population and housing trends of the three counties of the Restoration Area: Fresno, Madera, and Merced counties.

Population Trends

Between 2000 and 2006, the total population of Fresno, Madera, and Merced counties increased by 13.95 percent, with Madera and Merced counties growing at a faster rate (16.9 and 17.9 percent, respectively) than Fresno County (12.6 percent growth). From 2000 to 2006, nearly all cities in the three counties (with the exception of Fresno and Reedley) increased at a greater rate than Fresno, Madera, and Merced counties at large. Growth projections through 2050 indicate that all counties in the three-county area, as for the counties of the larger Friant Division service area, are projected to grow at a rate more than double the State's rate of growth (60.0 percent), with total growth in the three-county area projected to be 131.9 percent through 2050 (CDF 2007).

In 2006, Merced County had the highest percentage of minorities (64.8 percent) compared to the State (57.2 percent). Between 2000 and 2006, the minority population in the three-county area had a higher growth rate (20.8 percent) compared to the State (15.5 percent).

Housing Trends

As of 2006, the three-county area had a total of 379,527 housing units, representing 3.1 percent of the total number of housing units in the State. From 2000 to 2006, the three-county area experienced a 12.6 percent increase in the total number of housing units along with a 20.9 percent increase in the number of vacant housing units, which was greater than the State increase of 7.5 percent for the same time frame. During this 6-year period, Madera and Merced counties had the largest increase in the number of housing units in the three-county area (15.7 and 17.3 percent, respectively). Vacant housing units increased 87.8 percent in the three-county area. Overall, from 2000 to 2006, the vacancy of housing units in the three-county area outpaced the development of housing units.

3.13.2 Friant Division Water Contractors Service Areas and Vicinity

The Friant Division service area includes five counties: Fresno, Kern, Madera, Merced, and Tulare. The following section describes population and housing trends in the Friant Division service area and vicinity.

Population Trends

Demographic data were collected for Kings County to evaluate potential socioeconomic effects that the Proposed Action could have on the vicinity, especially the towns of Hanford and Corcoran. Because the county is adjacent to the Friant Division service area, it possible that some county residents would be employed by water users in the service area.

As of 2006, the population in the five counties and the two neighboring towns in Kings County was approximately 2.64 million people. Fresno County contributed 34.1 percent of the population of these counties, with more than half of the residents living in the City of Fresno. Between 2000 and 2006, the total population of the counties in the Friant Division increased by 15.1 percent, with all five counties growing at approximately the same rate (14.0 to 17.0 percent growth). Kern and Madera counties showed the highest growth rates, with 17.8 percent and 17.9 percent, respectively. From 2000 to 2006, all cities in Kern, and Tulare counties increased at a greater rate than the five-county area, with the exception of Lindsay and Wasco.

The five counties are an ethnically diverse part of the State, composed largely of Hispanic and Latino populations. In terms of racial diversity, Black/African-American and Asian populations in each county are less than State averages, and all the counties had a higher proportion of White/Caucasians than State averages.

Between 2000 and 2006, the minority population in counties of the Friant Division service area had a greater growth rate (24.4 percent) compared to the State (15.5 percent). The five counties had a slightly larger American Indian population than the State (ranging from 0.9 to 1.2 percent), and similar to the State, experienced a decrease between 2000 and 2006 (U.S. Census Bureau 2000, 2007).

Housing Trends

As of 2006, the five-county area had a total of 864,255 housing units, representing 6.5 percent of the total number of housing units in the State. From 2000 to 2006, these counties experienced a 12.6 percent increase in the total number of housing units, along with a 20.9 percent increase in the number of vacant housing units, which was higher than the State increase of 7.5 percent for the same time frame.

3.14 Recreation

The study area contains a number of parks and public lands offering diverse recreation opportunities, particularly associated with the many reservoirs, rivers, and other water bodies found throughout this portion of California. In addition, numerous recreational opportunities exist on private lands, including fishing, hunting, and other activities.

This section describes the existing recreation environment in the areas potentially affected by the Proposed Action and the No-action Alternatives: the San Joaquin River upstream from Friant Dam, the Restoration Area, the San Joaquin River from Friant Dam to the Merced River, the San Joaquin River from the Merced River to the Delta, and the Sacramento-San Joaquin Delta.

3.14.1 San Joaquin River Upstream from Friant Dam

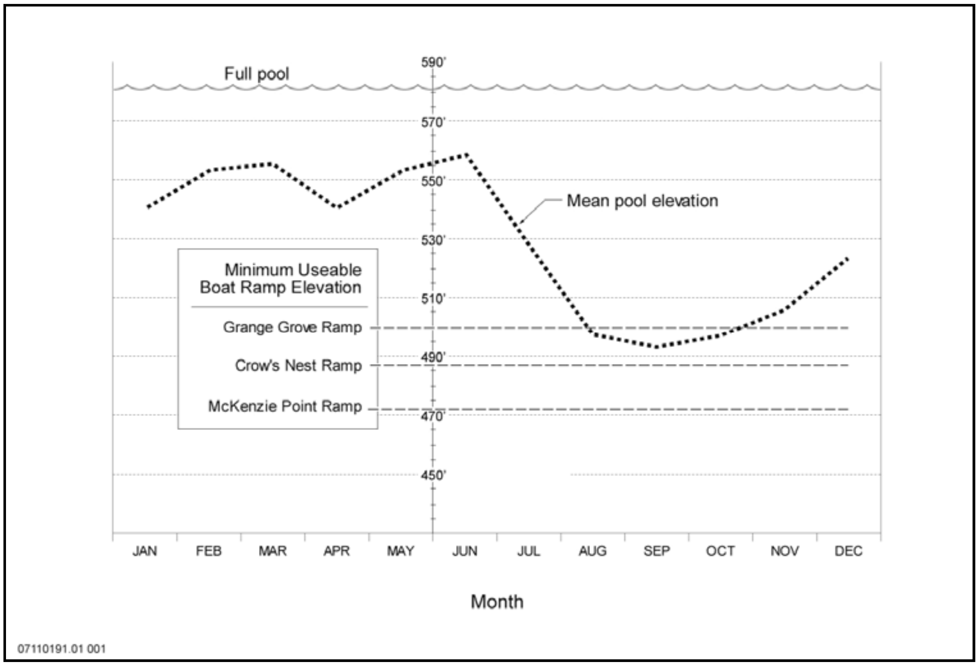
Millerton Lake, the centerpiece of the Millerton Lake SRA, has a surface area of approximately 4,900 acres, and approximately 44 miles of shoreline in the SRA at the lake's maximum elevation (580.6 feet above msl). The SRA encompasses approximately 10,500 acres in total (State Parks 2006) and is one of the most popular recreation areas in the San Joaquin Valley, with typically 300,000 to 500,000 visits annually (State Parks 2007a, 2007b). The City of Fresno, with a 2000 census population of 430,000, is located approximately 20 miles to the southwest (U.S. Census Bureau 2007).

Motorboating, sailing, waterskiing, jet-skiing, swimming, and tournament and recreational fishing are the primary water-based recreation activities. Shoreline activities include picnicking, hiking, biking, horseback riding, seasonal hunting, camping, fishing, and nature watching (State Parks 2007c). During winter, the lake also has special boat tours to view the San Joaquin Valley's largest population of bald eagles (Warszawski 2007).

Most recreational facilities for the SRA are located on the southern and northern shores of the lower portion of the lake, where they are closest to population centers. Facilities include boat ramps, picnic areas, drive-in and walk-in campgrounds, a marina, and trails. A few, more isolated facilities are at the upstream portion of the lake, including boat-in camping areas. Public access is widely available at Millerton Lake.

Seasonally, the reservoir fluctuates substantially under normal operations. The annual maximum water level typically occurs in May or June and is close to the gross pool elevation of 581 feet during most years. The reservoir is typically drawn down from 75 to 100 feet annually, with the minimum annual elevation occurring in October or November, before the reservoir begins to refill with the onset of winter rains. Boat ramps on the lake were designed to accommodate approximately 100 feet of fluctuation in surface elevation (Reclamation and State Parks 2008).

Figure 3-30 illustrates the minimum elevation at which the primary public boat ramps on Millerton Lake are usable in relation to the mean end-of-month pool level between April and August. This 4-month spring and summer period is when most boating activity occurs on the lake. The primary ramp at Grange Grove (actually consisting of four linked ramps used at progressively lower pool levels) is usable down to a pool elevation of 500 feet, which corresponds to the mean pool level at the end of August. Smaller ramps at Crow's Nest and McKenzie Point are usable down to an additional 13 feet and 28 feet of drawdown, respectively. A ramp on the north shore that primarily serves an adjacent campground is available at all pool levels.



Sources: Mean pool elevation - CalSim model run for Millerton Lake elevations under existing storage conditions; minimum useable elevation of ramps - Reclamation and State Parks 2005

Figure 3-30.
Millerton Lake Mean End-of-Month Pool Elevation vs. Minimum Useable Elevations of Boat Ramps

3.14.2 San Joaquin River from Friant Dam to Merced River

The following text describes recreation facilities and activities located within each river reach of the Restoration Area. The facilities are described starting at the upstream end of the reach and continuing downstream. Nearly all existing recreation opportunities associated with the river are located in Reach 1. They consist of formal developed and constructed recreation facilities and services as well as user-defined opportunities, such as foot trails used to access fishing sites and concentrated use areas. Formal and informal recreational uses of the different reaches include hiking, fishing, bird-watching, canoeing, kayaking, and gold panning. Water-dependent uses such as boating and fishing occur throughout the year along the river, except in Reach 2 and portions of Reach 4 because of lack of flows.

The San Joaquin River Parkway is a mosaic of parks, trails, and ecological reserves located along the San Joaquin River between Friant Dam and Highway 145 and is managed by the San Joaquin River Parkway and Conservation Trust (Figure 3-31), a nonprofit entity, and several local and State partner agencies. The lands in the vicinity of the Restoration Area are primarily managed for agricultural land uses; however, several Federal wildlife refuges and State wildlife management areas are located within the valley, along with several State Park units. Some of these are directly adjacent to the San Joaquin River within the Restoration Area, while others are some distance away from the river, but within the San Joaquin Valley. All of the Federal refuges and State wildlife management areas are part of the 160,000-acre Grassland Ecological Area, which represents the largest remaining contiguous block of wetlands in California (Audubon Society 2004a).

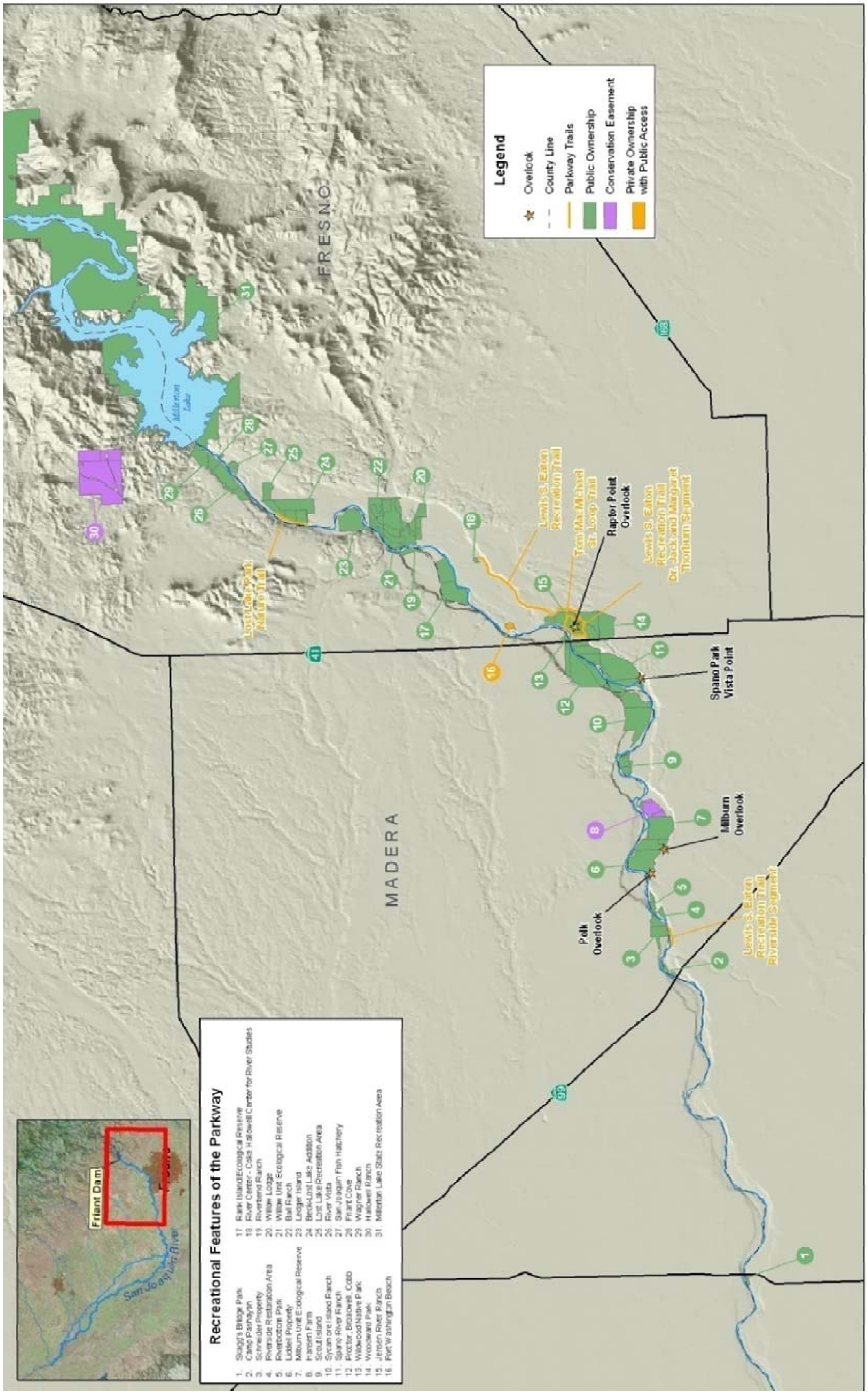


Figure 3-31.
San Joaquin River Parkway and Surrounding Areas

Both the San Luis and San Joaquin River NWRs are located on the San Joaquin River, but only the San Luis NWR is located in the Restoration Area. The largest of the Federal refuges is the San Luis NWR, a mixture of managed seasonal and permanent wetlands, riparian habitat associated with the San Joaquin and two tributary sloughs, and native grasslands, alkali sinks, and vernal pools. The refuge is managed primarily to provide habitat for migratory and wintering birds. Major public uses include interpretive wildlife observation programs and waterfowl and pheasant hunting. The San Luis NWR offers auto tour routes. Foot traffic is permitted on the auto tour routes and on trails in the San Luis NWR. Fishing, by rod and reel only, is also permitted (USFWS 2008a). The Merced NWR is located a few miles east of the San Joaquin River in Merced County. The San Luis NWR receives about 150,000 annual visits, and the Merced NWR receives about 100,000 annual visits (Grassland Water District 2001).

DFG administers several wildlife areas in the San Joaquin Valley in the vicinity of the Restoration Area. Mendota Wildlife Area, located a few miles south of the San Joaquin River and the City of Mendota in Fresno County, consists of nearly 12,000 acres of managed impoundments and wetland and upland habitat, providing opportunities for bird watching and waterfowl hunting. Just east of the Mendota Wildlife Area are two DFG-administered ecological reserves, Kerman and Alkali Sink ecological reserves, which also provide opportunities for hunting and wildlife viewing. Four wildlife areas are located west of the San Joaquin River, in Merced County: the 6,000-acre Los Banos Wildlife Area, 2,800-acre Volta Wildlife Area, 7,000-acre North Grasslands Wildlife Area, and 115-acre Dos Amigos Wildlife Area. These wildlife areas support opportunities for wildlife viewing, and for hunting, fishing, boating, and camping in designated areas. Wildlife viewing and hunting opportunities are also available at the boat-in only West Hilmar Wildlife Area, located on the Stanislaus/Merced County border, which receive a total of 30,000-50,000 visits annually (Grassland Water District 2001). Additional wildlife areas, including the San Luis Reservoir Wildlife Area and Cottonwood Creek Wildlife Area, are located at the west edge of the valley near San Luis Reservoir and the O'Neill Forebay. These areas encompass several thousand acres that support opportunities for wildlife and wildflower viewing, and hunting (DFG 2007).

On the western edge of the San Joaquin Valley, in Merced County, the DPR provides camping, boating, and day use facilities in the San Luis Reservoir SRA, which surrounds the 12,700-acre San Luis Reservoir and adjacent O'Neill Forebay. Pacheco State Park, located on the west side of the reservoir, provides numerous trails.

Reach 1

Approximately 12 developed and undeveloped park units in the San Joaquin River Parkway are owned and managed by several public and private entities. Table 3-60 shows information about each of these parks. Public lands totaling more than 3,000 acres have been acquired within the parkway. Most boating in the Restoration Area occurs in Reaches 1A and 1B, in the San Joaquin River Parkway, and downstream to SR 145, where boat access is provided at several locations. A flow of 200 cfs is the approximate minimum within the ideal range for boating. Although boating is possible at lower flows, disadvantages would include increased dragging of boats on the river bottom and walking boats through shallows and over gravel bars and other obstructions. Boating is possible above 1,000 cfs but becomes increasingly hazardous and unattractive to most boaters because of the strength of the current, flows moving through brushy and wooded areas, and increased “strainers” (flow through the branches of standing trees and downed trees in the channel that can trap boaters).

Table 3-60.
Existing Parks and Public Lands in San Joaquin River Parkway – Reach 1

Recreation Facility/ Park Unit	Owner[1]	Area (acres)	Primary Recreation Opportunities					
			Fishing	Boat Access to River	Outdoor Education	Trails/Trail Access	Camping	Picnicking
Camp Pashayan	DFG, SJRPCT	32	X	X		X		X
Coke Hallowell Center for River Studies	SJRPCT	20			X	X		
Fort Washington Beach	Private	NA	X	X			X	X
Friant Cove	SJRC	6	X	X				X
Jensen River Ranch	SJRC	167				X		X
Lost Lake Park	Fresno County, DFG	305	X	X	X	X	X	X
San Joaquin River Ecological Reserve	DFG	800[2]			X			
Scout Island	Fresno County	85		X	X		X	
Sycamore Island Ranch	SJRC	350	X	X		X		X
Wildwood Native Park	SJRC	22	X	X		X		
Willow Lodge (Willow Unit of Ecological Reserve)	DFG	88			X	X		
Woodward Regional Park	City of Fresno	300				X		X

Notes:
[1] Management of several of the parks is by an entity other than the owner, in some cases with the park owner. The San Joaquin River Conservancy owns and manages 2,541 acres in total, much of which is managed for conservation and future low-impact recreation. In addition, on land owned by the Conservancy, Islewood Golf Course is operated by a private entity. In addition to the properties providing the recreation opportunities in the table, DFG also owns and operates the San Joaquin Hatchery, below Friant Dam, where the public can view and feed trout in the hatchery raceways.
[2] The ecological reserve is composed of several widely dispersed units in the parkway, which in total equal 800 acres; access is by special permit only.

Key:
DFG = California Department of Fish and Game
NA = not applicable
SJRC = San Joaquin River Conservancy
SJRPCT = San Joaquin River Parkway and Conservation Trust

Skagg's Bridge Park is a Fresno County park located approximately 9 miles downstream from the lower end of the parkway, on the south bank of the river at SR 145 (Madera Avenue). This 17-acre park is used for picnicking, day use, and fishing activities and offers picnic units and playground area (Fresno County 2009).

The City of Fresno manages the 300-acre Woodward Regional Park, which is situated on the bluff above the river, on the south side of Reach 1 at Highway 41. The park does not provide direct access to the river, but serves as a trailhead for parkway trails.

Reach 2

The only public recreational facility near Reach 2 is the 85-acre Mendota Pool Park, managed by the City of Mendota, which provides a launch ramp, picnic area, and playground, about one-half mile south of Mendota Dam (City of Mendota 2007). Lone Willow Slough, an Audubon Society-designated Important Bird Area near the reach, provides bird-watching opportunities but is located on private property (Audubon Society 2004b) and does not provide access to the river.

Reach 3

An unpaved boat ramp on the river bank just below Mendota Dam provides access to Reach 3 for small boats, and the reach has been described as being especially suited for canoes and touring kayaks (American Whitewater 2007). Fishing is permitted atop Mendota Dam (American Whitewater 2007).

The community of Firebaugh manages two parks, Dunkle Park, also known as the City Park, and Maldonado Park. Dunkle Park, about 9 miles downstream from Mendota Dam, has a gazebo near the river and informal river access for anglers and boaters (American Whitewater 2007). An unnamed grassy area adjacent to Dunkle Park is also managed and available for recreational activities. Basketball, softball, and soccer fields and a skateboard park are planned for Maldonado Park.

This reach can support informal recreation uses, including fishing from the shore; however, this activity is not encouraged by adjacent landowners and may involve trespassing on private property.

Reach 4

The San Luis NWR, which is bisected by the San Joaquin River, has the only recreational facilities in Reach 4 (Figure 1-2). Three of the six contiguous units of the refuge border on the lower portion of Reach 4 within the Restoration Area: the San Luis, East Bear Creek, and West Bear Creek units. The Merced NWR is several miles east of the river on the Eastside Bypass (Figure 1-2). The two comanaged refuges, totaling more than 36,000 acres, are managed primarily for migratory and wintering bird habitat. An indigenous tule elk herd is located in the San Luis NWR, and both refuges host many endangered, threatened, and sensitive species, including sandhill cranes and vernal pool species.

There are two auto tour routes in the San Luis NWR: one for viewing waterfowl and one for viewing tule elk. Stops with interpretive information and wildlife observation platforms are provided along the routes. Hikers are also allowed on the auto tour routes, and hiking is encouraged along Salt Slough Road. There are two hiking trails and an additional spur trail to the river and a historical site. The Salt Slough Fishing Area is open for fishing during daylight hours; one fishing site is reserved for persons with disabilities. Several hunting blinds are available in the refuge for waterfowl and pheasant hunting (USFWS 2007).

Reach 5

Downstream from Bear Creek is the 2,800-acre Great Valley Grasslands State Park. This State Park includes one of the few intact examples of native grasslands on the floor of the Central Valley, and is part of the larger 160,000-acre Grassland Ecological Area, which includes Federal, State, and private lands managed for wildlife values and represents the largest remaining contiguous block of wetlands in California (Audubon Society 2004a). Although the State Park is undeveloped, people visit the park to view springtime wildflower displays and wildlife and to fish (State Parks 2007d).

A portion of the West Bear Creek Unit of the San Luis NWR, to the east of Great Valley Grasslands State Park, and the Kesterson Unit, to the west, are also in Reach 5. The 3,900-acre West Bear Creek Unit contains a wildlife observation tour route, a designated hunting area surrounding several ponds, and foot trails. The Kesterson Unit has 10,621 acres of seasonal and permanent wetlands, riparian habitat, native grasslands, and vernal pools. Mud Slough bisects the unit. Waterfowl hunting is a primary use of the Kesterson Unit. Many two- and three-person hunting blinds are located in the three areas of the unit. The unit is also used for wildlife viewing (USFWS 2007).

3.14.3 San Joaquin River from Merced River to the Delta

Two Stanislaus County parks provide the only developed recreation access to this segment of the San Joaquin River. The Las Palmas Fishing Access, a few miles east of the town of Patterson, is a 3-acre park with a concrete boat ramp and day use facilities (Stanislaus County 2009a). Laird Park, 2 miles east of the town of Grayson, is a 97-acre “community park” with river access and day use facilities (Stanislaus County 2009b).

The San Joaquin River NWR is located along the San Joaquin River between the Tuolumne and Stanislaus rivers, two major tributaries to the San Joaquin River. The refuge boundaries encompass over 7,000 acres of riparian woodlands, wetlands, and grasslands. Although the refuge is primarily undeveloped, a wildlife viewing platform has been constructed at a favored location for viewing geese and other water birds (USFWS 2009).

The West Hilmar Wildlife Area, on the west bank of the river a few miles downstream from the Merced River confluence, is a 340-acre State wildlife area, with no facilities and accessible only by boat (DFG 2009).

Although not on the San Joaquin River but in the vicinity, two small developed park units managed by DPR (each less than 75 acres) are located on the bank of the lower Merced River in Merced County. These units consist of one area near the confluence with the San Joaquin River and one area approximately 18 miles upstream from the confluence with the San Joaquin River. McConnell and George J. Hatfield SRAs give access to the Merced River for boating, fishing, swimming, picnicking, and hiking on short trails. McConnell SRA also offers family and group camping.

Farther north, the Turlock Lake SRA furnishes camping, boating, and day use facilities at the 3,500-acre Turlock Lake and adjacent Tuolumne River, on the eastern edge of the valley in Stanislaus County. Caswell Memorial State Park is located along the Stanislaus River in San Joaquin County, approximately 5 miles upstream from the confluence with the San Joaquin River. This 258-acre park offers opportunities for fishing and swimming in the Stanislaus River and camping facilities and nature trails through the park's riparian oak woodland.

3.14.4 Sacramento-San Joaquin Delta

At the southeast margin of the Delta on the San Joaquin River are two boating facilities that provide access both to the Delta to and the river upstream. The Mossdale Crossing Regional Park, operated by San Joaquin County, has a paved two-lane boat ramp and day use facilities. Across from the park is the privately operated Mossdale Marina, with 23 boat berths, and services such as fueling, a restaurant and bar, and a store. A few miles downstream are Dos Reis County Park, a facility operated by San Joaquin County that has a boat ramp and day use area as well as a 26-site recreational vehicle (RV) camp. Nearby is Haven Acres Marina, a small private facility with a boat ramp and bar and grill.

Numerous additional recreation opportunities are available in the Delta. The Delta has many miles of rivers and sloughs for boating and fishing, and recreation visitors have a choice of many private facilities, primarily small marinas and resorts, and two State Park units. Brannan Island SRA, in the central Delta on the Sacramento River, offers boat access to the river and sloughs, and camping, swimming, and day use facilities. Franks Tract SRA consists of a large flooded island that was formerly farmland, surrounded by remnant levees. There are no developed facilities in the Franks Tract SRA.

3.15 Transportation and Traffic

This section describes existing traffic conditions and the various roadway, railroad, and utility crossings in the study area that could be affected by the WY 2010 Interim Flows project. Roadways in Fresno, Madera, and Merced counties range from SRs with heavy truck and commuter traffic to local roads with a small amount of local agricultural equipment traffic. For the purpose of describing general conditions, roads are classified into the following groups:

- **State Routes** typically are four- to six-lane high-speed facilities (65 miles per hour (mph) or faster) with the primary purpose of connecting the local and county transportation system with those outside the region. These roadways are under the jurisdiction of the California Department of Transportation (Caltrans).

- **Expressways** typically are four-lane high-speed facilities (55 mph or faster) with the primary purpose of connecting county areas or cities in a county. Some expressways do not meet respective county standards and are designated for upgrade by their respective local (county) transportation authority.

- **Arterial** roads have the primary purpose of connecting major traffic generators to the freeway, expressway, and arterial street systems. They can be classified as either urban or rural, and are under the authority of the local (county) transportation authority.

- The purpose of **collectors** is to link the local road network to the arterial street system. Collectors are typically two- or four-lane roadways with low to moderate speeds (35 to 40 mph), and are under respective county jurisdictions.

- The purpose of **local roads** is to connect properties and the collector roadway system. These facilities typically are two-lane undivided roadways, and are under the respective county jurisdiction.

3.15.1 San Joaquin River from Friant Dam to Merced River

Transportation and infrastructure in the Restoration Area are described below.

Road, Railroad, and Utilities Crossings

This section describes the various roadway, railroad, and utility crossings of the San Joaquin River from Friant Dam to the Merced River.

Reach 1. Between Friant Dam and the SR 99 bridge that provides access across the San Joaquin River, several roads parallel the river in Reaches 1A and 1B. Additionally, six bridges (North Fork Road Bridge, Yosemite Freeway (SR 41), West Nees Bridge, and three unnamed bridges) cross the river in these reaches. State highways in this reach are SR 99, SR 41, and SR 145. Traffic on these State highways is generally the heaviest in the area, outside urban areas, because of truck and commuter traffic. The arterial in this reach is North Blackstone Avenue. Traffic appears to be composed of local agricultural trucks and residential commuters. The access road and bridge near Friant Road, Gravel

Haul Road, and unnamed roads are considered local roads and appear to be two-lane paved or unpaved roads under either the jurisdiction of Madera County or Fresno County. Traffic on these roads appears to be composed primarily of agricultural truck traffic or local residential commuters.

In Reach 1, three communication lines cross the river: two are AT&T lines and one is Level 3 communications. PG&E owns 13 natural gas transmission lines, 156 electrical distribution lines, and 14 electrical transmission lines. Of these, 152 of the electrical distribution lines are overhead, all of the natural gas transmission lines are underground, and all of the electrical transmission lines are overhead. Four electrical distribution lines are unknown.

Fresno Irrigation District has 11 outfall structures crossing the river. Also, six outlets to the river are owned by the Fresno Metropolitan Flood Control District. Fresno Irrigation District owns the Riverside Powell Spillway, Epstein Spillway, and Biola Spillway in this reach.

Reach 2.   One bridge (Madera Avenue) provides access across the river along Reach 2A. Several roads parallel the river along this reach, and multiple confining levees protect agricultural land uses in this reach.

Several roads are located adjacent to the river along Reach 2B, although no bridges are present. Crossings in this reach, including San Mateo Road, are considered local roads under either the jurisdiction of Madera County or Fresno County, and these roads appear to have light local agricultural truck and commuter traffic. With the exception of the City of Mendota, no urbanized traffic areas, major SRs, arterials, or other roads appear to have heavy traffic in this reach.

There are 157 overhead PG&E-owned electrical distribution lines crossing the San Joaquin River in this reach. All of the electrical distribution lines are overhead. In addition, two underground gas transmission lines owned by PG&E cross the river.

Fresno Irrigation District owns the Big Sandridge Spillway and the Herndon Spillway in this reach.

Reach 3.   The City of Firebaugh, located between the San Joaquin River and Helm Canal, is the only urban land use along Reach 3. Several roads provide access to or parallel the river, and one bridge (13 Street/Avenue 7½ bridge) provides access across the river in this reach. Roads in this area are generally rural in character except in Firebaugh, where they are typically urban. There are no state highways along Reach 3, although SR 33 and SR 152 skirt the edges of the reach and serve as transportation corridors from Firebaugh to other areas. Roads that cross the river are considered local roads under the jurisdiction of either Madera County or Fresno County, and appear to have light local traffic.

In this reach, AT&T owns one communication line that crosses the river. PG&E owns 7 underground gas transmission lines, 134 electrical distribution lines, and 4 underground electrical transmission lines that cross the river in this reach. Of these, 2 of the electrical distribution lines are underground, 132 are overhead, and the location of 2 lines is unknown.

Reach 4. Several roads are located adjacent or provide access to the river along Reach 4A, and the Brazil Road (SR 152) bridge provides access across the river.
Several roads are located along Reach 4B. The primary heavy-traffic roads in Reach 4 are SR 33 (Reach 4A) and SR 152 (Reach 4B). Because there are no urbanized areas in this reach and agricultural production is moderate, traffic levels on arterials, collectors, and local roads are likely to be moderate, consisting of local agricultural trucks and commuters. With the exception of the SR 152 bridge, river crossings are arterials, collectors, or local roads under the jurisdiction of either Madera, Merced, or Fresno counties.

PG&E owns 2 overhead electrical transmission lines and 59 overhead electrical distribution lines that cross the river in Reach 4.

Reach 5. Several roads and two bridges (Lander Avenue bridge and the SR 140 bridge) are located along Reach 5. Roads correspond to local land uses and, thus, appear to have light traffic and be rural in nature. Besides SR 140 and SR 165/Lander Avenue, roads are mostly collectors and local roads with moderate-to-light traffic under the jurisdiction of Merced County.

PG&E owns five overhead electrical distribution lines in this river reach.

Chowchilla Bypass. Several roads parallel the Chowchilla Bypass, and four bridges provide access across it. No urban areas are located along the bypass. Accordingly, roads are primarily arterials, collectors, and local roads under the jurisdiction of Madera County.

There are no data regarding utility crossings in the Chowchilla Bypass.

Eastside Bypass, Mariposa Bypass, and Tributaries. Several access roads parallel the bypass south of the Mariposa Bypass, and 11 bridges provide access across the bypass. A number of crossings in this bypass area may be unusable during high-flow conditions, including West El Nido Road, Headquarters Road, Dan McNamara Road, and several unnamed crossings. Roads are collectors and local roads, and appear to have generally moderate-to-light traffic.

There are no data regarding utility crossings in the Eastside Bypass.

Existing Traffic Conditions

The following subsections describe existing traffic conditions in the Restoration Area, focusing on conditions in Fresno, Madera, and Merced counties.

Fresno County General Traffic Conditions. According to the Fresno County *General Plan Background Report (*2000*)*, the county's circulation system consists of a roadway network that is primarily rural in character, with the exception of the urbanized areas surrounding the Cities of Fresno and Clovis and various smaller communities in the southern and western parts of the county. The most important interregional roadways in the county are the SRs/highways, particularly SR 99, Interstate 5, and SR 41, which traverse the county from north to south. Interstate 5 is the primary north-south route for interregional and interstate business, freight, and tourist and recreational travel, linking Southern California to Northern California and the Pacific Northwest. On the regional level, SR 99 performs a similar function, connecting most of the cities of the San Joaquin Valley to Sacramento and Southern California. Fresno County is linked to Yosemite National Park and the Sierra communities to the north via SR 41, as well as to Kings County and the Central Coast to the south. In addition to Interstate 5, SR 99, and SR 41, Fresno County is served by SRs 33, 43, 63, 145, 168, 180, 198, and 269 (Fresno County 2000).

The county is also served by other major roadways that carry local and regional traffic, connect the cities and communities of Fresno County, and provide farm-to-market routes. These roadways provide critical freight and commercial linkages between production/manufacturing and the larger interregional distribution system.

Madera County General Traffic Conditions. Madera County's *General Plan Background Report* (1995) states that physical constraints on the county's circulation system are natural and human-made barriers to travel that limit existing and future roadway connections and alignments, and thus constrain the county's access and circulation capability.

Circulation constraints in Madera County vary between the valley region and the foothill/mountain region. In the flat valley of the western county, major circulation elements are the north/south-oriented SR 99 and railroad tracks that also run north/south, parallel to SR 99. SR 99 and railroad tracks facilitate north/south travel and hinder east/west travel. Access to the north, west, and south of the county is limited by the Chowchilla and San Joaquin rivers. The Fresno River, which runs generally in an east/west direction, also poses a constraint to north/south travel. In addition, numerous creeks and canals pose minor constraints to travel in the county.

Merced County General Traffic Conditions. The street and highway system in Merced County is composed of approximately 30 miles of Federal interstate highways, 220 miles of State highways, and 1,780 miles of county roads. Both traffic volume and traffic speeds are the principal determinants of travel quality on roadways. The traffic volumes on the major road system in Merced County vary from a high of 75,000 vehicles per day on SR 99 north of Delhi near Turlock to fewer than 1,000 vehicles per day. With a few exceptions, the highest volume roads in Merced County are State highways.

Point of Interest Traffic Counts. To quantitatively describe existing traffic conditions, points of interest (POI) were determined by reviewing traffic monitoring locations within 5 miles of the Restoration Area. No relevant traffic POIs were available for Reach 5, the Eastside Bypass, or the Chowchilla Bypass.

Caltrans annual average daily traffic data are the total volume of counts for the year divided by 365 days. The Caltrans traffic count year is from October 1 through September 30. Data regarding Madera and Fresno counties on State highways, interstate highways, and local and arterial roads consist of “raw” traffic counts, which are recorded at a particular location on a particular day for a period of 24 hours. These are not adjusted to reflect the day of the week or seasonal variations that could affect observed traffic volumes.

Traffic counts were researched from the following existing data sources at POIs: Caltrans 2006 Traffic and Vehicle Data Systems Unit (all data on California State Highway System) (Caltrans 2007), the *Madera County Transportation Commission Traffic Monitoring Program 2007 Traffic Volumes Report* (2007), the *Council of Fresno County Governments Fresno Regional Traffic Monitoring Report (1998–2002)* (2004), and the *Merced County Association of Governments’ Final Environmental Impact Report for Merced County’s 2004 Regional Transportation Plan* (2007).

3.15.2 San Joaquin River from Merced River to the Delta

A number of local rural roads parallel portions of the section of the San Joaquin River extending from the confluence of the Merced River to the Delta, located just north of SR 132 (Maze Road). Highways and roads with bridge crossings of the San Joaquin River include Hills Ferry Road at the Merced River confluence in Merced County, and Crows Landing Road, West Main Avenue, West Grayson Road, and SR 132, all in Stanislaus County.

3.16 Utilities and Public Service Systems

This section provides an overview of existing utilities and public service systems within the Restoration Area, focusing on fire protection services, law enforcement services, and emergency services. Buried utilities that cross under the San Joaquin River include (i.e., San Francisco Public Utilities Commission (SFPUC) Regional Water System San Joaquin Pipelines Nos. 1, 2, and 3, and various oil and gas underborings), as well as wastewater collection and solid waste services. Other portions of the study area and wastewater collection and solid waste management would not be affected by the Proposed Action and are not discussed. Many utilities and public service systems are covered to some degree in previous sections.

3.16.1 Fire Protection Services

This discussion identifies the general characteristics of fire protection facilities and services in the Restoration Area and the San Joaquin River from the Merced River to the Delta.

Fire protection services in Reaches 1 through 3 are provided by the Fresno County Fire Protection District, the City of Fresno Fire Department, and the Madera County Fire Department. The Fresno County Fire Protection District provides fire protection services to the communities of Calwa, Easton, Malaga, Del Rey, Caruthers, San Joaquin, Tranquility, Prather, Friant, Tollhouse, Wonder Valley, Cantua Creek, Three Rocks, Five Points, Centerville, Tivy Valley, and Sand Creek and to the Cities of San Joaquin, Parlier, Mendota, and Huron. The district has 13 fire stations and 48 personnel (Fresno County Fire Protection District 2009).

Fire protection services are provided to the City of Fresno by the City of Fresno Fire Department through a network of 22 fire stations, an airport rescue fire fighting station, 354 career firefighters, 39 apparatus and support vehicles, 2 personal watercrafts, and 2 aircraft rescue units (Fresno Fire Department 2009).

The Madera County Fire Department provides fire protection services to unincorporated areas of Madera County through a network of 15 fire stations, 19 career fire suppression personnel, 185 paid call firefighters, 11 support personnel, and 50 apparatus and support vehicles. The department is administered, and career suppression personnel are provided, through a contract with the California Department of Forestry and Fire Protection (CAL FIRE). Fire prevention, clerical, and automotive support personnel are county employees. The department assists with providing fire protection to the City of Madera through a mutual aid agreement and has a cooperative agreement with Central California Women's Facility for fire protection services in the north end of Madera County (Madera County Fire Department 2008).

Fire protection services in Reach 4A are provided by the Fresno County Fire Protection District and the Madera County Fire Department (see the discussion of these agencies above). Fire protection services in Reaches 4B1 and 4B2 are provided by the Merced County Fire Department. The Merced County Fire Department provides fire protection and emergency services to unincorporated areas of the county through a network of 20 fire stations, 227 paid call firefighters and volunteers, and a fleet of 80 vehicles. The department is administered, and suppression personnel are provided, through a contract with CAL FIRE. Support personnel are Merced County employees. The department also provides fire protection to the Cities of Gustine, Dos Palos, and Livingston through mutual aid agreements (Merced County 2007).

Fire protection services in Reach 5 are provided by the Merced County Fire Department. Fire protection services in the Chowchilla Bypass area are provided by the Madera County Fire Department and Merced County Fire Department. Fire protection services in the Eastside Bypass, Mariposa Bypass, and tributaries areas are provided by the Merced County Fire Department.

San Joaquin River from Merced River to the Delta

Fire protection services in the San Joaquin River system from the Merced River to the Delta are provided by the Stanislaus Consolidated Fire Protection District and the Merced County Fire Department.

3.16.2 Law Enforcement Services

This discussion identifies the general characteristics of law enforcement facilities and services in the Restoration Area and the San Joaquin River from the Merced River to the Delta.

San Joaquin River from Friant Dam to Merced River

The following sections describe law enforcement services within the Restoration Area.

Law enforcement services in Reach 1 are provided by the Fresno County Sheriff's Department, the City of Fresno Police Department, and the Madera County Sheriff's Department.

The Fresno County Sheriff's Department provides law enforcement services to the unincorporated areas of the county and the Cities of Coalinga, Huron, San Joaquin, Kerman, Mendota, and Firebaugh. The Sheriff's Department also provides the contract law enforcement for the Cities of San Joaquin and Mendota (Fresno County Sheriff's Department 2008). The department serves four geographic areas and maintains four stations and one substation. Specialized members of the Sheriff's Department also serve on additional specialty teams, including the Air Support Unit, Off-Road Safety Team, Forensics Laboratory, Boating Enforcement Unit, Special Weapons and Tactics (SWAT) Unit, Dive Team, and Search and Rescue Unit.

The Fresno Police Department provides law enforcement services to the City of Fresno. The department serves five policing districts (northeast, northwest, central, southeast, and southwest) and maintains four stations and one substation. Specialized members of the police department also serve on additional units, including the SWAT Team, K-9 Unit, Explosive Ordnance Disposal Unit, Skywatch, District Crime Suppression Teams, and Mounted Patrol (Fresno Police Department 2007).

Law enforcement in unincorporated Madera County is provided by the Madera County Sheriff's Department. The department is divided into three distinct divisions (Valley Division, Mountain Division, and Administrative Division), and has 116 personnel with 82 sworn law enforcement officers. Specialized members of the sheriff's department also serve on additional units, including the Agricultural Crimes Unit, Off-Highway Vehicle Unit, SWAT Team, Dive Team, and Search and Rescue Team (Madera County Sheriff's Department 2008).

Law enforcement services in Reaches 2 through 4 are provided by the Fresno County Sheriff's Department and the Madera County Sheriff's Department (see the discussion of the Fresno County Sheriff's Department and Madera County Sheriff's Department for Reach 1 above). Law enforcement services in Reaches 4B1 and 4B2 are provided by the Merced County Sheriff's Department. Law enforcement services in unincorporated areas of Merced County are also provided by the Merced County Sheriff's Department. The department maintains stations in Merced, Los Banos, and Delhi, and operates the John Lotorraca Correctional Center in El Nido and Sheriff's Community Law Enforcement Office stations in the communities of Merced, Planada, Santa Nella, Delhi, Hilmar, and Winton. The Merced County Sheriff's Department employs approximately 101 sworn officers and maintains 22 patrol vehicles and 4 additional unmarked nonpatrol vehicles. Specialized members of the Sheriff's Department also serve in additional units, including a narcotics task force, investigation unit, major-crimes unit, Federal drug trafficking task force, SWAT team, and Sheriff Tactical and Reconnaissance Team (Merced County).

Law enforcement services in Reach 5 are also provided by the Merced County Sheriff's Department. Law enforcement services in the Fresno Slough/James Bypass area are provided by the Fresno County Sheriff's Department. Law enforcement services in the vicinity of the Chowchilla, Eastside, and Mariposa bypasses are provided by the Madera County Sheriff's Department and Merced County Sheriff's Department.

San Joaquin River from Merced River to the Delta

Law enforcement services in the San Joaquin River system from the Merced River to the Delta are provided by the Stanislaus County Sheriff's Department and the Merced County Sheriff's Department (see the discussion of the Merced County Sheriff's Department above).

3.16.3 Emergency Services

This discussion identifies emergency service providers in the Restoration Area and the San Joaquin River from the Merced River to the Delta.

San Joaquin River from Friant Dam to Merced River

Emergency services in Reaches 1 through 3 are provided by the California Highway Patrol (CHP), Fresno County Sheriff's Department, and Madera County Sheriff's Department. The CHP Central Division provides ground and air support for emergencies along the Interstate 5 corridor, SR 99, and other State highways throughout Fresno, Madera, and Merced counties and the City of Fresno. The CHP Central Division has 15 area offices, 6 resident posts, 2 commercial inspection facilities, 667 uniformed officers, and 226 nonuniformed personnel (CHP 2008).

The Fresno County Sheriff's Department coordinates emergency evacuation routes and programs for residents and businesses in Fresno County. Large-scale emergency services are handled by the department in cooperation with the Federal Emergency Management Agency (FEMA); USFWS; the State emergency response network run by the California Office of Emergency Services (OES); CAL FIRE; CHP; and local fire departments, hospitals, and ambulance services.

The Madera County Sheriff's Department is responsible for coordinating emergency services in Madera County. Large-scale emergency services are handled by the department in cooperation with FEMA; USFWS; the State emergency response network run by OES; CAL FIRE; CHP; and local fire departments, hospitals, and ambulance services.

Emergency services in Reaches 4B1, 4B2, and 5 are provided by the CHP Central Division and the Merced County Fire Department (see the discussion of the CHP Central Division above). The Merced County Fire Department coordinates emergency evacuation routes and programs for residents and businesses in Merced County. Large-scale emergency services are handled by the Merced County Fire Department in cooperation with FEMA; USFWS; the State emergency response network run by OES; CAL FIRE; the Merced County Health Department; and local fire departments, hospitals, and ambulance services (Merced County 2007).

Emergency services in the Fresno Slough/James Bypass area are provided by the CHP Central Division and the Fresno County Sheriff's Department. Emergency services in the Chowchilla Bypass area are provided by the CHP Central Division, Madera County Sheriff's Department, and Merced County Fire Department. Emergency services in the Eastside Bypass, Mariposa Bypass, and tributary areas are provided by the CHP Central Division and Merced County Fire Department.

San Joaquin River from Merced River to the Delta

Emergency services in the Sacramento River System for the Merced River to the Delta are provided by the CHP Central Division, Merced County Fire Department, and Stanislaus County OES (see the discussion of these agencies above).

3.17 Socioeconomics

This section addresses current socioeconomic conditions for the three-county Restoration Area and the five-county Friant Division service area, which are the portions of the study area that may experience socioeconomic effects from the Proposed Action. Topics closely related to Socioeconomics are described in Section 3.13, Population and Housing and Section 3.14, Recreation.

3.17.1 San Joaquin River from Friant Dam to Merced River

The following section describes socioeconomic trends of the three counties in the Restoration Area: Fresno, Madera, and Merced counties.

Income Trends

In 1999, annual per capita incomes for counties in the three-county area were generally similar for each county, ranging between $14,257 and $15,495 annually. Madera and Merced counties had similar per capita incomes at $14,682 and $14,257, respectively, and Fresno County had the highest at $15,495. This range is substantially lower than the per capita income for the State ($22,711). Overall, the three-county area had a less affluent population than in the State overall in 1999.

Labor Force, Employment, and Industry

For a discussion of the labor force, employment, and industry in the three counties of the Restoration Area, see “Friant Division Water Contractors Service Areas.”

3.17.2 Friant Division Water Contractors Service Areas

The following section describes population and housing trends in the Friant Division service area, which includes five counties: Fresno, Kern, Madera, Merced, and Tulare.

Income Trends

In 1999, annual per capita incomes were generally similar for each county, ranging between $14,006 and $15,848 annually. Kern County had the highest annual per capita incomes at $15,760. This range is substantially lower than the per capita income for the State, which falls at $22,711.

Labor Force. According to the California Employment Development Department (EDD), California had a labor force of 18,244,000 in January 2008. The labor force in the Friant Division service area counties accounts for 6.6 percent of California’s total labor force. In total, the five counties of the Friant Division service area have a labor force of 1,212,400; this is an increase of 36.6 percent in the 18-year period from 1990 to 2008.

Employment

Since 1990, unemployment rates in all five counties have been consistently and substantially higher than State trends. EDD reports that the unadjusted unemployment rate for the State was 6.3 percent. Similar to historical trends, unemployment rates in the five-county Friant Division service area are higher than the State as a whole. Kern County had an unemployment rate of 9.9 percent in January 2008. The unemployment rate was 11.4 percent in Tulare, and EDD data ranked Merced 55th for unemployment with an unemployment rate of 13.3 percent, the highest rate of all the counties in the Friant Division service area. Fresno County ranked 41st of all California counties, with an unemployment rate of 10.5 percent, and Madera County ranked 36th, with an unemployment rate of 9.4 percent, the lowest of the three counties.

Industry

For the majority of the counties in the Friant Division service area, the top five industries based on the number of employees are the government sector, trade, transportation, and utilities; and farm jobs (Table 3-61). The agricultural industry sector (farm jobs) ranked in the top three industries in all counties in the Friant Division service area.

Table 3-61.
Friant Division Water Contractors Service Area Counties – Number Employed and Percentage of Employment by Industry Sector – 2008
(Number Employed/Percentage of Employment)

Industry Sector	Fresno County	Kern County	Madera County	Merced County	Tulare County
Government	68,500 19.7%	61,500 2.2%	10,700 24.4%	15,700 23.0%	31,400 22.0%
Trade, Transportation, and Utilities	60,900 17.5%	46,600 16.8%	5,300 12.2%	11,600 17.0%	24,600 17.3%
Farm Jobs	44,500 12.8%	37,900 13.7%	9,000 20.5%	10,100 14.8%	30,200 21.2%
Natural Resources and Mining	200 0.1%	9,900 3.6%	2,100 4.8%	2,900 4.2%	7,200 5.0%
Construction	19,800 5.7%	17,200 6.2%	Included in mining category	Included in mining category	Included in mining category
Manufacturing	26,600 7.7%	13,600 4.9%	3,200 7.3%	9,000 13.2%	12,000 8.4%
Information	4,100 1.2%	2,700 1.0%	500 1.1%	1,300 1.9%	1,000 0.7%
Financial Activities	15,000 4.3%	8,900 3.2%	800 1.8%	1,900 2.8%	4,000 2.8%
Professional and Business Services	30,100 8.7%	26,100 9.4%	3,000 6.8%	4,200 6.1%	9,900 6.9%
Educational and Health Services	39,200 11.3%	24,600 8.9%	5,800 13.2%	5,500 8.0%	10,900 7.6%
Leisure and Hospitality	27,700 8.0%	20,900 7.5%	2,600 5.9%	4,800 7.0%	8,500 6.0%
Other Services	11,000 3.2%	7,100 2.6%	800 1.8%	1,400 2.0%	2,900 2.0%

Source: EDD 2008

Agricultural Water Use in the Friant Division

The Friant Division supports conjunctive water management in an area that was subject to groundwater overdraft before construction of Friant Dam. Reclamation employs a two-class system of water allocation, as described in Section 3.11. From 1965 to 2006, the Friant Division delivered an average of approximately 1,336,404 acre-feet of water annually, which is approximately 61.0 percent of the full contract amount. Between 1965 and 2006, an average of 93.0 percent of Class 1 water was delivered to contractors, with the full 800,000 acre-feet delivered in many years.

Agricultural Production

The San Joaquin Valley is one of the world's most productive agricultural areas, with 8 million acres of land producing more that 250 crops. The Friant Division includes 28 member districts spread among five counties that make up the Friant Division service area. Four of the districts (Chowchilla, Delano-Earlimart, Madera, and Orange Cove) each straddle more than one county. In total, the Friant Division includes over 1 million acres of land.

The most consistent and generally reliable sources of agricultural crop production in the region containing the Friant Division service area are the annual County Agricultural Commissioner's Reports. These reports are prepared in coordination with the California Agricultural Statistical Service and National Agricultural Statistics Service, and data collection methods follow generally accepted procedures (USDA 2007). Crop production and value information is reported using county-level data (Table 3-62).

Table 3-62.
Agricultural Production Values in 2006

County	Average Value in 2006 Constant Dollars
Fresno	$4,192,224,293
Kern	$2,881,556,321
Madera	$948,156,958
Merced	$2,130,654,039
Tulare	$3,893,036,989

Source: USDA 2007

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4.0 Environmental Consequences

This section presents the environmental consequences resulting from implementation of the Proposed Action or the No-Action Alternative. Requirements of both NEPA and CEQA Guidelines are addressed herein. The CEQA Guidelines require that environmental effects be identified by use of a checklist, matrix, or other method with brief explanations to support the entries (Section 15063(d)(3)). The Environmental Checklist Form, as presented in Appendix G of the State CEQA Guidelines, is considered to be the best method to satisfy CEQA Guidelines and was used herein to identify the potential impacts of implementing the Proposed Action ("proposed project" under CEQA). While CEQA Guidelines require that an IS and Environmental Checklist evaluate only the proposed project, NEPA requires that the No-Action Alternative also be evaluated. Consequently, the Environmental Checklist Form also addresses environmental effects from the No-Action Alternative.

The thresholds for determining the significance of impacts for this analysis are based on the Environmental Checklist in Appendix G of the State CEQA Guidelines, as presented for individual resource areas in this section. These thresholds also encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its effects. While NEPA discourages identifying the significance of impacts in an EA, CEQA requires that these conclusions be made in an IS. Consequently, statements as to the significance of impacts are included in this section to satisfy CEQA requirements, as are any proposed mitigation measures. This EA/IS uses the following CEQA terminology to denote the significance of environmental impacts of the Proposed Action and No-Action Alternative:

- An impact is **significant** if it would cause a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project. Levels of significance can vary by project alternative, based on the setting and nature of the change in the existing physical condition.

- An impact is **potentially significant** if it would be considered a significant impact as described above; however, the occurrence of the impact cannot be immediately determined with certainty. For CEQA purposes, a potentially significant impact is treated as if it were a significant impact. Therefore, under CEQA, mitigation measures or alternatives to the Proposed Action must be provided, where feasible, to avoid or reduce the magnitude of any significant impact.

- An impact would be **less than significant** if it would not result in a substantial or potentially substantial adverse change in the physical environment. This impact level does not require mitigation, even if applicable measures are available, under CEQA. If an impact is deemed beneficial, it is designated as a "less-than-significant impact" in the CEQA Environmental Checklist.

- An impact would be **less than significant with mitigation** if it would be a potentially significant or significant impact, but with mitigation, the impact is reduced to a less-than-significant impact.

- **No impact** indicates the project would not have any direct or indirect impacts on the environment, or the consequences are undetectable and/or not applicable.

The level of impact of the Proposed Action and the No-Action Alternative is determined by comparing estimated effects with baseline conditions. Under CEQA, the environmental setting (as defined in Section 3, "Affected Environment") normally represents "existing" baseline conditions. Under NEPA, the No-Action Alternative (expected future conditions without the project) is the baseline against which the effects of the Proposed Action are compared. For nearly all topics, conditions under the No-Action Alternative are considered to be substantively equivalent to existing conditions, unless otherwise noted. Therefore, comparisons of the effects of the Proposed Action (including the schedule and magnitude of flow releases, flow modifications, additional implementation considerations, and environmental commitments, as described in Section 2) are made to existing conditions (to satisfy CEQA requirements) and to the No-Action Alternative (to satisfy NEPA requirements).

4.1 Analytical Approach

A variety of models are used to estimate expected conditions under the Proposed Action and No-Action Alternative. Simulation results from the models are used to compare the differences in trends under the Proposed Action and No-Action Alternative. Limitations of the individual models used for the technical analyses are described in detail in Appendix G. Model results are useful in analyzing trends and for comparing similar factors between the Proposed Action and the No-Action Alternative. While models can provide useful insight to complex systems or overcome the deficiencies of incomplete observed data, they are a simplification of the true system or natural processes. Most of the models, including CalSim II and SJR5Q, have been peer reviewed and are regularly refined and improved as additional information is provided. Model limitations include the following:

- Models represent simplifications or estimations of certain processes.
- Model outputs are dependent on the quality of the input data.
- Numerical solution to the governing equations included in the models can also introduce error. Errors associated with model simulations can be cumulative. For instance, using one model's output as a second model's input carries assumptions made in the first analysis forward into the second. Careful attention was given to the analysis conducted in this EA/IS. However, due to the large cross-utilization of modeling data among analyses, the results here are best perceived in terms of trends and comparisons, and not relied upon for absolute predictive precision.
- Models are designed to compare and contrast the effect of current and assumed future operational conditions. The models are not predictive; they are intended to identify trends.

These models are the product of the best science available at the time this document was prepared.

CEQA ENVIRONMENTAL CHECKLIST FORM

PROJECT INFORMATION

1.	Project Title:	San Joaquin River Restoration Program Water Year 2010 Interim Flows
2.	Lead Agency Name and Address:	California Department of Water Resources San Joaquin District 3374 East Shields Avenue Fresno, CA 93726
3.	Contact Person and Phone Number:	Paula J. Landis San Joaquin District (559) 230-3310
4.	Project Location:	Millerton Lake (Fresno and Madera counties); San Joaquin River from Friant Dam to the Sacramento-San Joaquin Delta (Stanislaus, San Joaquin, Sacramento, Solano, and Contra Costa counties), Eastside Bypass (Fresno, Madera, and Merced counties), Mariposa Bypass (Merced); and place of water use (all counties named above, as well as any other counties within the Central Valley Project or State Water Project service areas south of the Delta)
5.	Project Sponsor's Name and Address:	N/A
6.	General Plan Designation:	Fresno County: Agriculture; Madera County: Open Space; Merced County: Agricultural
7.	Zoning:	Fresno County: AE-20; Madera County: OS; Merced County: A-1

8. Description of Project: (Describe the whole action involved, including but not limited to later phases of the project, and any secondary, support, or off-site features necessary for its implementation. Attach additional sheets if necessary.)
The Proposed Action involves implementing temporary changes to Friant Dam operations in Water Year 2010 (October 1, 2009, through September 30, 2010) to release Interim Flows from Friant Dam into the San Joaquin River and potentially downstream as far as the Sacramento-San Joaquin Delta. The Proposed Action is specified in the Stipulation of Settlement in *NRDC, et al. v. Kirk Rodgers, et al.* and is part of the San Joaquin River Restoration Program. The Interim Flows would be recaptured by existing water diversion facilities along the San Joaquin River and/or in the Sacramento-San Joaquin Delta for agricultural, municipal and industrial, or fish and wildlife uses. Section 2, "Project Description," of the Environmental Assessment/Initial Study contains a full project description.

9. Surrounding Land Uses and Setting: (Briefly describe the project's surroundings)
The San Joaquin River flows through or near the cities of Friant, Fresno, Firebaugh, and Stockton, and includes urban and nonurban areas. Most of the identified study area is surrounded by various types of agricultural lands with the San Joaquin River flowing through the region. The San Joaquin River has many existing flood management and water diversion structures located along its length. Land uses in the study area are primarily agriculture and rangeland but also include urban, recreation, and open space.

10: Other public agencies whose approval is required: U.S. Department of the Interior, Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, California Department of Fish and Game, Central Valley Flood Protection Board , U.S. Army Corps of Engineers

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐ Aesthetics	☐ Agriculture Resources	☐ Air Quality
☐ Biological Resources	☐ Cultural Resources	☐ Geology / Soils
☐ Hazards & Hazardous Materials	☐ Hydrology / Water Quality	☐ Land Use / Planning
☐ Mineral Resources	☐ Noise	☐ Population / Housing
☐ Public Services	☐ Recreation	☐ Transportation / Traffic
☐ Utilities / Service Systems	☐ Mandatory Findings of Significance	☒ None With Mitigation

DETERMINATION (To be completed by the Lead Agency)

On the basis of this initial evaluation:

I find that the proposed project **COULD NOT** have a significant effect on the environment, and a **NEGATIVE DECLARATION** will be prepared.	☐
I find that although the proposed project COULD have a significant effect on the environment, there WILL NOT be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A **MITIGATED NEGATIVE DECLARATION** will be prepared.	☒
I find that the proposed project **MAY** have a significant effect on the environment, and an **ENVIRONMENTAL IMPACT REPORT** is required.	☐
I find that the proposed project **MAY** have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An **ENVIRONMENTAL IMPACT REPORT** is required, but it must analyze only the effects that remain to be addressed.	☐
I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier **EIR** or **NEGATIVE DECLARATION** pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier **EIR** or **NEGATIVE DECLARATION**, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.	☐

Paula J Landis	6-1-09
Signature	Date
Paula J. Landis	California Department of Water Resources
Printed Name	Agency

4.2 Aesthetics

Environmental Issues	Potentially Significant Adverse Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
I. Aesthetics. Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒

a) Have a substantial adverse effect on a scenic vista?

A scenic vista is generally considered to be a view of an area that has a remarkable scenic quality or a natural or cultural quality that is indigenous to the area. Some may consider views of Millerton Lake from upper elevations descending from the crest of the Sierra Nevada to be scenic vistas, as well as views of Millerton Lake and of the Sierra Nevada from the grasslands surrounding the lake. Reoperation of Friant Dam and recapture of Interim Flows would not affect flow patterns in the San Joaquin River above Millerton Lake. The changes in surface water elevation would be within the historic operational range of Millerton Lake. Therefore, no changes in visual expectations of viewers of Millerton Lake from the Sierra Nevada would change as a result of the Proposed Action. Some may also consider the views of Millerton Lake and the surrounding hills to be a scenic vista. Some portion of the water released from Millerton Lake for Interim Flows would be released earlier in the season (approximately October through March) than would occur under existing conditions for agricultural releases. Consequently, minimal variation in the seasonal Millerton Lake water level fluctuation is expected under the Proposed Action, although by the end of the water year (October 1, 2009, through September 30, 2010), there would be no measurable differences in reservoir levels between the Proposed Action and the No-Action Alternative. This impact is considered less than significant because Millerton Lake already experiences large seasonal fluctuations in water elevations, and the temporary reductions in water surface elevations early in the season would be within historic variations of the lake's water surface elevations. The scenic vista would be similar with or without the Proposed Action.

The San Joaquin River and land on both sides of the river, from Friant Dam to Highway 99 in the Restoration Area, are included in the proposed *San Joaquin River Parkway Plan* (San Joaquin River Conservancy 2000). WY 2010 Interim Flows would increase flow volumes and water velocities in the Restoration Area and downstream from the Merced River confluence to the Delta, which would disturb soil and vegetation in the affected reaches and could result in changes to the visual setting. However, such changes are expected to enhance the scenic value of the river and lands in the Restoration Area and not result in any adverse impacts on a scenic vista. Because of the temporary nature of this Proposed Action, impacts would be **less than significant** and beneficial (within the Restoration Area). Because flow increases that could affect soil and vegetation would not occur under the No-Action Alternative, there would be no impact on a scenic vista under this alternative and therefore less impact than the Proposed Action.

b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?

No officially designated State scenic highways are located in or immediately adjacent to Millerton Lake Reservoir, the Restoration Area, or along the San Joaquin River downstream from the confluence with the Merced River to the Delta, and the Proposed Action would not affect scenic resources along the San Joaquin River upstream from Millerton Lake Reservoir. Therefore, under both the Proposed Action and the No-Action Alternative, there would be **no impact**.

c) Substantially degrade the existing visual character or quality of the site and its surroundings?

For the same reasons stated in item a), the Proposed Action would not result in substantial degradation of the existing visual character or quality of Millerton Lake, the Restoration Area, the San Joaquin River below the Merced River confluence to the Delta, or their surroundings; therefore, this impact would be **less than significant** and beneficial (within the Restoration Area) under the Proposed Action. There would be no impact under the No-Action Alternative and therefore would be less degradation of visual character than the Proposed Action.

d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

The Proposed Action would not involve temporary or long-term installation or use of new sources of lighting. Likewise, no new sources of light or glare would be included in the No-Action Alternative. Therefore, under both the Proposed Action and the No-Action Alternative, there would be **no impact**.

4.3 Agricultural Resources

Environmental Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
II. Agricultural Resources.				
In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997, as updated) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland.				
Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use or a Williamson Act contract?	☐	☐	☐	☒
c) Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland to non-agricultural use?	☐	☐	☒	☐

a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?

Reoperation of Friant Dam to introduce WY 2010 Interim Flows would not convert lands designated as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland). Flows may temporarily inundate lands with Farmland designations, but the temporary inundation would not require a change to the designations or create a long-term adverse effect. The Proposed Action does not include any construction activities that may temporarily or permanently modify agricultural uses. Some water supply may be foregone for agricultural purposes, but this impact would be temporary and would not involve converting important agricultural lands to nonagricultural uses. Therefore, there would be **no impact** on designated Farmland under the Proposed Action or the No-Action Alternative.

b) Conflict with existing zoning for agricultural use or a Williamson Act contract?

Implementing the Proposed Action would not require any zoning changes or result in conflicts with Williamson Act contracts. Changes in zoning that would conflict with Williamson Act contracts also would not occur under the No-Action Alternative. Therefore, both the Proposed Action and the No-Action Alternative would have **no impact** related to existing zoning for agricultural use or a Williamson Act contract.

c) Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland to non-agricultural use?

During periods of WY 2010 (October 1, 2009, through September 30, 2010), Interim Flows could temporarily inundate some areas of active grazing lands in the bypasses. These flows would be similar to existing conditions in that flood flows resulting from 2- to 5-year storms occur intermittently and inundate productive farmland and grazing lands.

Potential flows under the Proposed Action also would be limited to volumes that do not cause substantial seepage effects on adjacent land. Seepage issues are discussed in Section 4.9, "Hydrology and Water Quality," and the plan for monitoring and managing seepage is provided as Appendix D. Measures in this plan were developed to avoid or minimize saturation of the upper soil layers, which contain most of the root system of crop plants and thus strongly affect crop growth, and the condition of the soil layers also affects the ability to use farm machinery. Thus, prolonged saturation of the upper soil layers would likely cause temporary, adverse effects on the ability to use land for agricultural purposes. Because the Proposed Action would not cause substantial prolonged saturation of the upper layers of soil, substantial adverse effects on the use of agricultural land because of soil saturation, or substantial damage to existing woody vines and trees in vineyards and orchards, would not occur.

The Proposed Action also would not alter the extent of disease on adjacent agricultural land such that it would prevent agricultural use of nearby land or substantially reduce its productivity. If the Proposed Action serves as a source of causal organisms, water and vegetation along river and bypass channels can affect the incidence of some diseases on adjacent land. Because some riparian plants are alternative hosts for the causal organisms of some diseases of fruit and nut crops, it is possible for riparian vegetation in the study area to affect the incidence of some diseases in orchards and vineyards. *Botryosphaeria dothidea* (white rot) has been isolated from riparian plants (Michailides 2009). White rot can cause a shoot blight on pistachio and a canker on almonds, and it occurs on a number of crop, ornamental, and wild plants, causing diseases in some (Ogawa and English 1991, pages 329–331; Michailides, Morgan, and Ma 2003; Micke 1996). Because this organism occurs on a variety of fruit and nut crops, and these crops occupy much larger acreages in the study area than do riparian host plants, riparian vegetation may be a less important source of this organism, and of other diseases, than orchard and vineyard vegetation. Furthermore, the incidence of disease is not solely or even primarily determined by the presence of causal organisms in the vicinity of an orchard or vineyard. Physical conditions (including weather), irrigation and other management practices, and susceptibility of crop cultivars and their rootstocks are also important factors in the incidence of disease. Because WY 2010 Interim Flows are not anticipated to substantially change the extent of riparian vegetation, and because existing orchards and vineyards provide a much more extensive potential source of a greater variety of disease-causing organisms, and multiple other factors besides the presence of causal organisms affect the incidence of disease, the Proposed Action is unlikely to cause a substantial change in agricultural productivity by increasing the incidence of disease.

No physical changes to the land are proposed that would convert productive farmland and grazing lands to nonagricultural use, such as a restoration use. The Proposed Action would not involve any urban development; therefore, farmers and ranchers would not be induced to modify farming or ranching practices or convert farmland to urban development. Also, because any potential inundation of productive farmland and grazing land would be temporary and similar to existing conditions, and because productive farmland and grazing land would not be converted to nonagricultural use, implementing the Proposed Action would not substantially affect agricultural lands or practices. Implementing the WY 2010 Interim Flows could result in a change in the amount of water delivered to Friant Division contractors; as a result, some Friant Division contractors would likely change cropping practices, the extent of groundwater pumping, or both. However, Friant Division contractors would not likely convert farmland to nonagricultural use. The impacts of the Proposed Action on conversion of farmland to nonagricultural use would be **less than significant.**

Additional effects of reduced deliveries to the Friant Division are addressed in the "Hydrology and Water Quality," "Population and Housing," and "Socioeconomic Effects and Environmental Justice" sections.

Because the No-Action Alternative would not involve any changes to the existing environment, implementing this alternative would result in no impact and the Proposed Action would have a greater impact than under the No-Action Alternative.

4.4 Air Quality

Environmental Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
III. Air Quality.				
Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied on to make the following determinations.				
Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☒	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☒	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☒	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☒	☐

a) Conflict with or obstruct implementation of the applicable air quality plan?

b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?

c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?

a, b, c) Operational Emissions

Criteria Air Pollutants and Precursors

Emissions related to WY 2010 Interim Flows would be temporary in duration (i.e., emissions would only be produced during the years indicated under the project description) and would potentially represent a significant impact with respect to air quality. Fugitive dust (PM_{10}) emissions are primarily associated with ground disturbance and vary as a function of such parameters as soil silt content, soil moisture, wind speed, acreage of disturbed area, and miles traveled by vehicles on site and off site. ROG and NO_X emissions are primarily associated with mobile equipment exhaust. With respect to the Proposed Action, vegetation management and maintenance activities would result in the generation of ROG, NO_X, and PM_{10} emissions from site preparation (e.g., clearing), material transport, and other miscellaneous activities. Related vehicle trips would be associated with material transport and worker commute trips. Project-generated ROG, NO_X, PM_{10}, and $PM_{2.5}$ were modeled using the URBEMIS 2007 Version 9.2.4 computer program. This modeling was based on the assumption that invasive plant surveys and removal would begin in spring and fall 2011, respectively, and on default URBEMIS model settings. The URBEMIS model is the product of the best science available at the time this document was prepared. Survey crews would consist of two to three workers and approximately one trip would be made per day per surveying crew. The survey period is unknown at this time but could last several months (3 months is assumed for modeling purposes). Vegetation-removal crews would consist of six to seven workers, and could include one heavy piece of equipment per crew (i.e., bobcat or backhoe). Other crew members would use hand tools, chainsaws, and weed whackers. Vegetation removal would result in approximately one haul truck trip per day per crew to move vegetation to an as-yet-undetermined waste or composting facility. Vegetation-removal activities are expected to last approximately 3 months and could occur for up to 3 consecutive years (2011–2013). The trip generation rates input into the URBEMIS model are representative of the Proposed Action and would result in approximately eight associated daily vehicle round trips per day (seven employees, one haul truck). A maximum of 10 crews is expected for vegetation removal and would remove approximately 1 acre of vegetation per day for all crews.

Bridge crossings would be maintained at Avenue 7 (Chowchilla Canal) and North Madera Avenue (Reach 1B). West Whitesbridge Avenue (SR 145) in Fresno County provides east-west access from North San Mateo Avenue to North Madera Avenue (SR 145). The distance between these two crossings is approximately 25 miles. Located in Merced County, Avenue 7 is an east-west road that connects with North Madera Avenue. The distance between these locations is approximately 15 miles. The distance of the Avenue 7 crossing from the North San Mateo Avenue crossing is approximately 5 miles. The air quality analysis evaluated potential mobile source emissions that could result from the increased vehicle miles travelled of up to 25 miles each way (50 miles round trip). The analysis shows that if traffic were redirected to utilize crossings at Avenue 7 and North Madera Avenue in lieu of the crossings at Dan McNamara Road and North San Mateo Avenue respectively, there would not be a significant increase in the emissions of ROG, NO_x, PM_{10}, or $PM_{2.5}$.

Some increased recreation could result from additional water flow (i.e., canoeing, kayaking, and fishing) and could create additional vehicle trips in and downstream from the Restoration Area. These trips are assumed to already exist, however; instead of traveling to other areas in the San Joaquin River watershed, it is assumed that recreationists would be attracted to the newly watered river reaches. Because criteria pollutant emissions are regional pollutants, and trips to the Restoration Area would be diversions from other parts of the region (the SJVAB), no net increase in criteria air pollutants in the region would occur. In addition, any new emissions from increased recreation activities would be similar to operational activities shown in Table 4-1, which are negligible.

Table 4-1 summarizes the modeled maximum project-generated, operational emissions of criteria air pollutants and ozone precursors under project operations in 2011. As summarized in Table 4-1, project operations during 2011 would result in daily unmitigated emissions of approximately 0.2 tons per year (TPY) of ROG, 1.1 TPY of NO_X, 0.4 TPY of PM_{10}, and 0.2 TPY of $PM_{2.5}$.

Table 4-1.
Summary of Modeled Emissions of Criteria Air Pollutants and Precursors Generated by Project Operations

Source	**Emissions (TPY)**			
2011	**ROG**	**NO_X**	**PM_{10}**	**$PM_{2.5}$**
Vegetation surveys	0.00	0.00	0.00	0.00
Vegetation removal	0.16	1.13	0.42	0.15
Total	0.16	1.13	0.42	0.15
SJVAPCD significance threshold	**10 TPY**	**10 TPY**	**--**[1]	**--**[1]

Notes:
[1] SJVAPCD does not have an adopted threshold for PM_{10} and $PM_{2.5}$.
Refer to Appendix G, Attachment 5, for detailed assumptions and modeling output files.
Key:
NO_X = oxides of nitrogen
PM_{10} = respirable particulate matter with an aerodynamic diameter of 10 micrometers or less
$PM_{2.5}$ = fine particulate matter with an aerodynamic diameter of 2.5 micrometers or less
ROG = reactive organic gases
SJVAPCD = San Joaquin Valley Air Pollution Control District
TPY = tons per year

Based on the modeling conducted, implementing the Proposed Action would result in no emissions of ROG and NO_X exceeding the 10 TPY threshold for ROG and NO_x recommended by SJVAPCD. Implementing the Proposed Action would generate no substantial operational emissions (e.g., would not exceed SJVAPCD's CEQA significance emissions thresholds), and there would be no permanent stationary or mobile emission sources.

Although the Proposed Action emissions would not exceed SJVAPCD thresholds, ground-clearing activities using large mechanical equipment for vegetation removal could result in emissions of PM_{10} and $PM_{2.5}$ and, thus, these activities would be subject to SJVAPCD Regulation VIII: Fugitive PM_{10} Prohibitions. Because the Proposed Action includes implementing measures necessary to comply with SJVAPCD Regulation VIII: Fugitive PM_{10} Prohibitions, project-generated operational emissions would not conflict with or obstruct implementation of an applicable air quality plan, violate an air quality standard, contribute substantially to an existing or projected air quality violation, or result in a cumulatively considerable net increase of any criteria pollutant for which the Proposed Action region is nonattainment under an applicable Federal or State ambient air quality standard. These impacts would be **less than significant**.

Impacts resulting from the Proposed Action would be greater than those resulting from the No-Action Alternative because under the No-Action Alternative, no nonnative plant management activities or no direct or indirect construction would occur. Conflicts with or obstruction of implementation of the applicable air quality plan would not occur. Moreover, implementing the No-Action Alternative would not violate any air quality standard or contribute substantially to an existing or projected air quality violation, nor would it result in a cumulatively considerable net increase of any criteria pollutant. Because it would not result in any emissions, the No-Action Alternative would not expose sensitive receptors to substantial pollutant concentrations or create objectionable odors. The No-Action Alternative would have no air quality impacts.

Global Climate Change

Operations of the Proposed Action would result in negligible regional emissions of GHGs from mobile sources. Implementation of the Proposed Action would not result in construction-, area-, or stationary-source GHG emissions. GHG emissions generated by the Proposed Action would predominantly be in the form of CO_2 from mobile sources. Although emissions of other GHGs, such as CH_4 and N_2O, are important with respect to global climate change, the emission levels of these GHGs for the sources associated with Proposed Action operations are relatively small compared with CO_2 emissions, even considering their higher global warming potential. Therefore, all GHG emissions are reported as CO_2. Emission factors and calculation methods for estimating GHG emissions have not been formally adopted for use by the State, SJVAPCD, or any other air district.

Mobile-source GHG emissions would be generated by vehicle trips for vegetation surveys and removal, and minor recreation increases during WY 2010. CO_2 emissions generated by operation of the Proposed Action were calculated using URBEMIS 2007, with the same assumptions used for mobile-source criteria air pollutants above. Table 4-2 presents annual operational GHG emissions associated with the Proposed Action.

As shown in Table 4-2, estimated annual GHG emissions associated with the entire Proposed Action would be approximately 532 metric tons of CO_2. Absent any air-quality-regulatory-agency-adopted threshold for GHG emissions, it is notable that the Proposed Action would generate substantially fewer emissions than 25,000 MT CO_2/yr, which is the threshold established by AB 32 for mandatory reporting to the ARB. This information is presented for informational purposes only, and it is not the intention of the Proposed

Action to adopt 25,000, 10,000, or 7,000 MT CO_2/yr as a numeric threshold. Rather, the intention is to put project-generated GHG emissions in the appropriate statewide context to evaluate whether the Proposed Action's contribution to the global impact of climate change is considered substantial. This approach is consistent with proposed CEQA guideline amendments for GHGs currently under consideration by the California Office of Planning and Research (2009). Because operation-related emissions would be temporary and finite and below the minimum standard for reporting requirements under AB 32, the Proposed Action's GHG emissions would not be a considerable contribution to the cumulative global impact. Therefore, the impact would be **less than significant.**

Because no emissions would be generated under the No-Action Alternative, implementing the alternative would not contribute to global climate change. The contribution of the Proposed Action to the cumulative impact of global climate change therefore would be greater than the contribution of the No-Action Alternative.

Table 4-2.
Summary of Modeled Operation-Generated Emissions of Greenhouse Gases

Source	Total Mass CO_2 Emissions (metric tons)
Vegetation surveys (2011)[1]	0.8
Vegetation removal (2011)	119.7
Total operational emissions (2011-2013)[2]	482.6

Notes:
Direct operational emissions (i.e., mobile sources) were modeled using the URBEMIS 2007 computer model, based on trip generation rates obtained from the traffic analysis, as well as the assumptions and input parameters used to estimate criteria air pollutant emissions. Mobile-source emissions assume one trip per month. URBEMIS also does not estimate GHG emissions other than CO_2, such as CH_4 or NO_2, because the emission levels of these pollutants are expected to be nominal in comparison to the estimated CO_2 levels despite their higher global warming potential.

[1] Emissions represented here are for 3 months of surveys. Modeling output is for 12 months of surveys.

[2] Total operational emissions include 3 years of vegetation removal and 1 year of vegetation surveys.

See Appendix G for detailed model input, assumptions, and threshold calculations.

Key:
CO_2 = carbon dioxide

d) Expose sensitive receptors to substantial pollutant concentrations?

The nearest sensitive receptors in the vicinity of the Proposed Action would be any residences, churches, schools, hospitals, and parks within 500 feet of the Restoration Area and the San Joaquin River downstream from the Merced River confluence to the Delta. As discussed in item a) above, implementing the Proposed Action or the No-Action Alternative would result in negligible emissions of criteria air pollutants and precursors. Thus, emissions of criteria air pollutants and precursors generated by the Proposed Action or the No-Action Alternative would not expose sensitive receptors to substantial criteria pollutant concentrations.

Operational, Local, Mobile-Source Emissions of Carbon Monoxide Generated by Project Operations

Concentrations of CO are a direct result of motor vehicle activity (e.g., idling time, traffic flow conditions), particularly during peak commute hours, and meteorological conditions. Under specific meteorological conditions (e.g., stable conditions that result in poor dispersion), CO concentrations may reach unhealthy levels with respect to local sensitive land uses, such as residential areas, schools, and hospitals.

Because increased CO concentrations usually are associated with roadways that are congested and have heavy traffic volumes, the *Transportation Project-Level Carbon Monoxide Protocol* (Garza et al. 1997) states that signalized intersections at level of service E or F represent a potential for a CO violation, also known as a “hot spot.” Intersections controlled by stop signs do not have high enough traffic volumes to result in violations of the ambient air quality standards (AAQS); therefore, CO modeling is not recommended (Garza et al. 1997).

Project-generated traffic would consist of eight trips per day total across the Restoration Area. This level of activity would not result in the congestion of any roadway or intersection. Because no roadway or intersection would be affected by the Proposed Action, no violation of AAQS would occur and no CO “hot spots” would be created. Thus, project-generated activities would not expose sensitive receptors to substantial CO concentrations.

Toxic Air Contaminant Emissions

Vegetation-removal activities would generate diesel exhaust emissions from the use of off-road diesel equipment required for removal of various invasive plants and from motor vehicles required for survey and work crews. Particulate exhaust emissions from diesel PM were identified as a toxic air contaminant by ARB in 1998. The dose to which the receptors are exposed (a function of concentration and duration of exposure) is the primary factor used to determine health risk (i.e., potential exposure to toxic air contaminant emission levels that exceed applicable standards). According to the California Office of Environmental Health Hazard Assessment, health risk assessments, which determine the exposure of sensitive receptors to toxic air contaminant emissions, should be based on a 70-year exposure period; however, such assessments should be limited to the period/duration of activities associated with the Proposed Action (Salinas, pers. comm., 2004).

The possible sensitive receptor exposure period for the Proposed Action is short (less than 3 years), and mobile equipment would not operate near any sensitive receptor for more than a few days. SJVAPCD does not have any current guidance on toxic air contaminant emissions from mobile equipment or a threshold of significance for exposure to emissions of diesel exhaust. In addition, diesel PM is highly dispersive, and studies have shown that measured concentrations of vehicle-related pollutants, including ultra-fine particles, decrease dramatically within approximately 300 feet of the source (Zhu et al. 2002, ARB 2005). Thus, because the use of mobilized equipment would be temporary, in combination with the dispersive properties of diesel PM, construction-related toxic air contaminant emissions would not be anticipated to expose sensitive receptors to substantial pollutant concentrations (10 chances per million, or greater than a hazard index of 1.0).

Mobile sources associated with the Proposed Action would include motor vehicle trips required for survey and work crews and diverted recreation trips. According to the ARB *Air Quality and Land Use Handbook*, projects should avoid siting new sensitive land uses within 500 feet of a freeway, urban roads with 100,000 vehicle trips per day, and rural roads with 50,000 vehicle trips per day (2005). Because implementing the Proposed Action would not create motor vehicle numbers of this magnitude, toxic air contaminant levels emitted as a result of Proposed Action implementation would result in negligible amounts of pollutant concentrations.

Based on this analysis of criteria air pollutant and precursor emissions, local mobile-source emissions of CO-generated by Proposed Action operations, and toxic air contaminant emissions, implementing the Proposed Action would not expose people to substantial pollutant concentrations. The impact would be **less than** significant and greater than under the No-Action Alternative because the No-Action Alternative would have no emissions.

e) Create objectionable odors affecting a substantial number of people?

No construction, stationary, or mobile sources of odor would exist under implementation of the Proposed Action that would affect a substantial number of people. Implementing the Proposed Action would result in diesel PM from vegetation-removal activities. The diesel PM would be intermittent and temporary and would dissipate rapidly from the source with an increase in distance. The evaporation of water in the San Joaquin River channel might create anaerobic odors related to decaying organic material. However, these odors would be temporary and intermittent, and these types of odors already occur annually as a result of low water levels typical throughout the Restoration Area. No other existing odor sources that could be affected are located in the project vicinity, and the Proposed Action would not include the operation of any new sources. Thus, implementation of the Proposed Action would not create, exacerbate, or change existing objectionable odors that would affect a substantial number of people. As a result, this impact would be **less than significant**. Because the No-Action Alternative would not involve any activities that could result in the creation of objectionable odors, odor impacts resulting from the Proposed Action would be greater than under the No-Action Alternative.

4.5 Biological Resources – Terrestrial Species

Environmental Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IV. Biological Resources. Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or the U.S. Fish and Wildlife Service?	☐	☐	☒	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Game or the U.S. Fish and Wildlife Service?	☐	☒	☐	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☒	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☒	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☒	☐
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☒	☐

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

The study area contains numerous special-status plant and animal species. Appendix H (Biological Resources) provides CNDDB database records (Attachment 1), a USFWS listing of special-status species that could occur in the study area (Attachment 2), and two tables that summarize information on the special-status plant and animal species known or with potential to occur in the Restoration Area (Attachment 3).

Special-status wildlife and plant species along the San Joaquin River and connected flood bypasses throughout the Restoration Area may be affected by loss or fragmentation of habitat; alteration of habitat conditions or resources; alteration of interactions with prey, pollinators, competitors, parasites, diseases, herbivores, and predators; disturbance, harm, or death from human activities; or alteration of natural processes that sustain habitats (e.g., river flow regimes).

By altering flow in the San Joaquin River and bypass system during WY 2010, the Proposed Action could potentially affect sensitive species in the Restoration Area, at least temporarily, by any of the impact mechanisms listed above. These potential effects are discussed separately for sensitive animal and plant species below and then summarized. However, habitat degradation or loss resulting from the spread of invasive plants is discussed in item b), below.

Although implementation of the Proposed Action would also alter flows outside the Restoration Area, these alterations would not substantially affect sensitive wildlife or plant species. These flow alterations would cause effects similar to those caused by flow alteration in the Restoration Area, but the effects would be much smaller. Effects along the San Joaquin River downstream from the confluence with the Merced River and in the Delta would be smaller than in the Restoration Area because releases from Friant Dam account for a smaller fraction of total flow downstream from the confluence with the Merced River. Also, the portion of total flow that WY 2010 Interim Flows account for further diminishes with increasing distance downstream as tributaries cumulatively add to the San Joaquin River's flow. These increased flows would largely be confined within existing channels, would not increase flood flows, would be within the range of historical flows, and would have a timing similar to historical flows. Releases from major reservoirs on the main tributaries to the San Joaquin River (e.g., Merced, Tuolumne, and Stanislaus rivers) are made in response to multiple operational objectives, including flood management, downstream diversions, instream fisheries flows, instream water quality flows, and releases to meet water quality and flow objectives at Vernalis (i.e., VAMP requirements). Thus, only small alterations to these flows would result from the Proposed Action and would be insufficient to affect vegetation and wildlife. At the Delta, conditions are also determined by the Sacramento River, water diversions, and tidal action. Thus, implementation of the Proposed Action is not anticipated to alter total flows to the Delta sufficiently to cause a measureable effect on sensitive wildlife or plant species. Therefore, effects on sensitive wildlife and plant species downstream from the confluence with the Merced River would be **less than significant** and are not discussed further.

Special-Status Animal Species

Effects of the Proposed Action on the various sensitive animal species found in the Restoration Area are discussed below, including the following:

- Listed vernal pool invertebrates
- Valley elderberry longhorn beetle
- Special-status amphibians
- Special-status reptiles
- Special-status birds
- Special-status mammals

Listed Vernal Pool Invertebrates. Four Federally listed vernal pool invertebrate species and their designated critical habitat are known to occur in the Restoration Area:

- Conservancy fairy shrimp, Federally listed as endangered
- Longhorn fairy shrimp, Federally listed as endangered
- Vernal pool fairy shrimp, Federally listed as threatened
- Vernal pool tadpole shrimp, Federally listed as endangered

These vernal pool invertebrates may be present in suitable vernal pools and seasonal wetlands in the Restoration Area. As previously described, flows would largely be confined within the existing channels, would not increase flood flows, would be within the range of historical flows, and would have a timing similar to historical flows. Therefore, increased flows under the Proposed Action would not inundate vernal pools. WY 2010 Interim Flows would be incrementally increased, which would prevent substantial potential effects of shallow subsurface water on adjacent, nonriparian land, including vernal pools and other seasonal wetlands. Therefore, the effects of WY 2010 Interim Flows on vernal pool invertebrates and designated critical habitat would be **less than significant**.

Valley Elderberry Longhorn Beetle. Blue elderberry shrubs, the host plant for valley elderberry longhorn beetle larvae, are abundant in Reaches 1 and 2 and are sparsely distributed in or absent from Reaches 3, 4, and 5, based on kayak, ground, and aerial surveys conducted in 2004 and 2005 (ESRP 2006). Approximately 410 elderberry shrubs were mapped in Reaches 1 and 2. In Reaches 3, 4, and 5, three elderberry shrubs were observed from the air but could not be located during kayak or ground surveys. Elderberry shrubs may be found in other areas than reported in previous studies, as current surveys for the SJRRP were not comprehensive, and elderberry shrubs can colonize new areas quickly. The impact analysis below does not solely rely on the 2004 and 2005 data to determine level of significance. Exit holes made by valley elderberry longhorn beetle larvae as they leave the host plant during metamorphosis to the adult stage were found in few shrubs throughout the Restoration Area; less than 1 percent of stems observed had exit holes (ESRP 2006). Although valley elderberry longhorn beetle may be rare in the Restoration Area, elderberry shrubs provide potentially suitable habitat throughout the Restoration Area, especially in Reaches 1 and 2. Elderberry shrubs grow rapidly and may occur in additional areas that have not been surveyed or may have grown in areas since the surveys were conducted. In addition, valley elderberry longhorn beetle could occur in more shrubs, as the exit-hole surveys were not comprehensive and results may be outdated.

In the Restoration Area, elderberry shrubs typically are located on the higher portions of levees and streambanks, which are not subject to inundation or scouring. During vegetation surveys of the Restoration Area, elderberry shrubs have been documented in Reach 1A in riparian forest along the lower portions of bluffs above the river and in several patches of elderberry savanna that are at higher elevations along Reaches 1 and 2 (DWR 2002). In a survey of Reach 2 in 2003, most elderberry shrubs were in uplands adjacent to the river channel; however, some shrubs were growing along the channel, which in this reach is typically dry under existing conditions (ESRP 2004).

Elderberry shrubs at most locations are not anticipated to be inundated by WY 2010 Interim Flows. A few elderberry shrubs in Reach 2 that are growing along the river channel may be partially inundated during a period in spring (up to an estimated maximum nonflood flow of between 1,370 and 1,470 cfs). The period of these higher estimated maximum nonflood flows would be from mid-March through June, which corresponds to the natural hydrograph of rivers receiving snowmelt from the Sierra Nevada. Elderberry shrubs in Reach 2 are currently subject to temporary flood flows that occur every 2 to 5 years under existing conditions. Elderberry is a riparian species that can withstand periodic inundation, and the WY 2010 Interim Flows are not likely to result in loss of elderberry shrubs or any resident beetles. Release of WY 2010 Interim Flows would increase the amount of water in the river channel, and for elderberry shrubs at higher elevations on the streambanks and the adjacent lowermost terraces, an increase in water available to elderberry roots may stimulate growth of elderberry shrubs and ultimately have a beneficial effect on habitat for this species. These effects would be **less than significant**.

Special-Status Amphibians. California red-legged frog, Federally listed as threatened and a California species of special concern, is unlikely to occur in the Restoration Area, because the area lacks suitable breeding habitat and because the species is presumed extirpated from the San Joaquin Valley region. There would be **no impact**.

California tiger salamander, Federally listed as threatened and a California candidate species, and western spadefoot toad, a California species of special concern, require the relatively calm waters of vernal pools, ponds, or seasonal wetlands for breeding and larval maturation. When they are not breeding, these species spend most of their life cycle in upland habitats using underground burrows for refuge. Critical habitat for California tiger salamander has been designated in and adjacent to Reach 1A. Although breeding habitats of these species are located adjacent to the Restoration Area, California tiger salamander would not be affected along any reach by the release of WY 2010 Interim Flows.

These amphibians are not expected to breed in the river channel. Water from the flow releases would be restricted to the river channel, which is characterized by open water, woody riparian vegetation, tules and cattails, or riverwash. If substantial effects resulting from changes in shallow, subsurface water in areas adjacent to the river are observed, flows would be reduced and/or diverted. Potential management actions to reduce or divert flows are described in Appendix D. Also, because the Proposed Action would avoid inundation of vernal pools in the Eastside Bypass, these vernal pools would not be inundated under the Proposed Action. The Proposed Action also would not affect the primary constituent elements of critical habitat for California tiger salamander. These effects would be **less than significant**.

Special-Status Reptiles. Aquatic reptiles, including giant garter snake, Federally listed and State-listed as threatened, and western pond turtle, a California species of special concern, are known to occur in suitable habitat in the San Luis NWR Complex, in the Mendota WA, and at the Mendota Pool. These reptiles are expected to occur in suitable habitat in other locations in the Restoration Area and may occur in the portions of the river channel that would be inundated by the release of WY 2010 Interim Flows. These species require aquatic habitat for breeding and foraging during spring and summer. Therefore, the presence of additional flows during these seasons, as well as in winter, would have a beneficial effect on these species. Although water velocities would increase in Mendota Pool between the San Joaquin River and Mendota Dam, velocity would not be substantially altered because, although hydraulically connected, most of the pool lies outside of the WY 2010 Interim Flow route. Velocities within the pool's backwater on the San Joaquin River would not increase substantially because of the pool's width. Impacts on upland habitats that these species use for refuge (giant garter snake) and nesting (western pond turtle) are not expected under the Proposed Action because flows generally would be restricted to the river channel and immediately adjacent, lower floodplain surfaces, and would not inundate a substantial amount of available upland habitat. If substantial effects resulting from changes in shallow, subsurface water in areas adjacent to the river are observed, flows would be reduced and/or diverted. Potential management actions to reduce or divert flows are described in Appendix D.

The coast horned lizard and San Joaquin whipsnake, both California species of special concern, occur in a variety of open vegetation types, including grassland, oak savanna, scrub, and woodlands. These species use small-mammal burrows for refuge and for hibernating during winter. There are no documented occurrences of either species in the Restoration Area, although they do have potential to be present based on the presence of suitable grassland and scrub habitats. Suitable upland habitats that may contain rodent burrows occupied by these species are located in the Restoration Area, but they would not be affected along any reach by the release of WY 2010 Interim Flows. Water from the flow releases generally would be restricted to the river channel and immediately adjacent, lower floodplain surfaces, and would not inundate a substantial amount of available upland habitat (DWR in preparation). These areas are seasonally inundated or periodically inundated by flood flows (every 2 to 5 years) in winter or spring and early summer (Jones and Stokes 2002, McBain and Trush 2002, DWR in preparation) and are characterized by woody riparian vegetation, emergent marsh, riverwash, and open water. Therefore, these species are not expected to be hibernating in areas that would be inundated during winter flow releases. This effect would be **less than significant**.

Silvery legless lizard, a California species of special concern, is known to occur in suitable habitat in the San Luis NWR and near the confluence with the Chowchilla Bypass. This species has a narrow range and limited dispersal capability. It occurs in upland habitats characterized by sandy soils and vegetation that produces leaf litter. It is not expected to occur in habitats that experience seasonal or periodic inundations. At present, all reaches that would receive WY 2010 Interim Flows are seasonally inundated, with the exception of Reaches 2A and 2B and portions of the Eastside Bypass. However, these reaches have been inundated periodically (every 2 to 5 years) by flood flows. It is not likely that silvery legless lizards occur in areas that would be inundated by WY 2010 Interim Flows. They also are not expected to disperse into areas that could be inundated during WY 2010 Interim Flows because their movements typically occur within a narrow home range and primarily consist of burrowing into sandy soils, infrequently emerging above the surface. There would be **no impact**.

BNLL, Federally listed and State listed as endangered, is a fully protected species under the California Fish and Game Code. BNLLs are found in areas with sandy soils and scattered vegetation and usually are absent from thickly vegetated habitats. They would be most likely to use alkali scrub habitat with sandy soils, rodent burrows, and sparse vegetation adjacent to portions of the Restoration Area. BNLLs use small rodent burrows for shelter, predator avoidance, and behavioral thermoregulation. Breeding activity of the species generally begins within a month after emergence from dormancy, usually the end of April, and continues through the beginning of June and occasionally to the end of June. Young hatch through August.

At present, all reaches that would receive WY 2010 Interim Flows are seasonally inundated, with the exception of Reaches 2A and 2B and portions of the Eastside Bypass, which are periodically inundated by flood flows and local runoff. The portions of Reaches 2A and 2B that could be inundated by WY 2010 Interim Flows are characterized by sandy riverwash and gravelly substrate. Habitat conditions in these areas are not highly suitable, and the presence of BNLL is unlikely because of regular inundation of this area from seasonal flood flows.

There is potential for the BNLL to occur in the vicinity of the Eastside Bypass, and to occur in portions of the Eastside Bypass that may be inundated by WY 2010 Interim Flows if suitable habitats are present nearby. If present, some individuals might not be able to escape rising flow waters that could ramp up during spring. As described in Section 2 of this EA/IS, surveys to identify habitat and species presence were conducted between April 15 and July 15, 2009 when the species is most active. Additional surveys were conducted between August 1 and September 15, 2009 when hatchlings and subadults are most commonly observed. Survey results did not document the presence of BNLL in areas that would likely be inundated by WY 2010 Interim Flows. Survey results are being reviewed to identify the potential presence of suitable BNLL habitat that was not surveyed. If the survey results suggest that no areas in the Eastside Bypass surveyed may contain suitable habitat for BNLL that would likely be inundated by WY 2010 Interim Flows, then WY 2010 Interim Flows would be reduced to not inundate these areas. This effect would be **less than significant**.

Special-Status Birds. Several raptors and other sensitive bird species have the potential or are known to occur in the Restoration Area (Appendix H, Attachment 3).

Many special-status birds occurring in the Restoration Area build nests in large trees or shrubs that would be well above the waterline under the Proposed Action during the breeding season (approximately February through August). Some special-status species, such as the least bittern, redhead, yellow-headed blackbird, tricolored blackbird, and white-faced ibis, nest closer to the ground in emergent marsh vegetation such as that present in portions of the river channel. Other California species of special concern listed in Appendix H, Attachment 3, nest directly on the ground in open areas (horned larks and western burrowing owls) or in areas surrounded by tall grasslands, crops, or wetland vegetation (short-eared owl and northern harrier).

The Proposed Action could progressively increase nonflood flows from February, March, April, and May throughout the Restoration Area. There is potential for increased flows to inundate nest sites of ground and low vegetation nesters if they are established before releases. This would result in nest abandonment and the loss of any viable eggs or chicks that have not yet fledged. Existing habitat types in these channel reaches have some potential to support these species; however, these areas already experience periodic flood flows during spring, and WY 2010 Interim Flows would generally be at nearly their highest levels by March 16 (see Table 2-2), before the nesting season of most birds, such as migratory passerines like the least Bell's vireo. Least Bell's vireos would migrate into the Restoration Area or downstream along the San Joaquin River sometime in April and would naturally construct their nests above the Interim Flow levels. Furthermore, the incidence of nests established below the WY 2010 Interim Flow levels during the breeding season is expected to be low given the prevalence of surrounding habitats that are suitable. Burrowing owls and other ground-nesting birds are not expected to nest within the low-flow channel, which is subject to regular or periodic inundation from seasonal flood flows. These effects would be **less than significant**.

Special-Status Mammals. The following special-status mammal species in the Restoration Area have the potential to be affected by the Proposed Action:

- Several special-status bats
- San Joaquin kit fox
- American badger
- Riparian brush rabbit
- San Joaquin Valley woodrat
- Ringtail
- Fresno kangaroo rat
- Nelson's antelope squirrel
- San Joaquin pocket mouse

Several special-status bat species have the potential or are known to occur in the Restoration Area (Appendix H, Attachment 3). Implementing the Proposed Action would not inundate portions of any structures that provide suitable thermal protection for roosting or hibernating bats, such as bridges or buildings. Bat species occurring in the Restoration Area may roost in large trees or shrubs that would be well above the waterline under the Proposed Action. Thus, the release of WY 2010 Interim Flows would have no impact on individual bats or their roost sites. However, there would be an increase in seasonally available foraging habitat for species that feed on insects that congregate over open water. The effect would be beneficial. San Joaquin kit fox, Federally listed as endangered and State-listed as threatened, and American badger, a California species of special concern, are large mammals that occupy grassland and scrub habitats in the Restoration Area. The San Joaquin kit fox recovery area overlaps with portions of the Restoration Area. These mammals create burrows for denning and refuge. Although occupied dens may be located near the river corridor, they would not be affected along any reach by the release of WY 2010 Interim Flows. Water from the flow releases would be restricted to the channel and adjacent lower floodplain surfaces, which are characterized by open water, riverwash, emergent wetland, and riparian scrub and forest. These habitats are not suitable for denning, although San Joaquin kit fox and American badger may forage and disperse through the river corridor or the Eastside Bypass. Implementing the Proposed Action would not affect the ability of these species to carry out these activities, because these species are mobile and wide ranging and often use road crossings and culverts to traverse aquatic features. They prey on a wide variety of terrestrial animals, and foraging habitat would remain plentiful along the river corridor, Eastside Bypass, and adjacent habitats. This effect would be **less than significant**.

The riparian brush rabbit, Federally and State-listed as endangered, has very limited distribution. Recent captive breeding and recovery efforts have included establishing one population in 2002 in restored habitat on the San Joaquin River refuge and releasing another small population in 2005 on private lands adjacent to the San Joaquin River NWR, west of Modesto. Other known populations are in Caswell Memorial State Park near Ripon, and in Paradise Cut and along the San Joaquin River west of Manteca. Riparian brush rabbits are not expected to occur upstream from the confluence with the Merced River. Because WY 2010 Interim Flows would have a very minimal effect on riparian habitats downstream of the Merced River (see discussion above), there would be **no impact**.

The San Joaquin Valley woodrat, Federally listed as endangered and a California species of special concern, and ringtail, a fully protected species under the California Fish and Game Code, have not been documented in the Restoration Area or its vicinity. San Joaquin Valley woodrat builds stick houses in dense riparian vegetation at the base of trees or in tree cavities and canopies. Ringtails are found in brushy and wooded areas in foothill areas, especially along water courses, and typically make dens in hollow trees. Although the range of ringtail in California excludes most of the San Joaquin Valley, the distribution of the species is not well documented and could include portions of the Restoration Area, especially the foothill portion of Reach 1. Potentially suitable habitat for San Joaquin Valley woodrat is present in riparian vegetation that could be inundated by WY 2010 Interim Flows. However, because the only verified extant population of San Joaquin Valley woodrat is located on the Stanislaus River at Caswell Memorial State Park, which is outside the Restoration Area, implementing the Proposed Action is not expected to affect this species. Although some habitat in Reach 1 for ringtail may be affected by WY 2010 Interim Flows, ringtail dens are not expected to be inundated if they were present in the Restoration Area because they are unlikely to den in the low-flow channel, which is subject to periodic inundation due to seasonal flood flows; therefore, impacts on ringtail are expected to be **less than significant**.

Fresno kangaroo rat (Federally listed and State-listed as endangered), Nelson's antelope ground squirrel (State-listed as threatened), and San Joaquin pocket mouse (tracked in the CNDDB) are all small burrowing mammals that have been reported in the vicinity of the Restoration Area. These species inhabit grassland and scrub habitats. They generally do not occupy riparian areas, although they may disperse through dry river washes. These species tend to have small home ranges and are not expected to regularly disperse across the river channel. Suitable upland habitats and occupied burrows may be located adjacent to the Restoration Area; however, these species would not be affected along any reach or bypass because the WY 2010 Interim Flows would be restricted to the river channel and lower floodplain surfaces.

Critical habitat designated for the Fresno kangaroo rat is located approximately 1.75 miles southeast of Reaches 2A and 2B; however, this species is considered by some to be extirpated along the San Joaquin River because of repeated negative findings during survey efforts since 1993 (DFG 2005). Nelson's antelope ground squirrel has not been documented in the vicinity of the Restoration Area since the early 1900s. Therefore, these species are not expected to be present in the river channel during the WY 2010 Interim Flows, and implementing the Proposed Action would have **no impact** on the Fresno kangaroo rat or Nelson's antelope squirrel.

The San Joaquin pocket mouse has been recorded in Reach 3 of the Restoration Area. Habitats that could be inundated by WY 2010 Interim Flows are of low quality for this species, which prefers friable soils for easy burrowing and grassy vegetation for forage. It is unlikely that this species is present in the river bed banks or lower floodplain surfaces. The effect would be **less than significant**.

Special Status Plant Species

Seven Federally listed or State-listed plant species are known from or could occur in the Restoration Area (Appendix H, Attachment 3). These species would not be affected by WY 2010 Interim Flows. Five of these are species occurring in vernal pool habitats: succulent owl's-clover, Bogg's Lake hedge-hyssop, Colusa grass, San Joaquin Valley Orcutt grass, and hairy Orcutt grass. Vernal pools are located on terraces above Reach 1A; however, these locations would not be inundated by WY 2010 Interim Flows. In the Eastside Bypass downstream from the Mariposa Bypass, vernal pools may be present in areas that could be inundated by WY 2010 Interim Flows; however, as previously described, inundation of vernal pools would be avoided under the Proposed Action. Because vernal pool habitats would not be inundated under the Proposed Action, the five

Federally listed or State-listed vernal pool species would not be affected. Thus, there would be **no impact**.

Two Federally listed or State-listed species that are known from or could occur in the Restoration Area are not associated with vernal pools: palmate-bracted bird's-beak and Delta button-celery. Palmate-bracted bird's-beak is a species of scrub that has been documented in the vicinity of Reach 3. This species is unlikely to be present on alluvial soils in areas that are seasonally inundated or periodically inundated by flood flows along the San Joaquin River. However, potentially suitable habitat may be present along the Eastside Bypass. Because alkali sink habitats would be avoided, as would most or all upland habitat adjacent to alkali sinks, effects on pollinators of palmate-bracted bird's-beak (and of other plant species) would likely not be substantial and, thus, not sufficient to cause a substantial effect on palmate-bracted bird's-beak. The Proposed Action includes measures to avoid inundation of potential habitat for palmate-bracted bird's-beak along the Eastside Bypass. When flows are greater than 475 cfs, a daily evaluation would be made of all information available, including recent groundwater levels, visual assessments made during levee patrols, flow and stage levels within the river channel, and landowner feedback. If effects from changes in shallow subsurface water in areas adjacent to the river and bypass channels are observed, flows would be reduced and/or diverted. Potential management actions to reduce or divert flows are described in Appendix D. Therefore, palmate-bracted bird's-beak would not be affected by WY 2010 Interim Flows. Thus, there would be **no impact**.

Delta button-celery occurs in periodically inundated, sparsely vegetated depressions in floodplains and has been documented along the Eastside Bypass (Appendix H, Attachment 1). Therefore, the habitat and populations of Delta-button celery could benefit from WY 2010 Interim Flows. However, the growth, reproduction, or survival of some individuals may be adversely affected by the extent of inundation during WY 2010 Interim Flows. Because of this uncertainty, to avoid any adverse effects on this species, the Proposed Action includes measures to avoid inundation of occupied floodplain habitat along the Eastside Bypass (as described in Section 2.2.3, "Additional Implementation Considerations"). Therefore, the Proposed Action would cause no adverse impacts on Delta button-celery. There would be **no impact**.

An additional 23 special-status plant species that are not Federally listed or State-listed are known from or could occur in the Restoration Area (Appendix H, Attachment 3). These species would not be substantially adversely affected by WY 2010 Interim Flows. Of special-status plants that are not Federally listed or State-listed, seven are species that occur primarily in vernal pool landscapes: alkali milk-vetch, vernal pool smallscale, Hoover's spurge, dwarf downingia, spiny-sepaled button-celery, little mousetail, and prostrate navarretia. As previously described, a minimization commitment to avoid inundation of vernal pool habitats has been incorporated into the Proposed Action; thus, these species would not be adversely affected. There would be **no impact**.

Of the special-status plant species that are not Federally listed or State-listed, six are species that occur primarily in alkaline scrub, grassland, and sink landscapes: heartscale, brittlescale, San Joaquin spearscale, lesser saltscale, Lost Hills crownscale, and hispid bird's-beak. These species are unlikely to be present on alluvial soils in areas that are seasonally inundated or periodically inundated by flood flows along the San Joaquin River. However, potentially suitable habitat for these species may be present along the Eastside Bypass. The minimization commitment to avoid inundation of potential habitat for palmate-bracted bird's-beak also would avoid habitat for these species. Therefore, these species are unlikely to be adversely affected by WY 2010 Interim Flows.

Five of the special-status species that are not Federally listed or State-listed are species of upland, annual grassland landscapes: subtle orache, recurved larkspur, round-leaved filaree, Munz's tidy-tips, and caper-fruited tropidocarpum. Potential habitat for these species may be inundated by the Proposed Action, particularly along Reaches 1 and 2 during spring and early summer flows. However, at any one location along the river, only a small portion of the upland grassland would potentially be inundated. These would also be areas that already experience periodic inundation by flood flows; thus, species in these areas have some ability to tolerate or recover from flood flows or reestablish from adjacent uplands. For these reasons, and because WY 2010 Interim Flows would affect only a single growing season, these species would not be substantially affected. These impacts would be **less than significant**.

Five of the special-status species that are not Federally listed or State-listed are species of riverine or marsh habitats or that could occur in riparian vegetation: four-angled spikerush, California satintail, slender-pondweed, Sanford's arrowhead, and Wright's trichocoronis. Sanford's arrowhead is known from the Mendota Pool, but marsh and riparian habitat at the Mendota Pool and its backwater along Reach 2B would not experience a substantial change in inundation as a result of the Proposed Action. Elsewhere, WY 2010 Interim Flows would alter inundation of marsh and riparian habitats and thus could affect these five special-status species. As described below in items b) and c), riparian and marsh plants could experience temporary adverse and beneficial impacts, but these impacts would not be substantial. Therefore, these species would not be substantially affected by WY 2010 Interim Flows. These impacts would be **less than significant**.

Upstream from Friant Dam, WY 2010 Interim Flows could affect the elevation of the water surface of Millerton Lake. The elevation would remain within the historical range, but the annual reduction in water surface elevation would occur earlier in the year than under the No-Action Alternative. Three special-status plant species could be present at the shoreline of Millerton Lake: Bogg's Lake hedge-hyssop, Madera leptosiphon, and blue elderberry (host to the Federally listed valley elderberry longhorn beetle). WY 2010 Interim Flows would not cause a substantial impact on these species. Bogg's Lake hedge-hyssop may be growing at or in the zone that is seasonally inundated. It is a species of habitats with substantial interannual variation in inundation and hydrology; thus, this difference in timing of drawdown during a single year would not cause a substantial impact on this species. Madera leptosiphon and blue elderberry would grow in woodland and riparian vegetation above the immediate shoreline and thus would not be substantially affected. These impacts would be **less than significant**.

In summary, for special-status plants, impacts on Federally listed or State-listed species would be avoided, and impacts on other special-status plants would be unlikely to occur, would be avoided, would not be substantial, or could be beneficial. These impacts would be **less than significant**.

Summary of Species Effects

In summary, implementing the Proposed Action would not have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by DFG or USFWS. The impact would be **less than significant**.

Implementing the No-Action Alternative also would not result in any substantial adverse effects, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations by DFG or USFWS. Most adverse and beneficial effects on these species that were described for the Proposed Action would either not occur or be less under the No-Action Alternative than under the Proposed Action.

Under the No-Action Alternative, existing habitats and use of the Restoration Area by sensitive species would remain comparable to existing conditions. Implementing the No-Action Alternative would not substantially eliminate or fragment habitat along the San Joaquin River or in the bypass system. It also would not substantially alter ecologically important interactions with other organisms. Implementing the No-Action Alternative would not substantially alter habitat conditions, including the existing regime of hydrologic conditions, and the associated scour and sediment deposition. There would be no impact under the No-Action Alternative.

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

Riparian habitat and other sensitive natural communities found in the Restoration Area could be adversely affected by loss or fragmentation, placement of fill, human-caused disturbances that remove vegetation (e.g., levee maintenance activities), introduction and spread of invasive nonnative species, alterations to surface water or groundwater hydrology, and alterations to geomorphic processes that scour and deposit sediment. Potential effects by these mechanisms are described below.

Implementing the Proposed Action would not convert riparian habitat or other sensitive natural communities to other vegetation types or to agricultural or developed land uses, and it would not fragment, fill, or remove native vegetation from riparian habitats or other sensitive natural communities. Implementing the WY 2010 Interim Flows, however, would provide additional habitat values and could provide additional riparian habitat along the San Joaquin River from Friant Dam downstream throughout the affected portions of the Restoration Area. In these areas, implementing the Proposed Action could cause inundation and/or raise groundwater levels and scour and deposit sediment for several months during WY 2010. These alterations could both adversely and beneficially affect riparian vegetation, depending on species and site-specific hydrologic changes; however, effects would not be substantial and would be temporary.

Upstream from Friant Dam, WY 2010 Interim Flows could affect the elevation of the water surface of Millerton Lake. The elevation would remain within the historical range, but the annual reduction in water surface elevation could occur earlier in the year than under the No-Action Alternative. This difference during a single year would not be sufficient to cause a substantial effect on the growth or survival of riparian or wetland communities at the lake's shoreline. This impact would be **less than significant**.

Downstream from Friant Dam, WY 2010 Interim Flows could inundate areas that are seasonally inundated during winter or spring to early summer (March 16 through June 30) in most years, and areas that are not inundated by most seasonal flows but that are periodically inundated by flood flows (every 2 to 5 years) in winter or spring to early summer (Jones and Stokes 2002, McBain and Trush 2002).

Most potential effects of the WY 2010 Interim Flows would be comparable to those of the periodic flood flows that have occurred historically and would continue under both the Proposed Action and the No-Action Alternative, and many of these effects are beneficial, such as greater availability of water to support growth. The primary and most ecologically important difference from existing flood flows would be the duration and seasonality of inundation: WY 2010 Interim Flows could inundate some areas for much longer periods than would seasonal flows or flood flows, and WY 2010 Interim Flows also would occur in seasons when flood flows do not occur (i.e., summer and fall).

In some locations, for 1 or more months, WY 2010 Interim Flows could submerge most of the stems and leaves of riparian plants. Such submergence would occur primarily in the herbaceous layer of riparian forest, and in riparian and willow scrub, because of their shorter stature and proximity to the water surface during lower flows. WY 2010 Interim Flows could be sufficient to submerge such vegetation at some locations along Reaches 1 and 2A; the portion of Reach 2B upstream from the backwater of Mendota Pool; Reaches 3, 4A, and 5; and the Eastside and Mariposa bypasses. In portions of those areas, the water surface could be up to several feet higher from March 16 through June 30, 2010.

Where WY 2010 Interim Flows submerge the shoots and leaves of riparian plants for weeks or months during the growing season, the growth of submerged plants would be reduced, and some plant parts would be damaged. Upland species and more widely distributed species occurring in riparian communities (e.g., nonnative grasses) could be damaged or killed by prolonged inundation. However, riparian plants possess adaptations that reduce physiological stress and damage when partially or completely submerged (Braendle and Crawford 1999, Karrenberg et al. 2002, Kozlowskiet al. 1991). Also, the riparian and willow scrub vegetation that could be submerged is resistant to damage from prolonged inundation (Karrenberg et al. 2002, Vaghti and Greco 2007). Furthermore, this vegetation exists in locations that already experience scour and deposition of sediment during periodic flood flows. Thus, extensive mortality of the trees, shrubs, and perennial forbs that dominate these communities is unlikely to result from prolonged inundation during a single growing season.

In many locations and times of year throughout the Restoration Area, WY 2010 Interim Flows could increase groundwater elevations in the root zones of riparian plants and possibly submerge some but not all of their aboveground parts. Where this hydration or partial submergence occurs during late spring to fall, plant growth for many species would increase because the growth of riparian plants is sensitive to water availability (Stillwater Sciences 2003). However, this beneficial effect would be limited to the single growing season affected by the WY 2010 Interim Flows.

The scour and deposition of sediment can damage riparian vegetation by abrasion or burial (Friedman and Auble 1999); however, substantial adverse effects are unlikely to result from sediment scour and deposition during the WY 2010 Interim Flows. Along Reach 2 (upstream from the backwater of the Mendota Pool), there may be scour and sediment deposition. Most riparian vegetation along this reach is riparian or willow scrub, however, and the dominant species of these scrubs (e.g., sandbar willow) are particularly resistant to damage by scour or burial. Furthermore, scour and deposition of sediment sustains floodplain habitats (such as the depressions with which Delta button-celery is associated) and creates opportunities for plant establishment and thus sustains the diversity of riparian and wetland vegetation. Therefore, scour and deposition of sediment during WY 2010 Interim Flows would not cause a substantial adverse effect on riparian vegetation.

In some locations, for 1 or more months, WY 2010 Interim Flows would inundate areas that do not currently support riparian vegetation. This inundation could create conditions suitable for dispersal and establishment of riparian plants. These conditions could be created by scour and sediment deposition, water transport of plant seeds and fragments to new locations, increased water availability, and reduced competition from upland plant species (such as some nonnative grasses) that are intolerant of prolonged submergence.

Establishment of additional riparian and wetland vegetation, however, would not be extensive. In Reaches 1 and 2, WY 2010 Interim Flows from March 16 through June 30 would inundate extensive areas that currently lack riparian and wetland vegetation (DWR in preparation). At most of these sites, seedlings of riparian species would be unlikely to survive. Most riparian species require relatively high moisture levels in the root zone of seedlings, including Fremont’s cottonwood and willow species (Mahoney and Rood 1998). At most sites inundated by spring and early summer flows, seedlings would have insufficient water to survive until fall because summer and fall WY 2010 Interim Flows would be much smaller, the coarse-textured soils of Reaches 1 and 2 store relatively little water, and the water table would be below the root zone of seedlings at most sites (EDAW 2008). In Reaches 3, 4A, and 5 and in the Eastside Bypass, the area inundated by WY 2010 Interim Flows that currently lacks riparian vegetation would be much less than in Reaches 1 and 2. However, establishment of some additional riparian vegetation may be more likely along these reaches or the Eastside Bypass than along Reaches 1 and 2 because the soils typically can hold more moisture, and water tables typically are closer to the soil surface than along Reaches 1 and 2.

The temporary nature of the WY 2010 Interim Flows also would limit adverse and beneficial effects on riparian and wetland vegetation. For example, any establishment of additional riparian vegetation (particularly in Reaches 1 and 2) likely would depend on additional flows in subsequent years.

WY 2010 Interim Flows also could affect riparian habitats by increasing the spread of invasive plant species. Downstream from Friant Dam, WY 2010 Interim Flows could substantially increase the quantity of water flowing through some reaches of the San Joaquin River, and in these reaches and portions of the bypass system, more water may be more continuously flowing during summer and fall. These hydrologic alterations could introduce and spread four species that are among the primary invasive species that have potential to substantially alter habitats and potentially increase substantially as a result of SJRRP operations: red sesbania, salt cedar, giant reed, and Chinese tallow. These hydrologic alterations also could potentially cause a substantial increase in the distribution of sponge plant, which is an aquatic invasive species that is present in Reach 1 but that currently has a very restricted distribution in California.

Although increased flows could disperse propagules of these species, flood flows already disperse propagules of these species throughout the Restoration Area. However, WY 2010 Interim Flows could aid the establishment of these species by providing water throughout the growing season, which is currently lacking along portions of the San Joaquin River and bypasses that would be affected by WY 2010 Interim Flows.

In the San Joaquin Valley, these invasive species are largely confined to sites with moderate or high levels of water availability. Therefore, by increasing water availability throughout the growing season, particularly in locations that would otherwise lack surface water (such as Reach 2A), WY 2010 Interim Flows could aid their establishment at locations along the San Joaquin River that receive WY 2010 Interim Flows. Because established plants are less sensitive to water availability than seedlings and have deeper and more extensive root systems, these plants, after they become established, would be likely to persist at additional sites, even with reduced flows in subsequent years. In particular, WY 2010 Interim Flows may aid the establishment of red sesbania at additional locations. Because red sesbania is abundant in Reach 1 and produces seed pods that float and seed that can remain dormant for at least several years, the increased water availability during the growing season would likely allow the establishment of numerous individuals in locations where they otherwise would not have been able to germinate, grow, and survive. Consequently, the spread of invasive plant species would be exacerbated under the Proposed Action compared to either existing conditions or conditions under the No-Action Alternative and is considered to be **significant** without mitigation.

Overall, for riparian habitat in the Restoration Area, the WY 2010 Interim Flows would likely alter plant growth at some locations and during some portions of the growing season, and the flows may increase plant establishment or mortality at some locations, but the WY 2010 Interim Flows are unlikely to substantially reduce the extent of existing riparian vegetation by increased mortality, and they may help to establish additional riparian and wetland vegetation. These effects would be **less than significant**.

For riparian habitat downstream from the confluence with the Merced River and in the Delta, effects of WY 2010 Interim Flows would also be less than significant and would be much less than in the Restoration Area. These flow alterations would cause effects similar to those caused by flow alterations in the Restoration Area, but the effects would be much smaller for the reasons given previously under item a). Thus, effects of the Proposed Action on riparian habitats downstream from the confluence with the Merced River would be **less than significant**.

Vernal pools are located on terraces above Reach 1A, but these locations would not be inundated by the WY 2010 Interim Flows. In the Eastside Bypass, vernal pools may be present in areas that could potentially be inundated by the WY 2010 Interim Flows, but the Proposed Action includes measures to avoid inundation of vernal pools in the Eastside Bypass that have been incorporated into the Proposed Action. As described in Section 2.0, release of WY 2010 Interim Flows into the Eastside and/or Mariposa bypasses would depend on the ability to determine that flows would remain within the existing low-flow channel in the bypass or otherwise would avoid inundating vernal pools. Therefore, these vernal pools also would not be inundated under the Proposed Action.

In summary, implementing the Proposed Action would not have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by DFG or USFWS. Implementing the Proposed Action would not convert sensitive natural communities to other vegetation types or to agricultural or developed land uses, and it would not fragment, fill, or remove native vegetation from riparian habitats or other sensitive natural communities, and effects on vernal pools would be avoided. Implementing the Proposed Action would provide additional habitat values and could provide additional wetland and riparian habitat along the San Joaquin River from Friant Dam to the most downstream extent of WY 2010 Interim Flows within the Restoration Area. In these areas, implementing the Proposed Action could cause inundation and/or raise groundwater levels and scour and deposit sediment for several months during WY 2010. These alterations would adversely and beneficially affect riparian habitat, depending on site-specific hydrologic changes; however, effects would not be substantial and would be temporary. Implementing the Proposed Action, however, would increase the distribution and spread of invasive species within riparian habitats or sensitive communities. Most adverse and beneficial effects described for the Proposed Action would either not occur or be less under the No-Action Alternative than under the Proposed Action. However, implementing the No-Action Alternative would result in an adverse effect on riparian habitat caused by the spread of invasive plants.

Implementing the No-Action Alternative would not convert sensitive natural communities or wetlands to other vegetation types or to agricultural or developed land uses, and it would not fragment, fill, or remove native vegetation from riparian habitats or sensitive natural communities. Implementing the No-Action Alternative also would not substantially alter the existing regime of hydrologic conditions and associated scour and deposition of sediment.

However, under the No-Action Alternative, existing populations of invasive plant species would continue to be introduced and spread along the San Joaquin River as a result of dispersal to suitable sites by flood flows; natural and agricultural drainage; and other water releases from Friant Dam, the Mendota Pool, and other facilities. In particular, five species have been identified as primary invasive species with the potential to affect habitats and potentially increase substantially as a result of continued water management operations along the San Joaquin River: red sesbania, salt cedar, giant reed, Chinese tallow, and sponge plant. Consequently, the spread of invasive plant species would continue under the No-Action Alternative, and depending on flood releases, could be potentially **significant**. Under the No-Action Alternative, no mitigation measures would be implemented.

Mitigation Measure Bio-1: Implement an Invasive Vegetation Management Plan.

Reclamation would monitor red sesbania, salt cedar, giant reed, Chinese tallow, and sponge plant along affected portions of the San Joaquin River and bypass system (before and after WY 2010 Interim Flows) and control and manage these species, as specified in the Invasive Species Management Plan for WY 2010 Interim Flows included as Appendix F. Potential adverse effects of implementing Mitigation Measure Bio-1 are addressed elsewhere in this, “Environmental Consequences” section.

Through implementation of Mitigation Measure Bio-1, the effect of the introduction and spread of invasive species resulting from WY 2010 Interim Flows would be substantially reduced through management. Consequently, effects on riparian habitat resulting from WY 2010 Interim Flows spreading invasive species would be **less than significant with mitigation** for the Proposed Action. Similar impacts would remain significant under the No-Action Alternative (depending on flood releases); however, no mitigation measure would be implemented if the No-Action Alternative is selected through the NEPA and CEQA processes.

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

Federally protected wetlands found in the Restoration Area could be adversely affected by loss or fragmentation, placement of fill, human-caused disturbances that remove vegetation (e.g., levee maintenance activities), introduction and spread of invasive nonnative species, alterations to surface water or groundwater hydrology, and alterations to geomorphic processes that scour and deposit sediment. Potential effects by these mechanisms are described below.

Implementing the Proposed Action would not have a substantial adverse effect on Federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, and coastal habitats) through direct removal, filling, hydrological interruption, or other means. Implementing the Proposed Action would not convert wetlands to other vegetation types or to agricultural or developed land uses, and it would not fragment, fill, or remove native vegetation from wetlands. Also, as previously described in item b), the Proposed Action would avoid affecting vernal pools. Implementing the Proposed Action, however, would provide additional habitat values and could provide additional wetland habitat along the San Joaquin River within the Restoration Area. Downstream from the confluence with the Merced River and in the Delta, effects of WY 2010 Interim Flows on wetlands would be much less than in the Restoration Area for the same reasons discussed previously for riparian habitats. In these areas, implementing the Proposed Action could cause inundation and/or raise groundwater levels and scour and deposit sediment for several months during WY 2010. The effects of these alterations on wetland vegetation would be similar to those previously described for riparian vegetation because wetland plants also can survive inundation, are resistant to the effects of scouring and burial, and are sensitive to water availability (Braendle and Crawford 1999, Coops et al. 1996, Grace and Harrison 1986, Keddy 2000, Karrenberg et al. 2002). These alterations could adversely and beneficially affect wetlands, depending on site-specific hydrologic changes; however, effects would not be substantial and would be temporary. The impact would be **less than significant**.

As previously described for riparian habitats, most adverse and beneficial effects on wetlands that are described for the Proposed Action would either not occur or be less under the No-Action Alternative than under the Proposed Action. However, without mitigation, implementing the No-Action Alternative would result in an adverse effect on wetlands caused by the spread of invasive plants.

Implementing the No-Action Alternative would not convert sensitive natural communities or wetlands to other vegetation types or to agricultural or developed land uses, and it would not fragment, fill, or remove native vegetation from riparian habitats or sensitive natural communities. Implementing the No-Action Alternative also would not substantially alter the existing regime of hydrologic conditions and the associated scour and deposition of sediment.

However, under the No-Action Alternative, existing populations of invasive plant species would continue to be introduced and spread along the San Joaquin River as a result of dispersal to suitable sites by flood flows; natural and agricultural drainage; and other water releases from Friant Dam, the Mendota Pool, and other facilities. In particular, five species could potentially increase substantially as a result of continued water management operations along the San Joaquin River and are invasive species with the potential to affect habitats along the San Joaquin River, including wetlands: red sesbania, salt cedar, giant reed, Chinese tallow, and sponge plant.

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

Implementing the Proposed Action would not 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.

Although in portions of the Restoration Area, terrestrial wildlife could be affected by implementation of the Proposed Action, such effects would not be substantial. Terrestrial reptiles and small mammals in the Restoration Area have small home ranges and are not expected to regularly disperse across the river channel. As described previously, riparian brush rabbits are not expected to occur upstream from the Merced River; and downstream from the Merced River, WY 2010 Interim Flows would not create a new barrier to movement and would not substantially increase inundated area or cause rapid fluctuation in flow. Therefore, WY 2010 Interim Flows would not substantially interfere with the movement of riparian brush rabbits in riparian areas. Larger mammals that are wider ranging are able to use road crossings to traverse aquatic features. Furthermore, any effects from implementing the Proposed Action would be temporary and would not continue after WY 2010. The impact would be **less than significant**.

Implementing the No-Action Alternative also would not 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. Effects would be even smaller under the No-Action Alternative than under the Proposed Action because the adverse and potentially beneficial effects on the movement of wildlife species that would result from changes in river flow under the Proposed Action would not occur under the No-Action Alternative.

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

Implementing the Proposed Action would not conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance. Implementing the Proposed Action would not adversely affect local policies or ordinances because it would not substantially affect special-status species, reduce the biological value or interfere with the management of protected biological resources, or eliminate opportunities to protect biological resources. However, implementing the Proposed Action would contribute to the future enhancement and restoration of biological resources along the San Joaquin River. In the Restoration Area, all potentially affected local plans have such goals or policies (e.g., *Fresno County General Plan* (Fresno County 2000), *Madera County General Plan Policy Document* (Madera County 1995), and

Merced County General Plan (Merced County 2000)), and implementing the Proposed Action would beneficially affect attainment of such goals and would not conflict with such policies. The impact overall would be **less than significant**, although there would be beneficial effects with respect to certain goals and policies.

Similar to the Proposed Action, implementing the No-Action Alternative would not adversely affect the attainment of local policies or conflict with ordinances because it would not substantially affect special-status species, reduce the biological value, interfere with the management of protected biological resources, or eliminate opportunities to protect biological resources. However, unlike implementing the Proposed Action, implementing the No-Action Alternative also would not beneficially affect attainment of these plans' goals for protecting biological resources, because it would not contribute to the future enhancement and restoration of biological resources along the San Joaquin River.

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

An activity would conflict with a conservation plan if it would substantially reduce the effectiveness of its conservation strategy or otherwise prevent attainment of the plan's goals and objectives. These conflicts can result from reducing the viability of populations that are targets of the plan's goals, objectives, and conservation strategy or from conflicting with implementation of the plan. Therefore, in addition to the mechanisms by which an activity can reduce the viability of populations (which were the mechanisms causing adverse effects described previously under "Special Status Plant Species"), activities can conflict with conservation plans by reducing the habitat value of conserved lands (e.g., by creating adjacent, incompatible land uses), interfering with the management of conserved lands (e.g., by eliminating access or water supplies), or eliminating opportunities for conservation activities (e.g., by developing land identified for preservation in the plan). By all of these mechanisms, an activity can also conflict with a local policy for protecting biological resources.

Implementing the Proposed Action would not conflict with the provisions of an adopted habitat conservation plan; natural community conservation plan; or other approved local, regional, or State habitat conservation plan. Implementing the Proposed Action would not adversely affect adopted conservation plans because it would not substantially reduce the viability of target species, reduce the habitat value or interfere with the management of conserved lands, or eliminate opportunities for conservation activities. However, implementing the Proposed Action would support the future enhancement and restoration of biological resources along the San Joaquin River in the Restoration Area. In the Restoration Area, all potentially affected Federal, State, regional, and local plans have such goals or objectives (e.g., *San Joaquin River Management Plan* (DWR 1995), Central Valley Joint Venture, Riparian Habitat Joint Venture, *San Joaquin River Parkway Master Plan* (SJRC 2000)), and implementing the Proposed Action would beneficially affect their attainment. However, the contribution of the Proposed Action to attainment of these goals and objectives would not be substantial. The impact would be **less than significant**.

Similar to implementing the Proposed Action, implementing the No-Action Alternative would not result in a substantial effect on an adopted habitat conservation plan; natural community conservation plan; or other approved local, regional, or State habitat conservation plan. Implementing the No-Action Alternative would not conflict with the provisions of these plans because it would not substantially reduce the viability of target species, reduce the habitat value or interfere with the management of conserved lands, eliminate opportunities for conservation activities, or otherwise prevent the attainment of the goals or objectives of these plans. However, unlike the Proposed Action, the No-Action Alternative also would not beneficially affect plans, because it would not support their attainment of goals or objectives related to enhancement or restoration of biological resources along the San Joaquin River (all of the potentially affected Federal, State, regional, and local plans in the Restoration Area have such goals or objectives).

4.6 Biological Resources – Fish

Environmental Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IV. Biological Resources. Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game, National Marine Fisheries Service or the U.S. Fish and Wildlife Service?	☐	☐	☒	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Game or the U.S. Fish and Wildlife Service? (*Addressed in 4.4, Biological Resources – Terrestrial Species.)*	☐	☐	☐	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means? (*Addressed in 4.4, Biological Resources – Terrestrial Species.)*	☐	☐	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☒	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance? (*Addressed in 4.4, Biological Resources – Terrestrial Species.)*	☐	☐	☐	☐

Environmental Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IV. Biological Resources. Would the project:				
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan? (*Addressed in 4.4, Biological Resources – Terrestrial Species.)*	☐	☐	☐	☐

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

Special-status fish that could be affected by WY 2010 Interim Flows are located in the San Joaquin River from the Merced River confluence downstream to the Delta, in major tributaries to the San Joaquin River in this reach, and in the Delta. No self-sustaining special-status fish in the Restoration Area. However, under extended wet conditions, anadromous fish including Central Valley steelhead may occasionally be found in the Restoration Area. Special-status fish may be affected by alteration of habitat conditions or resources; alteration of interactions with predators and prey; diversions; or alteration of natural processes that sustain habitats (e.g., river flow regimes). Effects to special-status fish species' movements or migration are discussed under item d) below. Increasing flows in the San Joaquin River below the Merced River confluence under the Proposed Action would not cause substantial adverse effects directly on special-status fish or their habitats in the San Joaquin River. Any such effects would be **less than significant**. Effects of the Proposed Action on the various sensitive fish species found in the Delta, listed below, are discussed:

- Delta smelt
- Longfin smelt
- Fall-run Chinook salmon
- Central Valley steelhead
- Green sturgeon
- Sacramento splittail

The effects of the SJRRP on Delta fish were assessed using environmental factors of potential importance to fish and associated evaluation variables (Table 4-3).

Table 4-3.
Environmental Factors and Variables Evaluated for Effects of the Proposed Action on Delta Fish

Environmental Factor	Evaluation Variable
Fish movement/distribution	San Joaquin River flow at Vernalis, Old and Middle rivers flow, X2
Entrainment	San Joaquin River flow at Vernalis, Old and Middle rivers flow
Predation	San Joaquin River flow at Vernalis, Old and Middle rivers flow
Habitat quality and quantity	San Joaquin River flow at Vernalis, Old and Middle rivers flow, X2
Food web support	San Joaquin River flow at Vernalis, Old and Middle rivers flow, X2

Key: X2 = distance upstream from Golden Gate Bridge where salinity equals 2 parts per thousand.

Flow patterns and diversion rates in the south Delta are believed to strongly influence fish distributions in the south Delta. Three flow variables simulated by CalSim (San Joaquin River flow at Vernalis, combined Old River and Middle River flows, and X2) were used to quantify WY 2010 Interim Flow effects on Delta fishes with regards to movement/distribution, susceptibility to entrainment at diversions, predation, habitat quality and quantity, and food supply. Evaluations were conducted comparing the effects during different water year-types. Water year-types for all Delta analyses are based on the Sacramento Valley Index because the Sacramento Index better represents what is happening in the Delta (because of the disproportionate influence of the Sacramento River). Additional information on the methodology and assumptions used in CalSim simulations in support of this EA/IS is presented in the Modeling Appendix (Appendix G). As stated previously, the CalSim model represented the best science available at the time this document was prepared.

The Delta is a highly modified and complex environment, and most factors responsible for changes in fish populations are poorly understood, despite years of research effort. Because changes in flow are thought to be a key factor affecting Delta fisheries, the assessment of project-related effects uses changes in tidally averaged flow to define the level of effects to fish populations. The largest flows in the Delta are tidal flows, which far exceed other flows in most Delta channels, but nontidal flows determine the net direction of water movement and thereby affect fish movements.

Changes in Delta channels and patterns of flow circulation have strongly affected fish distribution, migration behaviors, survival, and spawning success for in-Delta spawners such as delta smelt and longfin smelt. Effects on movement are especially important in the south Delta, where the Jones and Banks pumping facilities can have substantial effects on Delta hydrodynamics, as well as direct effects through entrainment and indirect effects through increased predation and other mechanisms.

Barriers installed in south Delta channels to control water levels impede fish movements and degrade their condition. Inflow from the San Joaquin River is beneficial in helping to move fish downstream and away from the influence of the pumps. Mechanisms that are believed responsible for causing reverse flows and other unnatural flow patterns adversely affect fish movements in the south Delta by directly transporting weak swimming fish to the pumping facilities and attracting larger fish migrating downstream to the ocean to follow the reverse flows to the pumps in the south Delta where survival rates are low. Reverse flows in the south Delta make fish more vulnerable to entrainment at the pumps and delay migrations through or from the south Delta.

Although the WY 2010 Interim Flows would then be implemented pursuant to FWS 2008 and NMFS 2009 CVP and SWP Operations BOs, the Proposed Action is expected to result in increased mean monthly San Joaquin River inflow into the Delta in each WY type, except during December, January, and August (Table 4-4). Changes from the No-Action Alternative to the Proposed Action in mean monthly combined Old River and Middle River flow for years in which the flows under the No-Action Alternative were negative are displayed in Table 4-5. Large increases in mean reverse flows were found for most water year-types during April and for above-normal and below-normal years in March. March had large decreases in mean reverse flows for wet and dry years. The changes were small for most other months. The anomalously large mean percent increase in reverse flow for February of dry years (74 percent), as shown in Table 4-5, results from a change for February 1949 from -395 cfs for the No-Action Alternative to -5,606 cfs for the Proposed Action, a 1,320 percent increase in reverse flow. This predicted change may result from a modeling artifact, and likely does not accurately represent expected changes. When 1949 is excluded, the mean percent change for February of dry years is 1 percent.

Table 4-4.
Percent Change in Mean Monthly San Joaquin River Delta Inflow from No-Action Alternative to Proposed Action

Water Year-Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	3	10	-1	-3	-3	5	6	2	6	0	0	2
Above-Normal	3	9	-1	-1	1	15	15	3	1	1	0	2
Below-Normal	4	10	0	0	4	27	17	4	2	1	0	1
Dry	4	10	0	0	4	26	16	3	4	1	0	1
Critical	3	8	0	0	5	22	7	3	6	1	1	1

Note: Water year-types are based on the San Joaquin Valley Index.

Table 4-5.
Percent Change in Mean Monthly Old River and Middle River Flow from No-Action Alternative to Proposed Action

Water Year-Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	1	2	1	5	7	-28	5	0	2	0	-1	0
Above-Normal	1	0	5	1	1	6	3	1	-3	0	-1	0
Below-Normal	0	0	1	1	11	13	5	1	0	0	1	0
Dry	0	2	1	1	74	-16	7	0	0	-1	4	1
Critical	0	3	0	-2	1	-3	2	1	-1	4	-2	-1

Note: Water year-types are based on the Sacramento Valley Index.

The mean monthly ratios of San Joaquin River inflow to Old River and Middle River reverse flows increased substantially in November, March, April, and June (Table 4-6). In other months, changes in the mean ratios were generally small. The largest decreases in the mean ratios, minus 4 percent, were found for December of above-normal years and January of wet years. Higher ratios represent increases in natural, downstream flow relative to reverse, upstream flow toward the south Delta and the Jones and Banks export pumps and, therefore, are considered beneficial to most fishes.

Table 4-6.
Percent Change in Mean Monthly Ratio of San Joaquin River Delta Inflow to Reverse Flow of Old River and Middle Rivers from No-Action Alternative to Proposed Action

Water Year-Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	2	7	-1	-4	-2	6	3	1	7	0	1	2
Above-Normal	3	11	-4	-2	0	18	8	8	10	1	1	2
Below-Normal	4	10	-1	-1	-2	23	8	1	2	1	0	2
Dry	4	8	0	0	3	25	9	3	4	2	-2	1
Critical	2	5	0	2	3	18	6	3	8	-3	3	2

Note: Water year-types are based on the Sacramento Valley Index.

Changes in circulation patterns and volume of water diverted affect fish entrainment rates at the export facilities. The biggest Delta diversions are in the south Delta, where the Jones and Banks export facilities entrain millions of fish each year (Reclamation 2008). Current and potential future diversions from the Jones and Banks export facilities are made under, consistent with the USFWS BO issued in December 2008, and the NFMS BO issued in June 2009. The effects of pumping on steelhead in the south Delta were addressed in the NMFS 2009 BO. Reclamation is currently revising CalSim to represent the Reasonable and Prudent Alternatives (RPA) under these BOs; however, this model is not yet available to assess the potential impacts of SJRRP.

Delta operations under the new BO requirements are structured to reduce impacts to steelhead migrating from the San Joaquin system (NMFS 2009). As noted above, recapture of WY 2010 Interim Flows would be subject to the RPAs under the 2008 and 2009 BOs. The new RPAs would reduce potential impacts of the WY 2010 Interim Flows on steelhead migrants and reduce the relative occurrence of entrainment at the pumps. Anticipated changes in Delta flow patterns may benefit steelhead by reducing migration delays and by directing less fish towards the south Delta.

RPAs in the NMFS 2009 BO that would protect steelhead in the San Joaquin system from potential effects of the WY 2010 Interim Flows include the following:

- ***Action III.1.1.*** Establish Stanislaus Operations Group for real-time operational decision-making as described in these actions and implementation procedures.
- ***Action III.1.3:*** Operate the East Side Division dams to meet the minimum flows, as measured at Goodwin Dam.

- ***Action III.2.1.*** San Joaquin River inflow-to-export ratio.

  Increase the inflow-to-export ratio.

- ***Action IV 2.2.*** Six-year acoustic tag experiment.

  Tagged fish will be released to coincide with different periods and operations: March 1 to March 31 (operations dictated by Action IV 2.1), April 1 through May 31 (exports dictated by Action IV. 2.1), and June 1 through June 15 (minimum 1:1 inflow to export ratio).

- ***Action IV.2.3.*** Old River and Middle River flow management.

  From January 1 through June 15, reduce exports as necessary, to limit negative flows to -2,500 to -5,000 cfs in Old River and Middle Rivers, depending on the presence of salmonids.

- ***Action IV.3.*** Reduce likelihood of entrainment and salvage at the export facilities.

  From November 1 through April 30, operations of the Tracy and Skinner Fish Collection Facilities shall be modified according to monitoring data from upstream of the Delta. From January 1 through April 30, implement Action IV.2.3, which includes restrictions on Old and Middle River (OMR) flows rather than set levels of combined export pumping.

- ***Action IV.4.*** Modifications of the operations and infrastructure of the CVP and SWP fish collection facilities.

  Achieve 75 percent performance goal for facility salvage at both Federal and State facilities.

Hundreds of agricultural diversions that entrain small fish are also located in the south Delta. Diversions not only entrain fish, but also affect them indirectly by altering flow patterns, food supply, and habitat. The mean monthly volume of Jones and Banks diversions is expected to increase with the Proposed Action during most months and year-types, with especially large increases during November and February through April of most water year-types (Table 4-7). For all of these months except February, the Proposed Action is also expected to increase the ratio of San Joaquin River inflow to Old River and Middle River flow (Table 4-6).

Table 4-7.
Mean Monthly Changes in Diversions at Jones and Banks Pumping Plants from No-Action Alternative to Proposed Action (cfs)

Water Year-Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	124	136	52	48	262	444	352	13	-10	33	-69	8
Above-Normal	79	38	117	-44	88	146	363	48	53	-8	-34	-22
Below-Normal	14	56	99	54	114	380	333	42	35	49	70	-1
Dry	58	136	82	35	448	225	195	24	17	-27	114	47
Critical	39	240	-11	-78	69	177	47	25	-43	118	-157	-64

Note: Water year-types are based on the Sacramento Valley Index.
Key:
cfs = cubic feet per second

Predation rates in the south Delta are believed to be higher than in other parts of the Delta for a variety of reasons, including (1) turbidity is generally lower in the south Delta (Nobriga et al. 2008; Feyrer et al. 2007) and therefore fish are more visible to their predators, (2) many of the structures and facilities in the south Delta provide excellent conditions for predacious fish, particularly the Clifton Court Forebay and fish louver screens at the Jones and Banks facilities, and (3) recent invasions by the submerged plant, *Egeria densa,* provide favorable habitat conditions for black bass species, which prey heavily on young life stages of other fishes (Nobriga et al. 2005). Increased San Joaquin River Delta inflow and reduced Old River and Middle River reversed flow (as part of the USFWS 2008 BO RPAs) predicted for the Proposed Action would likely reduce numbers of special-status fish species in the south Delta during April through May, and thereby reduce their losses to predation.

Delta outflow establishes the location in the Delta of the low salinity zone, an area that has historically high prey densities and other favorable habitat conditions for rearing juvenile delta smelt, striped bass, and other fish species. The low salinity zone is often referenced by X2, which is the distance upstream from the Golden Gate Bridge where salinity is equal to 2 parts per thousand (ppt). The low salinity zone is believed to provide the best combination of habitat quality when X2 is located downstream from the confluence of the Sacramento and San Joaquin rivers. When Delta outflow is low, X2 is located in the relatively narrow channel of these rivers, and at higher outflows, it moves downstream into more open waters. The Proposed Action would have very little effect on X2. The largest predicted increases are less than 1.5 kilometers. None of the predicted changes in X2 resulted in its movement either from downstream to upstream of the confluence of the Sacramento and San Joaquin rivers. Such a small effect on X2 would be expected because the San Joaquin River has much less effect on Delta outflow than the Sacramento River.

In addition, habitat quality and quantity are affected when inflow and exports change the distribution of fish in the Delta because the Delta varies among regions in habitat quality and quantity. For many fish species, habitat quality in the south Delta is believed to be poor. For instance, turbidity in the south Delta is low, which is considered to reduce the quality of this habitat for delta smelt and other species (Nobriga et al. 2008; Freyer et al. 2007). Therefore, circulation patterns that cause fish to move to the south Delta are likely to affect the populations adversely.

Food web conditions are considered poor in the south Delta because of degraded water quality, high water temperatures, and high diversion rates. Low turbidity levels in the south Delta increase predation on sensitive life stages, and also reduce feeding rates of delta smelt (Baskerville-Bridges et al. 2004) and probably other planktivorous species such as longfin smelt and the early life stages of nearly all species.

Delta Smelt Delta smelt are small fish that spend their entire lives in the Delta. Therefore, they are particularly vulnerable to changes in flows toward the south Delta. Delta smelt juveniles and immature adults reside in the low salinity zone (typically in Suisun Bay or the western Delta), but the adults move upstream to spawn in freshwater during December through April. In years with relatively high Delta outflow, most spawning occurs in Suisun Bay, but in years of low Delta outflow, delta smelt spawn in the upper Delta, including the lower Sacramento and San Joaquin rivers. Delta smelt in the lower San Joaquin River are especially at risk of being drawn into the south Delta by reverse flows. The larvae begin hatching in April and larvae are typically present until June. The larvae are slowly transported downstream as they develop. However, many juveniles remain in upstream portions of the Delta for a month or more, particularly in years with low Delta inflow.

The mean monthly ratio of San Joaquin River inflow to reverse flow in the Old and Middle rivers, used to evaluate the combined effect of the two flow variables, changed little from the No-Action Alternative to the Proposed Action from December through February for most year-types, but increased in March and April for all year-types and in May and June for Above-Normal year-types (Table 4-6). From July through October, changes in the mean monthly ratio were very small (less than 5 percent) for all year-types. The March and April increases in this ratio are considered beneficial for spawning adult delta smelt and for delta smelt larvae and juveniles in the upper Delta. In addition, the Proposed Action would be operated under the 2008 USFWS and 2009 NMFS BOs for the long-term coordinated operations of the CVP and SWP so RPAs would provide adequate protection for delta smelt. The effect of increases in the ratio during March and April would be **less than significant,** but beneficial to delta smelt.

Rearing juvenile delta smelt and immature adults reside in the low salinity zone; therefore, the position of X2 with respect to the south Delta affects the vulnerability of these life stages. However, the changes in X2 under the Proposed Action are negligible and therefore have **no impact** to delta smelt.

Because of the change in Delta flow patterns, the Proposed Action is expected to reduce the movement of mature adult, juvenile, and larval delta smelt towards the south Delta where survival is lowest. Additionally, the Proposed Action is expected to have no effect on the location of the low salinity zone, where most juvenile and immature adult delta smelt reside. On balance, therefore, the effect of the Proposed Action on the distribution of delta smelt would be **less than significant** but beneficial.

Delta smelt are preyed on by numerous piscivorous fish species. Water clarity, structures, and submerged vegetation favor piscivorous fish in the south Delta; therefore, the effects of the Proposed Action on delta smelt would be **less than significant,** but beneficial, by lowering risk of exposure to the south Delta. The high water clarity of the south Delta benefits piscivorous species (i.e., fish that feed on other fish), but adversely affects delta smelt feeding (Baskerville-Bridges et al. 2004). This impact would be **less than significant** but beneficial by reducing the amount of time delta smelt are exposed to the poor feeding conditions in the south Delta.

Overall, the effects of the Proposed Action on delta smelt would be **less than significant** but beneficial by reducing the amount of time they are exposed to the poor habitat and feeding conditions in the south Delta as well as the elevated risks of entrainment and predation.

Longfin Smelt. Longfin smelt spend much of their lives downstream from the Delta, but they migrate to Suisun Bay and the upper Delta to spawn. In Dry years, spawning may occur in the lower sections of the Sacramento and San Joaquin rivers within the Delta. The adults migrate upstream from December through March, and the larvae and small juveniles remain in the Delta from January through May. Because longfin smelt are relatively small, they are probably more vulnerable to the poor conditions of the south Delta and to being entrained into the south Delta by reverse flows. This would be particularly true for larvae that hatch in the lower San Joaquin River. Larvae are poor swimmers and are easily transported by flows.

The mean monthly ratio of San Joaquin River inflow to reverse flow in the Old and Middle rivers changed little from the No-Action Alternative to the Proposed Action from December through February of most year-types, but increased substantially during March and April of all year-types and in May of Above -Normal year-types (Table 4-6). In addition, the Proposed Action would be operated under the 2008 USFWS and 2009 NMFS BOs for the long-term coordinated operations of the CVP and SWP so RPAs would provide adequate protection for longfin smelt. Therefore, the impact of the Proposed Action on the distribution of adult longfin would be **less than significant,** but beneficial. The Proposed Action would reduce the risk to the larval and juvenile stages of movement to the south Delta.

Longfin smelt abundance is correlated with X2. This is believed to result in part from more effective movement of young longfin smelt to downstream rearing areas when Delta outflow, which largely determines X2, is high. However, the Proposed Action causes very little change in X2; therefore, the impact on longfin smelt would be **less than significant**.

Because of the change in Delta flow patterns, the Proposed Action is expected to reduce the movement of mature adult, juvenile, and larval longfin smelt towards the south Delta where survival is lowest. In addition, the Proposed Action is expected to have no effect on longfin smelt abundance due to changes in X2. On balance, therefore, the effect of the Proposed Action on longfin smelt movements is expected to be **less than significant**.

Effects on longfin smelt resulting from predation under the Proposed Action would likely be the same as those for Delta smelt. Therefore, the effects of the Proposed Action would be **less than significant,** but beneficial, by reducing exposure time to predators in the south Delta.

The high water clarity of the south Delta benefits piscivorous species, but adversely affects longfin smelt feeding (Baskerville-Bridges et al. 2004). The effect of the Proposed Action on longfin smelt would be **less than significant** but beneficial by reducing the amount of time the smelt are exposed to the poor feeding conditions in the south Delta.

Overall, the effect of the Proposed Action on longfin smelt would be **less than significant** but beneficial by reducing the amount of time the smelt are exposed to the poor habitat and feeding conditions in the south Delta, as well as the elevated risks of entrainment and predation.

Central Valley Fall-Run Chinook Salmon and Other Evolutionarily Significant Units. Fall-run Chinook salmon migrate through the Delta as adults from September to November to spawn in the east-side tributaries of the San Joaquin River, and as juveniles and smolts emigrating in March through June. Increased flows resulting from the Proposed Action may trigger upstream migration. The Proposed Action is predicted to result in slightly higher mean monthly San Joaquin River Delta inflow during September and October and substantially higher inflow during November of all year-types (Table 4-4). Higher inflow helps prevent straying of San Joaquin River Chinook salmon into the Sacramento River basin (Mesick 2001).

Increased San Joaquin River Delta inflow would likely benefit emigrating Chinook salmon. Tagging studies conducted for VAMP have demonstrated that smolt survival through the Delta is positively correlated with San Joaquin River inflow (SJRGA 2001 to 2009). The Proposed Action would result in substantially increased San Joaquin River inflows into the Delta in most nonwet years during March and April, and more modest increases in May and June (Table 4-4). The effects of these changes are expected to be **less than significant,** but beneficial to emigrating Chinook salmon migration and distribution. This is true for all evolutionarily significant units of Chinook salmon.

Adult Chinook salmon migration in the San Joaquin River is often delayed by low dissolved oxygen levels near the Stockton Deep Water Ship Channel (Giovannini 2005). Increased inflow in these months would potentially provide stronger cues to initiate spawning migration, improve the dissolved oxygen conditions near Stockton, and help keep the salmon from straying out of the San Joaquin River channel into the south Delta. The effects of the Proposed Action to Chinook salmon migration and distribution would be **less than significant** but beneficial from increased Delta inflow. This is true for all evolutionarily significant units of Chinook salmon.

Reverse flows likely cause increased straying of migrating adults into the south Delta, where their progress may be impeded by barriers and irregular flow patterns. The October and November increases in the ratio of San Joaquin River Delta inflow to reverse flow of the Old and Middle rivers expected for the Proposed Action similarly suggest that environmental cues would improve for keeping the adults from straying from the river. All of these effects are positive, but the changes in flows are generally not large enough to provide much benefit for the adult salmon. In addition, the Proposed Action would be operated under the 2008 USFWS and 2009 NMFS BOs for the long-term coordinated operations of the CVP and SWP so RPAs would provide adequate protection for Chinook salmon. Therefore, there would be **no impact** to Chinook salmon migration resulting from reverse flows. This is true for all evolutionarily significant units of Chinook salmon, including both winter-run and spring-run Chinook salmon from the Sacramento River.

The Proposed Action would be 2008 USFWS and 2009 NMFS BOs and RPAs would provide adequate protection for Chinook salmon The effects of the Proposed Action to Chinook salmon, especially fall-run Chinook salmon in the San Joaquin River, would be **less than significant** but beneficial by reducing the transit time of emigrating Chinook salmon through the south Delta, resulting in reduced predation.

Adult Chinook salmon do not feed during their spawning migrations, whereas juvenile Chinook salmon feed primarily on zooplankton and other macroinvertebrates while emigrating through the Delta. Food web conditions are considered poor in the south Delta because of poor water quality, high water temperatures, and high diversion rates. The high water clarity of the south Delta benefits piscivorous species, but is likely to adversely affect plankton feeding by juvenile Chinook salmon. The Proposed Action is expected to reduce the transit time of emigrating smolts through the south Delta, which would allow the smolts to more quickly access areas with better food web conditions and cause a **less-than-significant** but beneficial effect on all runs of Chinook salmon.

The Proposed Action is expected to have a **less than significant** but beneficial effect on San Joaquin River fall-run Chinook salmon.

Central Valley Steelhead. Less information regarding steelhead in the San Joaquin basin is available than for Chinook salmon, in part due to low population sizes in the tributaries. Steelhead adults migrate upstream through the Delta primarily from November through January as they move toward the San Joaquin River tributaries. Increased San Joaquin River inflow would likely trigger and improve conditions for upstream migrating steelhead, but at a lower level than for Chinook salmon because December and January are likely to experience little to no changes in the mean monthly ratio between Delta inflow and reverse flow between the Proposed Action and the No-Action Alternative (Table 4-6). In addition, the Proposed Action would be operated under the 2008 USFWS and 2009 NMFS BOs for the long-term coordinated operations of the CVP and SWP so RPAs would provide adequate protection for Central Valley steelhead. The Proposed Action would have a low magnitude of changes in flows on the Merced, Tuolumne, and Stanislaus rivers shown in the Hydrology and Water Quality section, when compared with historical variability.

Steelhead juveniles and smolts emigrate through the Delta in spring, with the median migrations occurring in March. The effects of the Proposed Action on steelhead resulting from Delta flows and diversions are expected to be similar to those on salmon, although effects on steelhead have not been studied.

The effects of the Proposed Action on predation and food web support of emigrating steelhead are poorly known, but likely to be similar to those for emigrating Chinook salmon. The effects of the Proposed Action in reducing predation effects, and improving food web conditions to steelhead, are considered **less than significant**.

Overall, effects of the Proposed Action on migrating adult steelhead and emigrating smolts is expected to be minor. Therefore, effects of the Proposed Action on Central Valley steelhead are expected to be **less than significant**.

Green Sturgeon. Little is known about factors in the Delta that affect the abundance of green sturgeon. Adults migrate up the Sacramento River to spawn from April through June, but likely do not spawn in the San Joaquin River. Juvenile sturgeon are entrained in the Jones and Banks export facilities, but entrainment numbers are low relative to those of most Delta species. Movements of adult green sturgeon are likely impeded by the temporary barriers used to control water levels in the south Delta. It may be assumed that sturgeon are adversely affected by poor habitat conditions in the south Delta and would benefit from flows that reduced their exposure to this portion of the Delta.

Because green sturgeon reside in the Delta throughout the year, they would be potentially affected by changes resulting from the Proposed Action in any month. In addition, the Proposed Action would be operated under the 2008 USFWS and 2009 NMFS BOs for the long-term coordinated operations of the CVP and SWP so RPAs would provide adequate protection for green sturgeon.. San Joaquin River Delta inflows and reverse flows may affect movement of adult or juvenile green sturgeon into the south Delta. Flow conditions expected under the Proposed Action would likely result in reduced exposure of green sturgeon to the south Delta. The estimated mean monthly ratio of inflow to reverse flow of the Old and Middle rivers was greater for the Proposed Action than the No-Action Alternative during October and November and March through June of most year-types, while the change was generally small or evenly balanced between increases in decrease during the other months (Table 4-6). Therefore, the effect of the Proposed Action on green sturgeon movement and distribution would be **less than significant**.

Little is known about predation on juvenile green sturgeon. Water clarity, structure, and submerged vegetation favor piscivorous fish in the south Delta; therefore, the effect of the Proposed Action on green sturgeon would be **less than significant** but beneficial by lowering risk of exposure in the south Delta to predators.

Green sturgeon feed on benthic macroinvertebrates and small fish. The effect of the Proposed Action on the abundance of the prey items or on feeding opportunities for green sturgeon would be **less than significant**.

Overall, the Proposed Action is expected to have no effect or a minor benefit on adult and juvenile green sturgeon. Therefore, the impact on the species would be **less than significant**.

Sacramento Splittail. Sacramento splittail migrate upstream to spawn, but juveniles and adults are found in the Delta throughout the year. Sacramento splittail primarily spawn in the Sacramento River, but in wetter years spawning also occurs in the San Joaquin River (Moyle et al. 2004). Sacramento splittail are particularly vulnerable to entrainment in the Jones and Banks pumping facilities during their upstream migrations from December through March and downstream migrations as juveniles during May and June. Sacramento splittail are affected by poor conditions in the south Delta and are most likely to occur in the south Delta during the same months in which they are most vulnerable to entrainment in the south Delta pumps.

Increased San Joaquin Delta inflow and reversed Old River and Middle River flow are considered to have the greatest effect on Sacramento splittail from the Proposed Action. From December through March, when adult Sacramento splittail are most vulnerable to entrainment (Moyle et al. 2004), the mean ratio of these flows is predicted to increase from the Proposed Action during March of all year-types, but is predicted to change little or decrease slightly during the other months (Table 4-6). Juvenile Sacramento splittail are most vulnerable during May and June. The ratio is expected to increase substantially during June of Wet, Above-Normal, and Critical year-types, and during May of Above-Normal year-types. These results indicate that the effects of the Proposed Action on juvenile Sacramento splittail movement are expected to be **less than significant** but beneficial, and the effects on movements of adults would be **less than significant**. In addition, the Proposed Action would be operated under the 2008 USFWS and 2009 NMFS BOs for the long-term coordinated operations of the CVP and SWP so RPAs would provide adequate protection for Sacramento splittail.

Adult Sacramento splittail are strong swimmers and may be able to avoid most potential predators. However, the larvae and juveniles are preyed on by a number of piscivorous fish species. Water clarity, structure, and submerged vegetation favor piscivorous fish in the south Delta; therefore, the Proposed Action would likely reduce predation on young Sacramento splittail by reducing the time young Sacramento splittail spend in the south Delta. This effect would be **less than significant** but beneficial.

Older Sacramento splittail take much of their prey from the bottom. Important food items include mollusks, benthic invertebrates, and detritus. Food web conditions for adult Sacramento splittail are poor in the south Delta because of poor water quality, high water temperatures, and high diversion rates. Sacramento splittail larvae and small juveniles are planktivorous. The high water clarity likely has an adverse effect on the planktivorous feeding of the young juveniles and larvae. The effect of the Proposed Action on Sacramento splittail would be **less than significant** but beneficial by reducing the amount of time they are exposed to the poor feeding conditions in the south Delta.

Overall, the effect of the Proposed Action on Sacramento splittail would be **less than significant** but beneficial by reducing the amount of time they are exposed to the poor habitat and feeding conditions in the south Delta, as well as to elevated risks of entrainment and predation.

Summary of Species Effects

In summary, implementing the Proposed Action would not have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by DFG or USFWS. The overall impact would be **less than significant**.

Implementing the No-Action Alternative also would not result in any substantial adverse effects, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations by DFG or USFWS. Most adverse and beneficial effects on these species that were described for the Proposed Action would either not occur or be less under the No-Action Alternative than under the Proposed Action.

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

This question is addressed above under “Biological Resources – Terrestrial Species.”

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

This question is addressed above under “Biological Resources – Terrestrial Species.”

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

San Joaquin River Upstream from Friant Dam

No special-status fish species are found in Millerton Lake. Millerton Lake surface water elevations would change minimally, and within the historical range, under the Proposed Action. Spawning for both spotted and largemouth bass occurs between March and June. It is possible that both species would experience lower reservoir elevations, which could reduce the amount of shallow-water habitat available for spawning and rearing. Both species may also experience a more rapid decrease in elevation during the spawning season for a period of time. However, it is not anticipated that this difference would result in a substantial reduction in the populations. Millerton Lake is already subject to highly fluctuating and generally declining water surface elevations throughout the spring, summer, and fall. Therefore, impacts to Millerton Lake fish are **less than significant**.

San Joaquin River from Friant Dam to the Merced River

Part of the purpose of the WY 2010 Interim Flows is to support collection of relevant data concerning flows, water temperatures, and potential habitat that might exist after the reintroduction of Chinook salmon. As a result, flows would increase in all river reaches throughout the WY 2010 Interim Flow period (note that WY 2010 Interim Flows are not released between November 21, 2009, and January 31, 2010). In addition, Interim Flows would not pass through Reach 4B1; therefore, no evaluation of fisheries would be conducted for this reach. WY 2010 Interim Flows would instead flow through the Eastside Bypass. Therefore, it is assumed that the Restoration Area would have continuous flow and, as a result, resident fish that currently exist in the Restoration Area would have the ability to move more readily throughout the Restoration Area, and those that occur downstream from the Restoration Area may be able to move into the Restoration Area.

Currently, perennial cold-water flows occur in Reach 1. Increased flow in Reaches 1 and 2 under the Proposed Action would likely result in beneficial effects by potentially increasing the amount of habitat available for different life stages, as well as potentially triggering geomorphic processes that could assist in increasing habitat complexity. When sufficient flows and water temperatures occur in Reach 2, fish would likely move downstream to occupy Reach 2 except where barriers exist. These impacts are considered to be **less than significant** but beneficial.

Flows in Reach 3 under the Proposed Action would increase relative to the No-Action Alternative in most months unless the water year-type is Wet or Normal-Wet, in which case, there might be a slight decrease in flows for flood operations. In addition, water temperatures would likely decrease in March through April, and perhaps also in May. As a result, the impacts to cold-water fish would be **less than significant** but beneficial.

Reaches 4A and 4B2 would be affected similar to Reach 3. February to May would have increases in flow, but could have some decreases in flow during Wet and Normal-Wet water year-types from flood operations. Water temperatures would likely decrease in February to May. Therefore, these impacts would be **less than significant** but beneficial.

Reach 4B would not receive additional flow, and would have no change relative to the No-Action Alternative. There would be **no impact** to fish in Reach 4B.

As with Reaches 3 and 4A, flows in Reach 5 would likely decrease from December through June if a Wet water year-type occurs, and from December through January if a Normal-Wet water year-type occurs. In all other water year-types, flows would increase relative to the No-Action Alternative. Water temperatures would slightly decrease in March through May. Therefore, these impacts would be **less than significant** but beneficial to fish.

Because a monitoring and salvage operation is identified for Central Valley steelhead upstream from the confluence with the Merced River, the impact to steelhead would be **less than significant**.

San Joaquin River from Merced River to the Delta

The San Joaquin River downstream from the confluence with the Merced River could experience temperature changes under the Proposed Action. Potential changes from the No-Action Alternative do not appear to cross a threshold between suitable and unsuitable conditions for steelhead as compared with existing conditions. In general, ambient air temperatures control water temperatures in the lower San Joaquin River and operations exert little influence.

Table 4-8 reports simulated changes in water temperature on the San Joaquin River as a result of WY 2010 Interim Flows for 1981 – 2003 and differences from the No-Action Alternative. Tables 4-9 and 4-10 display water temperatures during the emigration period both upstream and downstream from the Merced River confluence, and with and without WY 2010 Interim Flows. Water temperature changes were simulated through application of the SJR5Q model of the San Joaquin River. SJR5Q includes a representation of operations on the San Joaquin River, and a boundary condition for Merced River operations. This allows the model to investigate changes in temperatures on the San Joaquin River as a result of operations at Friant Dam, while holding operations on the Merced River constant.

Table 4-8.
Simulated Water Temperatures in San Joaquin River Downstream from Merced River During Water Year 2010 Interim Flows and Difference from No-Action Alternative

Water Year	October		November		December		January		February		March		April		May		June		July		August		September	
	°F	Diff	°F	Diff	°F	Diff	°F	Diff	°F	Diff	°F	Diff	°F	Diff	°F	Diff	°F	Diff	°F	Diff	°F	Diff	°F	Diff
1981	65	0.7	56	0.5	48	0.0	48	0.0	55	0.5	60	0.4	69	0.9	73	1.1	81	0.7	82	0.4	81	0.4	77	0.5
1982	66	0.6	56	0.6	48	0.0	46	0.1	53	0.3	58	0.1	61	0.0	67	-0.2	74	-0.3	79	0.1	80	0.3	73	0.3
1983	62	0.3	52	-0.1	48	-0.2	46	0.0	52	0.1	57	0.0	60	0.0	67	0.1	70	0.1	73	0.0	77	0.1	71	0.0
1984	62	0.2	55	0.1	49	-0.1	49	0.0	53	0.1	63	0.8	66	1.0	75	1.1	79	0.5	83	0.4	81	0.3	77	0.4
1985	64	0.4	54	0.3	50	-0.2	46	0.0	54	0.3	61	0.8	69	1.0	72	1.1	79	0.5	82	0.3	80	0.3	74	0.3
1986	65	0.6	53	0.5	46	0.1	49	0.0	54	0.3	59	0.3	63	0.0	70	-0.1	77	0.1	82	0.1	80	0.2	73	0.2
1987	66	0.4	56	0.7	46	0.0	46	0.0	54	0.4	61	0.6	71	0.9	74	0.7	78	0.5	80	0.3	80	0.3	76	0.5
1988	69	0.9	54	0.6	48	0.1	48	0.0	57	0.6	64	1.2	67	1.1	71	0.7	77	0.4	83	0.3	81	0.3	76	0.4
1989	68	0.7	55	0.9	48	0.0	48	0.0	54	0.3	61	1.2	70	1.5	73	1.2	77	0.5	81	0.3	80	0.2	75	0.3
1990	67	0.6	57	0.7	47	0.1	48	0.0	51	0.0	62	1.3	69	1.4	72	0.7	77	0.4	83	0.2	82	0.2	77	0.2
1991	69	0.8	55	0.9	46	0.0	48	0.0	55	0.7	61	1.2	67	1.5	73	1.6	78	0.5	83	0.3	81	0.2	78	0.4
1992	69	1.0	56	1.0	48	0.1	46	0.0	55	0.3	63	1.2	70	1.1	76	0.9	79	0.4	81	0.2	82	0.2	76	0.3
1993	69	0.6	55	1.1	47	0.1	48	0.0	54	0.0	64	0.6	64	-0.1	70	0.1	76	0.8	81	0.1	76	0.3	72	0.4
1994	64	0.5	56	0.5	48	0.0	48	0.0	53	0.1	63	1.4	67	1.1	71	0.7	79	0.4	80	0.3	82	0.2	77	0.2
1995	66	0.5	52	0.4	47	0.0	50	0.0	55	0.6	58	0.1	62	0.0	66	0.0	68	-0.9	76	-0.1	80	0.1	75	0.3
1996	62	0.4	60	0.7	52	0.1	50	0.0	55	0.0	60	0.1	66	0.8	68	-0.2	78	-0.2	82	0.2	81	0.1	75	0.2
1997	65	0.3	56	0.3	50	0.1	50	0.0	53	0.0	61	0.6	66	1.5	74	1.3	79	1.1	83	0.3	82	0.1	78	0.2
1998	67	0.3	58	0.7	48	0.1	50	0.0	53	0.3	60	0.0	63	0.0	65	0.1	70	-0.2	77	0.2	79	0.2	71	0.3
1999	63	0.5	56	0.4	48	0.2	49	0.0	54	0.1	60	0.6	63	1.5	70	1.2	79	0.4	83	0.3	81	0.1	77	0.3
2000	69	0.5	58	0.7	50	0.1	51	0.0	54	0.1	58	0.5	68	2.0	72	1.2	79	0.1	80	0.2	81	0.2	75	0.3
2001	65	0.4	53	0.1	50	0.0	49	0.0	52	0.2	63	0.9	66	1.7	74	1.6	79	0.4	80	0.2	79	0.2	77	0.3
2002	67	0.5	57	0.6	48	0.0	49	0.0	55	0.4	61	0.9	68	1.9	70	1.2	77	0.5	82	0.3	80	0.3	79	0.3
2003	67	0.5	56	0.7	51	0.1	51	0.0	56	0.4	63	1.0	66	2.0	71	1.3	79	0.4	82	0.3	79	0.3	76	0.3

Key:
°F = degrees Fahrenheit
Diff = difference

Table 4-9.
Mean Monthly Water Temperatures Under Existing Flows Upstream (top table) and Downstream (bottom table) from Merced River Confluence

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	68	56	47	47.0	54.7	60.6	68.5	73.1	80.1	82	81	77
1982	66	56	48	46.1	53.5	59.2	63.5	71.3	76.7	81	81	74
1983	66	53	48	45.4	52.2	57.2	61.5	68.1	72.7	75	80	75
1984	66	55	48	48.1	53.4	62.6	66.4	75.0	78.9	83	81	77
1985	65	53	46	43.9	54.1	61.0	69.0	72.4	78.9	82	80	74
1986	66	53	46	49.0	53.4	59.7	66.0	72.4	78.1	82	80	74
1987	67	56	47	46.2	54.1	61.2	70.6	74.5	78.3	80	80	75
1988	69	55	49	48.0	***56.3***	63.6	66.5	71.3	76.8	83	80	76
1989	68	55	48	47.7	54.0	60.9	68.9	73.5	77.6	81	80	75
1990	67	57	48	48.4	51.4	61.1	68.6	72.0	77.5	83	82	77
1991	69	56	46	47.4	54.4	61.8	67.3	73.5	78.6	83	82	78
1992	70	57	48	46.3	54.8	63.0	70.2	77.0	79.1	81	82	77
1993	70	56	47	47.5	54.5	64.2	67.9	74.1	78.6	83	81	77
1994	69	56	48	48.1	52.6	62.2	***67.4***	73.2	79.7	83	82	77
1995	68	53	46	50.4	54.6	58.4	64.1	69.2	76.1	79	83	78
1996	69	60	52	50.2	56.7	62.1	67.0	71.2	78.5	82	81	75
1997	66	56	50	49.3	53.2	62.4	66.2	75.6	77.9	83	82	78
1998	67	58	48	49.7	52.2	61.5	64.1	67.1	73.7	80	83	78
1999	67	56	47	47.9	55.2	60.9	65.0	72.2	79.4	83	81	77
2000	69	58	50	50.7	54.5	60.6	68.4	72.8	79.0	80	81	75
2001	66	54	50	49.2	53.1	62.9	***67.5***	78.1	79.1	80	80	77
2002	68	57	47	49.3	55.2	61.4	***67.6***	72.7	77.9	83	81	79
2003	68	57	51	51.5	56.1	62.5	66.1	72.7	79.4	82	80	77

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	65	55	48	47.6	54.5	59.9	***67.9***	72.3	79.8	82	80	76
1982	65	55	48	46.2	53.2	58.3	60.9	67.4	74.3	79	79	73
1983	62	52	48	46.0	52.3	56.6	60.2	66.5	69.9	73	77	71
1984	62	54	49	48.8	53.3	61.9	65.4	73.8	78.1	83	81	77
1985	64	53	50	46.2	53.9	60.4	68.3	71.4	78.4	82	80	73
1986	65	53	46	49.0	53.4	58.9	63.5	69.6	77.4	82	80	73
1987	66	56	46	46.3	53.9	60.7	70.1	73.5	77.8	80	79	75
1988	68	54	48	48.0	56.0	63.2	66.0	70.5	76.5	83	80	76
1989	67	54	48	47.5	53.6	60.2	68.3	72.1	77.0	81	80	75
1990	67	56	47	48.2	51.1	60.4	***67.7***	70.9	76.9	83	82	77
1991	68	54	46	48.2	54.3	59.4	65.8	70.9	77.9	82	81	77
1992	68	55	48	46.4	54.8	62.3	69.0	75.0	78.4	81	82	76
1993	68	54	47	47.7	54.2	63.4	63.7	69.6	75.0	81	75	72
1994	64	55	48	48.2	52.4	61.6	65.6	70.3	78.4	80	82	77
1995	66	52	47	50.5	54.6	57.6	61.7	66.0	***68.8***	76	80	74
1996	62	59	51	50.0	55.2	59.4	65.1	***68.2***	78.0	82	81	75
1997	64	55	50	49.7	52.6	60.8	64.3	73.1	77.4	82	82	78
1998	66	57	48	50.1	52.2	60.0	62.5	65.3	70.6	77	79	71
1999	62	56	48	48.9	54.2	59.7	61.5	68.9	78.5	83	81	77
2000	68	57	50	50.7	54.1	58.0	65.9	70.4	78.6	80	80	75
2001	64	53	50	48.7	52.3	62.2	64.8	72.6	78.1	79	79	76
2002	67	56	48	48.9	54.8	60.4	65.9	68.6	76.7	82	80	78
2003	66	56	51	51.2	55.3	61.9	63.5	69.2	78.3	82	79	76

Table 4-10.
Mean Monthly Water Temperatures Under Water Year 2010 Interim Flows Upstream (top table) and Downstream (bottom table) from Merced River Confluence

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	68	57	47	47.0	55.4	60.8	69.2	74.1	81.0	83	81	77
1982	66	57	48	46.2	54.1	59.8	63.7	71.9	77.2	82	81	75
1983	66	53	48	45.4	52.4	57.2	61.4	68.4	72.9	76	80	75
1984	67	55	48	48.1	53.6	63.4	66.9	75.9	79.5	84	81	78
1985	65	54	46	43.9	54.4	61.5	69.8	73.5	79.6	83	80	74
1986	66	54	46	49.0	53.8	60.2	66.2	72.6	78.4	82	80	74
1987	67	57	47	46.2	54.6	61.7	71.5	75.3	78.9	80	80	76
1988	70	55	49	48.0	***57.0***	64.8	67.7	72.1	77.2	83	81	76
1989	68	55	48	47.7	54.3	62.0	70.4	74.6	78.1	81	80	75
1990	68	58	48	48.4	51.3	62.3	70.1	72.8	77.9	83	82	77
1991	70	56	46	47.4	55.5	61.9	67.9	74.2	79.1	83	82	78
1992	70	58	48	46.3	55.1	64.1	71.1	77.7	79.5	81	83	77
1993	71	57	47	47.5	54.5	64.6	67.7	74.1	78.2	83	81	77
1994	70	57	48	48.1	52.7	63.6	***68.6***	73.9	80.0	84	82	78
1995	68	53	46	50.4	55.4	58.4	64.3	70.3	76.5	79	83	78
1996	69	61	52	50.2	56.8	62.1	67.3	71.9	78.3	82	82	75
1997	66	56	49	49.2	53.3	63.0	67.1	75.9	78.8	83	83	79
1998	67	58	48	49.7	52.8	61.4	64.2	67.7	74.4	81	83	78
1999	67	57	47	47.9	55.4	61.4	65.5	72.9	79.8	83	81	78
2000	70	59	50	50.7	54.7	60.9	69.7	73.6	79.2	81	81	76
2001	66	54	50	49.2	53.2	63.7	***68.4***	79.2	79.5	80	80	77
2002	68	58	47	49.3	55.7	61.9	***69.1***	73.4	78.4	83	81	79
2003	68	58	51	51.5	56.5	63.4	66.7	73.4	79.9	82	80	77

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	65	56	48	47.6	55.1	60.3	***68.8***	73.3	80.5	82	81	77
1982	66	56	48	46.2	53.5	58.4	60.9	67.2	74.0	79	80	73
1983	62	52	48	46.0	52.4	56.5	60.2	66.7	70.0	73	77	71
1984	62	55	49	48.8	53.4	62.7	66.4	74.9	78.7	83	81	77
1985	64	54	50	46.2	54.2	61.1	69.4	72.5	79.0	82	80	74
1986	65	53	46	49.0	53.7	59.2	63.5	69.6	77.5	82	80	73
1987	66	56	46	46.3	54.3	61.4	70.9	74.2	78.3	80	80	76
1988	69	54	48	48.0	56.6	64.4	67.1	71.1	76.9	83	81	76
1989	68	55	48	47.5	53.9	61.4	69.8	73.3	77.4	81	80	75
1990	67	57	47	48.2	51.1	61.7	***69.1***	71.6	77.3	83	82	77
1991	69	55	46	48.2	55.0	60.6	67.3	72.5	78.4	83	81	78
1992	69	56	48	46.4	55.1	63.5	70.1	75.9	78.8	81	82	76
1993	69	55	47	47.7	54.2	64.0	63.6	69.7	75.8	81	76	72
1994	64	56	48	48.2	52.6	63.0	66.8	71.0	78.8	80	82	77
1995	66	52	47	50.5	55.3	57.7	61.7	66.1	***67.9***	76	80	75
1996	62	60	52	50.0	55.2	59.5	65.8	***67.9***	77.8	82	81	75
1997	65	56	50	49.7	52.6	61.4	65.8	74.3	78.6	83	82	78
1998	67	58	48	50.1	52.5	60.0	62.5	65.4	70.5	77	79	71
1999	63	56	48	48.9	54.4	60.4	63.0	70.1	78.9	83	81	77
2000	69	58	50	50.7	54.3	58.5	67.9	71.6	78.7	80	81	75
2001	65	53	50	48.7	52.5	63.2	66.5	74.2	78.5	80	79	77
2002	67	57	48	48.9	55.2	61.3	67.8	69.8	77.2	82	80	79
2003	67	56	51	51.2	55.7	62.9	65.5	70.5	78.7	82	79	76

Tables 4-8 through 4-10 were developed using mean monthly data from the SJR5Q model. Shorter term, such as 7-day, averages were not computed because of the limited accuracy in actual daily data used to define the SJR5Q simulation. However, these mean monthly results can be used to identify trends in water temperatures and identify the potential magnitude of impacts.

Tables 4-12, 4-13, and 4-16 show changes in water temperatures from upstream to downstream of the Merced River confluence both under existing conditions and WY 2010 Interim Flows. The juvenile migration period is highlighted. Green indicates temperatures suitable for smoltification of Central Valley steelhead. Yellow represents water temperatures that are suitable for juvenile migration. Orange represents water temperatures that exceed the suitable criteria established by USEPA (2003). Modeling results indicate that with WY 2010 Interim Flows, water temperatures, particularly downstream from the Merced River confluence, would change on four different occasions to a different level of suitability for salmonids; two of the changes are positive.

Most steelhead emigrate from the San Joaquin system in spring, primarily between February and May, but may emigrate in January and June as well (NMFS 2009). Recommended water temperatures for steelhead smoltification based on a 7-day average of the daily maximum (7DADM) are 57°F and below, but emigration may take place before or after smoltification, when water temperature tolerances are higher (up to 68°F) (USEPA 2003). Fall-run Chinook salmon juveniles emigrate between January and June, with most juveniles emigrating between February and May (NMFS 2009). Optimal water temperatures for Chinook salmon smoltification is 56°F, but rearing/emigrating juveniles can tolerate warmer water temperatures up to 68°F (USEPA 2003).

As shown in Table 4-8, water temperatures in the San Joaquin River downstream from the Merced River would be suitable for steelhead and fall-run Chinook salmon migration and/or smoltification, both with and without WY 2010 Interim Flows, during January of all simulated years, and most years in February. The increment of change between existing conditions and WY 2010 Interim Flows is small (less than 2°F), particularly since the natural variability in the system is already high. In addition, the differences in water temperature between existing conditions and WY 2010 Interim Flows are typically fractional, and may be a result of model noise.

In March, both with and without the WY 2010 Interim Flows, average monthly water temperatures in the San Joaquin River downstream from the confluence with the Merced River would almost always exceed 58°F (and therefore would not be suitable for smoltification), but would not exceed 68°F (and therefore would be suitable for emigration before or after smoltification). Water temperatures in April are sometimes greater than 68°F without WY 2010 Interim Flows, and WY 2010 Interim Flows increase the temperatures by no more than 2°F. Because water temperatures through March in most years would continue to be within the suitable range during WY 2010 Interim Flows (less than 68°F), and because April temperatures which typically already exceed healthy steelhead and Chinook salmon criteria would change slightly, the changes would not adversely affect steelhead and Chinook salmon beyond those effects and stressors to the species that currently exist. In May and June, water temperatures typically exceed healthy criteria for steelhead and Chinook salmon; however, on two occasions, WY 2010 Interim Flows would improve water temperatures. In general, water temperatures improve downstream from the Merced River confluence, particularly in May.

Linear regressions of recorded water temperature and mean daily flow were also performed to estimate the correlation between temperature and flow in the Merced, Tuolumne, and Stanislaus rivers in the months of March and April. Based on this analysis, flows in these three tributaries of the San Joaquin River have a negligible correlation with water temperature. The relationship between flow and temperature was not linear and the range of possible temperatures varied by +/- 10ºF, particularly during lower releases expected by the CalSim modeling under both No–Action Alternative and WY 2010 Interim Flows. The results indicate that as water flows farther from Friant Dam, ambient air temperature conditions dominate over the flow rate in controlling temperature. Therefore, WY 2010 Interim Flows are not likely to affect temperatures on the tributaries.

The San Joaquin River downstream from the confluence with the Merced River would experience an increase, or no change, in flows in all months. Immediately downstream from the confluence, water temperature would increase very slightly in October, March, April, and May. Because the increase would be only 1°F to 2°F (Table 4-8), it is expected that the water would equilibrate quickly downstream, thus minimizing any effects to fish. In addition, Reclamation would implement a program to monitor water temperatures on the Merced River near the San Joaquin River confluence, as described in Section 2. The changes in flow, which would be small, would have no impact to fish, and the water temperature increase would be less than significant.

Records of flow rates and temperatures were compiled for the tributary rivers, as close to the confluences as could be found. The relationship between flow and temperature was not linear: the range of possible temperatures varied by +/- 10ºF, particularly during lower releases expected by CalSim modeling under both the No–Action Alternative and Proposed Action. Conceptually, as water flows farther from Friant Dam, ambient air temperature conditions dominate over the flow rate in controlling water temperature. At the confluence of the tributaries with the San Joaquin River, flow rates do not appear to influence temperatures at lower ranges of release. Changes in tributary flows as a result of WY 2010 Interim Flows are unlikely to change water temperatures because ambient air temperature conditions dominate.

The temperature model, SJR5Q, is a 6-hour time step model of the San Joaquin River from Millerton Lake to the confluence with the Merced River. SJR5Q is a subset of a larger model of the San Joaquin River system that extends downstream to the Delta and upstream on the tributary rivers.

A short “stub” represents the Merced River in the SJR5Q model. This does not include any storage on the Merced River or in most of the reach of the river from Lake McClure to the San Joaquin River. All of the information on how the Merced River flows could change because of WY 2010 Interim Flows comes from the CalSim monthly model.

Real-time flow changes could be much different on a daily basis because of operational and local inflow variations, especially since the VAMP period and the WY 2010 Interim flow periods could move within their respective time windows, changing the days when they do or do not interact.

Historical data were used to determine whether a relationship exists between flow and temperature in the tributary rivers near the confluence with the San Joaquin River that could be used to approximate any potential changes in Merced River inflow to the San Joaquin. Historical data showed almost zero correlation between Merced River flows and temperature at the confluence with the San Joaquin River. This indicates that the temperatures at this location have reached equilibrium and would not change because of changes in Merced River flows, including potential changes that could occur as a result of WY 2010 Interim Flows. In addition, water temperatures recorded from the DWR gages on the San Joaquin River at Crows Landing, and in the Merced River at Stevenson, were graphed for a wet and dry water year, to show the current trend in water temperatures throughout the year (Figures 4-1 and 4-2)

Tables 4-11 through 4-22 show flows and temperatures at three locations, as reported by SJR5Q.

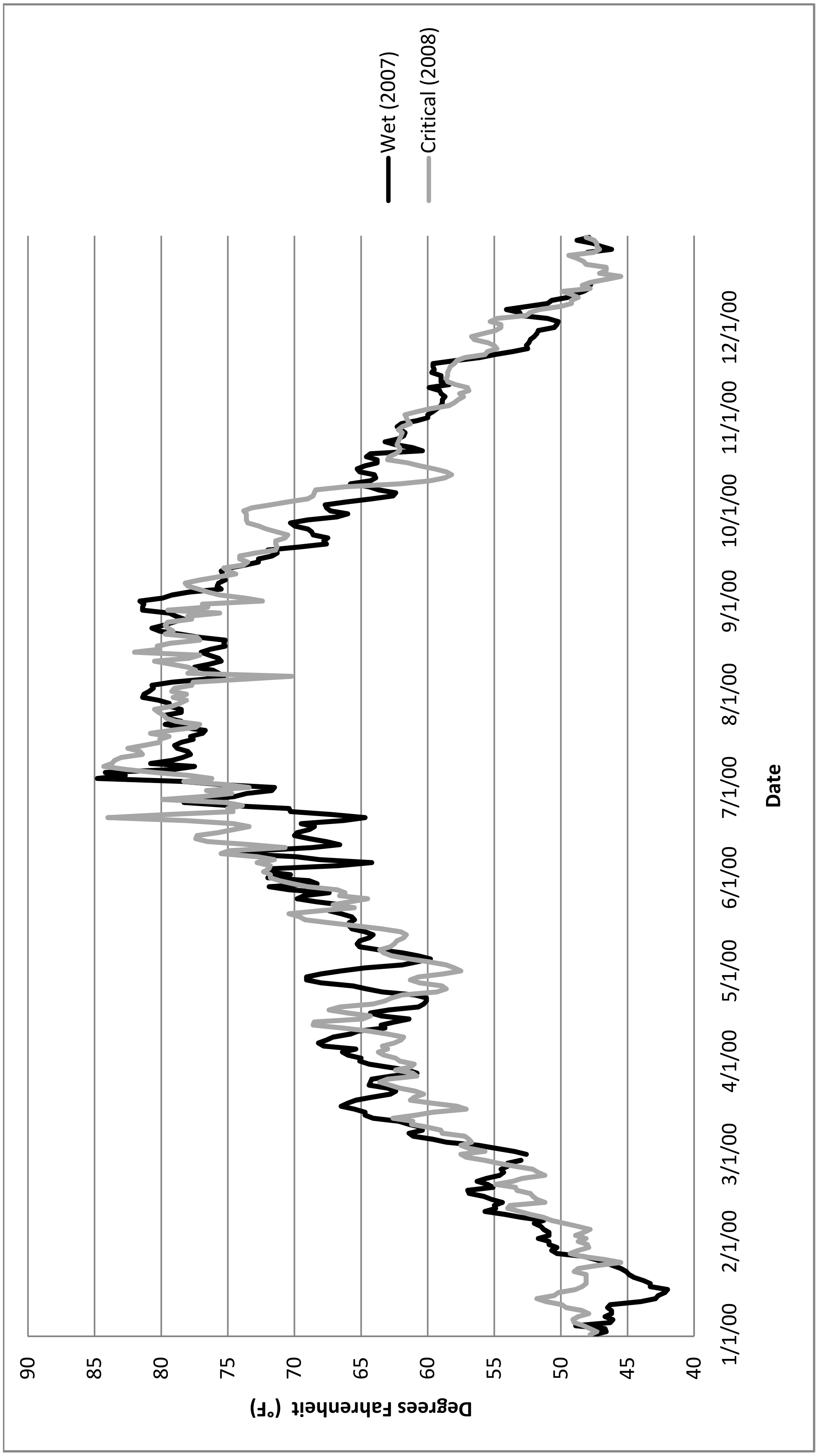

Figure 4-1.
Mean Daily Water Temperature at Merced River at Stevenson

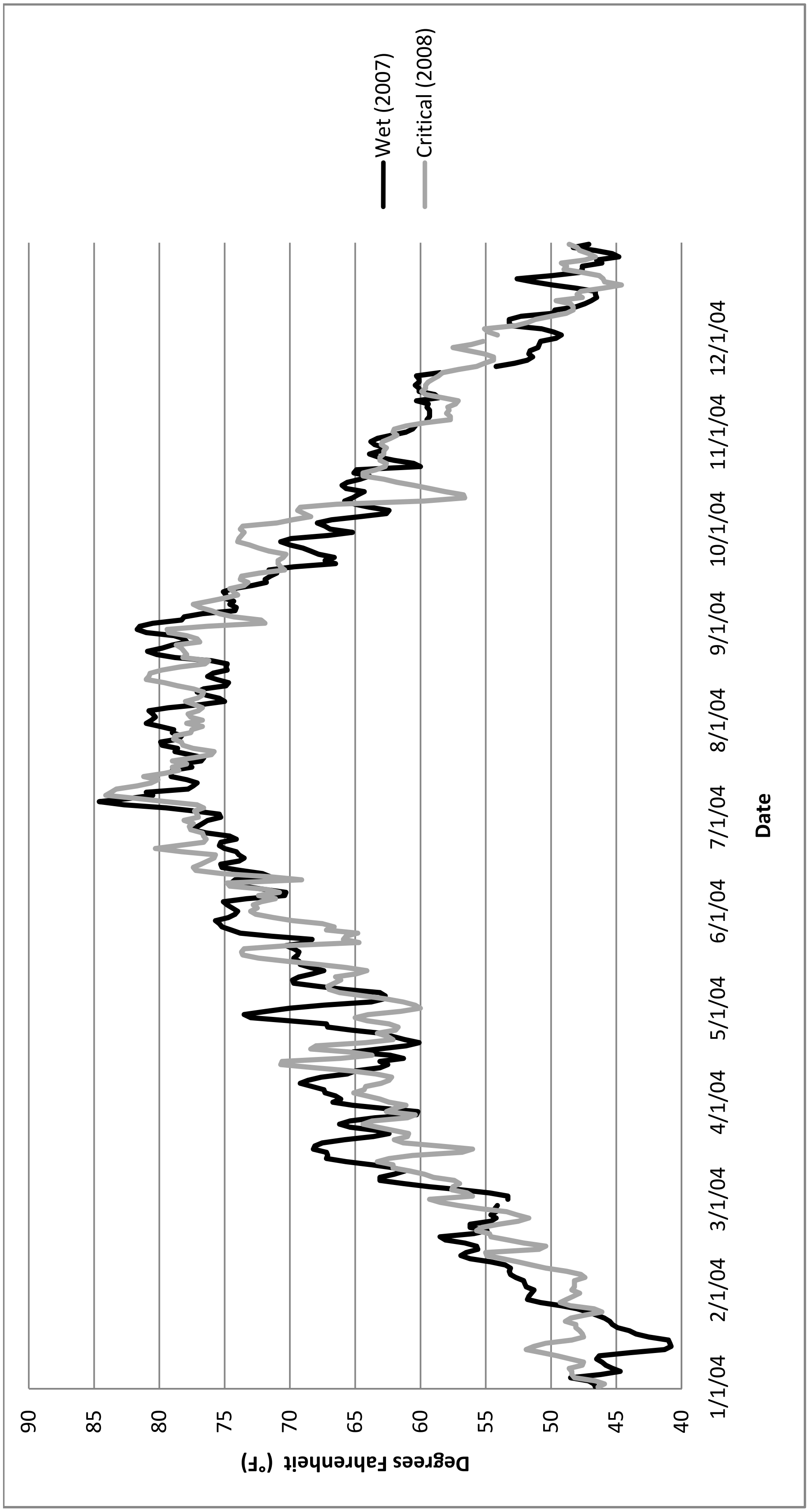

Figure 4-2.
Mean Daily Water Temperature at San Joaquin River at Crows Landing

Table 4-11.
Simulated Monthly San Joaquin River Flows, Upstream from Merced River Confluence, under Existing Conditions (cubic feet per second)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	477	286	309	486	704	959	543	410	310	389	410	367
1982	314	359	447	1,066	2,802	3,433	8,353	7,456	2,973	1,280	754	1,019
1983	1,142	2,229	8,423	9,822	15,241	16,539	13,477	11,523	12,838	9,738	1,452	1,639
1984	2,388	2,658	6,118	5,801	879	859	717	550	558	538	627	602
1985	620	218	128	295	503	711	676	488	482	545	603	572
1986	407	269	402	545	5,080	9,187	6,063	3,823	3,329	1,190	874	793
1987	558	366	359	417	561	868	587	461	478	552	544	423
1988	299	374	282	479	447	611	493	358	433	415	537	448
1989	339	174	238	295	344	417	514	351	370	434	484	433
1990	425	391	394	359	425	407	329	273	277	377	421	303
1991	210	161	116	98	104	592	316	158	162	232	257	176
1992	142	111	118	163	485	460	287	148	195	237	274	246
1993	193	97	150	1,556	1,256	1,042	1,273	1,338	791	878	475	399
1994	418	468	457	445	730	533	332	223	271	333	403	351
1995	281	232	292	1,608	2,445	6,537	6,409	7,525	3,084	6,347	957	785
1996	652	483	523	634	1,870	2,836	778	2,338	1,333	613	735	617
1997	533	703	3,110	16,659	11,725	1,511	463	1,163	395	434	536	473
1998	547	458	609	1,070	8,383	4,905	7,800	7,996	6,378	7,076	861	822
1999	913	705	605	441	896	888	560	412	402	505	583	528
2000	588	470	290	415	1,285	1,264	595	531	573	530	495	401
2001	535	575	525	628	680	947	487	382	398	417	452	380
2002	389	517	446	669	546	612	316	299	313	379	378	351
2003	352	468	732	654	547	762	337	288	355	394	396	343
Minimum	*142*	*97*	*116*	*98*	*104*	*407*	*287*	*148*	*162*	*232*	*257*	*176*
Average	*553*	*555*	*1,090*	*1,939*	*2,519*	*2,473*	*2,248*	*2,108*	*1,595*	*1,471*	*587*	*542*
Maximum	*2,388*	*2,658*	*8,423*	*16,659*	*15,241*	*16,539*	*13,477*	*11,523*	*12,838*	*9,738*	*1,452*	*1,639*

Table 4-12.
Simulated Monthly San Joaquin River Temperatures, Upstream from Merced River Confluence, under Existing Conditions (degrees Fahrenheit)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	68	56	47	47	55	61	69	73	80	82	81	77
1982	66	56	48	46	54	59	63	71	77	81	81	74
1983	66	53	48	45	52	57	61	68	73	75	80	75
1984	66	55	48	48	53	63	66	75	79	83	81	77
1985	65	53	46	44	54	61	69	72	79	82	80	74
1986	66	53	46	49	53	60	66	72	78	82	80	74
1987	67	56	47	46	54	61	71	75	78	80	80	75
1988	69	55	49	48	56	64	66	71	77	83	80	76
1989	68	55	48	48	54	61	69	74	78	81	80	75
1990	67	57	48	48	51	61	69	72	78	83	82	77
1991	69	56	46	47	54	62	67	73	79	83	82	78
1992	70	57	48	46	55	63	70	77	79	81	82	77
1993	70	56	47	48	55	64	68	74	79	83	81	77
1994	69	56	48	48	53	62	67	73	80	83	82	77
1995	68	53	46	50	55	58	64	69	76	79	83	78
1996	69	60	52	50	57	62	67	71	78	82	81	75
1997	66	56	50	49	53	62	66	76	78	83	82	78
1998	67	58	48	50	52	62	64	67	74	80	83	78
1999	67	56	47	48	55	61	65	72	79	83	81	77
2000	69	58	50	51	55	61	68	73	79	80	81	75
2001	66	54	50	49	53	63	68	78	79	80	80	77
2002	68	57	47	49	55	61	68	73	78	83	81	79
2003	68	57	51	52	56	62	66	73	79	82	80	77
Minimum	*65*	*53*	*46*	*44*	*51*	*57*	*61*	*67*	*73*	*75*	*80*	*74*
Average	*68*	*56*	*48*	*48*	*54*	*61*	*67*	*73*	*78*	*82*	*81*	*76*
Maximum	*70*	*60*	*52*	*52*	*57*	*64*	*71*	*78*	*80*	*83*	*83*	*79*

Table 4-13.
Simulated Monthly San Joaquin River Flows, Upstream from Merced River Confluence, Under the Proposed Action (cubic feet per second)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	659	548	384	495	911	1,675	1,343	697	445	478	527	498
1982	490	605	515	993	1,639	2,644	8,013	6,272	2,197	1,315	875	1,157
1983	1,184	1,881	7,662	9,420	14,212	16,504	13,467	10,748	12,312	9,658	1,484	1,640
1984	2,492	2,904	5,149	5,519	1,051	1,579	1,899	979	690	659	745	736
1985	799	497	205	304	715	1,445	1,456	768	599	657	723	705
1986	571	536	476	473	4,142	8,270	5,717	3,458	3,083	1,315	993	925
1987	744	635	422	425	760	1,565	914	597	605	661	652	555
1988	459	639	348	483	629	1,280	806	500	545	502	621	558
1989	479	404	295	305	532	1,123	1,270	623	475	505	548	533
1990	569	624	434	368	617	1,073	631	385	362	436	475	384
1991	331	384	154	100	275	1,297	1,087	416	245	293	314	264
1992	256	334	157	164	664	1,130	590	261	277	295	327	317
1993	304	319	189	1,550	1,211	1,543	1,369	1,431	1,697	1,093	529	470
1994	531	695	497	447	899	1,199	634	339	353	392	456	422
1995	393	455	331	1,536	1,393	6,714	5,913	5,817	2,245	6,130	999	862
1996	764	705	562	635	1,917	2,984	1,634	1,112	1,042	674	789	691
1997	645	934	1,945	16,286	10,886	1,799	1,705	1,714	1,560	782	589	544
1998	659	679	648	1,014	6,481	4,953	7,528	6,857	4,988	6,028	913	893
1999	1,025	896	643	441	1,059	1,613	1,810	817	498	576	636	599
2000	704	710	343	418	1,479	1,750	1,754	950	536	589	552	472
2001	647	797	564	630	850	1,652	1,248	653	480	478	506	451
2002	500	739	485	671	716	1,306	1,068	554	400	439	438	427
2003	464	691	771	656	714	1,483	1,544	688	436	453	455	414
Minimum	*256*	*319*	*154*	*100*	*275*	*1,073*	*590*	*261*	*245*	*293*	*314*	*264*
Average	*681*	*766*	*1,008*	*1,884*	*2,337*	*2,895*	*2,756*	*2,028*	*1,568*	*1,496*	*659*	*631*
Maximum	*2,492*	*2,904*	*7,662*	*16,286*	*14,212*	*16,504*	*13,467*	*10,748*	*12,312*	*9,658*	*1,484*	*1,640*

Table 4-14.
Simulated Monthly San Joaquin River Temperature, Upstream from Merced River Confluence, Under the Proposed Action (degrees Fahrenheit)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	68	57	47	47	55	61	69	74	81	83	81	77
1982	66	57	48	46	54	60	64	72	77	82	81	75
1983	66	53	48	45	52	57	61	68	73	76	80	75
1984	67	55	48	48	54	63	67	76	80	84	81	78
1985	65	54	46	44	54	62	70	74	80	83	80	74
1986	66	54	46	49	54	60	66	73	78	82	80	74
1987	67	57	47	46	55	62	72	75	79	80	80	76
1988	70	55	49	48	57	65	68	72	77	83	81	76
1989	68	55	48	48	54	62	70	75	78	81	80	75
1990	68	58	48	48	51	62	70	73	78	83	82	77
1991	70	56	46	47	55	62	68	74	79	83	82	78
1992	70	58	48	46	55	64	71	78	80	81	83	77
1993	71	57	47	48	54	65	68	74	78	83	81	77
1994	70	57	48	48	53	64	69	74	80	84	82	78
1995	68	53	46	50	55	58	64	70	77	79	83	78
1996	69	61	52	50	57	62	67	72	78	82	82	75
1997	66	56	49	49	53	63	67	76	79	83	83	79
1998	67	58	48	50	53	61	64	68	74	81	83	78
1999	67	57	47	48	55	61	65	73	80	83	81	78
2000	70	59	50	51	55	61	70	74	79	81	81	76
2001	66	54	50	49	53	64	68	79	80	80	80	77
2002	68	58	47	49	56	62	69	73	78	83	81	79
2003	68	58	51	52	56	63	67	73	80	82	80	77
Minimum	*65*	*53*	*46*	*44*	*51*	*57*	*61*	*68*	*73*	*76*	*80*	*74*
Average	*68*	*56*	*48*	*48*	*54*	*62*	*68*	*73*	*78*	*82*	*81*	*77*
Maximum	*71*	*61*	*52*	*52*	*57*	*65*	*72*	*79*	*81*	*84*	*83*	*79*

Table 4-15.
Simulated Monthly Merced River Flows, Upstream from San Joaquin River Confluence, Under Existing Conditions and Proposed Action (cubic feet per second)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	539	500	445	279	188	268	158	143	89	63	65	67
1982	74	195	194	291	1,239	1,711	4,619	3,702	1,097	693	250	520
1983	1,359	868	2,030	2,199	3,677	4,401	4,119	3,013	4,083	2,772	693	1,118
1984	2,156	655	1,810	3,098	1,051	423	297	273	224	115	75	90
1985	211	506	1,167	605	238	189	199	220	150	74	67	123
1986	219	188	247	159	551	2,943	2,854	1,735	539	103	80	123
1987	325	181	160	175	193	217	152	193	151	80	64	66
1988	77	195	187	204	194	186	149	170	112	57	59	24
1989	63	190	212	216	218	254	222	201	138	60	54	42
1990	72	206	204	204	228	200	201	189	127	56	46	40
1991	71	204	210	148	119	330	151	142	71	52	55	82
1992	87	248	257	251	306	257	159	146	79	52	55	54
1993	243	275	225	337	273	269	1,488	1,339	660	404	707	690
1994	1,304	220	231	239	265	265	389	441	137	365	57	63
1995	350	237	235	338	226	2,291	3,371	3,680	3,080	2,486	423	636
1996	1,618	461	480	292	2,169	2,640	840	1,134	259	103	96	143
1997	429	291	2,031	7,648	6,785	1,588	669	603	146	83	79	111
1998	155	253	229	781	4,618	2,525	2,896	2,672	2,469	1,981	648	1,096
1999	1,101	321	468	824	1,614	735	1,124	769	195	107	61	111
2000	280	269	282	288	1,735	2,349	792	577	190	123	103	172
2001	531	406	321	277	254	324	553	617	149	102	76	95
2002	408	470	518	298	248	247	391	664	186	94	82	78
2003	333	264	235	209	241	252	510	649	181	108	94	104
Minimum	*63*	*181*	*160*	*148*	*119*	*186*	*149*	*142*	*71*	*52*	*46*	*24*
Average	*522*	*331*	*538*	*842*	*1,158*	*1,081*	*1,144*	*1,012*	*631*	*441*	*173*	*246*
Maximum	*2,156*	*868*	*2,031*	*7,648*	*6,785*	*4,401*	*4,619*	*3,702*	*4,083*	*2,772*	*707*	*1,118*

Table 4-16.
Simulated Monthly Merced River Temperatures, Upstream from San Joaquin River Confluence, Under Existing Conditions and Proposed Action (degrees Fahrenheit)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	62	55	48	48	54	58	65	70	78	80	78	74
1982	63	53	48	47	52	56	56	59	68	73	76	70
1983	59	51	50	49	52	54	55	60	61	65	71	64
1984	57	53	51	50	53	60	63	71	76	80	78	75
1985	62	52	50	47	54	58	66	69	77	80	77	71
1986	62	52	45	49	53	56	58	63	73	79	77	71
1987	63	54	46	47	53	59	67	70	76	78	77	73
1988	66	52	48	48	55	61	64	68	75	81	78	75
1989	65	52	48	48	53	59	66	69	75	79	78	74
1990	64	54	46	48	51	59	66	69	75	81	79	75
1991	65	53	46	49	54	55	63	67	75	80	78	76
1992	66	55	48	47	55	61	67	73	76	79	79	73
1993	65	54	46	48	53	61	60	65	71	77	71	68
1994	62	53	47	49	52	60	64	69	76	77	79	75
1995	64	50	47	51	55	56	57	59	62	66	75	70
1996	59	57	51	50	54	56	63	65	76	80	79	72
1997	62	54	51	50	52	59	63	70	76	80	78	75
1998	64	56	48	51	52	57	58	59	62	67	74	66
1999	59	54	49	50	54	58	60	67	76	80	78	74
2000	65	55	49	51	54	57	64	68	77	78	78	72
2001	63	53	49	48	50	60	62	68	75	78	77	74
2002	65	55	49	48	54	58	64	66	74	79	77	75
2003	64	54	49	50	54	60	62	67	76	79	76	73
Minimum	*57*	*50*	*45*	*47*	*50*	*54*	*55*	*59*	*61*	*65*	*71*	*64*
Average	*63*	*54*	*48*	*49*	*53*	*58*	*62*	*67*	*73*	*77*	*77*	*72*
Maximum	*66*	*57*	*51*	*51*	*55*	*61*	*67*	*73*	*78*	*81*	*79*	*76*

Table 4-17.
Simulated San Joaquin River Flows, Downstream from Merced River Confluence, Under Existing Conditions (cubic feet per second)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	1,020	785	754	761	897	1,227	703	554	400	452	475	433
1982	389	551	642	1,355	4,022	5,137	12,934	11,197	4,085	1,987	1,003	1,533
1983	2,489	3,095	10,399	11,964	18,943	20,943	17,611	14,550	16,873	12,613	2,147	2,753
1984	4,539	3,307	7,875	8,940	1,934	1,285	1,015	823	781	654	701	692
1985	832	723	1,295	901	742	897	877	708	632	618	669	694
1986	628	456	651	700	5,587	12,123	8,941	5,566	3,882	1,298	955	916
1987	885	548	519	592	754	1,084	741	653	629	633	607	490
1988	375	571	469	682	641	798	642	527	545	472	595	474
1989	402	365	449	512	562	670	734	555	508	494	538	476
1990	497	597	599	563	653	608	530	460	405	433	467	343
1991	280	365	326	247	223	920	470	300	233	284	312	259
1992	228	359	375	415	790	716	448	294	274	289	328	300
1993	436	372	375	1,891	1,521	1,312	2,755	2,689	1,448	1,285	1,181	1,091
1994	1,723	689	689	684	993	800	722	666	408	699	460	415
1995	631	470	526	1,932	2,673	8,783	9,789	11,205	6,190	8,844	1,384	1,419
1996	2,273	945	1,002	924	4,024	5,481	1,630	3,471	1,596	717	831	761
1997	961	995	5,095	24,247	18,617	3,135	1,136	1,769	542	516	615	584
1998	702	710	839	1,841	12,957	7,442	10,701	10,670	8,835	9,108	1,509	1,917
1999	2,017	1,027	1,075	1,264	2,507	1,628	1,682	1,183	599	611	643	639
2000	868	740	572	702	3,001	3,629	1,381	1,113	764	653	598	573
2001	1,062	983	847	904	932	1,275	1,040	1,001	547	520	528	475
2002	794	987	963	974	794	859	707	965	499	473	461	429
2003	685	732	964	865	786	1,015	847	939	535	502	491	447
Minimum	*228*	*359*	*326*	*247*	*223*	*608*	*448*	*294*	*233*	*284*	*312*	*259*
Average	*1,075*	*886*	*1,622*	*2,776*	*3,676*	*3,555*	*3,393*	*3,124*	*2,227*	*1,920*	*761*	*788*
Maximum	*4,539*	*3,307*	*10,399*	*24,247*	*18,943*	*20,943*	*17,611*	*14,550*	*16,873*	*12,613*	*2,147*	*2,753*

Table 4-18.
Simulated San Joaquin River Temperatures, Downstream from Merced River Confluence, Under Existing Conditions (degrees Fahrenheit)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	65	55	48	48	55	60	68	72	80	82	80	76
1982	65	55	48	46	53	58	61	67	74	79	79	73
1983	62	52	48	46	52	57	60	67	70	73	77	71
1984	62	54	49	49	53	62	65	74	78	83	81	77
1985	64	53	50	46	54	60	68	71	78	82	80	73
1986	65	53	46	49	53	59	63	70	77	82	80	73
1987	66	56	46	46	54	61	70	73	78	80	79	75
1988	68	54	48	48	56	63	66	70	76	83	80	76
1989	67	54	48	48	54	60	68	72	77	81	80	75
1990	67	56	47	48	51	60	68	71	77	83	82	77
1991	68	54	46	48	54	59	66	71	78	82	81	77
1992	68	55	48	46	55	62	69	75	78	81	82	76
1993	68	54	47	48	54	63	64	70	75	81	75	72
1994	64	55	48	48	52	62	66	70	78	80	82	77
1995	66	52	47	50	55	58	62	66	69	76	80	74
1996	62	59	51	50	55	59	65	68	78	82	81	75
1997	64	55	50	50	53	61	64	73	77	82	82	78
1998	66	57	48	50	52	60	63	65	71	77	79	71
1999	62	56	48	49	54	60	61	69	78	83	81	77
2000	68	57	50	51	54	58	66	70	79	80	80	75
2001	64	53	50	49	52	62	65	73	78	79	79	76
2002	67	56	48	49	55	60	66	69	77	82	80	78
2003	66	56	51	51	55	62	64	69	78	82	79	76
Minimum	*62*	*52*	*46*	*46*	*51*	*57*	*60*	*65*	*69*	*73*	*75*	*71*
Average	*65*	*55*	*48*	*48*	*54*	*60*	*65*	*70*	*77*	*81*	*80*	*75*
Maximum	*68*	*59*	*51*	*51*	*56*	*63*	*70*	*75*	*80*	*83*	*82*	*78*

Table 4-19.
Simulated San Joaquin River Flows, Downstream from Merced River Confluence, Under the Proposed Action (cubic feet per second)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	1,201	1,047	831	769	1,101	1,940	1,504	843	535	542	592	565
1982	564	797	711	1,283	2,865	4,344	12,594	10,016	3,303	2,021	1,124	1,671
1983	2,541	2,738	9,643	11,561	17,919	20,899	17,603	13,777	16,347	12,531	2,178	2,755
1984	4,642	3,554	6,907	8,655	2,104	2,002	2,197	1,258	913	774	820	826
1985	1,010	1,002	1,374	910	953	1,629	1,658	990	749	730	790	827
1986	792	723	725	629	4,650	11,206	8,594	5,201	3,634	1,423	1,073	1,048
1987	1,070	817	582	600	951	1,780	1,070	789	756	741	716	622
1988	535	836	535	686	821	1,466	957	669	657	560	679	583
1989	541	595	508	521	748	1,374	1,491	829	612	565	601	575
1990	640	830	639	572	843	1,273	834	573	490	492	521	424
1991	402	588	366	249	391	1,623	1,243	560	316	345	369	347
1992	342	582	415	416	967	1,385	753	407	356	348	382	371
1993	547	594	414	1,885	1,475	1,812	2,854	2,781	2,345	1,511	1,234	1,162
1994	1,836	916	729	686	1,160	1,464	1,026	782	490	758	513	486
1995	742	693	566	1,862	1,623	8,956	9,300	9,500	5,347	8,623	1,426	1,496
1996	2,385	1,168	1,042	924	4,069	5,626	2,490	2,249	1,302	777	885	834
1997	1,072	1,226	3,946	23,875	17,780	3,417	2,375	2,320	1,709	868	669	655
1998	813	931	879	1,786	11,059	7,485	10,432	9,534	7,472	8,028	1,561	1,988
1999	2,129	1,218	1,114	1,264	2,668	2,349	2,932	1,592	694	682	697	709
2000	984	980	627	704	3,193	4,116	2,537	1,536	727	712	656	644
2001	1,174	1,205	886	906	1,100	1,977	1,802	1,275	630	580	582	546
2002	905	1,210	1,002	977	962	1,552	1,460	1,223	587	533	520	504
2003	796	955	1,004	867	952	1,733	2,055	1,343	616	561	549	518
Minimum	*342*	*582*	*366*	*249*	*391*	*1,273*	*753*	*407*	*316*	*345*	*369*	*347*
Average	*1,203*	*1,096*	*1,541*	*2,721*	*3,494*	*3,974*	*3,903*	*3,045*	*2,199*	*1,944*	*832*	*876*
Maximum	*4,642*	*3,554*	*9,643*	*23,875*	*17,919*	*20,899*	*17,603*	*13,777*	*16,347*	*12,531*	*2,178*	*2,755*

Table 4-20.
Simulated San Joaquin River Temperatures, Downstream from Merced River Confluence, Under the Proposed Action (degrees Fahrenheit)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	65	56	48	48	55	60	69	73	81	82	81	77
1982	66	56	48	46	53	58	61	67	74	79	80	73
1983	62	52	48	46	52	57	60	67	70	73	77	71
1984	62	55	49	49	53	63	66	75	79	83	81	77
1985	64	54	50	46	54	61	69	72	79	82	80	74
1986	65	53	46	49	54	59	63	70	77	82	80	73
1987	66	56	46	46	54	61	71	74	78	80	80	76
1988	69	54	48	48	57	64	67	71	77	83	81	76
1989	68	55	48	48	54	61	70	73	77	81	80	75
1990	67	57	47	48	51	62	69	72	77	83	82	77
1991	69	55	46	48	55	61	67	73	78	83	81	78
1992	69	56	48	46	55	63	70	76	79	81	82	76
1993	69	55	47	48	54	64	64	70	76	81	76	72
1994	64	56	48	48	53	63	67	71	79	80	82	77
1995	66	52	47	50	55	58	62	66	68	76	80	75
1996	62	60	52	50	55	60	66	68	78	82	81	75
1997	65	56	50	50	53	61	66	74	79	83	82	78
1998	67	58	48	50	53	60	63	65	70	77	79	71
1999	63	56	48	49	54	60	63	70	79	83	81	77
2000	69	58	50	51	54	58	68	72	79	80	81	75
2001	65	53	50	49	52	63	66	74	79	80	79	77
2002	67	57	48	49	55	61	68	70	77	82	80	79
2003	67	56	51	51	56	63	66	71	79	82	79	76
Minimum	*62*	*52*	*46*	*46*	*51*	*57*	*60*	*65*	*68*	*73*	*76*	*71*
Average	*66*	*55*	*48*	*48*	*54*	*61*	*66*	*71*	*77*	*81*	*80*	*75*
Maximum	*69*	*60*	*52*	*51*	*57*	*64*	*71*	*76*	*81*	*83*	*82*	*79*

Table 4-21. Simulated San Joaquin River Flows, Downstream from Merced River Confluence, Under Proposed Action Compared with Existing Conditions (cubic feet per second, Proposed Action minus Existing Conditions)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	181	262	76	8	205	714	801	290	134	90	117	132
1982	176	246	69	(71)	(1,158)	(793)	(340)	(1,181)	(782)	34	121	137
1983	52	(357)	(756)	(403)	(1,024)	(44)	(7)	(774)	(526)	(82)	31	1
1984	103	247	(968)	(286)	170	717	1,182	434	132	120	119	134
1985	178	279	78	9	210	731	781	282	117	112	121	133
1986	163	267	74	(70)	(937)	(917)	(347)	(365)	(248)	125	119	132
1987	185	269	64	8	197	695	329	136	127	109	108	132
1988	160	265	67	4	180	668	315	142	112	88	84	110
1989	139	230	59	9	186	704	757	274	104	71	63	100
1990	143	233	41	9	191	664	304	113	85	59	54	81
1991	121	222	40	2	169	703	772	260	83	61	57	88
1992	114	222	40	1	177	668	305	113	82	59	53	71
1993	111	222	40	(6)	(46)	500	99	92	897	226	53	71
1994	113	228	41	2	167	665	304	116	82	59	53	71
1995	111	222	40	(70)	(1,050)	172	(489)	(1,706)	(843)	(221)	42	76
1996	111	222	40	0	45	145	859	(1,222)	(294)	61	54	73
1997	111	231	(1,149)	(371)	(837)	282	1,239	551	1,167	353	53	71
1998	111	221	40	(55)	(1,898)	43	(269)	(1,137)	(1,362)	(1,081)	53	71
1999	111	191	39	0	161	721	1,250	409	95	71	53	71
2000	116	240	55	2	192	487	1,155	423	(37)	59	57	71
2001	111	222	40	2	168	702	762	274	83	60	54	71
2002	111	222	40	2	168	693	754	258	88	60	60	76
2003	111	223	40	2	165	719	1,208	404	81	59	58	71
Minimum	*52*	*(357)*	*(1,149)*	*(403)*	*(1,898)*	*(917)*	*(489)*	*(1,706)*	*(1,362)*	*(1,081)*	*31*	*1*
Average	*128*	*210*	*(81)*	*(55)*	*(183)*	*419*	*510*	*(79)*	*(27)*	*24*	*71*	*89*
Maximum	*185*	*279*	*78*	*9*	*210*	*731*	*1,250*	*551*	*1,167*	*353*	*121*	*137*

Table 4-22. Simulated San Joaquin River Temperatures, Downstream from Merced River Confluence, Under Proposed Action Compared with Existing Conditions (cubic degrees Fahrenheit, Proposed Action minus Existing Conditions)

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1981	0.7	0.5	(0.0)	0.0	0.5	0.4	0.9	1.1	0.7	0.4	0.4	0.5
1982	0.6	0.6	(0.0)	0.1	0.3	0.1	0.0	(0.2)	(0.3)	0.1	0.3	0.3
1983	0.3	(0.1)	(0.2)	0.0	0.1	(0.0)	(0.0)	0.1	0.1	0.0	0.1	0.0
1984	0.2	0.1	(0.1)	0.0	0.1	0.8	1.0	1.1	0.5	0.4	0.3	0.4
1985	0.4	0.3	(0.2)	(0.0)	0.3	0.8	1.0	1.1	0.5	0.3	0.3	0.3
1986	0.6	0.5	0.1	(0.0)	0.3	0.3	0.0	(0.1)	0.1	0.1	0.2	0.2
1987	0.4	0.7	0.0	0.0	0.4	0.6	0.9	0.7	0.5	0.3	0.3	0.5
1988	0.9	0.6	0.1	0.0	0.6	1.2	1.1	0.7	0.4	0.3	0.3	0.4
1989	0.7	0.9	(0.0)	(0.0)	0.3	1.2	1.5	1.2	0.5	0.3	0.2	0.3
1990	0.6	0.7	0.1	(0.0)	(0.0)	1.3	1.4	0.7	0.4	0.2	0.2	0.2
1991	0.8	0.9	0.0	0.0	0.7	1.2	1.5	1.6	0.5	0.3	0.2	0.4
1992	1.0	1.0	0.1	(0.0)	0.3	1.2	1.1	0.9	0.4	0.2	0.2	0.3
1993	0.6	1.1	0.1	(0.0)	(0.0)	0.6	(0.1)	0.1	0.8	0.1	0.3	0.4
1994	0.5	0.5	0.0	0.0	0.1	1.4	1.1	0.7	0.4	0.3	0.2	0.2
1995	0.5	0.4	(0.0)	0.0	0.6	0.1	0.0	0.0	(0.9)	(0.1)	0.1	0.3
1996	0.4	0.7	0.1	0.0	0.0	0.1	0.8	(0.2)	(0.2)	0.2	0.1	0.2
1997	0.3	0.3	0.1	(0.0)	0.0	0.6	1.5	1.3	1.1	0.3	0.1	0.2
1998	0.3	0.7	0.1	0.0	0.3	(0.0)	(0.0)	0.1	(0.2)	0.2	0.2	0.3
1999	0.5	0.4	0.2	0.0	0.1	0.6	1.5	1.2	0.4	0.3	0.1	0.3
2000	0.5	0.7	0.1	0.0	0.1	0.5	2.0	1.2	0.1	0.2	0.2	0.3
2001	0.4	0.1	(0.0)	0.0	0.2	0.9	1.7	1.6	0.4	0.2	0.2	0.3
2002	0.5	0.6	0.0	0.0	0.4	0.9	1.9	1.2	0.5	0.3	0.3	0.3
2003	0.5	0.7	0.1	0.0	0.4	1.0	2.0	1.3	0.4	0.3	0.3	0.3
Minimum	*0.2*	*(0.1)*	*(0.2)*	*(0.0)*	*(0.0)*	*(0.0)*	*(0.1)*	*(0.2)*	*(0.9)*	*(0.1)*	*0.1*	*0.0*
Average	*0.5*	*0.6*	*0.0*	*0.0*	*0.3*	*0.7*	*1.0*	*0.8*	*0.3*	*0.2*	*0.2*	*0.3*
Maximum	*1.0*	*1.1*	*0.2*	*0.1*	*0.7*	*1.4*	*2.0*	*1.6*	*1.1*	*0.4*	*0.4*	*0.5*

San Joaquin River Tributaries

The Merced, Tuolumne, and Stanislaus rivers are the three main tributaries to the lower San Joaquin River. Each tributary supports populations of fall-run Chinook salmon and Central Valley steelhead. Releases from major reservoirs on the three main tributaries are made in response to multiple operational objectives, including flood management, downstream diversions, instream fisheries flows, instream water quality flows, and releases to meet water quality and flow objectives at Vernalis (i.e., VAMP requirements).

Regulated flows in the San Joaquin River upstream from Vernalis resulting from WY 2010 Interim Flows would be similar to or greater than those for the No-Action Alternative under all potential hydrologic conditions (Wet years, as shown in Figure 4-3). In response to WY 2010 Interim Flows, tributary releases to meet VAMP spring pulse flow objectives at Vernalis would be affected in one of two ways. In conditions when WY 2010 Interim Flows contribute toward meeting the same VAMP flow threshold that would have been in place in the No-Action Alterative, required releases from tributary reservoirs could be reduced. In conditions when WY 2010 Interim Flows cause a higher VAMP flow target than would have been in place in the No-Action Alterative, required releases from tributary reservoirs would be made to achieve the higher threshold. Changes in VAMP contribution releases from tributary reservoirs should not affect the ability to meet instream fish and water quality flow requirements in the Merced, Tuolumne, or Stanislaus rivers.

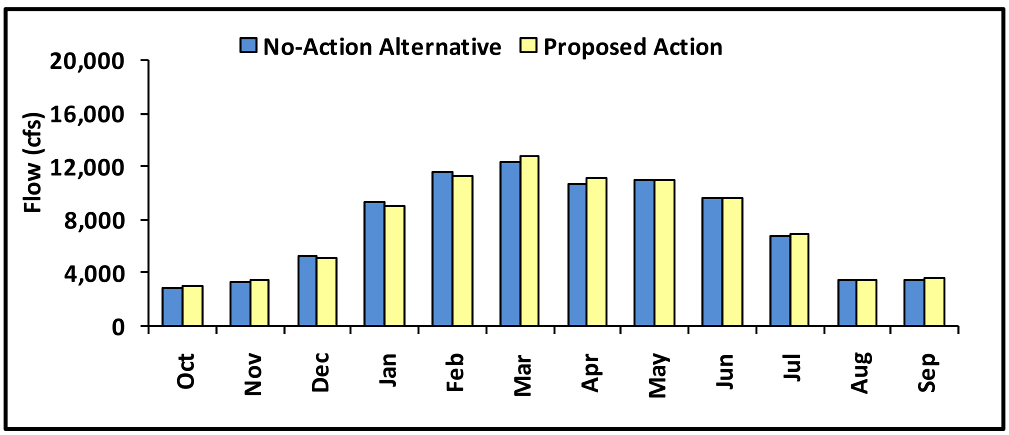

Figure 4-3.
Monthly Averages of Simulated San Joaquin River Flow Upstream from Vernalis in Wet Years (includes flood releases)

Similarly, increased flows in the lower San Joaquin River resulting from WY 2010 Interim Flows would improve water quality conditions upstream from the Stanislaus River, thereby reducing required releases from New Melones Reservoir pursuant to SWRCB Water Right Decision 1641 (D-1641) to achieve water quality objectives at Vernalis. These changes should not affect the ability to meet instream fish and water quality flow requirements in the Stanislaus River.

CalSim model results indicate changes in tributaries flows are generally between zero and ten percent with one extreme in March of critical years (see Section 4.10, Tables 4-33 through 4-35). This is due to the potential that less flow may be needed from the Stanislaus River to maintain water quality at Vernalis (described above). If that condition were to occur, flows would still be within the operating parameters of the RPA of the NMFS BO. The results of modeling showing the potential for flow decreases in March are due to the fact that modeling was performed prior to the development of RPAs as part of the BO for the long-term coordinated operations for the CVP and SWP that were designed to provide fishery protection on the Stanislaus River.

The modeled change in the tributary flows is small relative to the magnitude of the baseline flows under the No-Action Alternative. Additionally, the flows under the Proposed Action are within the same range of the monthly variation found in the No-Action Alternative. For further information refer to Section 4.10.

As a result of the Proposed Action, there would be a **less than significant** effect on fall-run Chinook salmon and other native fishes in the Merced, Tuolumne, and Stanislaus rivers.

Summary of Species Effects

In summary, the effects of implementing the Proposed Action would generally be **less than significant** or **less than significant** but beneficial effects on all fish species.

Implementing the No-Action Alternative would result in **no impact**. Most adverse and beneficial effects on these species that were described for the Proposed Action would either not occur or be less under the No-Action Alternative than under the Proposed Action.

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

This question is addressed above under "Biological Resources – Terrestrial Species."

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

This question is addressed above under "Biological Resources – Terrestrial Species."

g) Reservoir Fisheries Effects

Minimal variation in the seasonal Millerton Lake water level fluctuation is expected under the Proposed Action. Spawning for both spotted and largemouth bass occurs between March and June. It is possible that both species would experience lower reservoir elevations in some months compared with the No-Action Alternative, which could reduce the amount of shallow water habitat available during those months. Both species may also experience a more rapid decrease in elevation during the spawning season for a period of time. However, it is not anticipated that this difference would result in a substantial reduction in the populations. This impact would be **less than significant**.

Predicted changes in reservoir surface levels are expected to reduce the surface area, in some months, of reservoir open water habitat for striped bass, and improve the quality of striped bass spawning habitat at the mouth of the San Joaquin River in upper Millerton Lake.

4.7 Cultural Resources

Environmental Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
V. Cultural Resources. Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5?	☐	☐	☒	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?	☐	☐	☒	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☒	☐

a) Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5?

Ground-disturbing activities (performed with hand tools) to control the spread of invasive species have only very limited potential to adversely affect cultural resources. Nonetheless, the Section 106 process would be completed for all areas identified as needing substantial ground-disturbing activities for invasive species control. This would include taking into consideration potential impacts to buried cultural resources. In general, all efforts would be made to avoid cultural resources. Therefore, the impact on cultural resources would be **less than significant** with implementation of the Proposed Action. Because it would not involve the use of construction equipment, implementing the No-Action Alternative would result in no impact.

b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?

A number of archaeological sites are situated within the existing Millerton Lake fluctuation zone. Minimal variations in seasonal Millerton Lake water level fluctuation expected under the Proposed Action would alter the timing and magnitude of reservoir elevation fluctuations in Millerton Lake, although the range of elevations would remain within the historical range. Based on the geological/soils evaluation presented Section 4.8, variation in reservoir levels under the No-Action Alternative may result in localized erosion of soils and loss of soil horizons down to bedrock along the reservoir shore in the zone of water elevation variation. Under the Proposed Action, the variation in Millerton Lake water elevations is not expected to change substantially from current operating conditions (where there is considerable interannual variation). For this reason, the impact on archaeological sites attributable to fluctuations in the height of the reservoir under the Proposed Action would be **less than significant** and slightly greater than under the No-Action Alternative.

Archaeological sites are also present along the banks of the San Joaquin River. Ground-disturbing activities to control the spread of invasive species have the potential to adversely impact cultural resources. As described above for Cultural Resources checklist question a), the impact on cultural resources would be **less than significant** with implementation of the Proposed Action. Because it would not involve the use of construction equipment, implementing the No-Action Alternative would have no impact.

Based on geological/soils studies (see “4.8 Geology and Soils”), alterations to river flows through release of WY 2010 Interim Flows could potentially change downstream stream erosion characteristics, particularly during spring months. However, the magnitude and duration of flows resulting from the Proposed Action are not expected to substantially alter erosion characteristics under current operating conditions in most of the Restoration Area. Effects on the San Joaquin River downstream from the Merced River would be less than in the Restoration Area because this area is already permanently watered and subject to episodic high flows during significant storm events. This impact would be **less than significant** and slightly greater than under the No-Action Alternative because under the No-Action Alternative, operating conditions would not change.

c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Paleontological resources are generally buried several feet beneath the surface of the ground. Adverse impacts on unique paleontological resources could occur if ground-disturbing equipment, such as bulldozers or excavators, were to unearth and crush resources during Proposed Action activities. Because vegetation removal activities associated with the Proposed Action would only disturb between 4 and 8 inches of the top soil surface, and no ground-disturbing equipment would be used, there would be **no impact** on unique paleontological resources with implementation of the Proposed Action. Because it would not involve the use of construction equipment, implementing the No-Action Alternative also would have no impact.

d) Disturb any human remains, including those interred outside of formal cemeteries?

As mentioned, ground-disturbing activities to control the spread of invasive species have the potential to adversely impact cultural resources. As described above for Cultural Resources checklist questions a) and b), the impact on cultural resources would be **less than significant** with implementation of the Proposed Action. Because it would not involve the use of construction equipment, implementing the No-Action Alternative would have no impact.

The magnitude and duration of flows under the Proposed Action are not expected to substantially alter those under current operating conditions in most of the Restoration Area and downstream on the San Joaquin River to the Delta. For this reason, the potential to disturb human remains by alterations to river flows through release of WY 2010 Interim Flows would be **less than significant**. Because the magnitude and duration of flows under the No-Action Alternative would not differ from current conditions, there would be no impact under the No-Action Alternative. Therefore, the impact of the Proposed Action would be greater.

4.8 Geology and Soils

Environmental Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VI. Geology and Soils. Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to California Geological Survey Special Publication 42.)	☐	☐	☐	☒
ii) Strong seismic ground shaking?	☐	☐	☐	☒
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒
iv) Landslides?	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☐	☒	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated), creating substantial risks to life or property?	☐	☐	☐	☒
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to California Geological Survey Special Publication 42.)

ii. Strong seismic ground shaking?

iii. Seismic-related ground failure, including liquefaction?

iv. Landslides?

The release of WY 2010 Interim Flows would not involve conditions that could result in seismic activity or related ground failure or landslides. No WY 2010 Interim Flows would be released from Friant Dam under the No-Action Alternative. Water releases from the dam would continue to vary based on time of year, water year-type, and system conditions under the No-Action Alternative. Implementation of the No-Action Alternative would also not increase the risk of seismic activity or related ground failure or landslides. The Proposed Action and the No-Action Alternative would have **no impact**.

b) Result in substantial soil erosion or the loss of topsoil?

The potential for the Proposed Action to result in substantial soil erosion or loss of topsoil is addressed below for three geographic subareas, including the San Joaquin River upstream from Friant Dam, the San Joaquin River from Friant Dam to the Merced River, and the San Joaquin River from the Merced River to the Delta.

San Joaquin River Upstream from Friant Dam

Reoperation of Friant Dam under the Proposed Action would alter the timing and magnitude of reservoir elevation fluctuations in Millerton Lake, although the range of elevations would remain within the historical range. Variation in reservoir levels under the No-Action Alternative may result in localized erosion of soils and loss of soil horizons down to bedrock along the reservoir shore in the zone of water elevation variation. Under the Proposed Action, the variation in Millerton Lake water elevations is not expected to change substantially from current operating conditions. This impact would be **less than significant**.

San Joaquin River from Friant Dam to Merced River

Alterations to river flows through release of WY 2010 Interim Flows under the Proposed Action could potentially change downstream stream erosion characteristics and result in localized changes in downstream geomorphologic characteristics. However, the frequency and duration of flows under the Proposed Action are not expected to substantially alter flows under current operating conditions in the Restoration Area. This impact would be **less than significant**.

Release of WY 2010 Interim Flows from Friant Dam to Reach 2 could result in localized bed load movement during spring flows in 2010 if that year is relatively Wet, similar to existing conditions. Under existing conditions, Reach 2A experiences net erosion, and Reach 2B experiences net deposition. Sediment mobilization under the Proposed Action would be localized within these reaches, and would not be anticipated to change the overall bottom elevation of any given reach. This impact would be **less than significant**.

San Joaquin River from the Merced River to the Delta

Alterations to river flows by release of WY 2010 Interim Flows could potentially change downstream stream erosion characteristics and result in localized changes downstream geomorphologic characteristics. However, the frequency and duration of flows under the Proposed Action are not expected to substantially alter flows under current operating conditions from the Merced River confluence to the Delta. This impact would be **less than significant**.

No WY 2010 Interim Flows would be released from Friant Dam under the No-Action Alternative. Water releases from the dam would continue to vary based on time of year, water year types, and system conditions. The No-Action Alternative would result in no change in the current rates of stream channel erosion and meander migration, soil erosion along the reservoir shore, or the current rate of soil erosion along the banks of the San Joaquin River. Therefore, there would be no impact under the No-Action Alternative. Thus, the Proposed Action would have a greater impact than the No-Action Alternative.

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

The release of WY 2010 Interim Flows would not induce landslide, lateral spreading, liquefaction, or collapse. Subsidence is known to be occurring in the Central Valley because of aquifer compaction caused by pumping-related reduction of groundwater levels. A decrease in deliveries to CVP contractors due to the Proposed Action could result in a temporary increase in groundwater pumping and a related increase in aquifer compaction. The Proposed Action includes a measure consistent with the Settlement to monitor and record reductions (as a direct result of WY 2010 Interim Flows) in surface water deliveries to Friant Division long-term contractors. This impact would be **less than significant**, and greater than the No-Action Alternative because implementation of the No-Action Alternative would not increase the risk of landslides, lateral spreading, liquefaction, or collapse, and would not affect water deliveries that would result in increased pumping and aquifer compaction. Therefore, the Proposed Action would have a greater impact on instability than the No-Action Alternative.

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated), creating substantial risks to life or property?

Reoperation of Friant Dam to release WY 2010 Interim Flows under the Proposed Action would be within the range of normal operations; therefore, risks to life or property due to the presence of expansive soils within the region would not increase over the No-Action Alternative. There would be **no impact.**

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

The reoperation of Friant Dam to release WY 2010 Interim Flows under the Proposed Action would not involve temporary or long-term installation or use of wastewater disposal systems, and the demand for wastewater disposal would be the same as under the No-Action Alternative. There would be **no impact**.

4.9 Hazards and Hazardous Materials

Environmental Issues	Potentially Significant Adverse Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VII. Hazards and Hazardous Materials. Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and/or accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☒	☐
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☒	☐
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☒	☐
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐

Environmental Issues	Potentially Significant Adverse Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VII. Hazards and Hazardous Materials. Would the project:				
h) Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

Neither the Proposed Action nor the No-Action Alternative would involve any construction nor the routine transport or disposal of any hazardous materials, with the exception of herbicides applied by hand during invasive plant species control (see item b) below). The chance of a spill is very low, and the small quantities that could be applied would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of these chemicals. Therefore, the effect of the Proposed Action would be **less than significant**. The No-Action Alternative would have no impact.

b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and/or accident conditions involving the release of hazardous materials into the environment?

All counties in the study area have reported cases of WNV (CDPH et al. 2009), and habitat for all mosquito species' life cycles is located in this geographic region within several miles of wetted portions of the San Joaquin River, bypasses, and tributaries. Implementing the Proposed Action would introduce flows to some river reaches in the Restoration Area that have typically been dry. This would likely create new pools and other new areas of standing water that could contribute to the spread of, and/or increase, mosquito populations. At the same time, however, more continuous and/or higher-than-existing flow velocities would occur in other reaches of the Restoration Area and in the San Joaquin River below the Merced River confluence to the Delta that currently contribute to mosquito populations. In such reaches, mosquito breeding would likely decrease because conditions would no longer be suitable. Implementing the Proposed Action, therefore, is not expected to result in the need for increased mosquito control efforts by public agencies, including mosquito abatement districts and mosquito and vector control districts, or private businesses that currently conduct mosquito control efforts. The impact of the Proposed Action on public health hazards would be **less than significant** associated with mosquito vectors.

Hand application of chemical treatment with herbicides could be necessary to control and manage nonnative invasive plant species if their presence increased under the Proposed Action. Some herbicides have been shown to be hazardous to human health, wildlife, and/or aquatic organisms. However, handling and use of the chemicals, including formulation and application rate, would be conducted in compliance with the registered label(s) and all applicable laws and regulations. Moreover, applications would be by hand (compared to broadcast or aerial spraying), and the herbicides proposed for use (e.g., glyphosate, imazapyr) are regarded as posing relatively low risk for use in natural areas because they are not likely to contaminate groundwater, have limited persistence in the environment, and are of low toxicity to animals (TNC 2001, 2003, 2004). Therefore, potential impacts from chemical eradication of nonnative invasive plant species would be **less than significant**.

Furthermore, although *Coccidioidomycosis*, the fungus that causes Valley Fever, is likely present in the Restoration Area, and there may be other anthropogenic sources of hazardous substances (e.g., LUST sites) in the vicinity of the Restoration Area, such hazardous substances existing naturally (e.g., *Coccidioidomycosis* spores) or originating from anthropogenic sources would not likely be emitted as a result of implementing the Proposed Action because no ground-disturbing activities would occur.

For the reasons discussed above, the potential for the Proposed Action to create a hazard to the public or the environment through the release of hazardous materials would be **less than significant**.

Because no WY 2010 Interim Flows would be released from Friant Dam under the No-Action Alternative, and water releases from the dam would continue to vary based on time of year, water year-type, and system conditions, implementing the No-Action Alternative would not affect public health or existing public services. Implementing the No-Action Alternative would not alter the existing transport, use, or disposal of hazardous materials or create a significant hazard to the public or the environment through upset and/or accident conditions involving the release of hazardous materials. Therefore, impacts related to public health or public services would be greater under the Proposed Action than under the No-Action Alternative.

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

Implementing the Proposed Action would not involve any grading or earth-moving activities,, and chemicals that would be used to control and manage potential infestations of nonnative species pose a relatively low risk when applied in accordance with the registered label(s) and applicable laws and regulations. Hazardous substances existing naturally (e.g., *Coccidioidomycosis* spores) or from anthropogenic sources (e.g., herbicides, LUST sites) would not likely be emitted within a quarter-mile of a school as a result of implementing the Proposed Action. Therefore, the impact would be **less than significant**, and because the No-Action Alternative would not cause a new hazardous or acutely hazardous material, substance, or waste to be handled within one-quarter mile of an existing or proposed school, the impact from the Proposed Action would be greater than from the No-Action Alternative.

d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

Numerous hazardous waste sites have been identified in the vicinity of the study area based on a review of the California Department of Toxic Substances Control Cortese List, SWRCB Geotracker (SWRCB 2008), and USEPA Enviromapper (EPA 2008) databases. However, implementing the Proposed Action would not involve any construction; therefore none of the identified sites would be affected by ground-disturbing activities. Thus, implementing the Proposed Action would not create a significant hazard to the public or the environment. There would be **no impact** under either the Proposed Action or the No-Action Alternative.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?

Three airports located within 2 miles of the Restoration Area (Sierra Sky Park Airport, Firebaugh Municipal Airport, and Mendota Municipal Airport) have adopted a comprehensive land use plan. Implementing the Proposed Action would not affect existing airport use or air traffic patterns. Release of WY 2010 Interim Flows could create additional foraging habitat that may be attractive to certain bird species. Because the Proposed Action is temporary, the likelihood is low that substantially more birds would be attracted to the area and would increase the risk for bird strikes with aircraft relative to existing conditions; therefore, implementing the Proposed Action would not result in a substantial safety hazard for people residing or working in the study area. This impact would be **less than significant,** and because there would be no land use changes within 2 miles of a public airport or public use airport under the No-Action Alternative, the impact of the Proposed Action would be greater.

f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?

Several private agricultural airstrips are present in the vicinity of the study area that operate seasonal flights for crop spraying. However, for the reasons discussed in item e), reoperating Friant Dam to deliver WY 2010 Interim Flows would not result in a significant safety hazard; therefore, the impact on people residing or working in the study area would be **less than significant** and greater than under the No-Action Alternative.

g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

California has developed an emergency response plan to coordinate emergency services provided by Federal, State, and local governments and private agencies. Response to hazardous material incidents is one part of this plan. The plan is managed by the Governor's OES, which coordinates the responses of other agencies, including Cal/EPA, CHP, DFG, and Central Valley RWQCB.

San Mateo Road (in Reach 2B) and Dan MacNamara Road (in the Eastside Bypass) could be temporarily inundated by the introduction of WY 2010 Interim Flows. This condition occurs at times under existing conditions. A number of crossings in this bypass area are unusable during high-flow conditions in winter and spring under existing conditions, including West El Nido Road, Headquarters Road, and several unnamed crossings. The roads are collectors and local roads, and appear to have generally moderate to light traffic. Under the Proposed Action, traffic would be redirected during the WY 2010 Interim Flow periods to maintain emergency access and to assist drivers with crossing the Eastside Bypass safely. With implementation of the detours, inundation of San Mateo Road and Dan MacNamara Road would not impair or interfere with implementation of adopted emergency response plans or emergency evaluation plans; therefore, this impact would be **less than significant**. Because the No-Action Alternative would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan, the impact of the Proposed Action would be greater than that of the No-Action Alternative.

h) Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

The Restoration Area is generally classified as an unzoned area for fire hazards (urban or nonflammable open space); however, portions of the area are located in a Moderate Fire Hazard Severity Zone (wildlands with low fire frequency or urbanized areas with high density of nonburnable surfaces) (CALFIRE 2009). Implementing the Proposed Action would not involve construction of any buildings or structures, would not require additional staffing, and would not contribute to any conditions that may foster wildland fires in the Restoration Area or elsewhere in the study area. This would also be the case under the No-Action Alternative. Therefore, the existing wildland fire risks along the San Joaquin River from Friant Dam to the Delta would be unchanged under both the Proposed Action and No-Action Alternative. There would be **no impact** in both cases because no people or structures would be exposed to a risk of loss, injury, or death involving wildland fires under either the Proposed Action or the No-Action Alternative.

4.10 Hydrology and Water Quality

Environmental issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VIII. Hydrology and Water Quality. Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☒	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☒	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial on- or off-site erosion or siltation?	☐	☐	☒	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration 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 on- or off-site flooding?	☐	☐	☒	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☒
f) Otherwise substantially degrade water quality?	☐	☐	☒	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒

Environmental issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☒	☐
j) Result in inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒
k) Result in substantial changes in water supply or flood management operations?	☐	☐	☒	☐

a) Violate any water quality standards or waste discharge requirements?

The potential for the Proposed Action or No-Action Alternative to violate any water quality standards or waste discharge requirements is addressed below for five geographic subareas, including the San Joaquin River upstream from Friant Dam, 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 CVP/SWP water service areas.

San Joaquin River Upstream from Friant Dam

Reservoir fluctuations would be within normal annual reservoir water surface elevations, and would likely reflect water quality conditions similar to the No-Action Alternative. Any potential surface water quality effects are not likely to result in violations of existing water quality standards, or substantial water quality changes that adversely affect beneficial uses, or have substantive impacts on public health. These impacts would be **less than significant**.

San Joaquin River from Friant Dam to Merced River

With implementation of the Proposed Action, surface water quality conditions within Reach 1 would continue to reflect the generally high quality of water released at Friant Dam from Millerton Lake. Constituent concentrations within Reach 1 are likely to be similar or less than concentrations observed under the No-Action Alternative because of the increase in the proportion of high-quality water released at Friant Dam to the existing lower quality return flows within the other reaches. This impact would be **less than significant** and beneficial.

Water temperature conditions within upstream sections of Reach 1 under the Proposed Action are likely to be similar to conditions under the No-Action Alternative. The temperature of water released at Friant Dam and water temperature within Reach 1 could be higher in summer and fall 2010 if the increased release of WY 2010 Interim Flows to the San Joaquin River from the low-level river outlets at Friant Dam reduces the cold-water volume in Millerton Lake compared to the No-Action Alternative. Water temperature of releases from Friant Dam in fall 2009 would not exceed conditions expected under the No-Action Alternative, because the cold-water volume in Millerton Lake would be the same under both the No-Action Alternative and the Proposed Action during summer 2009. During spring 2010, water temperatures within Reach 1 are likely to be similar to conditions under the No-Action Alternative because WY 2010 Interim Flows are not likely to affect the cold-water volume at Millerton Lake until any flood releases from Friant Dam are completed. Increased river flow associated with WY 2010 Interim Flows would likely result in less thermal heating of San Joaquin River flows and cooler water temperatures within Reach 1 compared to the No-Action Alternative. This reduced thermal heating rate would tend to offset any increase in Millerton Lake release temperatures. These impacts would be **less than significant**.

Water temperatures within Reach 2 are likely to be similar to No-Action Alternative conditions during spring 2010, and may be lower during summer 2010. This impact would be **less than significant** and beneficial.

As detailed in the Draft Technical Memorandum: Monitoring Plan for Physical Parameters (SJRRP 2008a), continuous measurement of physical conditions would be recorded at eight stations using multiple parameter sondes connected to digital dataloggers. Parameters would include temperature, EC (salinity), pH, dissolved oxygen, turbidity, and chlorophyll. Each parameter would be measured every 15 minutes and sent via satellite to the Internet as preliminary data. In addition, samples would be collected for laboratory analysis, including selenium, mercury, boron, nutrients, and other compounds that cannot be measured with field sensors. The complete list of constituents to be measured at various sites along the Restoration Area would be determined according to the needs of the scientists handling the fish restoration. Water quality monitoring for WY 2010 Interim Flows would be conducted in conjunction with ongoing efforts to monitor water quality in the study area. Monitoring results would be provided to all the resource agencies annually.

Surface water quality conditions within Reach 2 are likely to be similar or less than conditions observed under the No-Action Alternative because of the increase in the proportion of high-quality water released at Friant Dam to the existing lower quality return flows within the reach. As described in Section 3, constituents associated with agricultural practices in the region may have accumulated in Reaches 2 and 4A because of the lack of continuous flows in these reaches. Both reaches are occasionally flushed during flood flows that occur approximately every 2 years (1997, 2001, 2005, 2006, and 2007). Water quality data collected by the Central Valley RWQCB (2009)suggest that EC, total organic carbon, turbidity, and TSS were influenced by storm events, especially during the first storm runoff. Concentrations of these constituents spiked during storm events, likely because of mobilization of existing constituents in the channels, and increased runoff over agricultural lands during storm events. Constituents not flushed during flood flows could be flushed by the Proposed Action sooner than under the No-Action Alternative.

Because no flushing flow has occurred since 2007, up to 3 years of materials have accumulated in the channel. The WY 2010 Interim Flows may flush out these materials from the San Joaquin riverbed, similar to what has occurred during recent flood events; however, this action does not include the additional flows from agricultural runoff that typically accompany a flood event. This mobilization of constituents could lead to short term increases in surface water contaminant loads during WY 2010 Interim Flows. However, concentrations of contaminants in Reaches 2 and 4A are likely to be similar to or less than current conditions because of the increase in the proportion of high-quality water released at Friant Dam to the existing lower quality return flows within Reaches 2 and 4A. Under the Proposed Action, San Joaquin River concentrations of ED and TDS within the Restoration Area are likely to be the same or less compared to conditions under the No-Action Alternative. This impact would be **less than significant** and beneficial.

Below Sack Dam (Reach 4A), simulated monthly average EC would be less under the Proposed Action compared to the No-Action Alternative. Constituents, including pollutants associated with agricultural practices in the region that may have accumulated in dry segments of Reach 4A, would be flushed from sediments within the river channel through implementation of the Proposed Action, as described above. Surface water quality impacts within Reach 4A under the Proposed Action would be **less than significant**.

Based on simulated daily water temperatures aggregated to time intervals consistent with the WY 2010 Interim Flows schedule for all water year-types, San Joaquin River water temperatures below Mendota Dam to the Sand Slough Control Structure would be similar to the No-Action Alternative under the Proposed Action. Water temperatures would be less than the No-Action Alternative during March and April, and similar to the No-Action Alternative during January to February, May to October, and December. Monthly average water temperatures would increase by no more than 2 percent on an average annual basis during October to November. Overall, water temperature impacts within Reach 3 and Reach 4A would be **less than significant**.

Surface water quality conditions within Reach 4B would not be affected by the Proposed Action. Within the Eastside Bypass and Reach 5, surface water quality conditions would be similar to conditions under the No-Action Alternative during most periods. During instances when Eastside Bypass flows arrive at Reach 5, surface water quality conditions would be minimally affected by the Proposed Action through mixing of any remaining WY 2010 Interim Flows with Bear Creek inflows within the Eastside Bypass. On an average annual basis, monthly average water temperatures within the Eastside Bypass under the Proposed Action would be similar to the No-Action Alternative, with decreases in water temperature during March to April, and increases of up to 1 percent during February and November. Monthly average water temperatures within Reach 5 under the Proposed Action would be similar to the No-Action Alternative, with increases of up to 1 percent during February to May and October to November. Impacts to surface water quality within the Eastside Bypass and Reach 5 would be **less than significant**.

Water quality criteria applicable to beneficial uses are not currently met within Reaches 3, 4, and 5 because of constituent loading to and within the reaches. Under the Proposed Action, concentrations of these constituents may decrease, but it is not anticipated that water quality criteria would be met. This impact would be **less than significant** and beneficial.

These potential surface water quality effects within the San Joaquin River from Friant Dam to the Merced River would not result in any additional violations of existing water quality standards or substantial water quality changes that would adversely affect beneficial uses, or have substantive impacts on public health. These impacts would be **less than significant** and beneficial.

San Joaquin River from Merced River to the Delta

Surface water quality conditions within the San Joaquin River from Merced River to the Delta would be similar under the Proposed Action to the No-Action Alternative. On an average annual basis, mixing of any remaining WY 2010 Interim Flows with additional inflows to the San Joaquin River would reduce EC during most months at San Joaquin River sites below the Merced River and below the Tuolumne River. EC at these sites during December and January would increase by no more than 2 percent on an average annual basis (note that WY 2010 Interim Flows would not be released between November 21, 2009, and January 31, 2010). During most months, this impact would be **less than significant** and beneficial; during December and January, this impact would be **less than significant.**

Below the Merced River confluence, monthly average San Joaquin River water temperatures under the Proposed Action would be similar to the No-Action Alternative on an average annual basis, with increases of up to 1 percent during March to May and October to November. Impacts to water temperature within the San Joaquin River from Merced River to the Delta would be **less than significant**.

The Vernalis Water Quality Standard is an EC requirement of 700 and 1,000 micromhos/centimeter (μmho/cm) for the irrigation (April to August) and nonirrigation (September to March) seasons, respectively. This is modeled in CalSim by estimating the water quality at Vernalis using a link-node salinity algorithm, consisting of a series of EC mass balance equations, covering the San Joaquin River from Lander Avenue to Vernalis. The computed EC from an upstream node is used as the input EC of a downstream node. Flow-EC regressions are used for the San Joaquin River at Lander Avenue, Merced River near Stevinson, and Tuolumne River near Modesto. Mud and Salt sloughs, both return flow and accretion EC, use monthly average values. If the estimated EC does not meet the standard at Vernalis, higher quality releases are made from New Melones Reservoir on the Stanislaus River to mix with the San Joaquin River to meet the standard. On an average annual basis, EC at San Joaquin River at Vernalis would decrease during some months (February to June, October, and November) or remain the same during others (January, July to September, and December) through implementation of the Proposed Action (note that WY 2010 Interim Flows would not be released between November 21, 2009, and January 31, 2010). During February through June, October, and November, this impact would be **less than significant** and beneficial. During January, July through September, and December, this impact would be **less than significant**.

These potential surface water quality effects within the San Joaquin River from the Merced River to the Delta would not result in any additional violations of existing water quality standards or substantial water quality changes that would adversely affect beneficial uses, or have substantive impacts on public health. Overall, surface water quality impacts in the San Joaquin River from the Merced River to the Delta under the Proposed Action would be **less than significant**.

Sacramento-San Joaquin Delta

Mixing of any remaining WY 2010 Interim Flows under the Proposed Action with additional inflows to the San Joaquin River and the Delta would result in impacts that would be less than significant to surface water quality in the Delta. On an average annual basis, simulated monthly average salinity values at sites evaluated in the Delta under the Proposed Action are similar to the No-Action Alternative. Simulated monthly average chloride concentrations at sites evaluated in the Delta under the Proposed Action are similar to the No-Action Alternative. The monthly average X2 positions simulated for the Proposed Action are similar to the No-Action Alternative on an average annual basis. Water temperature in the Delta would not be impacted by the Proposed Action.

These potential surface water quality effects within the Delta would not result in any additional violations of existing water quality standards or substantial water quality changes that would adversely affect beneficial uses, or have substantive impacts on public health. Overall, water quality impacts in the Delta under the Proposed Action would be **less than significant**.

Central Valley Project/State Water Project Water Service Areas

Water quality conditions for water delivered to Friant Division contractors via the Friant-Kern and Madera canals from Millerton Lake would not be adversely affected by the Proposed Action.

WY 2010 Interim Flows associated with the Proposed Action, and potential decreased deliveries of Delta water supplies to the Mendota Pool, are likely to reduce salinity concentrations in water supplies diverted at Mendota Dam, the Arroyo Canal, Lone Tree Unit, and East Bear Creek Unit diversions during the irrigation season.

Because simulated water quality impacts in the Delta under the Proposed Action would be less than significant, impacts to water quality in other CVP and SWP water service areas would be less than significant. The Proposed Action would not likely result in any violations of existing water quality standards or substantial water quality changes that adversely affect beneficial uses, or have substantive impacts on public health within the CVP or SWP water service areas. These impacts would be **less than significant**.

Under the No-Action Alternative, existing water quality in the Restoration Area would remain comparable to existing conditions. Implementing the No-Action Alternative would not violate any water quality standards or waste discharge requirements along the San Joaquin River or in the bypass system. There would be **no impact** under the No-Action Alternative.

b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)?

A decrease in deliveries to Friant Division long-term contractors due to the Proposed Action could result in a temporary increase in groundwater pumping to offset the reduction in surface water deliveries, and in a corresponding small decrease in groundwater levels. As stated in Section 2, recirculation of WY 2010 Interim Flow releases would be subject to available capacity within CVP/SWP storage and conveyance facilities. Recaptured water would be available to Friant Division long-term contractors, and would supplement actual delivery reductions that would otherwise potentially result in increased groundwater pumping. The technical analysis did not include estimates of recaptured and recirculated water to Friant Division long-term contractors. However, if the full quantity of recaptured WY 2010 Interim Flows is successfully recirculated to Friant Division long-term contractors, no increase in groundwater pumping would occur because of the Proposed Action. A simplified numerical tool developed by Schmidt (2005) was used to evaluate changes in groundwater conditions in the Friant Division water service area as part of the regional groundwater analysis. This regional groundwater tool estimates the depth to groundwater within the Friant Division water service areas according to relationships describing annual groundwater pumping and resulting depth-to-groundwater developed by Schmidt (2005). The results of the analysis indicate that the potential drawdown of groundwater levels in the Friant Division water service area resulting from a decrease in deliveries due to the Proposed Action would be within the range of groundwater level fluctuations historically exhibited within the groundwater basin (see Appendix G). Therefore, potential changes in groundwater pumping would not be expected to substantially deplete groundwater supplies. These impacts would be **less than significant**.

Under the No-Action Alternative, historical surface and groundwater management operations would continue unchanged. Accordingly, no change in surface flows down the San Joaquin River would occur that would increase or decrease groundwater levels. There would also be no change in surface water deliveries to CVP contractors that would change groundwater pumping levels. Therefore, the impact to groundwater supplies would be greater under the Proposed Action than under the No-Action Alternative.

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial on- or off-site erosion or siltation?

The frequency and duration of flows resulting from the Proposed Action are not expected to substantially alter flows under current operating conditions in the Restoration Area. However, WY 2010 Interim Flows would follow existing channels, but could potentially alter downstream stream erosion characteristics and result in localized changes in downstream geomorphologic characteristics, particularly during spring months. The Proposed Action would have a negligible effect on surface runoff or on- or off-site flooding. The impact of the Proposed Action would be **less than significant**, and the No-Action Alternative would have no impact.

d) Substantially alter the existing drainage pattern of the site or area, including through the alteration 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 on- or off-site flooding?

WY 2010 Interim Flows would follow existing channels and would not increase the rate or amount of surface runoff. The Proposed Action would have a negligible effect on surface runoff or on- or off-site flooding. The impact of the Proposed Action would be **less than significant**, and the No-Action Alternative would have no impact.

e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

WY 2010 Interim Flows would follow existing channels and would have no effect on surface runoff or on- or off-site flooding. There would be no additional contribution to runoff water that would exceed the existing stormwater drainage systems. The Proposed Action and the No-Action Alternative would have **no impact**.

f) Otherwise substantially degrade water quality?

As previously discussed in item a), the release of WY 2010 Interim Flows would not degrade water quality. Concentrations of some pollutants could decrease under the Proposed Action. The Proposed Action would have a beneficial effect that would be considered **less than significant**.

g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

WY 2010 Interim Flows would not exceed existing channel capacity and would not include the release of flows in addition to flood flows. The Proposed Action would not involve construction of any new structures within the 100-year mapped hazard area or require new delineation maps of flood hazards. The Proposed Action and the No-Action Alternative would have **no impact**.

h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?

WY 2010 Interim Flows would not involve construction of any new structures within the 100-year mapped hazard area. Under the No-Action Alternative, it is assumed that no new housing projects would involve construction within a 100-year flood hazard area, as mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map. The Proposed Action and the No-Action Alternative would have **no impact**.

i) Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam?

While only minimal variation in the seasonal Millerton Lake water level fluctuation is expected under the Proposed Action, on average it is likely that the change in facilities operations would lower water levels at the start of the flood control season, potentially allowing more capture of flood inflows under the Proposed Action than under the No-Action Alternative (depending on hydrologic conditions in WY 2010). This additional capture has the potential to slightly reduce the magnitude and duration of any potential flood peaks occurring in WY 2010. By the end of WY 2010, Millerton Lake water storage and water levels would be expected to be similar. Therefore, changes in risk of dam failure would be **less than significant** and potentially beneficial.

The Proposed Action would increase flows in the San Joaquin River and Eastside Bypass between Friant Dam and the Merced River relative to the No-Action Alternative. The Proposed Action does not include physical changes to the levees or flood control structures within the study area. The estimated maximum flows released under the Proposed Action in the San Joaquin River and Eastside Bypass would not exceed existing channel capacity or the range of historical flows, and no new structures would be exposed to increased flood risk within the floodplain. Under the Proposed Action, no changes would be made to the existing floodplain that could expose any existing structures to increased flood risk.

Existing channel capacities in the Restoration Area exceed potential flows included in the Proposed Action. As described in Section 2, maximum WY 2010 Interim Flows would be constrained by the existing channel capacity in Reach 2B. Although Reach 2B design capacity is 2,500 cfs, operational experience has demonstrated that seepage problems occur under both irrigation and flood control operations at lower flows. Mendota Dam, at the downstream end of Reach 2B, raises the water surface level in the Mendota Pool and backs water up the San Joaquin River and Fresno Slough (RMC 2007). During irrigation seasons when the Mendota Pool is in operation, 1,300 cfs may be conveyed through Reach 2B without causing seepage problems on adjacent lands. During the nonirrigation season when the boards can be pulled from Mendota Dam, 2,500 cfs may pass through the Reach 2B portion of the Chowchilla Bifurcation Structure with minor amounts of seepage problems (McBain and Trush 2002). Mendota Pool surface water elevation is held a fairly constant, between elevation 14.2 feet and 14.5, to maintain water deliveries to water users in the upper end of the Mendota Pool/Fresno Slough areas. To maintain this constant elevation, releases from Mendota Dam are made thru the dam gates with the boards at the dam in place. Under the Proposed Action, flows would increase thru Mendota Pool and Mendota Dam; however, water levels within Mendota Pool would be within existing operational ranges. The Proposed Action does not include removing the boards from Mendota Dam and, therefore, would limit maximum flows through Reach 2B to the reported flow capacity of 1,300 cfs. Therefore, the change in risk of levee failure under the Proposed Action compared to the No-Action Alternative is **less than significant**. The No-Action Alternative would have no impact.

The Proposed Action would not result in any significant impacts to flood management. Although no specific mitigation measures are required, Reclamation would use all available information, including any monitoring programs established for the SJRRP, feedback from landowners, and feedback from the LSJLD, to monitor levee conditions within the study area. In addition, the Proposed Action includes visual inspection for early indicators of levee seepage and attendant flow reductions in response to observed conditions, as described in the Seepage Monitoring and Management Plan (see Appendix D).

j) Result in inundation by seiche, tsunami, or mudflow?

Reoperation of Friant Dam to release WY 2010 Interim Flows would not involve conditions that could result in seiche, tsunami, or mudflow. The Proposed Action and the No-Action Alternative would have **no impact**.

k) Result in substantial changes in water supply or flood management operations?

The potential for the Proposed Action or the No-Action Alternative to result in substantial changes in water supply or flood management is addressed below for five geographic subareas, including the San Joaquin River upstream from Friant Dam, 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 CVP/SWP water service areas.

San Joaquin River Upstream from Friant Dam

Millerton Lake is operated as a single-year reservoir, with no annual carryover, and is fully exercised (i.e., full to minimum storage) in virtually all years; this operational scenario would not change under the Proposed Action. While only minimal variation in seasonal Millerton Lake water level fluctuations is expected under the Proposed Action, it is likely that the change in facilities operations would change water levels on specific dates. During spring flood operations, the reservoir is operated to specific storage targets and by late summer, the reservoir is typically drawn down as far as possible based on the physical diversion elevation. Since these limits would not be affected by the Proposed Action, fluctuations in reservoir levels would remain within historical operational scenarios.

Peak flood flows during spring could be reduced because of the increased capacity for Millerton Lake to capture more flood inflows because of the releases of WY 2010 Interim Flows early in the water year. No substantial changes to Millerton Lake flood releases are expected from the Proposed Action and, therefore, no substantial changes are expected in any downstream reach of the San Joaquin River during Millerton Lake flood operations and releases. These impacts would be **less than significant**.

San Joaquin River from Friant Dam to Merced River

Changes in Reach 1 flow under the Proposed Action from the No-Action Alternative are shown in Table 4-23. WY 2010 Interim Flows would result in an increase in monthly average flows in Reach 1 in minor or nonflood flow periods. Additional capture of flood flows would result in decreases in flows from the Proposed Action to the No-Action Alternative. During nonflood flow periods, flows in Reach 1 of the San Joaquin River would be maintained according to the WY 2010 Interim Flows schedule; these flows would be greater than flows expected under the No-Action Alternative. There are riparian diversions throughout portions of this reach of the San Joaquin River. Under existing conditions, releases from Millerton Lake are made to satisfy these diversions. The WY 2010 Interim Flows schedule would result in Millerton Lake releases greater than would be expected under the No-Action Alternative, which would provide adequate flows to satisfy these diversions. As described in Section 4.5, the Proposed Action could spread invasive species from Reach 1 to downstream reaches of the river, where propagules may enter water supply facilities through riparian diversions. However, the current vegetation management practices within water supply systems would be sufficient to inhibit establishment of invasive vegetation and prevent consequent impacts to water supply operations.

Table 4-23.
Monthly Averages of Simulated Reach 1 Flow

Dates of WY 2010 Interim Flow Release	Average of All Years			Dry Years		
	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)
Mar 1-15	996	1,389	393 (39%)	124	857	733 (589%)
Mar 16-31	915	1,521	607 (66%)	135	866	731 (543%)
Apr 1-15	1,044	1,595	552 (53%)	145	510	365 (252%)
Apr 16-30	1,160	1,527	367 (32%)	160	350	190 (119%)
May 1-31	1,283	1,171	-112 (-9%)	186	350	164 (88%)
Jun 1-30	1,306	1,305	-1 (0%)	195	350	155 (79%)
Jul 1-31	910	1,019	109 (12%)	225	350	125 (55%)
Aug 1-31	237	358	121 (51%)	227	350	123 (54%)
Sep 1-30	207	350	143 (69%)	207	350	143 (69%)
Oct 1-31	182	364	181 (99%)	161	364	202 (125%)
Nov 1-11	143	431	288 (202%)	134	431	296 (221%)
Nov 12-30	160	399	240 (150%)	123	399	277 (225%)
Dec 1-31	454	325	-128 (-28%)	118	158	40 (34%)
Jan 1-31	792	669	-123 (-16%)	161	140	-21 (-13%)
Feb 1-28	1,085	937	-148 (-14%)	552	532	-20 (-4%)

Notes:
Summarized from SJR5Q flow and temperature model.
Simulation period: January 1980 – September 2003.
Year-type as defined by the Restoration year-types.
(%) indicates percent change from No-Action Alternative.
Key:
cfs = cubic feet per second

Estimated maximum spring and early summer flows of 1,500 cfs to 1,660 cfs that could occur in Reach 1 under the Proposed Action are within the range of, or are exceeded by, flows that occurred in the historical record. Recent examples include a 5-day period in late April 2005, when flows were approximately 2,000 cfs, and a 10-day period in late May of that year when flows exceeded 8,000 cfs. Flows also exceeded 4,000 cfs for nearly the entire 3-month period of April through June in 2006, when extensive flooding occurred throughout the San Joaquin River system. These impacts would be l**ess than significant**.

The changes in flow between the Proposed Action and the No-Action Alternative in Reach 2, as shown in Tables 4-24 and 4-25, are expected to be similar to Reach 1, as previously discussed. Currently, Reach 3 conveys releases of up to 600 cfs from Mendota Dam to satisfy diversion requirements at Sack Dam (under nonflood conditions). As shown in Table 4-26, Reach 3, under the Proposed Action, would convey up to an additional 100 cfs to Sack Dam. This additional flow is within the channel capacity of Reach 3 and is not expected to cause any substantial adverse effects.

Table 4-24.
Monthly Averages of Simulated Reach 2A Flow

Dates of WY 2010 Interim Flow Release	Average of All Years			Dry Years		
	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)
Mar 1-15	1,068	1,440	372 (35%)	53	767	715 (1,358%)
Mar 16-31	980	1,583	603 (62%)	60	808	748 (1,247%)
Apr 1-15	989	1,545	556 (56%)	38	423	385 (1,014%)
Apr 16-30	1,042	1,426	384 (37%)	32	223	192 (608%)
May 1-31	1,148	1,045	-103 (-9%)	39	204	165 (421%)
Jun 1-30	1,109	1,103	-6 (-1%)	22	177	155 (705%)
Jul 1-31	758	865	107 (14%)	26	152	125 (479%)
Aug 1-31	51	171	120 (236%)	33	155	122 (369%)
Sep 1-30	42	183	142 (338%)	38	180	142 (372%)
Oct 1-31	49	229	180 (365%)	21	220	199 (965%)
Nov 1-11	44	323	279 (636%)	25	317	292 (1,170%)
Nov 12-30	60	315	255 (424%)	23	306	283 (1,243%)
Dec 1-31	391	273	-118 (-30%)	36	81	45 (124%)
Jan 1-31	831	703	-128 (-15%)	240	222	-19 (-8%)
Feb 1-28	1,178	1,022	-156 (-13%)	540	509	-31 (-6%)

Notes:
Summarized from SJR5Q flow and temperature model.
Simulation period: January 1980 – September 2003.
Year-type as defined by the Restoration year-types.
(%) indicates percent change from No-Action Alternative.
Key:
cfs = cubic feet per second

Table 4-25.
Monthly Averages of Simulated Reach 2B Flow

Dates of WY 2010 Interim Flow Release	Average of All Years			Dry Years		
	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)	No-Action Alternativ e (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)
Mar 1-15	279	746	467 (167%)	8	705	697 (9,263%)
Mar 16-31	206	812	606 (294%)	13	756	743 (5,810%)
Apr 1-15	131	696	565 (431%)	6	374	368 (6,357%)
Apr 16-30	119	573	454 (383%)	3	169	166 (6,051%)
May 1-31	205	354	149 (73%)	4	149	146 (3,974%)
Jun 1-30	297	387	91 (31%)	1	122	121 (19,608%)
Jul 1-31	190	278	88 (46%)	1	97	96 (7,113%)
Aug 1-31	22	117	95 (432%)	4	100	96 (2,164%)
Sep 1-30	10	128	119 (1,227%)	5	125	120 (2,526%)
Oct 1-31	17	172	154 (893%)	1	164	164 (20,921%)
Nov 1-11	17	258	241 (1,435%)	1	260	259 (19,491%)
Nov 12-30	5	242	236 (4,396%)	1	252	251 (20,048%)
Dec 1-31	63	68	5 (7%)	3	38	35 (1,246%)
Jan 1-31	143	118	-26 (-18%)	184	164	-20 (-11%)
Feb 1-28	314	421	107 (34%)	357	431	73 (21%)

Notes:
Summarized from SJR5Q flow and temperature model.
Simulation period: January 1980 – September 2003.
Year-type as defined by the Restoration year-types.
(%) indicates percent change from No-Action Alternative.
Key:
cfs = cubic feet per second

Table 4-26.
Monthly Averages of Simulated Reach 3 Flow

Dates of WY 2010 Interim Flow Release	Average of All Years			Dry Years		
	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)
Mar 1-15	906	1,355	449 (50%)	264	933	669 (254%)
Mar 16-31	857	1,427	570 (66%)	184	912	728 (396%)
Apr 1-15	840	1,402	562 (67%)	200	551	351 (175%)
Apr 16-30	919	1,358	439 (48%)	211	354	142 (67%)
May 1-31	832	974	142 (17%)	219	342	122 (56%)
Jun 1-30	818	892	75 (9%)	420	516	95 (23%)
Jul 1-31	697	766	69 (10%)	536	606	70 (13%)
Aug 1-31	464	538	74 (16%)	474	546	72 (15%)
Sep 1-30	293	388	94 (32%)	307	405	97 (32%)
Oct 1-31	281	413	132 (47%)	238	375	137 (57%)
Nov 1-11	218	434	216 (99%)	143	375	231 (162%)
Nov 12-30	266	481	215 (81%)	98	325	227 (230%)
Dec 1-31	489	487	-2 (0%)	165	191	26 (16%)
Jan 1-31	600	571	-29 (-5%)	188	164	-24 (-13%)
Feb 1-28	829	920	91 (11%)	450	504	54 (12%)

Notes:
Summarized from SJR5Q flow and temperature model.
Simulation period: January 1980 – September 2003.
Year-type as defined by the Restoration year-types.
(%) indicates percent change from No-Action Alternative.
Key:
cfs = cubic feet per second

Currently, a negligible amount of water leaks through Sack Dam and enters Reach 4A. Under the Proposed Action, the estimated maximum flow in Reach 4A (nonflood conditions) would be 1,300 cfs, because of upstream constraints described above in Reaches 2B and 3. This flow would then be diverted into the Eastside Bypass at the Sand Slough Control Structure. Reach 4A flow changes are shown in Table 4-27. Similar to other reaches, decreases in flows are due to additional capture of flood flows at Millerton Lake, and increases in flows are due to WY 2010 Interim Flows in minor or nonflood flow periods. These impacts would be **less than significant**.

Table 4-27.
Monthly Averages of Simulated Reach 4A Flow

Dates of WY 2010 Interim Flow Release	Average of All Years			Dry Years		
	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)
Mar 1-15	693	1,113	421 (61%)	17	645	628 (3,732%)
Mar 16-31	721	1,275	554 (77%)	31	778	746 (2,395%)
Apr 1-15	674	1,217	543 (81%)	34	410	376 (1,102%)
Apr 16-30	726	1,159	433 (60%)	34	177	143 (415%)
May 1-31	635	786	151 (24%)	35	155	120 (340%)
Jun 1-30	453	526	73 (16%)	73	168	95 (131%)
Jul 1-31	313	377	65 (21%)	124	195	71 (57%)
Aug 1-31	152	224	73 (48%)	153	225	72 (47%)
Sep 1-30	145	238	93 (64%)	135	231	96 (71%)
Oct 1-31	133	264	131 (98%)	88	222	134 (153%)
Nov 1-11	98	300	202 (206%)	20	244	224 (1,115%)
Nov 12-30	189	410	221 (117%)	24	258	234 (968%)
Dec 1-31	357	361	4 (1%)	37	68	31 (86%)
Jan 1-31	561	534	-27 (-5%)	143	123	-20 (-14%)
Feb 1-28	696	767	71 (10%)	325	358	33 (10%)

Notes:
Summarized from SJR5Q flow and temperature model.
Simulation period: January 1980 – September 2003.
Year-type as defined by the Restoration year-types.
(%) indicates percent change from No-Action Alternative.
Key:
cfs = cubic feet per second

Tables 4-28 and 4-29 show changes in flow in the Sand Slough and Eastside bypasses. As discussed in Section 2, WY 2010 Interim Flows would be conveyed through the bypasses to Reaches 4B2 and 5, unless downstream considerations (such as channel capacity or potential significant impacts) require that less (or no) flow enter downstream reaches. Therefore, these impacts would be **less than significant**.

**Table 4-28.
Monthly Averages of Simulated Sand Slough Bypass Flow**

Dates of WY 2010 Interim Flow Release	Average of All Years			Dry Years		
	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action (cfs)	No-Action Alternative Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)
Mar 1-15	691	1,095	403 (58%)	18	622	604 (3,385%)
Mar 16-31	724	1,275	551 (76%)	31	789	758 (2,443%)
Apr 1-15	672	1,219	547 (81%)	31	431	400 (1,295%)
Apr 16-30	725	1,166	442 (61%)	36	183	147 (403%)
May 1-31	640	801	161 (25%)	34	154	120 (358%)
Jun 1-30	450	525	74 (17%)	70	165	95 (137%)
Jul 1-31	326	388	62 (19%)	124	195	72 (58%)
Aug 1-31	150	222	72 (48%)	151	222	71 (47%)
Sep 1-30	145	237	92 (63%)	135	230	95 (70%)
Oct 1-31	133	262	129 (98%)	90	221	132 (147%)
Nov 1-11	101	293	193 (192%)	23	240	217 (958%)
Nov 12-30	178	404	226 (127%)	23	261	238 (1,020%)
Dec 1-31	353	363	9 (3%)	37	73	36 (98%)
Jan 1-31	555	530	-25 (-5%)	136	119	-17 (-13%)
Feb 1-28	692	750	58 (8%)	321	339	18 (6%)

Notes:
Summarized from SJR5Q flow and temperature model.
Simulation period: January 1980 – September 2003.
Year-type as defined by the Restoration year-types.
(%) indicates percent change from No-Action Alternative.
Key:
cfs = cubic feet per second

Table 4-29.
Monthly Averages of Simulated Eastside Bypass Flow Below Sand Slough Control Structure

Dates of WY 2010 Interim Flow Release	Average of All Years			Dry Years		
	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action (cfs)	No-Action Alternative Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)
Mar 1-15	691	1,095	403 (58%)	18	622	604 (3,385%)
Mar 16-31	724	1,275	551 (76%)	31	789	758 (2,443%)
Apr 1-15	672	1,219	547 (81%)	31	431	400 (1,295%)
Apr 16-30	725	1,166	442 (61%)	36	183	147 (403%)
May 1-31	640	801	161 (25%)	34	154	120 (358%)
Jun 1-30	450	525	74 (17%)	70	165	95 (137%)
Jul 1-31	326	388	62 (19%)	124	195	72 (58%)
Aug 1-31	150	222	72 (48%)	151	222	71 (47%)
Sep 1-30	145	237	92 (63%)	135	230	95 (70%)
Oct 1-31	133	262	129 (98%)	90	221	132 (147%)
Nov 1-11	101	293	193 (192%)	23	240	217 (958%)
Nov 12-30	178	404	226 (127%)	23	261	238 (1,020%)
Dec 1-31	353	363	9 (3%)	37	73	36 (98%)
Jan 1-31	555	530	-25 (-5%)	136	119	-17 (-13%)
Feb 1-28	692	750	58 (8%)	321	339	18 (6%)

Notes:

Summarized from SJR5Q flow and temperature model.

Simulation period: January 1980 – September 2003.

Year-type as defined by the Restoration year-types.

(%) indicates percent change from No-Action Alternative.

Key:

cfs = cubic feet per second

The changes in flows between the Proposed Action and the No-Action Alternative in Reach 5 are shown in Table 4-30. As noted above, decreases in flows are due to additional capture of flood flows at Millerton Lake, and increases in flows are due to WY 2010 Interim Flows in minor or nonflood flow periods. These impacts are attributable to full WY 2010 Interim Flows entering Reach 5. If biological considerations restrict WY 2010 Interim Flows in the bypasses, any impacts would be less than those shown in Table 4-30. These impacts would be **less than significant**.

Table 4-30.
Monthly Averages of Simulated Reach 5 Flow

Dates of WY 2010 Interim Flow Release	Average of All Years			Dry Years		
	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action (cfs)	No-Action Alternative Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)
Mar 1-15	1,711	1,949	238 (14%)	116	695	579 (499%)
Mar 16-31	1,782	2,308	525 (29%)	110	883	774 (706%)
Apr 1-15	1,650	2,182	533 (32%)	83	519	436 (527%)
Apr 16-30	1,675	2,075	399 (24%)	104	261	157 (152%)
May 1-31	1,635	1,555	-80 (-5%)	67	190	123 (183%)
Jun 1-30	1,245	1,211	-35 (-3%)	109	206	97 (89%)
Jul 1-31	1,081	1,111	30 (3%)	164	238	74 (45%)
Aug 1-31	246	318	72 (29%)	198	269	71 (36%)
Sep 1-30	245	336	91 (37%)	175	269	94 (54%)
Oct 1-31	234	362	128 (54%)	121	252	130 (107%)
Nov 1-11	195	369	175 (90%)	48	259	211 (436%)
Nov 12-30	246	480	234 (95%)	47	293	246 (518%)
Dec 1-31	690	599	-91 (-13%)	68	112	44 (64%)
Jan 1-31	1,406	1,279	-128 (-9%)	348	334	-14 (-4%)
Feb 1-28	1,818	1,613	-204 (-11%)	547	442	-104 (-19%)

Notes:
Summarized from SJR5Q flow and temperature model.
Simulation period: January 1980 – September 2003.
Year-type as defined by the Restoration year-types.
(%) indicates percent change from No-Action Alternative.
Key:
cfs = cubic feet per second

San Joaquin River from Merced River to the Delta

Flows in the San Joaquin River below the Restoration Area would increase slightly overall because of WY 2010 Interim Flows leaving Reach 5 (Table 4-30). CalSim modeling was completed to assess potential impacts of WY 2010 Interim Flows on corresponding tributary flows. Based on results of this modeling analysis, WY 2010 Interim Flows would result in changes in tributary river flows to the lower San Joaquin River, Stanislaus River, Tuolumne River, and Merced River, in response to three operational objectives:

- VAMP
- Vernalis Water Quality Standard
- Local tributary operations

Based on the analysis, WY 2010 Interim Flows may reduce tributary releases required for VAMP in late April and early May. WY 2010 Interim Flows may also result in either reductions or increases in tributary releases to meet the Vernalis WQ standard during any month in the year. These changes in releases result in changes in tributary reservoir storages that may impact local operations on the tributaries at a later time in the year.

Flows for both VAMP and the SJRRP would occur during similar times of the year and have potential to overlap in time. The Settlement does not provide guidance on coordination with VAMP flows. For WY 2010 Interim Flows, the SJRRP considered two possible approaches to VAMP:

1. Change VAMP targets at Vernalis – This approach would require renegotiation with all parties involved in the VAMP agreement, including SWRCB and SJRGA. Because the existing VAMP agreement would expire soon, SWRCB is addressing the responsibilities for meeting the Vernalis flow standard, and both Reclamation and NMFS are participating in these negotiations. Under the current San Joaquin River Agreement, VAMP operations for WY 2010 and 2011 are still being developed, and both flow targets and tributary contributions may change. Because of this uncertainty, operational standards are unknown for the 2010 VAMP period. In addition, any revised targets would need to be approved by SJRGA and SWRCB. Therefore, it was not considered feasible to develop revised VAMP targets at Vernalis that could be implemented with WY 2010 Interim Flows.

2. Meet flow targets at Vernalis under the existing VAMP agreement – Under this approach, WY 2010 Interim Flows would contribute to the baseline that determines tributary contributions. Tributary releases to meet VAMP and water quality objectives at Vernalis would be affected by this approach in one of two ways. In conditions when WY 2010 Interim Flows contribute toward meeting the same VAMP flow threshold that would have otherwise been in place, required releases from tributary reservoirs could be reduced. In conditions when WY 2010 Interim Flows would cause a higher VAMP flow threshold than would have otherwise been in place, required releases from tributary reservoirs would be made to achieve the higher threshold. As a result, tributary flows would increase

in some years and decrease in other years. Changes in VAMP contribution releases from tributary reservoirs would not affect the ability to meet instream fish and water quality minimum flow requirements in the Merced, Tuolumne, Stanislaus, or mainstem San Joaquin rivers. However, it is possible that flows in the tributaries could be less because of VAMP operations with WY 2010 Interim Flows than they would be without the WY 2010 Interim Flows.

Approach 2 was considered the best method for assessing of the potential impacts of the Proposed Action.

Given the lack of specific information on how VAMP would be implemented in WY 2010, the analysis applied the current VAMP framework, which is considered the most conservative representation for CalSim model evaluations (i.e., this approach would indicate the greatest level of potential change to instream flows in the tributaries). The analysis was also based on the inflexible application of the VAMP operating rules. Real-time operations under VAMP are based on the professional judgment of VAMP participants and, thus, are not easily represented or simulated in a modeling framework.

VAMP specifies a 31-day pulse flow during the 61-day window of April and May to coincide with fish movement in the area. Since CalSim cannot predict fish movements, VAMP flows are modeled as occurring for 16 days in April and 15 days in May, the usual assumption for planning purposes. The basic process followed in CalSim is to first allow the San Joaquin River and its tributaries to operate without considering VAMP requirements to compute a base flow, then to compute any additional release required to meet the VAMP requirements, and finally to assign this release to the various tributaries and CVP Exchange Contractors.

The VAMP requirement is assigned based on increasing the base flow to a specific step function (Table 4-31). For example, if the base flow is less than 2,000 cfs, the VAMP requirement is 2,000 cfs. If the current year plus last year's water types are wet enough, the requirement may be increased to the next higher step (double step) – in this example, 3,200 cfs. There is also a provision that if the current year plus the last 2 years are dry enough, there is a Dry year relaxation and no VAMP requirement (i.e., no tributary release to meet VAMP flows). The modeling procedure used for these analyses follows the procedure described in Appendix B of the San Joaquin River Agreement (SJRGA 1998).

Table 4-31.
Vamp Flow Step Requirements

Base Flow (cfs)	Vamp Requirement (cfs)	
	Step	**Double Step**
0	2,000	3,200
1,999	2,000	3,200
3,199	3,200	4,450
4,449	4,450	5,700
5,699	5,700	7,000
99,999	7,000	7,000

Key:
cfs = cubic feet per second
VAMP = Vernalis Adaptive Management Program

In CalSim, these flows are converted to the volume of water required to raise the base flow to the VAMP requirement for 16 days in April and 15 days in May. These volumes are then distributed to the following SJRGA members as reservoir releases and/or reductions in demands:

- Merced Irrigation District – Lake McClure on the Merced River
- Oakdale Irrigation District – New Melones on the Stanislaus River
- Mendota Pool Exchange Contractors – Mendota Pool Delta Mendota Canal deliveries
- Modesto Irrigation District and Turlock Irrigation District – Don Pedro on the Tuolumne River

The VAMP deficiency is met by alternating releases from each source based on several different steps (i.e., the first 25 TAF are shared between the four SJRGA members according to a step function, with one SJRGA member releasing first, then the next 11.5 TAF are distributed among the remaining SJRGA members, and so on). Table 4-32 shows the steps used in this process. CalSim also allows "trading" between New Melones and Don Pedro reservoirs (e.g., Don Pedro may make a portion of the New Melones VAMP requirement to help protect New Melones storage for other uses such as the Vernalis Water Quality Standard).

**Table 4-32.
Distribution of VAMP Requirements**

Volume (TAF)	MID (TAF)	OID (TAF)	Exchange (TAF)	MID/TID (TAF)
0.0	0.0	0.0	0.0	0.0
25.0	25.0	0.0	0.0	0.0
35.0	25.0	10.0	0.0	0.0
40.0	25.0	10.0	5.0	0.0
50.0	25.0	10.0	5.0	10.0
61.5	36.5	10.0	5.0	10.0
66.1	36.5	14.6	5.0	10.0
68.4	36.5	14.6	7.3	10.0
73.0	36.5	14.6	7.3	14.6
81.5	45.0	14.6	7.3	14.6
84.9	45.0	18.0	7.3	14.6
86.6	45.0	18.0	9.0	14.6
90.0	45.0	18.0	9.0	18.0
100.0	55.0	18.0	9.0	18.0
104.0	55.0	22.0	9.0	18.0
106.0	55.0	22.0	11.0	18.0
110.0	55.0	22.0	11.0	22.0
9999.0	55.0	22.0	11.0	22.0

Key:
Exchange = Mendota Pool Exchange Contractors
MID = Merced Irrigation District
MID/TID = Modesto and Turlock irrigation districts
OID = Oakdale Irrigation District
TAF = thousand acre-feet
VAMP = Vernalis Adaptive Management Program

Simulated changes in tributary flows under the Proposed Action include both increases and decreases from the No-Action Alternative. Generally, tributary flows shift to later in the year with a decrease during the WY 2010 Interim Flow spring period (February 1 through May 28) of Wet years, because the additional San Joaquin River flow would allow a reduction in releases from the tributary reservoirs. Water stored in tributaries during the spring period is then released at a later date to meet water supply demands, causing tributary flow increases during those periods. The magnitude of the changes is different between tributaries because of the sharing agreement for meeting VAMP requirements. Tables 4-33 through 4-35 contain mean monthly tributary flows, by D-1641 San Joaquin Valley Water Supply Index, and the change in these flows due to WY 2010 Interim Flows.

Table 4-33.
Merced River Mean Monthly Inflows to San Joaquin River, with WY 2010 Interim Flows

Year Type	Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep	
	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff
Wet	484	0%	479	0%	783	0%	1698	1%	2290	0%	1853	0%	1078	-4%	2017	1%	2631	0%	2001	0%	1188	0%	668	3%
Above-Normal	483	0%	497	0%	807	-2%	958	0%	1378	2%	609	0%	478	-29%	777	11%	296	1%	272	4%	377	0%	262	7%
Below-Normal	378	0%	429	0%	420	0%	499	0%	497	0%	389	0%	700	-4%	455	11%	280	0%	172	0%	128	0%	76	0%
Dry	521	6%	407	7%	431	0%	435	0%	473	0%	343	0%	649	2%	398	2%	184	0%	126	0%	115	0%	63	0%
Critical	408	0%	348	0%	357	0%	363	0%	360	0%	295	0%	342	-3%	218	-1%	139	0%	83	0%	74	0%	54	0%

Key:
cfs = cubic feet per second
Diff = difference
Avg = average

Table 4-34.
Tuolumne River Mean Monthly Inflows to San Joaquin River, with WY 2010 Interim Flows

Year Type	Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep	
	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff
Wet	654	0%	596	0%	1049	0%	2396	0%	3460	1%	4512	0%	3747	-1%	3486	-1%	3894	1%	2857	0%	699	0%	727	0%
Above-Normal	617	0%	797	0%	1440	0%	1620	0%	2080	0%	2385	0%	2097	0%	1806	0%	646	0%	549	0%	548	0%	548	0%
Below-Normal	550	0%	458	0%	585	0%	548	0%	696	0%	847	0%	1495	0%	1413	0%	413	0%	374	0%	371	0%	360	0%
Dry	639	0%	528	0%	500	0%	547	0%	543	0%	753	0%	917	0%	953	0%	348	0%	329	0%	343	0%	344	0%
Critical	494	0%	453	0%	378	0%	381	0%	419	0%	430	0%	538	0%	571	0%	257	0%	247	0%	261	0%	261	0%

Key:
Cfs = cubic feet per second
Diff = difference
Avg = average

Table 4-35.
Stanislaus River Mean Monthly Inflows to San Joaquin River, with WY 2010 Interim Flows

Year Type	Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep	
	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff	avg. cfs	Diff
Wet	732	1%	558	1%	691	1%	1015	0%	1648	3%	1601	1%	1652	0%	1559	0%	2016	0%	1160	1%	1043	0%	1184	2%
Above-Normal	805	0%	652	0%	899	4%	932	0%	951	0%	597	-5%	1404	1%	1344	2%	944	0%	451	0%	444	0%	473	0%
Below-Normal	674	0%	476	1%	465	1%	425	1%	463	-7%	418	-11%	1114	0%	1124	4%	540	0%	425	0%	407	0%	408	0%
Dry	800	0%	490	1%	463	2%	443	1%	507	-8%	347	-25%	937	-4%	956	1%	338	3%	345	0%	371	0%	387	0%
Critical	562	0%	419	0%	383	2%	281	0%	371	-2%	240	-54%	584	-1%	614	4%	328	10%	313	0%	340	0%	338	0%

Key:
Cfs = cubic feet per second
Diff = difference
Avg = average

Figures 4-4 through 4-18 show the minimum and maximum flows for the No–Action Alternative and the mean flow for both the No–Action Alternative and Proposed Action for tributaries for different year-types. The bars for minimum and maximum identify the historical range of flows. The columns for the means show a comparison between the two alternatives.

The figures show that the change in flows is small relative to the magnitude of the flows. They also show that flow under the Proposed Action is within the same range of the monthly variation found under the No–Action Alternative.

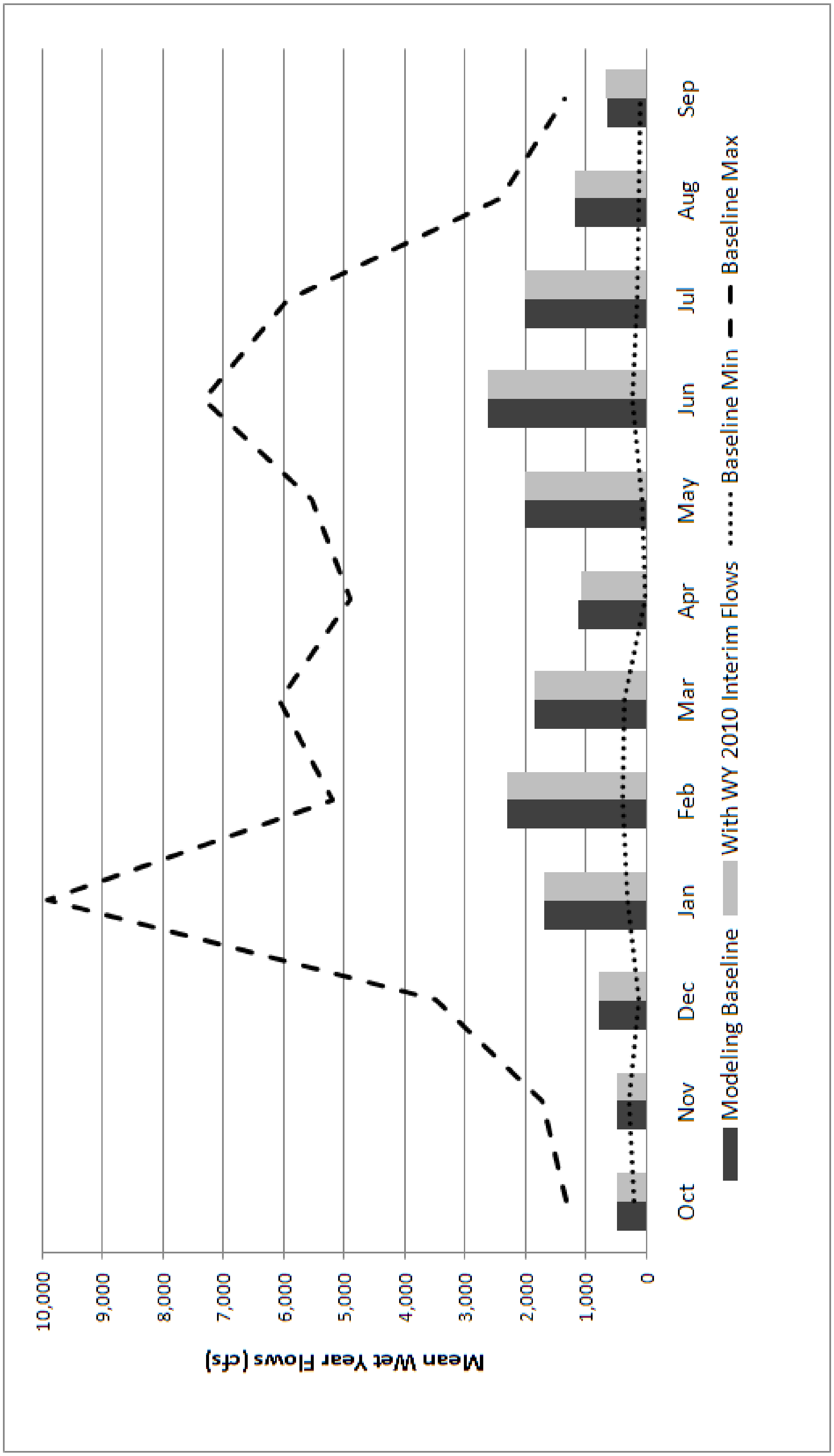

Figure 4-4.
Wet Year Comparison of No-Action Alternative and Proposed Action Merced River Flows

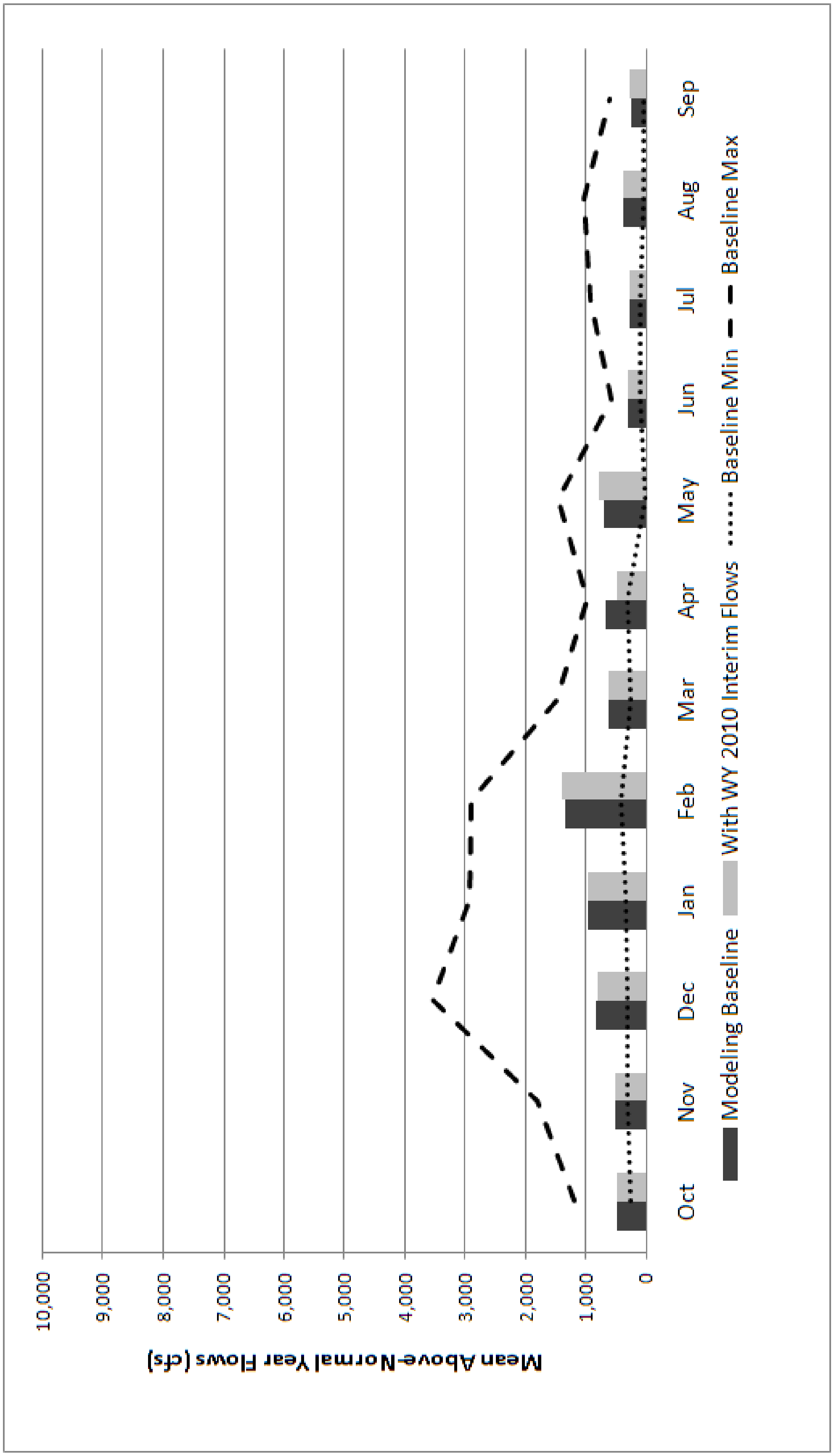

Figure 4-5.
Above-Normal Year Comparison of No–Action Alternative and Proposed Action Merced River Flows

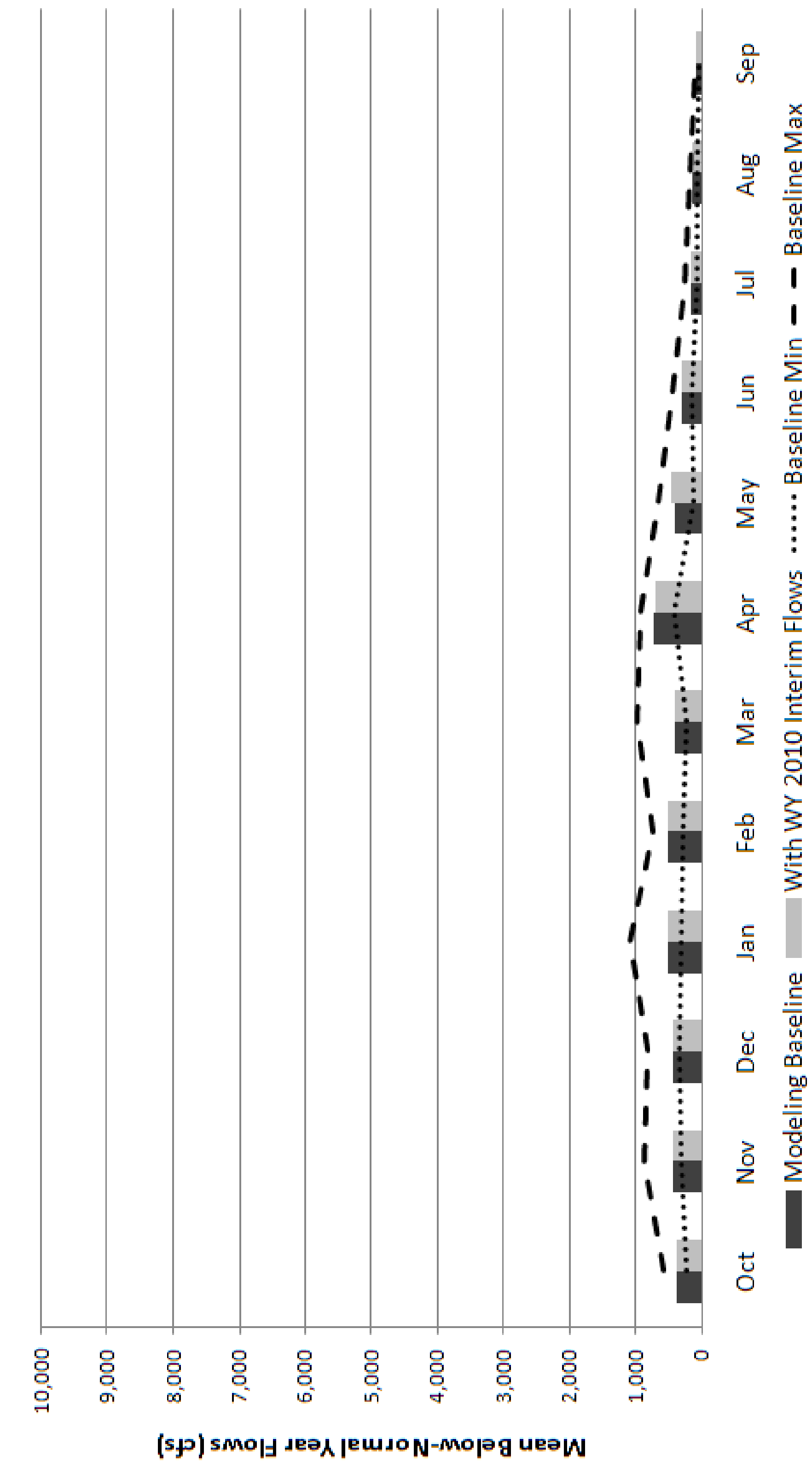

Figure 4-6.
Below-Normal Year Comparison of No-Action Alternative and Proposed Action Merced River Flows

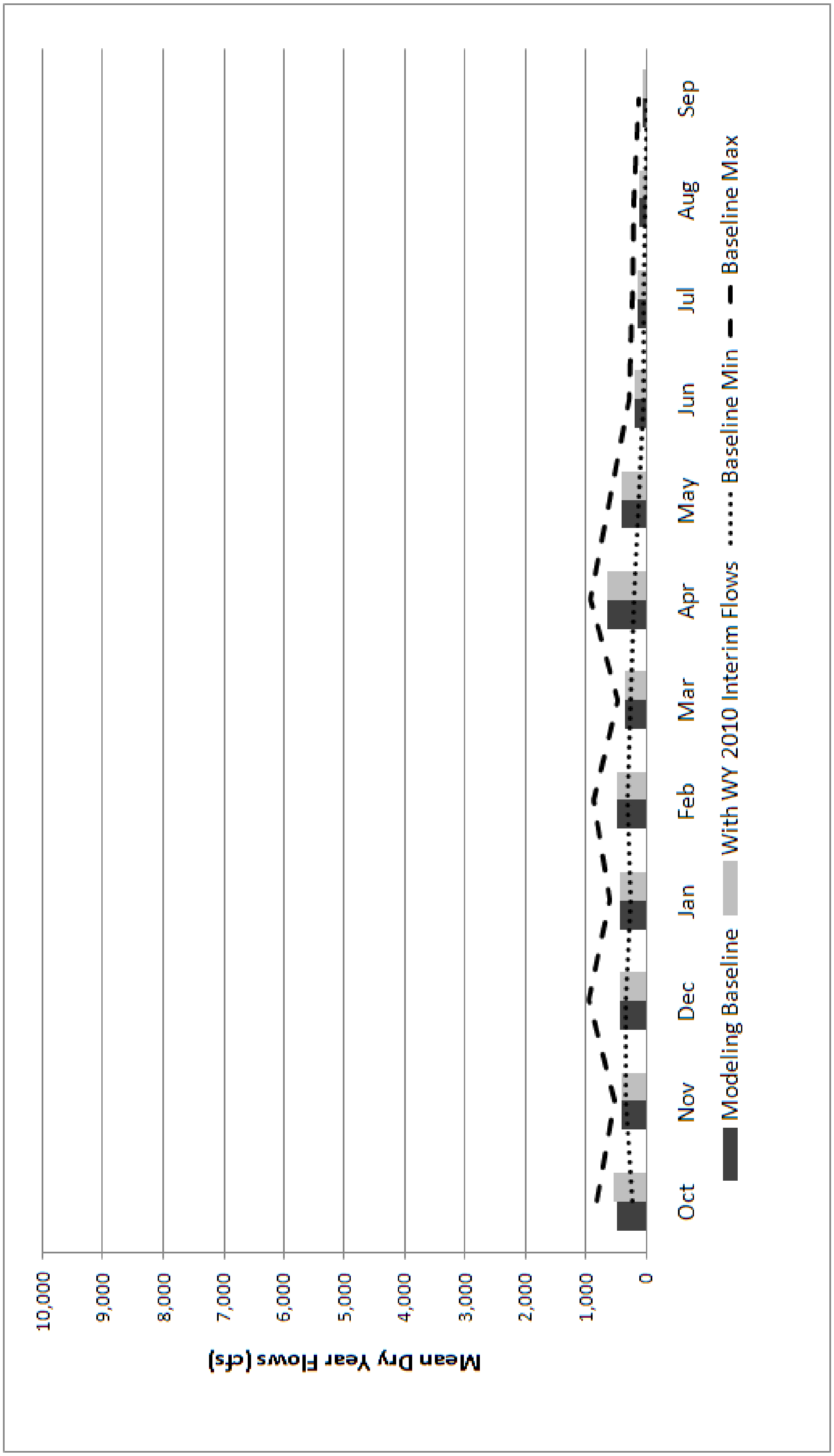

Figure 4-7.
Dry Year Comparison of No-Action Alternative and Proposed Action Merced River Flows

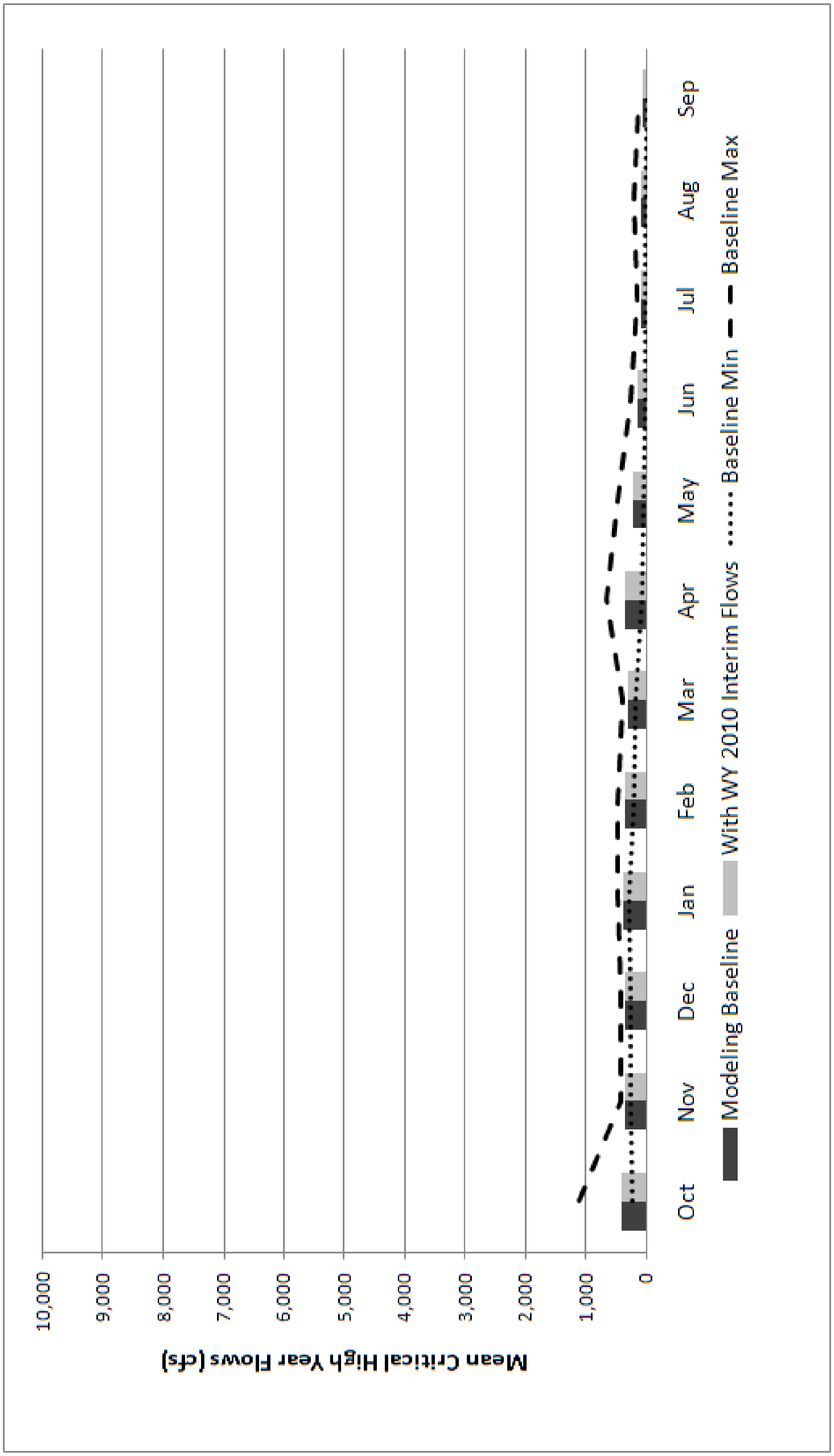

Figure 4-8.
Critical-High Year Comparison of No-Action Alternative and Proposed Action Merced River Flows

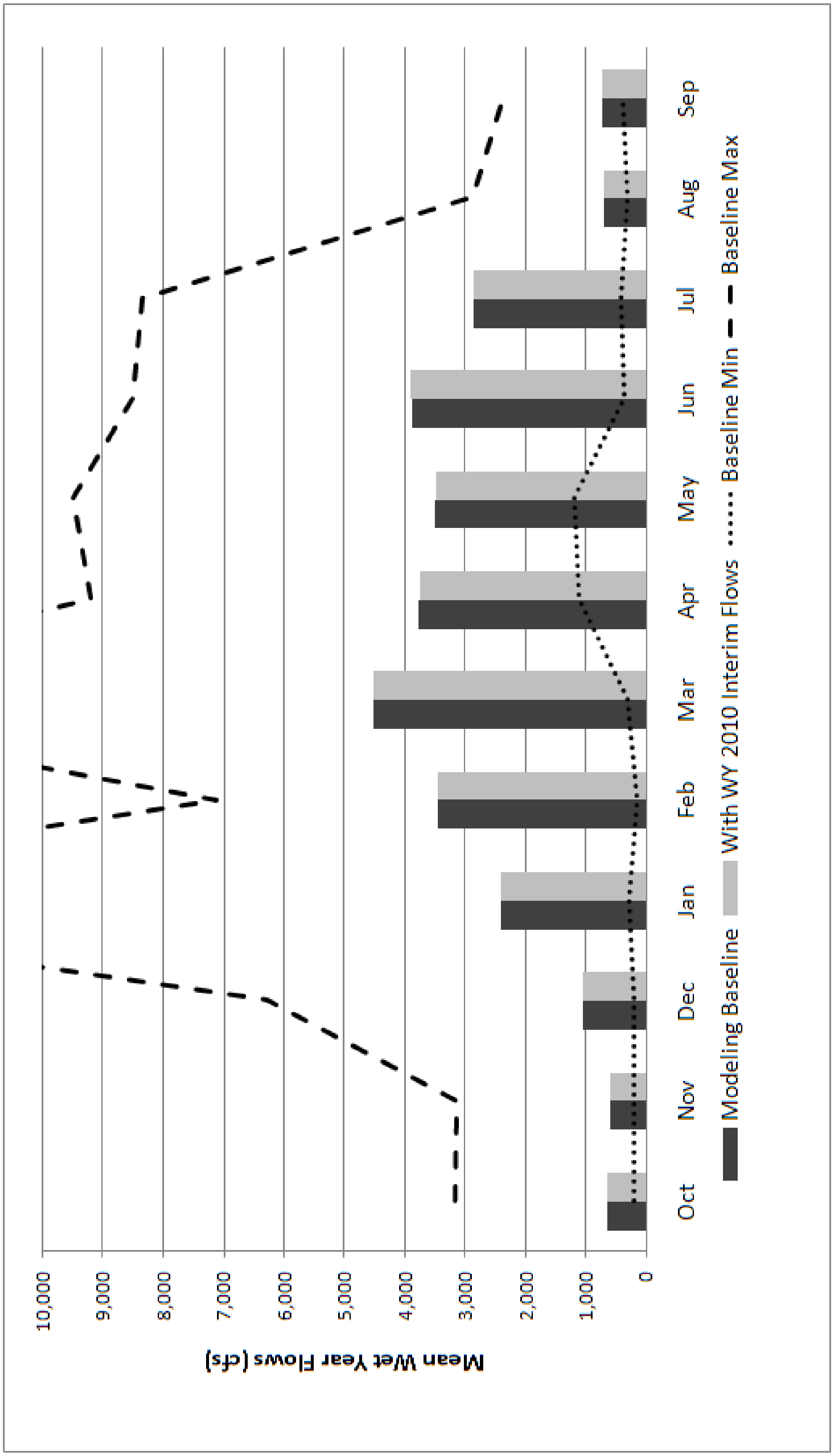

Figure 4-9.
Wet Year Comparison of No-Action Alternative and Proposed Action Tuolumne River Flows

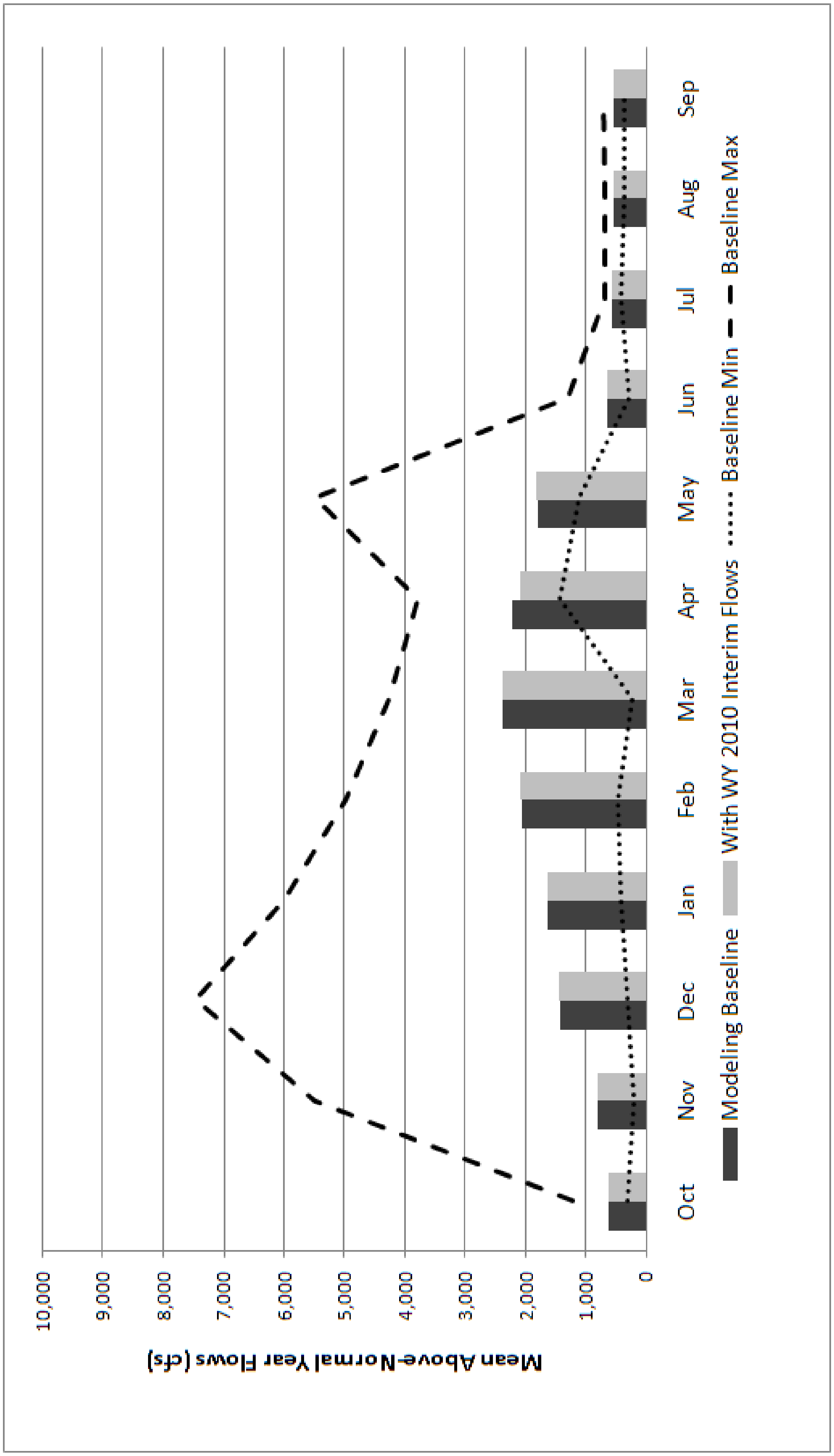

Figure 4-10.
Above-Normal Year Comparison of No-Action Alternative and Proposed Action Tuolumne River Flows

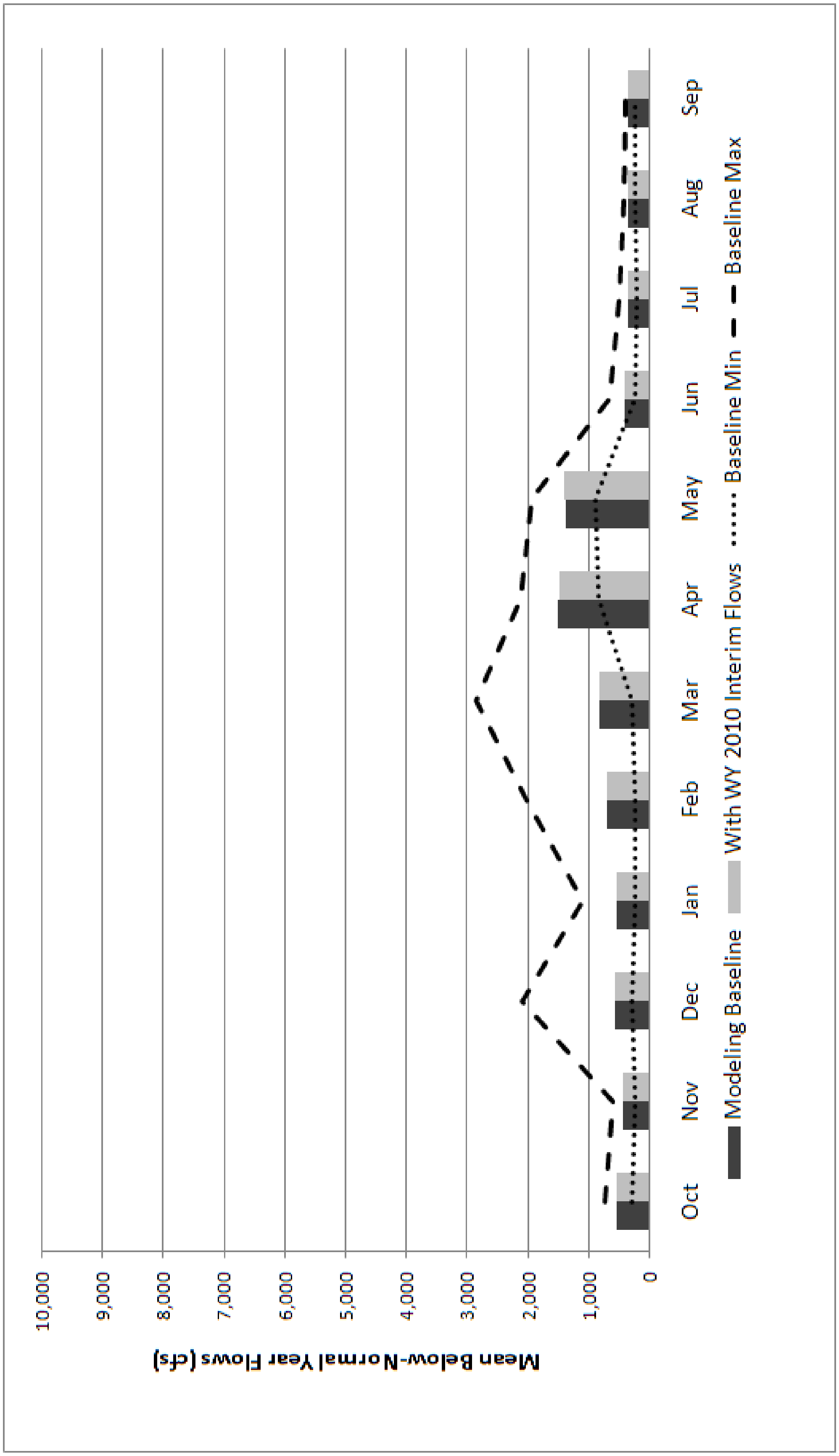

Figure 4-11.
Below-Normal Year Comparison of No–Action Alternative and Proposed Action Tuolumne River Flows

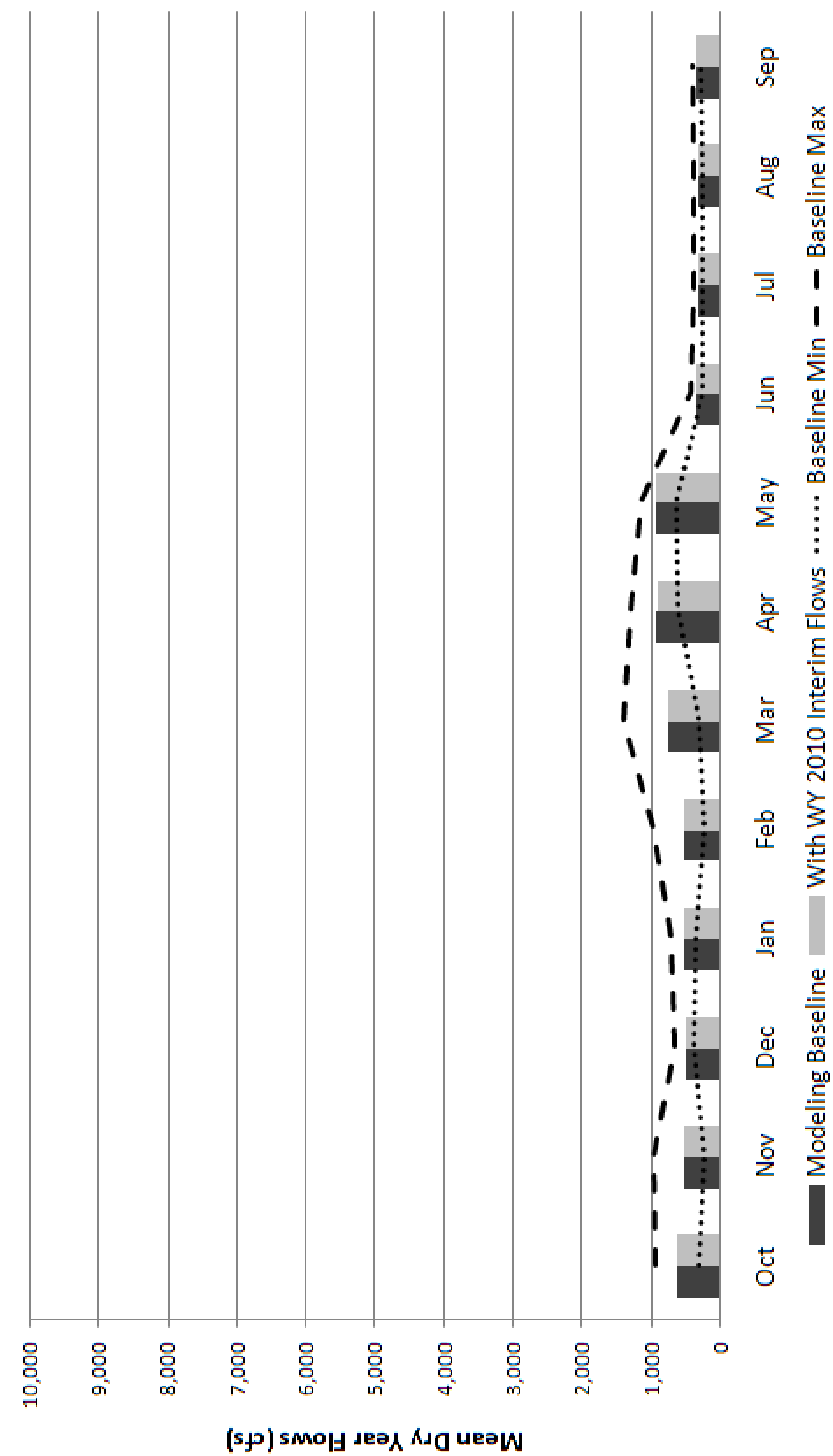

Figure 4-12.
Dry Year Comparison of No-Action Alternative and Proposed Action Tuolumne River Flows

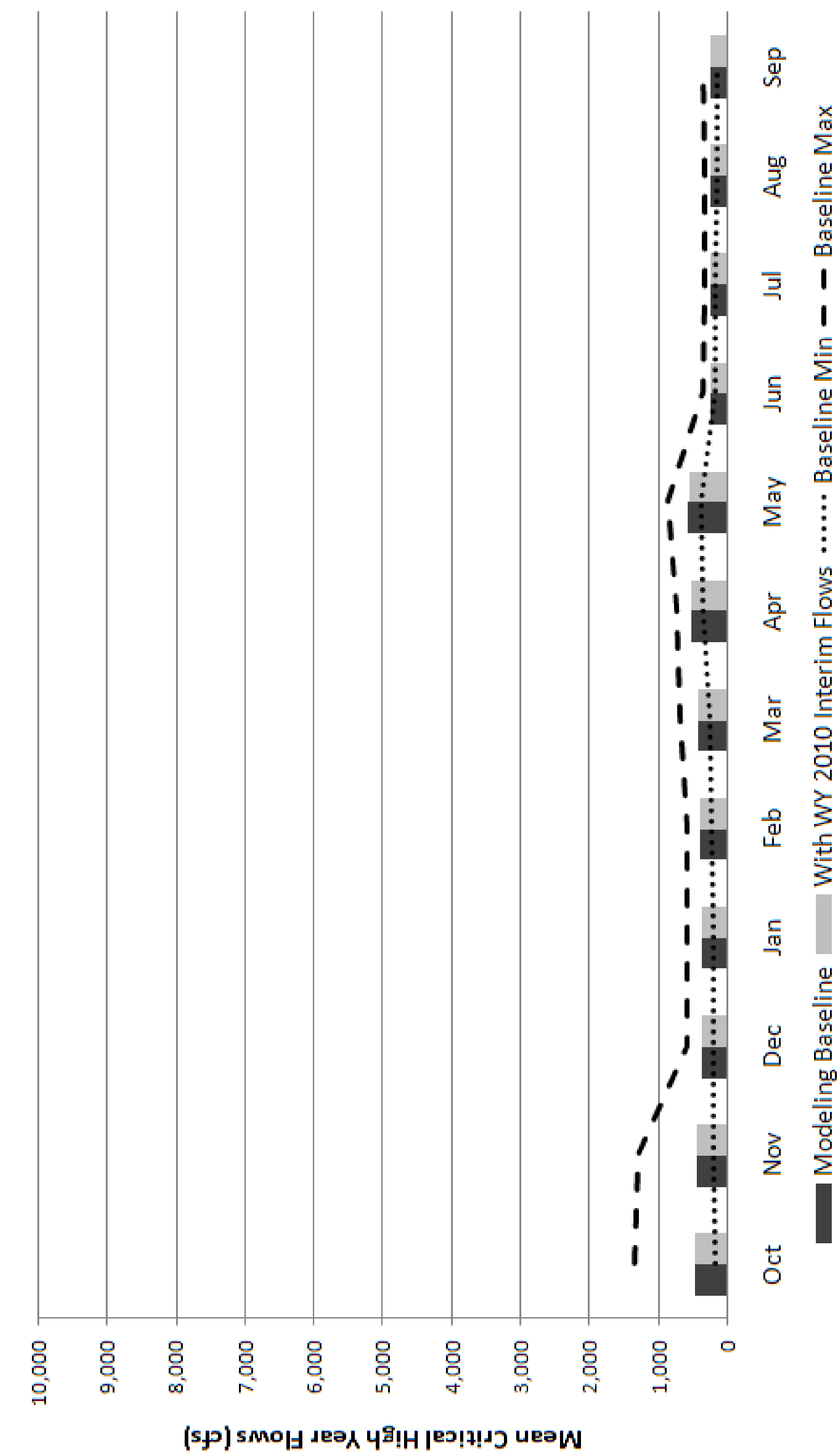

Figure 4-13.
Critical-High Year Comparison of No-Action Alternative and Proposed Action Tuolumne River Flows

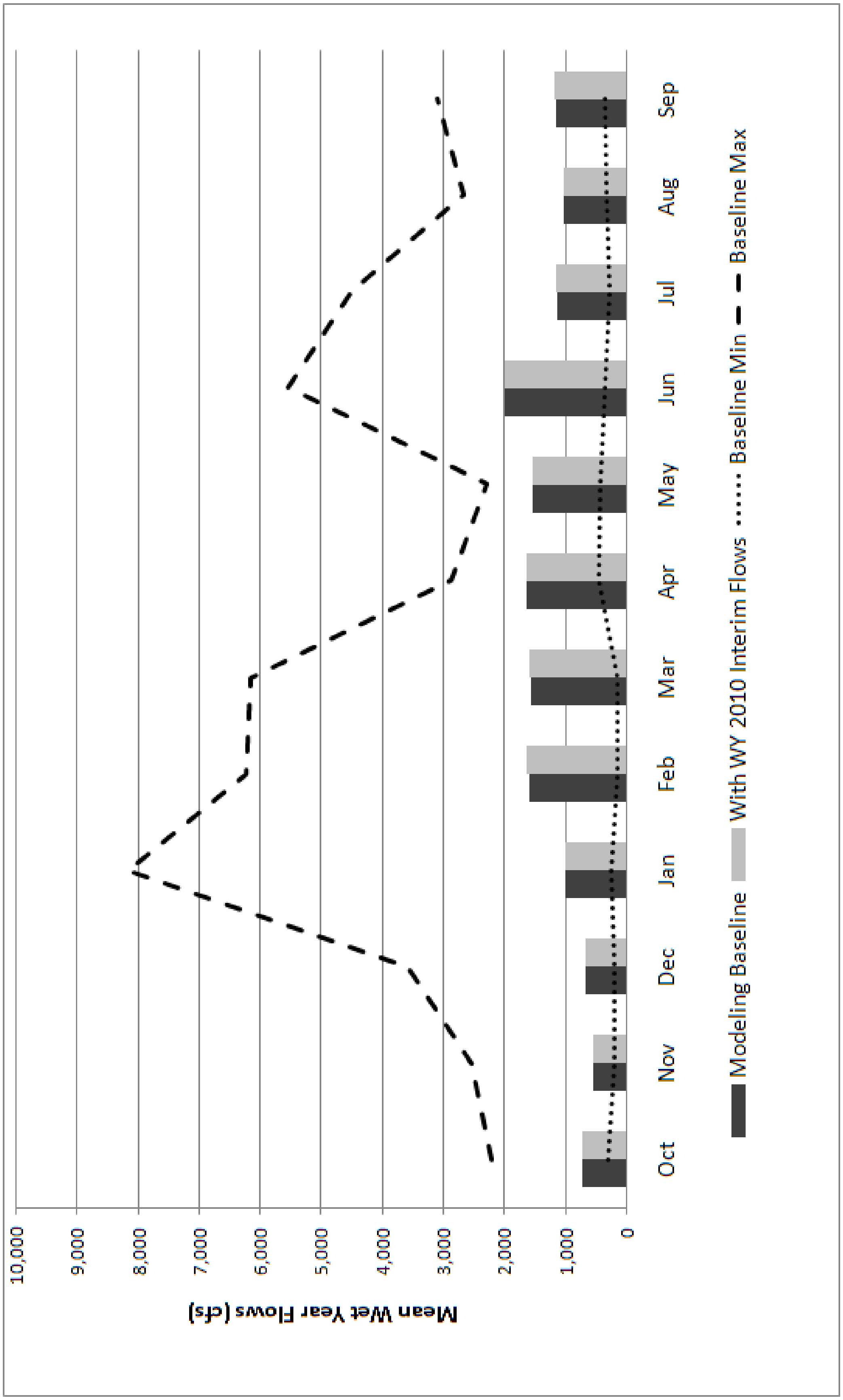

Figure 4-14.
Wet Year Comparison of No-Action Alternative and Proposed Action Stanislaus River Flows

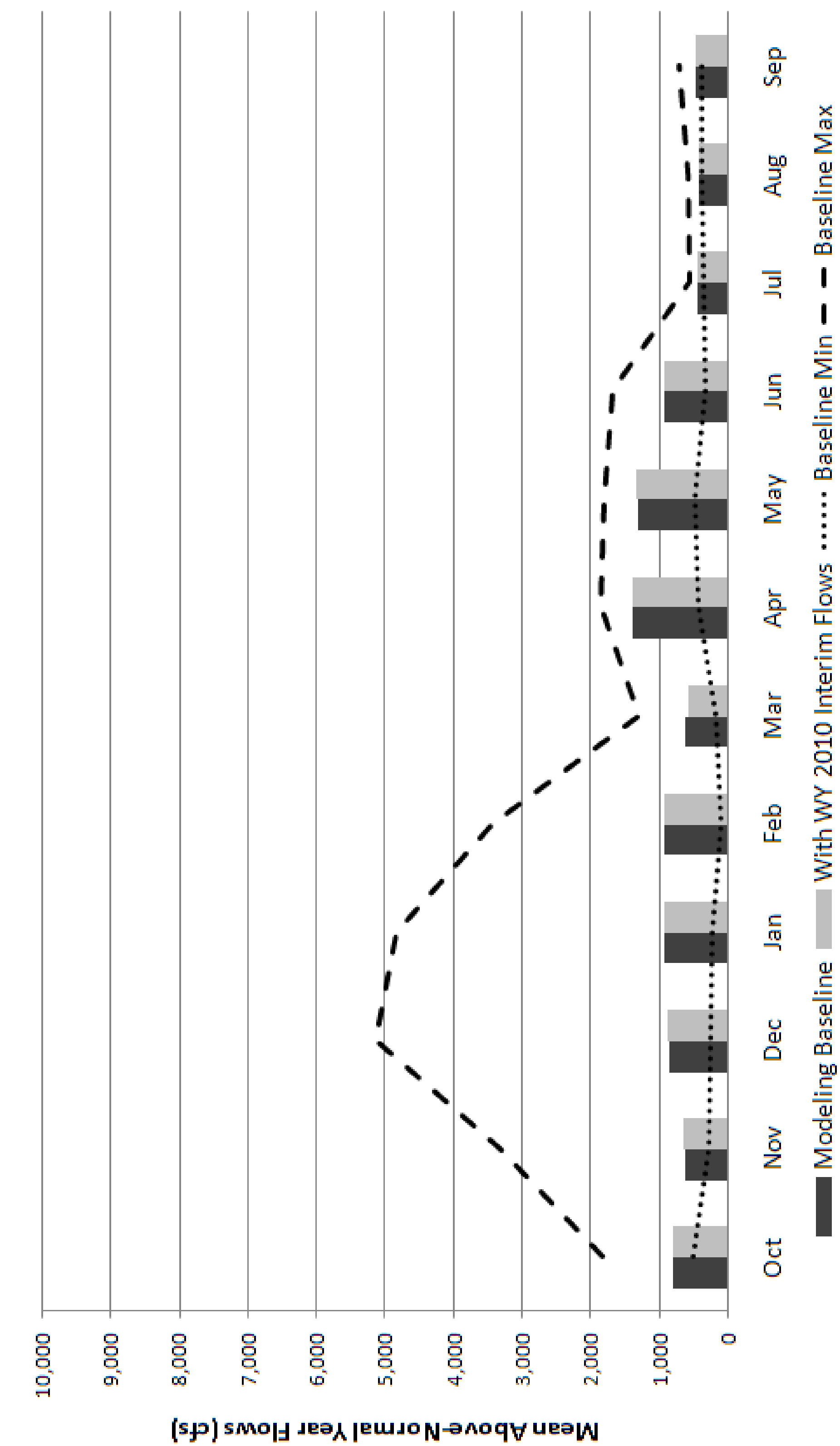

Figure 4-15.
Above-Normal Year Comparison of No-Action Alternative and Proposed Action Stanislaus River Flows

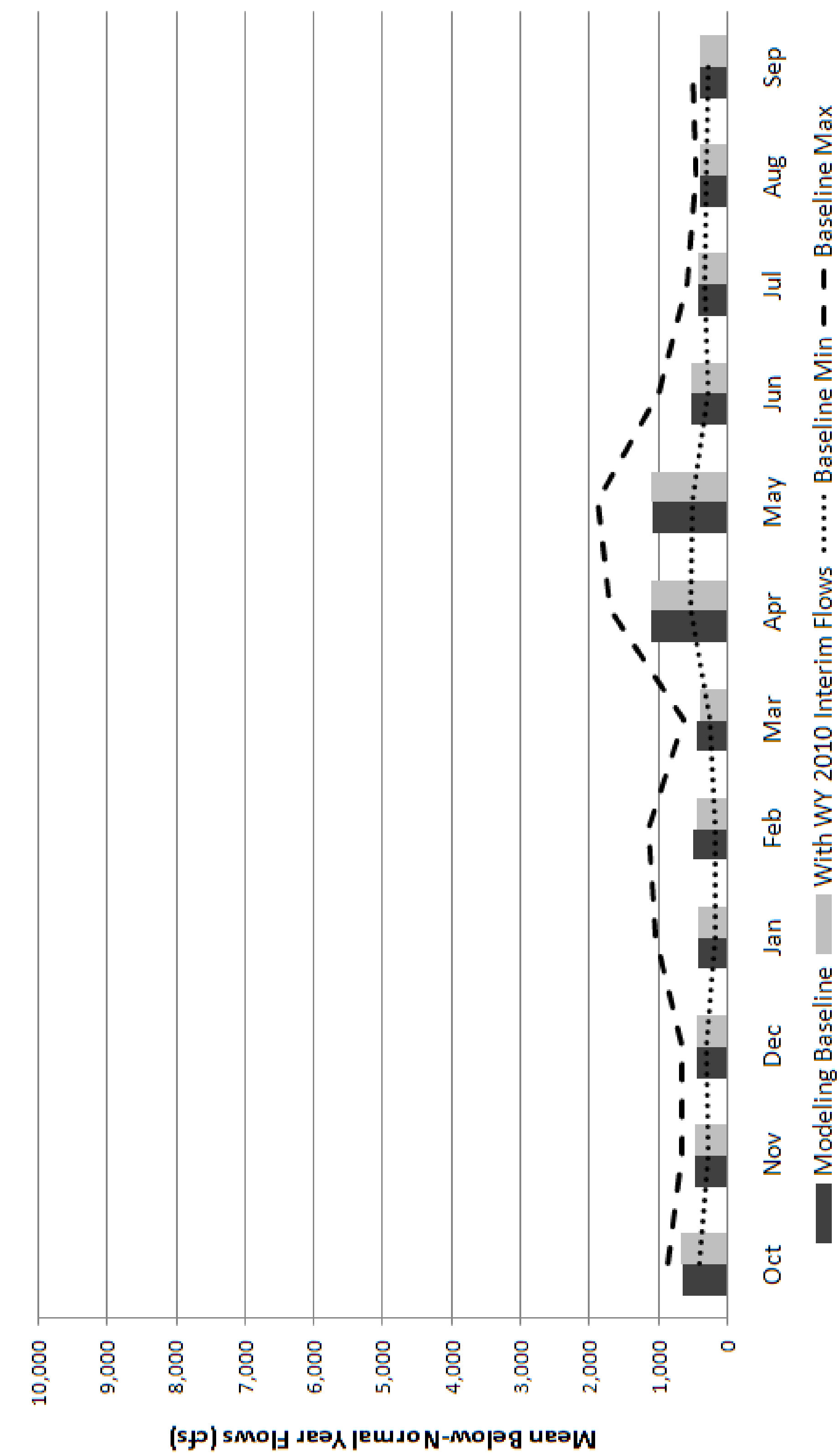

Figure 4-16.
Below-Normal Year Comparison of No–Action Alternative and Proposed Action Stanislaus River Flows

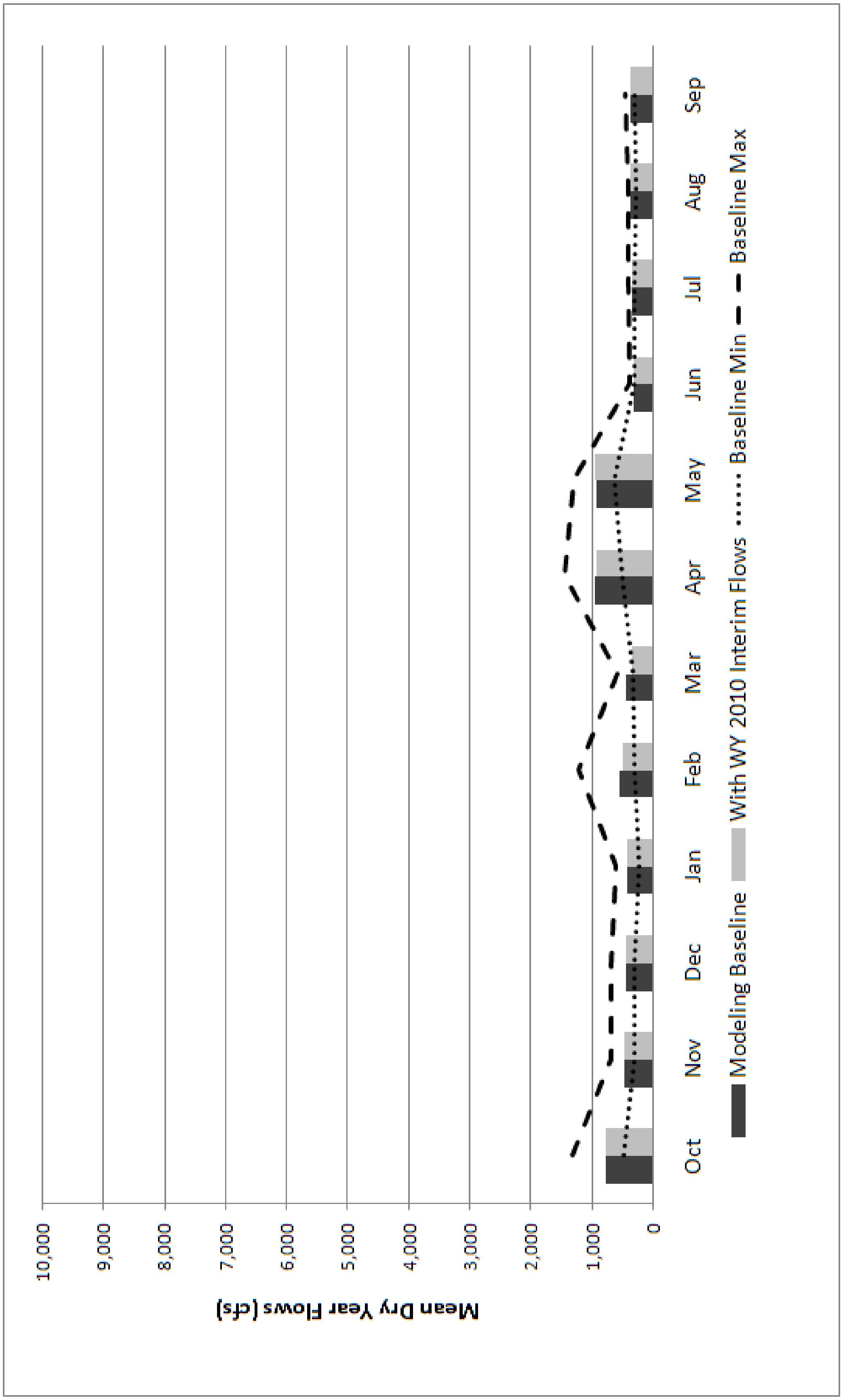

Figure 4-17.
Dry Year Comparison of No-Action Alternative and Proposed Action Stanislaus River Flows

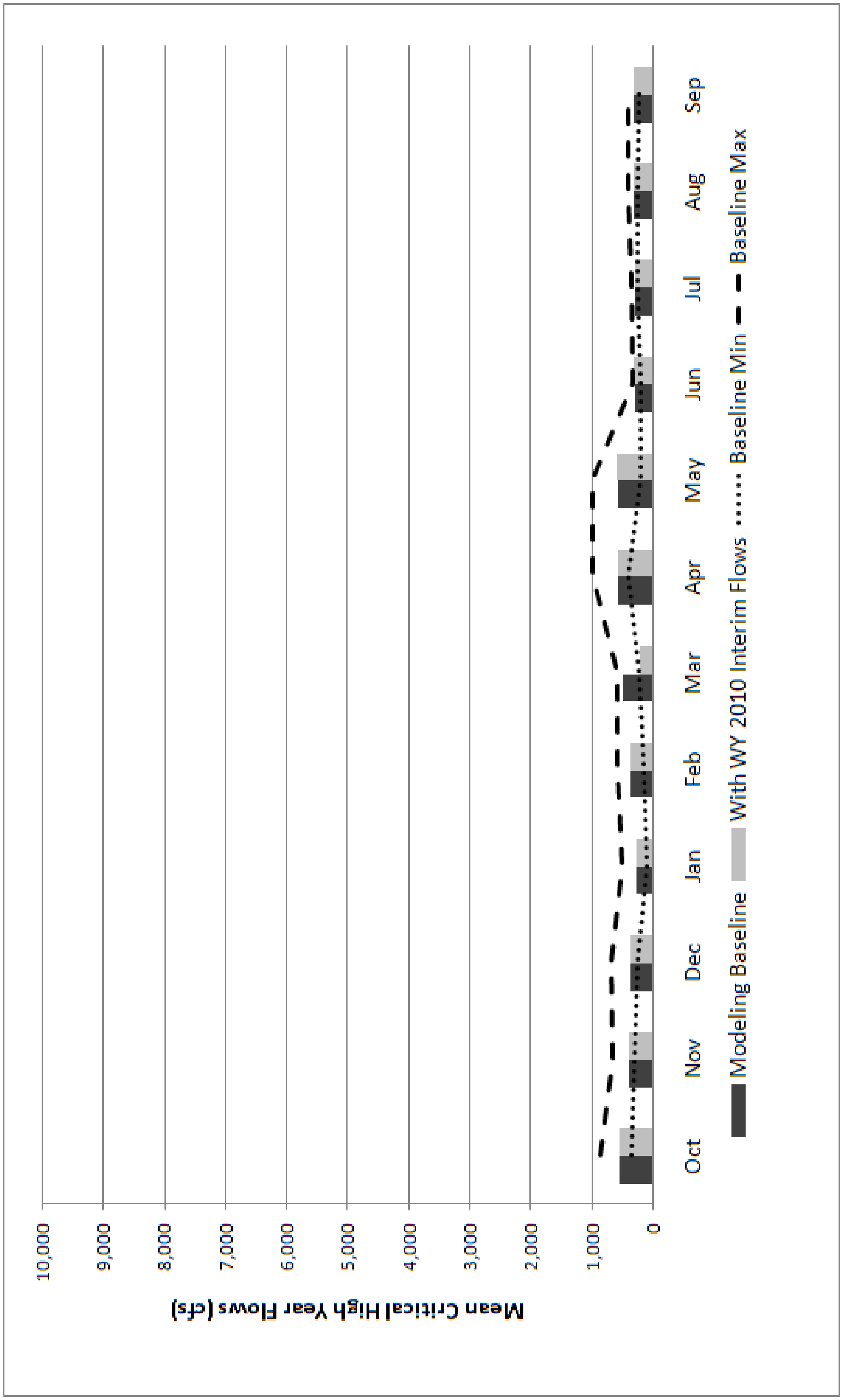

Figure 4-18.
Critical-High Year Comparison of No-Action Alternative and Proposed Action Stanislaus River Flows

Tables 4-36 through 4-45 contain the monthly tributary flows and change between the No–Action Alternative and the Proposed Action.

Table 4-45 presents a comparison between the SJRRP year-types and D-1641 San Joaquin Valley Water Supply Index water year-types for informational purposes.

Table 4-36.
Merced River Flow into San Joaquin River (modeling baseline, cfs)

WY	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	Wet	292	368	486	482	879	748	28	1251	3357	1387	867	453
1923	Above-Normal	469	304	962	1270	1017	261	305	586	582	159	762	598
1924	Critical	593	385	382	396	320	273	272	201	29	51	36	49
1925	Below-Normal	282	419	425	428	689	421	922	533	214	116	77	54
1926	Dry	266	354	375	375	336	271	514	401	61	51	37	51
1927	Above-Normal	274	322	313	381	441	280	589	267	166	136	84	89
1928	Below-Normal	426	352	389	361	493	341	898	426	271	179	88	80
1929	Critical	296	387	387	408	435	328	654	113	129	49	54	92
1930	Critical	276	367	359	361	375	303	558	244	31	35	35	93
1931	Critical	276	385	372	382	408	292	86	98	82	86	40	75
1932	Above-Normal	266	363	475	469	691	383	432	20	94	109	57	58
1933	Dry	310	386	383	426	371	337	512	214	78	60	41	30
1934	Critical	298	383	405	466	469	311	437	231	113	84	35	29
1935	Above-Normal	282	389	409	580	428	587	698	364	230	182	100	55
1936	Above-Normal	368	410	385	428	2906	665	811	1468	132	134	820	441
1937	Wet	707	424	417	416	4208	1251	311	2281	562	597	812	446
1938	Wet	442	401	2035	1341	4928	4767	1521	3341	4530	2238	1159	596
1939	Dry	833	397	383	443	509	453	849	488	135	67	73	68
1940	Above-Normal	331	424	418	573	489	280	419	1409	236	145	240	416
1941	Wet	459	427	1286	1340	3119	1858	842	3103	2347	1749	1069	508
1942	Wet	718	447	1183	1528	1720	517	522	1180	2978	1651	1021	509
1943	Wet	494	549	783	2172	1974	3163	910	1070	435	510	941	490
1944	Below-Normal	475	459	436	414	532	345	926	320	391	172	136	88
1945	Above-Normal	357	489	446	441	2769	834	677	561	170	934	937	421
1946	Above-Normal	840	640	1862	1067	829	469	689	597	303	170	129	81
1947	Dry	592	532	963	621	869	323	205	122	147	65	80	76
1948	Below-Normal	319	397	398	388	299	313	594	125	197	182	100	97
1949	Below-Normal	348	404	386	402	394	359	518	218	263	121	121	70
1950	Below-Normal	326	394	394	428	403	390	650	321	329	162	130	77
1951	Above-Normal	329	402	2100	1733	1641	454	703	213	308	186	116	63
1952	Wet	347	417	460	1941	1317	1922	1245	3703	3081	1943	1231	621
1953	Below-Normal	450	428	334	1080	727	358	729	537	190	140	126	55
1954	Below-Normal	360	405	403	406	439	277	423	252	277	167	131	81
1955	Dry	314	392	409	537	442	338	358	327	146	120	113	55
1956	Wet	311	386	133	3245	1983	498	793	1195	2336	1954	1152	610
1957	Below-Normal	580	422	409	411	406	364	694	520	332	195	154	81
1958	Wet	424	381	405	481	721	1286	2986	3555	2730	1720	1123	675
1959	Dry	483	395	382	395	564	335	875	547	172	107	116	94
1960	Critical	307	374	383	397	451	343	635	325	164	101	127	49
1961	Critical	286	365	387	372	395	321	166	200	143	70	55	40
1962	Below-Normal	264	341	359	360	681	975	755	346	446	253	182	78
1963	Above-Normal	346	362	376	376	410	467	882	758	454	277	194	158
1964	Dry	411	397	398	404	316	320	569	292	197	163	114	77
1965	Wet	346	356	528	1780	497	355	527	773	444	285	1448	634
1966	Below-Normal	474	866	812	1055	724	346	885	611	257	206	165	79
1967	Wet	293	366	400	408	424	746	1756	2666	4147	4063	1494	797
1968	Dry	747	411	330	382	500	358	936	605	249	196	177	130
1969	Wet	275	431	434	903	4093	1534	2098	5555	4141	2433	1233	711
1970	Above-Normal	825	320	444	2940	1265	917	986	657	329	256	222	150
1971	Below-Normal	383	375	359	425	384	331	907	661	314	256	188	102
1972	Dry	359	386	423	270	340	263	726	472	281	240	222	18
1973	Above-Normal	309	412	432	474	889	652	373	1106	476	600	1038	574
1974	Wet	815	776	1095	1690	870	1126	666	1563	594	841	1054	586
1975	Wet	667	350	409	307	2026	1073	793	680	2074	1163	1062	533
1976	Critical	1107	357	362	392	370	291	502	477	255	175	205	136
1977	Critical	354	311	322	373	253	234	531	311	173	106	81	44
1978	Wet	268	282	350	516	824	582	219	566	4016	2613	1294	1369
1979	Above-Normal	509	579	441	1541	1932	1485	901	973	355	262	731	443
1980	Wet	698	374	392	3976	4525	1490	621	961	1997	2284	1248	583
1981	Dry	629	398	444	479	452	479	945	596	240	168	168	97
1982	Wet	401	405	414	484	1795	2297	4921	3385	1922	2249	1390	1170
1983	Wet	1344	1754	2298	3657	4416	6069	1408	2947	7343	5943	2444	1100
1984	Above-Normal	1196	1802	3551	1903	1596	512	782	591	328	291	277	217
1985	Dry	537	338	334	488	759	371	607	382	274	236	206	100
1986	Wet	405	395	408	380	3446	4143	921	1748	1415	946	1113	737
1987	Critical	558	416	418	381	380	393	508	354	183	130	135	87
1988	Critical	356	340	375	377	305	246	297	300	201	97	92	52
1989	Critical	256	274	322	304	310	339	165	41	142	68	62	67
1990	Critical	305	303	327	310	346	205	110	181	146	72	68	26
1991	Critical	248	258	274	292	205	359	200	168	146	91	54	10
1992	Critical	270	289	297	291	352	298	201	139	139	76	55	11
1993	Wet	206	313	350	684	449	438	18	63	1693	1492	1085	640
1994	Critical	739	369	334	315	381	186	337	131	142	43	54	2
1995	Wet	239	327	317	611	386	3584	1035	3031	5130	4891	1700	509
1996	Wet	474	379	365	844	3009	1633	817	1696	290	374	903	480
1997	Wet	613	845	3494	9912	2144	1191	782	686	240	149	114	84
1998	Wet	369	336	356	1396	5205	2115	1235	1064	5045	4614	1499	759
1999	Above-Normal	741	382	296	820	2026	362	765	779	292	174	196	100
2000	Above-Normal	285	345	318	325	2186	1137	807	851	242	175	112	59
2001	Dry	668	496	392	389	391	365	617	394	244	74	84	25
2002	Dry	239	403	390	449	307	249	517	219	172	90	61	2
2003	Below-Normal	227	316	353	327	287	241	568	449	160	80	66	41

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	484	479	783	1687	2290	1849	1124	2003	2619	2004	1186	650
Above-Normal	483	497	827	958	1345	609	676	700	294	262	376	245
Below-Normal	378	429	420	499	497	389	728	409	280	172	128	76
Dry	491	407	431	435	473	343	633	389	184	126	115	63
Critical	408	348	357	363	360	295	354	220	139	83	74	54

Key: cfs = cubic feet per second

Table 4-37.
Merced River Flow into San Joaquin River (with Proposed Action, cfs)

WY	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	Wet	292	368	486	482	879	748	28	1251	3357	1387	867	453
1923	Above-Normal	469	304	962	1270	1017	261	209	679	582	159	762	598
1924	Critical	593	385	382	396	320	273	265	195	29	54	36	49
1925	Below-Normal	282	419	425	428	689	421	813	602	214	116	77	54
1926	Dry	266	354	375	375	336	271	476	373	61	51	37	51
1927	Above-Normal	274	322	313	381	441	280	169	439	166	136	84	89
1928	Below-Normal	426	352	389	361	493	341	867	456	271	179	88	80
1929	Critical	296	387	387	408	435	328	618	148	129	49	54	92
1930	Critical	276	367	359	361	375	303	558	168	31	35	35	93
1931	Critical	276	385	372	382	408	292	89	98	82	86	41	75
1932	Above-Normal	266	363	475	469	691	383	456	106	94	109	57	58
1933	Dry	310	386	383	426	371	337	469	256	78	60	41	30
1934	Critical	298	383	405	466	469	311	389	279	113	78	29	29
1935	Above-Normal	282	389	409	580	428	587	344	515	230	182	100	55
1936	Above-Normal	368	410	385	428	3123	665	811	1312	132	289	820	441
1937	Wet	707	424	417	416	4208	1251	311	2281	562	597	812	446
1938	Wet	442	401	2035	1341	4928	4767	1521	3341	4530	2238	1159	596
1939	Dry	833	397	383	443	509	453	849	488	135	67	73	68
1940	Above-Normal	331	424	418	573	489	280	419	1387	236	145	262	416
1941	Wet	459	427	1286	1340	3119	1858	842	3103	2347	1749	1069	508
1942	Wet	718	447	1183	1528	1720	517	522	1180	2978	1651	1021	509
1943	Wet	494	549	783	2172	1974	3163	910	1154	435	427	941	490
1944	Below-Normal	475	459	436	414	532	345	895	350	391	172	136	88
1945	Above-Normal	357	489	446	441	2769	834	450	565	392	934	937	421
1946	Above-Normal	840	640	1862	1067	829	469	483	490	303	170	129	267
1947	Dry	713	532	963	621	869	323	622	290	147	65	80	76
1948	Below-Normal	319	397	398	388	299	313	514	203	197	182	100	97
1949	Below-Normal	348	404	386	402	394	359	479	190	263	121	121	70
1950	Below-Normal	326	394	394	428	403	390	650	187	329	162	130	77
1951	Above-Normal	329	402	1777	1733	1641	454	282	486	308	186	116	63
1952	Wet	347	417	460	2071	1317	1922	1245	3703	3081	1943	1231	621
1953	Below-Normal	450	428	334	1080	727	358	698	567	190	140	126	55
1954	Below-Normal	360	405	403	406	439	277	392	252	277	167	131	81
1955	Dry	314	392	409	537	442	338	303	285	146	120	113	55
1956	Wet	311	386	133	3365	1983	498	582	1354	2383	1954	1152	610
1957	Below-Normal	580	422	409	411	406	364	674	501	332	195	154	81
1958	Wet	424	381	405	481	721	1322	2986	3555	2730	1720	1123	675
1959	Dry	483	395	382	395	564	335	875	547	172	107	116	94
1960	Critical	307	374	383	397	451	343	635	273	164	101	127	49
1961	Critical	286	365	387	372	395	321	166	200	143	70	55	40
1962	Below-Normal	264	341	359	360	681	975	788	640	446	253	182	78
1963	Above-Normal	346	362	376	376	410	467	540	787	454	277	194	158
1964	Dry	411	397	398	404	316	320	533	327	197	163	114	77
1965	Wet	346	356	528	1780	497	355	527	751	444	291	1448	634
1966	Below-Normal	474	866	812	1055	724	346	885	611	257	206	165	79
1967	Wet	293	366	400	408	424	746	1756	2666	4147	4063	1494	797
1968	Dry	747	411	330	382	500	358	927	614	249	196	177	130
1969	Wet	275	431	434	903	4093	1534	2098	5555	4141	2433	1233	711
1970	Above-Normal	825	320	444	2940	1265	917	986	657	329	256	222	150
1971	Below-Normal	383	375	359	425	384	331	876	690	314	256	188	102
1972	Dry	359	386	423	270	340	263	726	374	281	240	222	18
1973	Above-Normal	309	412	432	474	889	652	435	1326	286	600	1038	574
1974	Wet	815	776	1095	1690	870	1126	325	2091	390	841	1054	586
1975	Wet	667	350	409	307	2026	1073	423	776	2343	1163	1062	533
1976	Critical	1107	357	362	392	370	291	509	483	255	175	205	136
1977	Critical	354	311	322	373	253	234	528	313	173	106	81	44
1978	Wet	268	282	350	516	824	582	219	566	4016	2613	1294	1369
1979	Above-Normal	509	579	441	1541	1932	1485	531	1330	355	262	731	443
1980	Wet	698	374	392	3976	4525	1490	752	617	2222	2284	1248	583
1981	Dry	629	398	444	479	452	479	945	596	240	168	168	97
1982	Wet	401	405	414	484	1795	2297	4921	3385	1922	2249	1390	1170
1983	Wet	1344	1754	2298	3657	4416	6069	1408	2947	7343	5943	2444	1100
1984	Above-Normal	1196	1802	3551	1903	1596	512	362	748	328	291	277	217
1985	Dry	779	338	334	488	759	371	577	412	274	236	206	100
1986	Wet	405	395	408	380	3446	4143	921	1748	1415	946	1113	737
1987	Critical	558	416	418	381	380	393	476	385	183	130	135	87
1988	Critical	356	340	375	377	305	246	264	279	201	97	92	52
1989	Critical	256	274	322	304	310	339	165	41	142	68	62	67
1990	Critical	305	303	327	310	346	205	110	181	146	72	68	26
1991	Critical	248	258	274	292	205	359	200	168	146	91	54	10
1992	Critical	270	289	297	291	352	298	201	139	139	76	55	11
1993	Wet	206	313	350	684	449	438	44	63	1667	1492	1085	640
1994	Critical	739	369	334	315	381	186	293	131	142	41	54	2
1995	Wet	239	327	317	611	386	3626	1035	3031	5130	4891	1700	509
1996	Wet	474	379	365	844	3009	1633	673	1834	290	374	903	480
1997	Wet	613	845	3494	9912	2144	1191	589	385	240	149	157	512
1998	Wet	389	336	356	1396	5205	2115	1235	1064	5045	4614	1499	759
1999	Above-Normal	741	382	296	820	2026	362	554	682	292	174	196	100
2000	Above-Normal	285	345	318	325	2500	1137	614	923	242	175	112	150
2001	Dry	692	496	392	389	391	365	617	394	244	74	84	25
2002	Dry	239	403	390	449	307	249	517	219	172	90	61	2
2003	Below-Normal	227	316	353	327	287	241	568	664	160	80	66	41

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	484	479	783	1698	2290	1853	1078	2017	2631	2001	1188	668
Above-Normal	483	497	807	958	1378	609	478	777	296	272	377	262
Below-Normal	378	429	420	499	497	389	700	455	280	172	128	76
Dry	521	407	431	435	473	343	649	398	184	126	115	63
Critical	408	348	357	363	360	295	342	218	139	83	74	54

Key: cfs = cubic feet per second

Table 4-38.
Merced River Flow into San Joaquin River
(change, Proposed Action– baseline, cfs)

WY	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1923	Above-Normal	0	0	0	0	0	0	-96	93	0	0	0	0
1924	Critical	0	0	0	0	0	0	-7	-6	0	3	0	0
1925	Below-Normal	0	0	0	0	0	0	-109	69	0	0	0	0
1926	Dry	0	0	0	0	0	0	-38	-28	0	0	0	0
1927	Above-Normal	0	0	0	0	0	0	-420	172	0	0	0	0
1928	Below-Normal	0	0	0	0	0	0	-31	30	0	0	0	0
1929	Critical	0	0	0	0	0	0	-36	34	0	0	0	0
1930	Critical	0	0	0	0	0	0	0	-77	0	0	0	0
1931	Critical	0	0	0	0	0	0	3	0	0	0	0	0
1932	Above-Normal	0	0	0	0	0	0	24	86	0	0	0	0
1933	Dry	0	0	0	0	0	0	-43	41	0	0	0	0
1934	Critical	0	0	0	0	0	0	-49	47	0	-6	-6	0
1935	Above-Normal	0	0	0	0	0	0	-354	151	0	0	0	0
1936	Above-Normal	0	0	0	0	217	0	0	-157	0	155	0	0
1937	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1938	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1939	Dry	0	0	0	0	0	0	0	0	0	0	0	0
1940	Above-Normal	0	0	0	0	0	0	0	-23	0	0	22	0
1941	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1942	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1943	Wet	0	0	0	0	0	0	0	84	0	-83	0	0
1944	Below-Normal	0	0	0	0	0	0	-31	30	0	0	0	0
1945	Above-Normal	0	0	0	0	0	0	-228	4	222	0	0	0
1946	Above-Normal	0	0	0	0	0	0	-206	-108	0	0	0	186
1947	Dry	121	0	0	0	0	0	417	168	0	0	0	0
1948	Below-Normal	0	0	0	0	0	0	-80	78	0	0	0	0
1949	Below-Normal	0	0	0	0	0	0	-38	-28	0	0	0	0
1950	Below-Normal	0	0	0	0	0	0	0	-134	0	0	0	0
1951	Above-Normal	0	0	-323	0	0	0	-420	273	0	0	0	0
1952	Wet	0	0	0	130	0	0	0	0	0	0	0	0
1953	Below-Normal	0	0	0	0	0	0	-31	30	0	0	0	0
1954	Below-Normal	0	0	0	0	0	0	-31	0	0	0	0	0
1955	Dry	0	0	0	0	0	0	-54	-42	0	0	0	0
1956	Wet	0	0	0	120	0	0	-211	159	47	0	0	0
1957	Below-Normal	0	0	0	0	0	0	-19	-18	0	0	0	0
1958	Wet	0	0	0	0	0	36	0	0	0	0	0	0
1959	Dry	0	0	0	0	0	0	0	0	0	0	0	0
1960	Critical	0	0	0	0	0	0	0	-53	0	0	0	0
1961	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1962	Below-Normal	0	0	0	0	0	0	32	294	0	0	0	0
1963	Above-Normal	0	0	0	0	0	0	-341	29	0	0	0	0
1964	Dry	0	0	0	0	0	0	-37	35	0	0	0	0
1965	Wet	0	0	0	0	0	0	0	-22	0	6	0	0
1966	Below-Normal	0	0	0	0	0	0	0	0	0	0	0	0
1967	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1968	Dry	0	0	0	0	0	0	-9	9	0	0	0	0
1969	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1970	Above-Normal	0	0	0	0	0	0	0	0	0	0	0	0
1971	Below-Normal	0	0	0	0	0	0	-31	30	0	0	0	0
1972	Dry	0	0	0	0	0	0	0	-98	0	0	0	0
1973	Above-Normal	0	0	0	0	0	0	62	220	-190	0	0	0
1974	Wet	0	0	0	0	0	0	-341	528	-204	0	0	0
1975	Wet	0	0	0	0	0	0	-370	96	270	0	0	0
1976	Critical	0	0	0	0	0	0	7	7	0	0	0	0
1977	Critical	0	0	0	0	0	0	-2	2	0	0	0	0
1978	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1979	Above-Normal	0	0	0	0	0	0	-370	357	0	0	0	0
1980	Wet	0	0	0	0	0	0	131	-344	224	0	0	0
1981	Dry	0	0	0	0	0	0	0	0	0	0	0	0
1982	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1983	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1984	Above-Normal	0	0	0	0	0	0	-420	157	0	0	0	0
1985	Dry	242	0	0	0	0	0	-31	30	0	0	0	0
1986	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1987	Critical	0	0	0	0	0	0	-33	32	0	0	0	0
1988	Critical	0	0	0	0	0	0	-33	-21	0	0	0	0
1989	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1990	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1991	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1992	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1993	Wet	0	0	0	0	0	0	26	0	-26	0	0	0
1994	Critical	0	0	0	0	0	0	-45	0	0	-2	0	0
1995	Wet	0	0	0	0	0	42	0	0	0	0	0	0
1996	Wet	0	0	0	0	0	0	-144	139	0	0	0	0
1997	Wet	0	0	0	0	0	0	-193	-301	0	0	43	428
1998	Wet	20	0	0	0	0	0	0	0	0	0	0	0
1999	Above-Normal	0	0	0	0	0	0	-211	-96	0	0	0	0
2000	Above-Normal	0	0	0	0	314	0	-193	73	0	0	0	91
2001	Dry	24	0	0	0	0	0	0	0	0	0	0	0
2002	Dry	0	0	0	0	0	0	0	0	0	0	0	0
2003	Below-Normal	0	0	0	0	0	0	0	215	0	0	0	0

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	1	0	0	10	0	3	-46	14	13	-3	2	18
Above-Normal	0	0	-20	0	33	0	-198	77	2	10	1	17
Below-Normal	0	0	0	0	0	0	-28	46	0	0	0	0
Dry	30	0	0	0	0	0	16	9	0	0	0	0
Critical	0	0	0	0	0	0	-12	-2	0	0	0	0

Key: cfs = cubic feet per second

Table 4-39.
Tuolumne River Flow into San Joaquin River (modeling baseline, cfs)

WY	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	Wet	719	602	597	603	683	631	3297	1667	8518	1913	566	579
1923	Above-Normal	719	595	823	1978	1957	841	2985	1501	608	575	566	587
1924	Critical	732	605	580	579	606	584	527	523	342	331	342	353
1925	Below-Normal	428	442	440	427	454	473	1642	1621	470	380	389	408
1926	Dry	547	500	476	464	484	482	906	1011	391	379	389	405
1927	Above-Normal	479	449	452	456	519	517	1647	1692	697	556	568	582
1928	Below-Normal	733	615	613	601	621	2864	1738	1178	404	378	388	410
1929	Critical	547	495	477	468	498	474	742	837	349	333	341	363
1930	Critical	459	466	438	436	473	448	743	876	372	344	351	368
1931	Critical	457	453	449	437	465	440	532	527	345	334	344	354
1932	Above-Normal	424	437	430	427	525	463	1424	1417	697	577	568	578
1933	Dry	736	630	591	582	612	599	906	871	425	384	393	414
1934	Critical	482	471	451	434	461	442	530	523	347	331	341	353
1935	Above-Normal	435	445	437	436	468	429	1544	1665	707	562	565	587
1936	Above-Normal	733	609	597	593	674	3508	3274	1433	660	611	565	582
1937	Wet	732	621	600	590	3782	4503	3444	1476	640	555	566	586
1938	Wet	732	618	1922	1613	7111	7817	5429	5416	4410	3684	572	597
1939	Dry	931	650	602	593	874	1397	1194	1086	394	384	397	412
1940	Above-Normal	482	470	440	434	519	3547	3792	1118	744	625	514	528
1941	Wet	640	526	755	1268	5011	4925	4499	1205	1276	2545	618	547
1942	Wet	689	574	648	3278	3434	2720	4174	4351	2608	3292	735	704
1943	Wet	814	641	627	3422	3255	6231	3720	1494	1999	1073	501	436
1944	Below-Normal	753	584	626	650	763	983	1764	1401	490	414	405	359
1945	Above-Normal	526	453	389	529	2124	3969	2586	1587	536	688	634	572
1946	Above-Normal	684	466	3760	2702	3020	3174	2237	1849	782	637	600	580
1947	Dry	660	576	675	615	606	625	796	738	357	322	352	345
1948	Below-Normal	480	454	398	393	415	428	952	1052	663	489	407	344
1949	Below-Normal	519	468	412	519	487	742	851	896	384	354	359	343
1950	Below-Normal	525	475	463	686	427	519	1463	1391	559	395	379	370
1951	Above-Normal	513	206	4271	3760	3719	2865	2503	1780	364	422	399	370
1952	Wet	461	400	475	846	644	3807	4598	5070	4408	3733	617	591
1953	Below-Normal	680	479	517	734	1275	642	2118	1849	334	519	433	400
1954	Below-Normal	460	400	391	397	383	459	1097	1064	439	373	379	369
1955	Dry	468	385	420	702	365	481	845	794	368	338	352	341
1956	Wet	395	372	441	6940	4167	3171	2417	1459	3312	2933	681	574
1957	Below-Normal	697	478	491	518	551	712	2141	1942	393	399	408	405
1958	Wet	489	380	432	561	844	3499	6198	4879	5075	2724	672	646
1959	Dry	753	519	581	624	964	1299	1250	1055	362	349	333	366
1960	Critical	461	364	307	362	519	435	686	807	282	275	295	321
1961	Critical	310	330	282	337	346	385	465	436	246	236	256	235
1962	Below-Normal	298	314	323	314	941	510	1942	1820	370	358	396	408
1963	Above-Normal	464	273	315	425	493	245	1545	1369	485	527	500	515
1964	Dry	548	381	400	518	493	516	721	645	275	256	268	280
1965	Wet	343	266	234	2977	3543	3038	3135	1477	361	543	565	718
1966	Below-Normal	585	491	2109	1104	2041	1097	1183	1003	251	246	242	242
1967	Wet	389	267	318	582	285	1216	4504	3901	6478	6518	589	674
1968	Dry	645	449	485	515	484	894	1182	1149	347	350	338	330
1969	Wet	398	367	288	1110	5455	3913	5096	6796	7535	3812	459	508
1970	Above-Normal	1216	761	1146	5995	2584	3073	1764	1584	296	432	360	426
1971	Below-Normal	673	503	532	524	456	1067	1801	1739	367	333	350	358
1972	Dry	515	322	524	367	345	387	883	910	284	276	286	284
1973	Above-Normal	315	451	522	524	826	593	1555	1279	1024	484	509	512
1974	Wet	560	745	2027	2864	1754	3806	2617	1674	3033	1039	475	657
1975	Wet	1068	1088	789	643	2442	3655	2453	1875	2433	1262	558	621
1976	Critical	1352	812	584	543	516	584	613	557	260	245	278	280
1977	Critical	284	309	322	295	303	305	383	398	176	170	167	153
1978	Wet	217	243	251	432	550	578	1424	1394	3048	415	446	436
1979	Above-Normal	393	710	611	1045	3655	4273	2210	5496	490	547	625	516
1980	Wet	609	813	877	3183	6760	3798	2383	2097	5065	3500	567	697
1981	Dry	743	775	519	693	579	779	1288	1091	316	321	348	341
1982	Wet	439	421	600	560	6677	5622	9196	6364	4838	3679	592	2367
1983	Wet	3175	3152	5340	5281	6724	16125	5060	7883	4323	6266	2862	2081
1984	Above-Normal	941	5485	7476	4168	3409	3125	1679	1789	598	558	597	599
1985	Dry	743	974	430	489	609	658	865	1020	408	340	367	359
1986	Wet	334	363	356	284	2427	8056	2904	3247	3686	648	541	662
1987	Critical	1169	1300	566	596	523	708	620	614	276	256	265	253
1988	Critical	242	259	254	305	265	293	455	462	184	175	190	177
1989	Critical	194	220	245	244	243	340	575	574	188	187	203	212
1990	Critical	215	245	232	236	275	271	431	502	195	199	221	212
1991	Critical	214	239	223	208	232	449	491	600	170	183	201	188
1992	Critical	210	239	217	224	485	307	381	450	178	169	175	175
1993	Wet	213	208	217	781	481	305	1126	1329	4074	2059	326	404
1994	Critical	581	448	413	399	490	410	522	503	207	188	201	186
1995	Wet	230	218	223	518	152	7988	4702	9501	5103	8341	1781	792
1996	Wet	758	451	430	538	5666	4888	2802	2648	3078	794	483	533
1997	Wet	592	525	6295	17735	3718	2811	1734	1494	482	499	486	486
1998	Wet	693	337	431	900	6922	5108	3854	5548	6995	6737	517	560
1999	Above-Normal	962	506	695	2008	4999	3672	2172	1515	498	497	501	506
2000	Above-Normal	591	442	344	433	3609	3718	2462	1692	1295	488	691	721
2001	Dry	692	465	418	518	400	1393	916	894	326	293	314	300
2002	Dry	322	243	383	427	242	325	630	834	276	279	326	296
2003	Below-Normal	315	247	294	264	241	297	1069	1225	244	228	283	269

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	654	591	1049	2396	3437	4509	3782	3510	3866	2857	699	727
Above-Normal	617	797	1419	1620	2069	2376	2211	1798	655	549	548	548
Below-Normal	550	458	585	548	696	830	1520	1398	413	374	371	360
Dry	639	528	500	547	543	757	952	930	348	329	343	344
Critical	494	453	378	381	419	430	543	574	257	247	261	261

Key: cfs = cubic feet per second

Table 4-40. Tuolumne River Flow into San Joaquin River (with Proposed Action, cfs)

WY	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	Wet	719	602	597	603	683	631	3297	1667	8518	1913	566	579
1923	Above-Normal	719	595	823	1978	1957	841	2985	1388	608	575	566	587
1924	Critical	732	605	580	579	606	584	527	523	342	331	342	353
1925	Below-Normal	428	442	440	427	454	473	1599	1621	470	380	389	408
1926	Dry	547	500	476	464	484	482	861	1011	391	379	389	405
1927	Above-Normal	479	449	452	456	519	517	1479	1542	697	556	568	582
1928	Below-Normal	733	615	613	601	621	3174	1701	1178	404	378	388	410
1929	Critical	547	495	477	468	498	474	742	779	349	333	341	363
1930	Critical	459	466	438	436	473	448	743	876	372	344	351	368
1931	Critical	457	453	449	437	465	440	532	527	345	334	344	354
1932	Above-Normal	424	437	430	427	525	463	1424	1550	697	577	568	578
1933	Dry	736	630	591	582	612	599	858	871	425	384	393	414
1934	Critical	482	471	451	434	461	442	530	523	347	331	341	353
1935	Above-Normal	435	445	437	436	468	429	1544	1590	707	562	565	587
1936	Above-Normal	733	609	597	593	674	3654	3274	1433	660	611	565	582
1937	Wet	732	621	600	590	3782	4503	3444	1476	640	555	566	586
1938	Wet	732	618	1922	1613	7111	7817	5429	5416	4410	3684	572	597
1939	Dry	931	650	602	593	874	1397	1161	1117	394	384	397	412
1940	Above-Normal	482	470	440	434	519	3547	3792	1118	744	625	514	528
1941	Wet	640	526	755	1268	5011	4925	4499	1205	1276	2545	618	547
1942	Wet	689	574	648	3278	3434	2720	4174	4351	2608	3292	735	704
1943	Wet	814	641	627	3422	3255	6231	3720	1494	1999	1073	501	436
1944	Below-Normal	753	584	626	650	763	983	1724	1401	490	414	405	359
1945	Above-Normal	526	453	389	529	2166	3969	2267	1584	536	688	634	572
1946	Above-Normal	684	466	3991	2702	3020	3174	1914	1901	782	637	600	580
1947	Dry	660	576	675	615	606	625	856	988	357	322	352	345
1948	Below-Normal	480	454	398	393	415	428	909	1004	663	489	407	344
1949	Below-Normal	519	468	412	519	487	742	814	896	384	354	359	343
1950	Below-Normal	525	475	463	686	427	519	1463	1357	559	395	379	370
1951	Above-Normal	513	206	4370	3760	3719	2865	2454	1567	364	422	399	370
1952	Wet	461	400	475	846	813	3807	4598	5070	4408	3733	617	591
1953	Below-Normal	680	479	517	734	1275	642	2118	1805	334	519	433	400
1954	Below-Normal	460	400	391	397	383	459	1097	1064	439	373	379	369
1955	Dry	468	385	420	702	365	481	803	794	368	338	352	341
1956	Wet	395	372	441	6978	4167	3171	2081	1427	3578	2933	681	574
1957	Below-Normal	697	478	491	518	551	616	2092	1939	393	399	408	405
1958	Wet	489	380	432	561	844	3547	6198	4879	5075	2724	672	646
1959	Dry	753	519	581	624	964	1299	1178	1084	362	349	333	366
1960	Critical	461	364	307	362	519	435	686	807	282	275	295	321
1961	Critical	310	330	282	337	346	385	465	436	246	236	256	235
1962	Below-Normal	298	314	323	314	941	510	1942	2006	370	358	396	408
1963	Above-Normal	464	273	315	425	493	245	1457	1286	485	527	500	515
1964	Dry	548	381	400	518	493	516	721	643	275	256	268	280
1965	Wet	343	266	234	3025	3543	3038	3135	1477	361	543	565	718
1966	Below-Normal	585	491	2109	1104	2041	1097	1140	1009	251	246	242	242
1967	Wet	389	267	318	582	285	1251	4504	3901	6478	6518	589	674
1968	Dry	645	449	485	515	484	894	1158	1171	347	350	338	330
1969	Wet	398	367	288	1109	5455	3913	5096	6796	7535	3812	459	508
1970	Above-Normal	1216	761	1146	5995	2584	3073	1751	1597	296	432	360	426
1971	Below-Normal	673	503	532	524	456	1067	1763	1739	367	333	350	358
1972	Dry	515	322	524	367	345	387	815	987	284	276	286	284
1973	Above-Normal	315	451	522	524	826	593	1589	1604	779	484	509	512
1974	Wet	560	860	2027	2864	1754	3806	2617	1377	3316	1039	475	657
1975	Wet	1068	1088	789	643	2318	3655	2276	1805	2631	1262	558	621
1976	Critical	1352	812	584	543	516	584	613	557	260	245	278	280
1977	Critical	284	309	322	295	303	305	383	398	176	170	167	153
1978	Wet	217	243	251	432	550	578	1424	1394	2979	415	446	436
1979	Above-Normal	393	710	611	1045	3655	4273	2032	5620	490	547	625	516
1980	Wet	609	813	877	3071	6760	3798	2383	2097	5065	3500	567	697
1981	Dry	743	775	519	693	579	779	1221	1121	316	321	348	341
1982	Wet	439	421	600	595	6677	5622	9196	6364	4838	3679	592	2367
1983	Wet	3175	3152	5340	5281	6724	16125	5060	7883	4323	6266	2862	2081
1984	Above-Normal	941	5485	7476	4168	3409	3125	1600	1648	598	558	597	599
1985	Dry	743	974	430	489	609	658	827	968	408	340	367	359
1986	Wet	334	363	356	284	2614	8056	2904	3247	3686	648	541	662
1987	Critical	1169	1300	566	596	523	708	620	614	276	256	265	253
1988	Critical	242	259	254	305	265	293	455	462	184	175	190	177
1989	Critical	194	220	245	244	243	340	534	574	188	187	203	212
1990	Critical	215	245	232	236	275	271	431	502	195	199	221	212
1991	Critical	214	239	223	208	232	449	447	600	170	183	201	188
1992	Critical	210	239	217	224	485	307	381	450	178	169	175	175
1993	Wet	213	208	217	781	481	305	1126	1324	4069	2059	326	404
1994	Critical	581	448	413	399	490	410	522	503	207	188	201	186
1995	Wet	230	218	223	518	152	7988	4702	9501	5103	8341	1781	792
1996	Wet	758	451	430	538	5666	4888	2802	2648	3078	794	483	533
1997	Wet	592	525	6295	17735	3718	2811	1414	1320	482	499	486	486
1998	Wet	693	337	431	900	7243	5095	3854	5548	6995	6737	517	560
1999	Above-Normal	962	506	695	2008	4999	3672	1836	1578	498	497	501	506
2000	Above-Normal	591	442	344	433	3755	3718	2146	1894	1400	488	691	721
2001	Dry	692	465	418	518	400	1345	864	875	326	293	314	300
2002	Dry	322	243	383	427	242	325	605	763	276	279	326	296
2003	Below-Normal	315	247	294	264	241	297	1069	1355	244	228	283	269

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	654	596	1049	2396	3460	4512	3747	3486	3894	2857	699	727
Above-Normal	617	797	1440	1620	2080	2385	2097	1806	646	549	548	548
Below-Normal	550	458	585	548	696	847	1495	1413	413	374	371	360
Dry	639	528	500	547	543	753	917	953	348	329	343	344
Critical	494	453	378	381	419	430	538	571	257	247	261	261

Key: cfs = cubic feet per second

Table 4-41. Tuolumne River Flow into San Joaquin River (change, Proposed Action– baseline, cfs)

WY	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1923	Above-Normal	0	0	0	0	0	0	0	-113	0	0	0	0
1924	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1925	Below-Normal	0	0	0	0	0	0	-42	0	0	0	0	0
1926	Dry	0	0	0	0	0	0	-45	0	0	0	0	0
1927	Above-Normal	0	0	0	0	0	0	-168	-150	0	0	0	0
1928	Below-Normal	0	0	0	0	0	309	-37	0	0	0	0	0
1929	Critical	0	0	0	0	0	0	0	-58	0	0	0	0
1930	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1931	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1932	Above-Normal	0	0	0	0	0	0	0	133	0	0	0	0
1933	Dry	0	0	0	0	0	0	-48	0	0	0	0	0
1934	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1935	Above-Normal	0	0	0	0	0	0	0	-75	0	0	0	0
1936	Above-Normal	0	0	0	0	0	146	0	0	0	0	0	0
1937	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1938	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1939	Dry	0	0	0	0	0	0	-33	32	0	0	0	0
1940	Above-Normal	0	0	0	0	0	0	0	0	0	0	0	0
1941	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1942	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1943	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1944	Below-Normal	0	0	0	0	0	0	-41	0	0	0	0	0
1945	Above-Normal	0	0	0	0	43	0	-320	-3	0	0	0	0
1946	Above-Normal	0	0	231	0	0	0	-323	52	0	0	0	0
1947	Dry	0	0	0	0	0	0	59	250	0	0	0	0
1948	Below-Normal	0	0	0	0	0	0	-43	-48	0	0	0	0
1949	Below-Normal	0	0	0	0	0	0	-37	0	0	0	0	0
1950	Below-Normal	0	0	0	0	0	0	0	-33	0	0	0	0
1951	Above-Normal	0	0	99	0	0	0	-50	-213	0	0	0	0
1952	Wet	0	0	0	0	169	0	0	0	0	0	0	0
1953	Below-Normal	0	0	0	0	0	0	0	-44	0	0	0	0
1954	Below-Normal	0	0	0	0	0	0	0	0	0	0	0	0
1955	Dry	0	0	0	0	0	0	-42	0	0	0	0	0
1956	Wet	0	0	0	39	0	0	-336	-32	266	0	0	0
1957	Below-Normal	0	0	0	0	0	-96	-48	-3	0	0	0	0
1958	Wet	0	0	0	0	0	48	0	0	0	0	0	0
1959	Dry	0	0	0	0	0	0	-72	29	0	0	0	0
1960	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1961	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1962	Below-Normal	0	0	0	0	0	0	0	186	0	0	0	0
1963	Above-Normal	0	0	0	0	0	0	-88	-83	0	0	0	0
1964	Dry	0	0	0	0	0	0	0	-1	0	0	0	0
1965	Wet	0	0	0	48	0	0	0	0	0	0	0	0
1966	Below-Normal	0	0	0	0	0	0	-43	6	0	0	0	0
1967	Wet	0	0	0	0	0	35	0	0	0	0	0	0
1968	Dry	0	0	0	0	0	0	-23	23	0	0	0	0
1969	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1970	Above-Normal	0	0	0	0	0	0	-13	13	0	0	0	0
1971	Below-Normal	0	0	0	0	0	0	-38	0	0	0	0	0
1972	Dry	0	0	0	0	0	0	-68	77	0	0	0	0
1973	Above-Normal	0	0	0	0	0	0	34	325	-245	0	0	0
1974	Wet	0	115	0	0	0	0	0	-297	283	0	0	0
1975	Wet	0	0	0	0	-124	0	-177	-69	197	0	0	0
1976	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1977	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1978	Wet	0	0	0	0	0	0	0	0	-69	0	0	0
1979	Above-Normal	0	0	0	0	0	0	-178	123	0	0	0	0
1980	Wet	0	0	0	-112	0	0	0	0	0	0	0	0
1981	Dry	0	0	0	0	0	0	-68	30	0	0	0	0
1982	Wet	0	0	0	35	0	0	0	0	0	0	0	0
1983	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1984	Above-Normal	0	0	0	0	0	0	-79	-141	0	0	0	0
1985	Dry	0	0	0	0	0	0	-38	-51	0	0	0	0
1986	Wet	0	0	0	0	187	0	0	0	0	0	0	0
1987	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1988	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1989	Critical	0	0	0	0	0	0	-41	0	0	0	0	0
1990	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1991	Critical	0	0	0	0	0	0	-45	0	0	0	0	0
1992	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1993	Wet	0	0	0	0	0	0	0	-5	-5	0	0	0
1994	Critical	0	0	0	0	0	0	0	0	0	0	0	0
1995	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1996	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1997	Wet	0	0	0	0	0	0	-320	-174	0	0	0	0
1998	Wet	0	0	0	0	322	-13	0	0	0	0	0	0
1999	Above-Normal	0	0	0	0	0	0	-336	63	0	0	0	0
2000	Above-Normal	0	0	0	0	146	0	-316	202	105	0	0	0
2001	Dry	0	0	0	0	0	-48	-52	-18	0	0	0	0
2002	Dry	0	0	0	0	0	0	-26	-71	0	0	0	0
2003	Below-Normal	0	0	0	0	0	0	0	130	0	0	0	0

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0	5	0	0	23	3	-35	-24	28	0	0	0
Above-Normal	0	0	21	0	12	9	-115	8	-9	0	0	0
Below-Normal	0	0	0	0	0	16	-25	15	0	0	0	0
Dry	0	0	0	0	0	-4	-35	23	0	0	0	0
Critical	0	0	0	0	0	0	-5	-4	0	0	0	0

Key: cfs = cubic feet per second

Table 4-42.
Stanislaus River Flow into San Joaquin River (modeling baseline, cfs)

WY	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	Wet	310	269	320	251	296	457	1258	1068	387	376	422	426
1923	Above-Normal	683	520	569	406	283	1042	1512	1432	867	480	425	463
1924	Critical	832	490	435	367	422	535	543	520	308	365	411	415
1925	Below-Normal	552	444	400	224	188	279	1112	976	387	376	422	426
1926	Dry	601	403	345	257	314	440	592	630	314	376	422	426
1927	Above-Normal	555	513	346	246	179	407	1438	1121	391	376	422	426
1928	Below-Normal	690	466	422	364	293	571	1271	1119	342	376	422	426
1929	Critical	674	392	370	366	350	469	625	698	337	365	411	415
1930	Critical	539	320	257	239	366	472	627	573	318	365	411	415
1931	Critical	537	302	255	199	439	577	465	455	312	365	411	415
1932	Above-Normal	523	329	464	235	131	174	436	494	334	376	422	426
1933	Dry	546	361	296	232	383	414	512	705	334	376	422	426
1934	Critical	538	314	361	230	333	528	412	564	330	365	411	415
1935	Above-Normal	511	313	300	237	103	265	793	789	384	553	422	426
1936	Above-Normal	551	291	256	251	636	295	801	595	709	474	422	429
1937	Wet	568	369	366	259	255	566	1249	1042	624	474	422	426
1938	Wet	680	482	505	380	494	1533	1811	2029	5122	2000	1855	1993
1939	Dry	1313	647	571	462	403	320	1020	1001	305	376	422	439
1940	Above-Normal	680	348	307	427	295	592	1779	1525	1009	502	447	477
1941	Wet	795	616	600	562	537	801	1875	2310	1806	632	469	469
1942	Wet	825	851	646	1247	1956	682	1637	1644	1695	784	1721	1905
1943	Wet	1052	688	825	2482	2353	3395	1500	1648	1828	486	493	529
1944	Below-Normal	872	672	685	586	624	559	1399	1101	494	455	444	431
1945	Above-Normal	700	469	477	456	463	493	1421	1750	1235	554	503	508
1946	Above-Normal	781	495	366	655	594	487	1477	1654	1017	441	477	493
1947	Dry	757	506	509	517	486	482	1016	909	385	347	377	386
1948	Below-Normal	576	474	425	372	570	562	727	816	559	504	423	395
1949	Below-Normal	563	414	402	300	452	262	599	522	488	377	393	372
1950	Below-Normal	502	419	429	271	218	413	909	892	773	390	389	401
1951	Above-Normal	542	465	2051	2243	2323	904	1533	1732	998	403	408	403
1952	Wet	664	472	414	403	341	845	1500	1564	4291	2614	1977	1847
1953	Below-Normal	856	625	614	1046	1153	658	1451	1879	1011	607	442	471
1954	Below-Normal	775	483	474	460	512	395	1187	1207	394	369	377	351
1955	Dry	611	457	490	552	395	500	782	633	334	326	340	351
1956	Wet	509	397	369	761	506	597	1753	1592	1921	613	484	1023
1957	Below-Normal	870	536	523	509	668	497	1556	1495	824	447	441	467
1958	Wet	765	505	488	437	558	515	2123	1500	2981	1806	1869	1839
1959	Dry	867	651	694	602	964	565	1260	1193	335	346	384	425
1960	Critical	638	428	407	408	465	561	730	722	328	320	345	333
1961	Critical	468	363	365	259	472	591	573	555	310	281	302	303
1962	Below-Normal	425	375	379	212	248	304	547	779	278	411	395	394
1963	Above-Normal	529	397	357	268	376	325	990	808	735	496	435	428
1964	Dry	597	372	310	319	478	558	676	785	319	338	363	374
1965	Wet	510	396	258	369	162	462	1650	1864	1350	467	528	528
1966	Below-Normal	821	523	499	509	587	468	1169	1074	329	331	345	342
1967	Wet	606	362	351	337	484	501	1626	1500	1910	2269	1999	2028
1968	Dry	1019	552	580	548	1223	444	1447	1290	348	334	370	369
1969	Wet	673	417	438	416	2701	2006	1937	1974	3968	2089	1843	1745
1970	Above-Normal	1332	637	926	4827	2908	1283	1801	1509	1181	462	474	553
1971	Below-Normal	803	414	425	448	492	626	1704	1626	824	549	473	517
1972	Dry	954	379	331	447	584	598	1157	1023	329	342	362	359
1973	Above-Normal	549	396	402	325	482	420	1716	1419	1235	432	445	530
1974	Wet	741	451	440	369	570	1287	1895	1606	1958	557	500	790
1975	Wet	1344	587	694	608	1383	1441	1896	1552	1937	589	582	603
1976	Critical	711	655	482	520	534	534	991	900	325	316	331	320
1977	Critical	502	405	393	290	602	576	496	636	265	255	259	233
1978	Wet	364	280	293	262	188	245	956	862	597	544	442	471
1979	Above-Normal	679	517	459	245	291	360	1645	1328	1663	426	439	452
1980	Wet	722	494	372	322	3280	1060	1952	1920	2016	561	546	656
1981	Dry	1063	676	596	583	512	460	1246	1292	306	404	356	384
1982	Wet	671	355	384	454	5140	3466	2882	1586	1703	1432	1967	3096
1983	Wet	2228	2550	3187	4117	5160	6162	1577	1690	5557	4507	2694	3113
1984	Above-Normal	1830	3321	5140	2078	2245	1097	1865	1800	1065	499	568	712
1985	Dry	926	521	405	453	555	502	1225	1236	358	300	364	452
1986	Wet	709	533	461	371	2463	5074	1880	1672	1619	503	366	497
1987	Critical	861	601	702	525	404	390	993	981	322	314	333	301
1988	Critical	501	347	379	289	533	589	601	559	305	270	260	295
1989	Critical	406	343	362	198	165	551	603	566	302	349	361	402
1990	Critical	440	352	341	180	193	591	516	550	287	285	321	314
1991	Critical	530	540	320	142	156	229	455	505	291	276	306	286
1992	Critical	422	411	271	116	220	504	404	212	222	252	267	249
1993	Wet	313	213	223	337	160	164	471	456	354	286	352	426
1994	Critical	356	331	316	141	368	571	428	452	214	254	277	292
1995	Wet	330	276	289	529	202	514	1395	1431	619	386	387	366
1996	Wet	606	480	481	429	420	2721	1621	1678	1595	399	442	442
1997	Wet	706	755	3595	8177	6243	1409	1554	1571	892	449	418	418
1998	Wet	757	405	394	440	2623	2051	1565	1518	1553	2706	2230	2231
1999	Above-Normal	1717	923	987	1520	3434	1253	1542	1547	1451	366	418	444
2000	Above-Normal	686	420	411	465	451	692	1549	1507	825	371	374	390
2001	Dry	632	403	382	415	418	350	995	952	308	305	285	304
2002	Dry	475	299	365	333	436	395	712	678	308	301	349	335
2003	Below-Normal	421	294	323	185	476	496	792	582	309	335	321	299

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	727	550	683	1013	1603	1581	1648	1553	2012	1147	1042	1161
Above-Normal	803	647	864	930	950	631	1394	1313	944	451	444	472
Below-Normal	671	472	462	422	499	468	1110	1082	539	425	407	407
Dry	797	479	452	440	550	464	972	948	329	344	371	387
Critical	560	412	376	279	376	517	591	591	298	312	339	338

Key: cfs = cubic feet per second

Table 4-43.
Stanislaus River Flow into San Joaquin River (with Proposed Action, cfs)

WY	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	Wet	310	269	320	251	296	457	1258	1068	387	376	422	426
1923	Above-Normal	683	520	569	406	283	380	1512	1432	867	480	425	463
1924	Critical	832	519	463	367	422	141	549	526	308	365	411	415
1925	Below-Normal	553	445	401	225	188	302	1194	930	387	376	422	426
1926	Dry	618	454	396	280	243	147	600	637	344	376	422	426
1927	Above-Normal	556	514	347	248	179	419	1563	1260	413	376	422	434
1928	Below-Normal	690	496	452	375	304	577	1334	1188	353	376	422	427
1929	Critical	674	398	376	371	299	177	638	716	364	365	411	415
1930	Critical	540	321	257	239	276	316	600	640	383	366	411	415
1931	Critical	538	303	255	201	439	154	472	462	311	365	411	415
1932	Above-Normal	526	334	469	239	135	177	446	666	334	376	422	426
1933	Dry	548	321	255	234	279	164	402	652	345	376	422	426
1934	Critical	540	332	379	232	236	114	465	547	365	365	411	415
1935	Above-Normal	517	337	324	244	111	268	812	730	384	553	422	426
1936	Above-Normal	553	311	277	255	636	330	957	738	709	474	422	429
1937	Wet	594	383	380	294	252	577	1367	1173	630	474	422	426
1938	Wet	680	493	516	390	494	2007	1811	2029	5122	2000	1855	1993
1939	Dry	1313	647	571	462	403	320	1020	1001	321	376	422	439
1940	Above-Normal	680	348	307	427	295	592	1779	1524	961	501	446	476
1941	Wet	794	616	599	562	537	802	1875	2310	1812	632	469	469
1942	Wet	825	851	647	1271	1956	682	1637	1644	1695	784	1721	1905
1943	Wet	1052	688	825	2482	2353	3395	1500	1648	1828	486	493	529
1944	Below-Normal	872	672	685	586	624	559	1399	1101	494	455	444	431
1945	Above-Normal	700	469	477	456	463	493	1421	1750	981	554	503	508
1946	Above-Normal	781	514	386	655	594	489	1487	1665	1037	443	479	494
1947	Dry	761	541	544	519	488	273	988	995	385	347	377	386
1948	Below-Normal	579	416	366	376	486	335	744	849	559	504	423	395
1949	Below-Normal	571	422	411	311	373	263	485	530	488	377	393	372
1950	Below-Normal	503	420	430	273	210	429	889	993	773	390	389	401
1951	Above-Normal	554	472	2537	2242	2322	904	1533	1730	954	403	408	403
1952	Wet	664	497	438	403	341	898	1500	1564	4291	2614	1977	1847
1953	Below-Normal	856	625	614	1046	1153	492	1414	1879	1011	607	442	471
1954	Below-Normal	775	494	485	460	412	398	1187	1247	407	369	377	358
1955	Dry	612	461	493	556	333	335	719	650	345	330	340	351
1956	Wet	512	399	369	760	511	597	1753	1592	1921	613	484	1483
1957	Below-Normal	894	585	572	509	560	457	1556	1495	824	447	441	467
1958	Wet	765	505	488	437	558	515	2123	1500	3022	1806	1869	1839
1959	Dry	867	651	694	602	964	565	1260	1193	335	346	384	425
1960	Critical	638	428	407	408	465	258	703	759	351	320	345	333
1961	Critical	468	363	365	259	536	245	575	557	310	281	302	303
1962	Below-Normal	426	375	380	212	248	305	577	869	278	411	395	394
1963	Above-Normal	530	370	330	270	377	336	873	869	735	496	435	428
1964	Dry	605	407	345	330	388	296	682	790	329	338	363	374
1965	Wet	511	396	258	369	163	469	1659	1873	1302	468	530	529
1966	Below-Normal	824	529	506	516	594	475	1246	1158	337	331	345	342
1967	Wet	606	369	358	344	491	501	1626	1500	1910	2563	1999	2028
1968	Dry	1019	552	580	548	1223	444	1447	1290	348	334	370	369
1969	Wet	673	417	438	416	2701	2006	1937	1974	3968	2089	1843	1745
1970	Above-Normal	1332	637	926	4827	2908	1283	1733	1509	1138	462	474	553
1971	Below-Normal	803	414	425	448	492	627	1708	1631	778	550	474	518
1972	Dry	956	380	331	448	453	463	1079	1023	334	342	362	359
1973	Above-Normal	553	398	404	331	488	423	1731	1435	1627	434	448	533
1974	Wet	746	412	401	371	573	1175	1895	1606	1958	557	500	864
1975	Wet	1392	621	728	555	1383	1441	1896	1552	1937	589	582	603
1976	Critical	711	686	512	520	534	349	984	893	325	316	331	320
1977	Critical	501	404	393	288	602	576	498	634	265	255	259	233
1978	Wet	364	281	294	263	189	250	976	880	597	544	442	471
1979	Above-Normal	682	518	461	250	295	361	1650	1333	1663	427	440	453
1980	Wet	723	536	414	323	3383	1060	1952	1920	2016	561	546	656
1981	Dry	1063	676	596	583	512	460	1246	1292	311	404	356	384
1982	Wet	671	355	384	454	5135	3466	2882	1586	1703	1432	1967	3096
1983	Wet	2228	2550	3187	4117	5160	6162	1577	1690	5557	4507	2694	3113
1984	Above-Normal	1830	3321	5140	2078	2245	1097	1865	1800	1065	499	568	712
1985	Dry	926	540	424	453	555	502	1225	1236	358	302	364	452
1986	Wet	709	546	474	371	2464	5074	1880	1672	1619	503	366	497
1987	Critical	861	601	702	525	404	390	1000	936	342	318	333	301
1988	Critical	501	360	393	289	445	208	612	571	336	278	286	295
1989	Critical	422	343	362	198	216	138	505	592	334	349	361	402
1990	Critical	440	353	342	180	410	238	562	566	323	285	321	314
1991	Critical	532	544	325	145	159	233	282	526	332	276	306	286
1992	Critical	425	418	277	120	224	80	432	425	261	252	267	249
1993	Wet	316	220	229	337	165	169	384	371	354	286	352	426
1994	Critical	360	338	323	145	264	219	474	477	333	254	277	292
1995	Wet	335	285	299	529	208	523	1443	1485	715	395	395	375
1996	Wet	623	488	490	438	1346	2721	1621	1678	1595	399	442	442
1997	Wet	706	755	3595	8177	6243	1409	1542	1571	892	449	418	418
1998	Wet	757	455	444	440	2649	2064	1565	1518	1553	2706	2230	2231
1999	Above-Normal	1717	923	987	1520	3434	1253	1542	1547	1407	366	418	444
2000	Above-Normal	686	451	442	465	451	750	1551	1510	830	372	375	391
2001	Dry	633	434	413	416	418	348	937	931	316	311	285	304
2002	Dry	473	307	373	331	335	196	570	740	325	306	349	335
2003	Below-Normal	424	296	325	188	375	218	751	743	325	335	321	299

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	732	558	691	1015	1648	1601	1652	1559	2016	1160	1043	1184
Above-Normal	805	652	899	932	951	597	1404	1344	944	451	444	473
Below-Normal	674	476	465	425	463	418	1114	1124	540	425	407	408
Dry	800	490	463	443	507	347	937	956	338	345	371	387
Critical	562	419	383	281	371	240	584	614	328	313	340	338

Key: cfs = cubic feet per second

Table 4-44.
Stanislaus River Flow into San Joaquin River
(change, Proposed Action– baseline, cfs)

WY	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1922	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1923	Above-Normal	0	0	0	0	0	-662	0	0	0	0	0	0
1924	Critical	0	29	29	0	0	-394	7	6	0	0	0	0
1925	Below-Normal	1	1	1	2	0	23	83	-46	0	0	0	0
1926	Dry	17	51	51	23	-71	-294	8	7	30	0	0	0
1927	Above-Normal	1	1	1	2	0	11	125	139	22	0	0	8
1928	Below-Normal	0	30	30	11	11	6	63	69	11	0	0	1
1929	Critical	0	6	6	6	-52	-292	13	19	27	0	0	0
1930	Critical	0	0	0	1	-89	-156	-27	67	65	1	0	0
1931	Critical	1	1	1	1	0	-423	7	6	0	0	0	0
1932	Above-Normal	3	5	5	3	3	2	10	172	0	0	0	0
1933	Dry	2	-40	-40	2	-104	-250	-110	-53	11	0	0	0
1934	Critical	2	18	18	2	-97	-415	53	-17	36	0	0	0
1935	Above-Normal	7	24	24	8	8	4	19	-59	0	0	0	0
1936	Above-Normal	3	21	21	4	0	35	156	143	0	0	0	0
1937	Wet	25	14	14	35	-3	11	118	131	6	0	0	0
1938	Wet	0	11	11	11	0	474	0	0	0	0	0	0
1939	Dry	0	0	0	0	0	0	0	0	17	0	0	0
1940	Above-Normal	0	0	0	0	0	0	-1	-1	-48	0	0	0
1941	Wet	0	0	0	0	0	0	0	0	6	0	0	0
1942	Wet	0	0	0	25	0	0	0	0	0	0	0	0
1943	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1944	Below-Normal	0	0	0	0	0	0	0	0	0	0	0	0
1945	Above-Normal	0	0	0	0	0	0	0	0	-253	0	0	0
1946	Above-Normal	0	19	19	0	0	2	10	11	20	2	2	2
1947	Dry	4	35	35	2	2	-209	-28	86	0	0	0	0
1948	Below-Normal	3	-59	-59	4	-83	-227	16	32	0	0	0	0
1949	Below-Normal	8	8	8	12	-79	1	-114	8	0	0	0	0
1950	Below-Normal	1	1	1	1	-9	17	-20	102	0	0	0	0
1951	Above-Normal	12	7	486	-1	0	0	0	-2	-44	0	0	0
1952	Wet	0	25	25	0	0	53	0	0	0	0	0	0
1953	Below-Normal	0	0	0	0	0	-166	-37	0	0	0	0	0
1954	Below-Normal	0	11	11	0	-100	4	-1	40	12	0	0	6
1955	Dry	1	4	4	4	-62	-164	-63	18	11	3	0	0
1956	Wet	4	2	0	0	5	0	0	0	0	0	0	459
1957	Below-Normal	24	50	50	0	-108	-40	0	0	0	0	0	0
1958	Wet	0	0	0	0	0	0	0	0	41	0	0	0
1959	Dry	0	0	0	0	0	0	0	0	0	0	0	0
1960	Critical	0	0	0	0	0	-303	-27	36	23	0	0	0
1961	Critical	0	0	0	0	64	-345	2	2	0	0	0	0
1962	Below-Normal	0	0	0	0	0	1	30	90	0	0	0	0
1963	Above-Normal	1	-27	-27	1	1	12	-117	62	0	0	0	0
1964	Dry	8	35	35	12	-90	-263	6	5	10	0	0	0
1965	Wet	1	0	0	0	1	7	9	10	-47	2	2	2
1966	Below-Normal	3	7	7	7	7	7	77	85	8	0	0	0
1967	Wet	0	7	7	7	7	0	0	0	0	294	0	0
1968	Dry	0	0	0	0	0	0	0	0	0	0	0	0
1969	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1970	Above-Normal	0	0	0	0	0	0	-68	0	-42	0	0	0
1971	Below-Normal	0	0	0	0	0	1	4	5	-46	1	1	1
1972	Dry	2	1	1	1	-132	-135	-77	-1	5	0	0	0
1973	Above-Normal	4	2	2	6	6	3	15	16	392	3	3	3
1974	Wet	5	-39	-39	3	3	-112	0	0	0	0	0	74
1975	Wet	48	34	34	-53	0	0	0	0	0	0	0	0
1976	Critical	0	31	31	0	0	-185	-7	-7	0	0	0	0
1977	Critical	-1	-1	-1	-2	0	0	2	-2	0	0	0	0
1978	Wet	0	1	1	0	0	5	20	19	0	0	0	0
1979	Above-Normal	3	2	2	5	5	1	5	5	0	1	1	1
1980	Wet	2	42	42	1	103	0	0	0	0	0	0	0
1981	Dry	0	0	0	0	0	0	0	0	5	0	0	0
1982	Wet	0	0	0	0	-5	0	0	0	0	0	0	0
1983	Wet	0	0	0	0	0	0	0	0	0	0	0	0
1984	Above-Normal	0	0	0	0	0	0	0	0	0	0	0	0
1985	Dry	0	19	19	0	0	0	0	0	0	1	0	0
1986	Wet	0	13	13	0	1	0	0	0	0	0	0	0
1987	Critical	0	0	0	0	0	0	6	-45	21	5	0	0
1988	Critical	0	13	13	0	-88	-381	11	11	30	8	26	0
1989	Critical	16	0	0	0	52	-413	-98	26	32	0	0	0
1990	Critical	0	0	0	1	217	-353	46	16	36	0	0	0
1991	Critical	2	4	4	3	3	4	-173	21	41	0	0	0
1992	Critical	3	6	6	4	4	-424	28	212	39	0	0	0
1993	Wet	4	7	7	0	4	4	-87	-84	0	0	0	0
1994	Critical	4	7	7	4	-104	-352	45	24	119	0	0	0
1995	Wet	5	9	9	0	6	9	49	54	96	9	9	9
1996	Wet	17	9	9	9	926	0	0	0	0	0	0	0
1997	Wet	0	0	0	0	0	0	-12	0	0	0	0	0
1998	Wet	0	50	50	0	27	13	0	0	0	0	0	0
1999	Above-Normal	0	0	0	0	0	0	0	0	-44	0	0	0
2000	Above-Normal	0	31	31	0	0	58	2	3	5	0	0	0
2001	Dry	1	31	31	0	0	-2	-58	-21	8	5	0	0
2002	Dry	-1	8	8	-2	-101	-200	-142	62	17	5	0	0
2003	Below-Normal	3	1	1	4	-101	-278	-41	161	16	0	0	0

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	5	8	8	2	45	19	4	5	4	13	0	23
Above-Normal	2	5	35	2	1	-33	10	31	0	0	0	1
Below-Normal	3	4	4	3	-36	-50	5	42	0	0	0	1
Dry	3	11	11	3	-43	-117	-36	8	9	1	0	0
Critical	2	7	7	1	-6	-277	-7	24	29	1	2	0

Key: cfs = cubic feet per second

Table 4-45. Restoration Water Year-Type (1922 through 2004)

Water Year	October-through-September San Joaquin River Unimpaired Flow at Friant Dam (TAF)	Restoration Year Type*	San Joaquin Valley Water Year Types*
1922	2,355.1	Normal-Wet	Wet
1923	1,654.3	Normal-Wet	Above Normal
1924	444.1	Critical High	Critical
1925	1,438.7	Normal-Dry	Below Normal
1926	1,161.4	Normal-Dry	Dry
1927	2,001.3	Normal-Wet	Above Normal
1928	1,153.7	Normal-Dry	Below Normal
1929	862.4	Dry	Critical
1930	859.1	Dry	Critical
1931	480.2	Critical High	Critical
1932	2,047.4	Normal-Wet	Above Normal
1933	1,111.4	Normal-Dry	Dry
1934	691.5	Dry	Critical
1935	1,923.2	Normal-Wet	Above Normal
1936	1,853.3	Normal-Wet	Above Normal
1937	2,208.0	Normal-Wet	Wet
1938	3,688.4	Wet	Wet
1939	920.8	Dry	Dry
1940	1,880.6	Normal-Wet	Above Normal
1941	2,652.5	Wet	Wet
1942	2,254.0	Normal-Wet	Wet
1943	2,053.7	Normal-Wet	Wet
1944	1,265.4	Normal-Dry	Below Normal
1945	2,138.1	Normal-Wet	Above Normal
1946	1,729.6	Normal-Wet	Above Normal
1947	1,125.5	Normal-Dry	Dry
1948	1,214.8	Normal-Dry	Below Normal
1949	1,164.1	Normal-Dry	Below Normal
1950	1,310.5	Normal-Dry	Below Normal
1951	1,859.0	Normal-Wet	Above Normal
1952	2,840.1	Wet	Wet
1953	1,226.7	Normal-Dry	Below Normal
1954	1,313.8	Normal-Dry	Below Normal
1955	1,161.0	Normal-Dry	Dry
1956	2,960.1	Wet	Wet
1957	1,326.6	Normal-Dry	Below Normal
1958	2,631.0	Wet	Wet
1959	949.3	Normal-Dry	Dry
1960	828.6	Dry	Critical
1961	646.9	Critical High	Critical
1962	1,923.6	Normal-Wet	Below Normal
1963	1,944.9	Normal-Wet	Above Normal
1964	922.2	Dry	Dry
1965	2,272.2	Normal-Wet	Wet
1966	1,298.6	Normal-Dry	Below Normal
1967	3,232.2	Wet	Wet
1968	862.1	Dry	Dry
1969	4,040.3	Wet	Wet
1970	1,445.6	Normal-Dry	Above Normal
1971	1,417.5	Normal-Dry	Below Normal
1972	1,039.0	Normal-Dry	Dry
1973	2,047.0	Normal-Wet	Above Normal
1974	2,190.5	Normal-Wet	Wet
1975	1,795.7	Normal-Wet	Wet
1976	629.2	Critical High	Critical
1977	361.6	Critical Low	Critical
1978	3,401.9	Wet	Wet
1979	1,830.3	Normal-Wet	Above Normal
1980	2,972.7	Wet	Wet
1981	1,068.0	Normal-Dry	Dry
1982	3,316.1	Wet	Wet
1983	4,641.9	Wet	Wet
1984	2,048.9	Normal-Wet	Above Normal
1985	1,129.0	Normal-Dry	Dry
1986	3,031.4	Wet	Wet
1987	757.6	Dry	Critical
1988	862.1	Dry	Critical
1989	939.2	Normal-Dry	Critical
1990	742.5	Dry	Critical
1991	1,034.1	Normal-Dry	Critical
1992	808.5	Dry	Critical
1993	2,672.9	Wet	Wet
1994	826.4	Dry	Critical
1995	3,877.7	Wet	Wet
1996	2,202.8	Normal-Wet	Wet
1997	2,781.5	Wet	Wet
1998	3,159.8	Wet	Wet
1999	1,527.1	Normal-Wet	Above Normal
2000	1,741.9	Normal-Wet	Above Normal
2001	1,065.1	Normal-Dry	Dry
2002	1,170.9	Normal-Dry	Dry
2003	1,449.9	Normal-Wet	Below Normal
2004	1,130.7	Normal-Dry	Dry

*Based on D-1641

San Joaquin River Settlement Restoration Year Type	San Joaquin Valley Water Year Types: Wet	Above Normal	Below Normal	Dry	Critical
Wet	16				
Normal-Wet	8	15	2		
Normal-Dry		1	11	11	2
Dry				3	9
Critical High					4
Critical Low					1

San Joaquin River Restoration Year Types:

The total annual unimpaired runoff at Friant Dam for the water year (October through September) is the index by which the water year type is determined.

In order of descending wetness, the wettest 20 percent of the years are classified as Wet, the next 30 percent of the year are classified as Normal-Wet, the next 30 percent of the year are classified as Normal-Dry, the next 15 percent of the years are classified as Dry, and the remaining 5 percent of the year are classified as Critical. A subset of the Critial years, those with less than 400 TAF of unimparied runoff, are identified as Critical Low.

San Joaquin Valley Water Year Types:

The San Joaquin Valley Water Year Type is determined through the use of an index. The index is based upon Stanislaus River inflows to New Melones Lake, Tuolumne River inflows to New Don Pedro Reservoir, Merced River inflows to Lake McClure, and San Joaquin River inflows to Millerton Lake, in million acre-feet (MAF).

San Joaquin Valley Water Year Index
= 0.6 * Current Apr-Jul Runoff Forecast (MAF)
+ 0.2 * Current Oct-Mar Runoff in (MAF)
+ 0.2 * Previous Water Year's Index (if the Previous Water Year's Index exceeds 4.5, then 4.5 is used).

Wet Equal to or greater than 3.8 MAF;
Above-Normal Greater than 3.1, and less than 3.8;
Below-Normal Greater than 2.5, and equal to or less than 3.1;
Dry Greater than 2.1, and equal to or less than 2.5; and
Critical Equal to or less than 2.1

This index, originally specified in the 1995 SWRCB Water Quality Control Plan, is used to determine the San Joaquin Valley water year type as implemented in SWRCB D-1641. Water year types are set by first of month forecasts beginning in February. Final determination for San Joaquin River flow objectives is based on the May 1st 75% exceedence forecast.

Figures 4-19 through 4-27 show the modeled change in tributary inflow to the San Joaquin River for March, April, and May with the WY 2010 Interim Flows. These figures illustrate the percent chance of a specific change in tributary flow occurring from the release of Interim Flows during the WY 2010 Interim Flows period.

Figures 4-25 through 4-27 show the percent exceedence of changes on the Merced River. As shown in Figure 4-25, in March, there is about a 95 percent chance that the WY 2010 Interim Flows would not reduce Merced River flows. Because the Merced River does not operate to meet the Vernalis Water Quality Standard, this reduction is likely due to changes in local operations because of changes in reservoir storage from previous actions. In April, there is about a 60 percent chance of no reduction in Merced River flows, and an 80 to 90 percent chance that only minor reductions in flows would occur (see Figure 4-26). In May, there is about an 80 to 90 percent chance that Merced River flows would not be reduced (see Figure 4-27). There is also about a 10 to 25 percent chance that flows on the Merced River may actually be higher with WY 2010 Interim Flows.

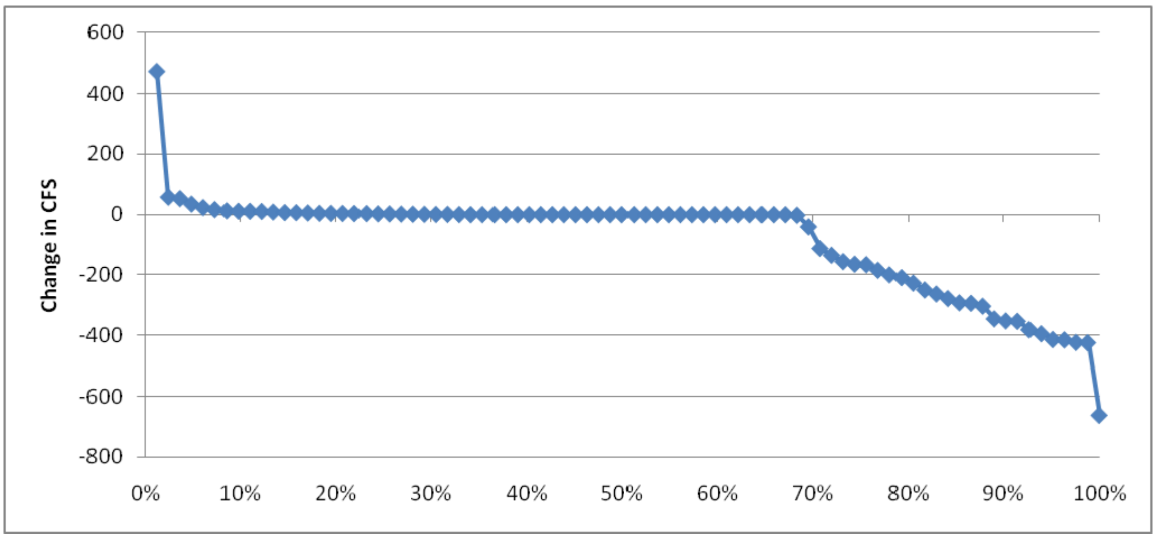

Figure 4-19.
Percent Exceedence of Changes in Stanislaus River Flows in March with WY 2010 Interim Flows

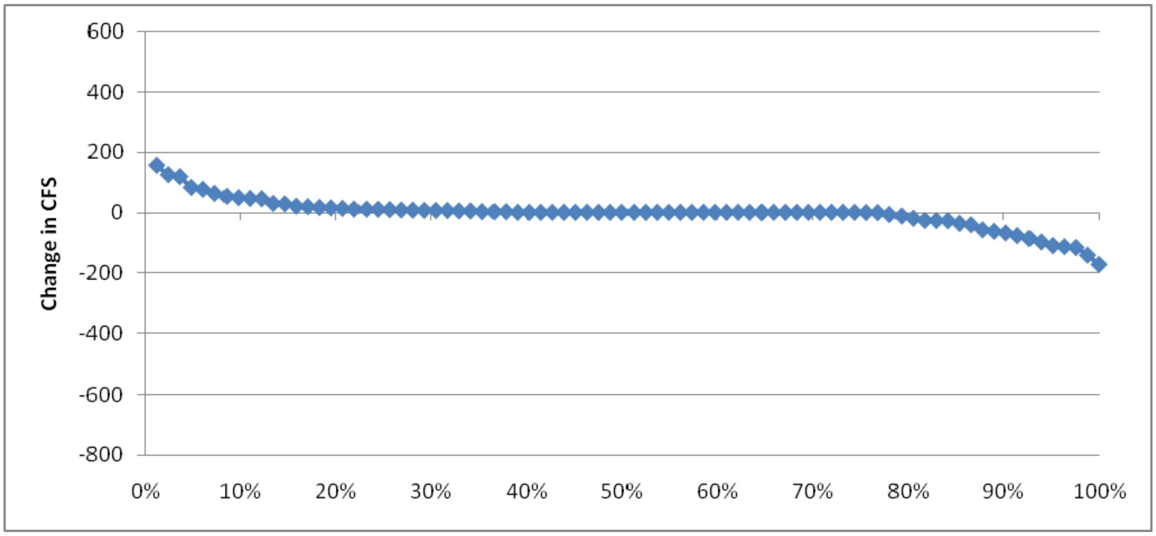

Figure 4-20.
Percent Exceedence of Changes in Stanislaus River Flows in April with WY 2010 Interim Flows

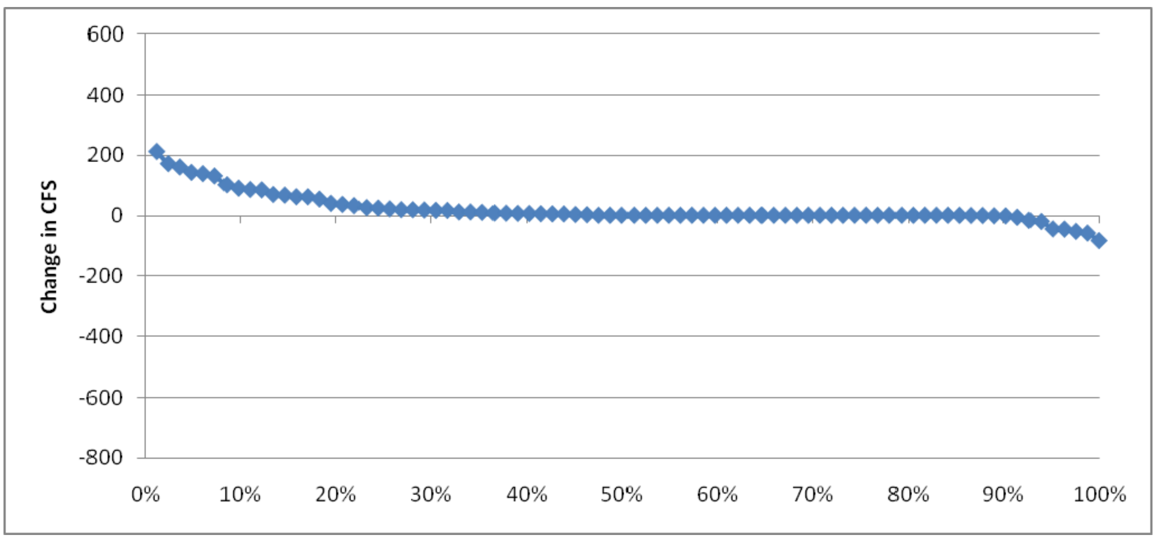

Figure 4-21.
Percent Exceedence of Changes in Stanislaus River Flows in May with WY 2010 Interim Flows

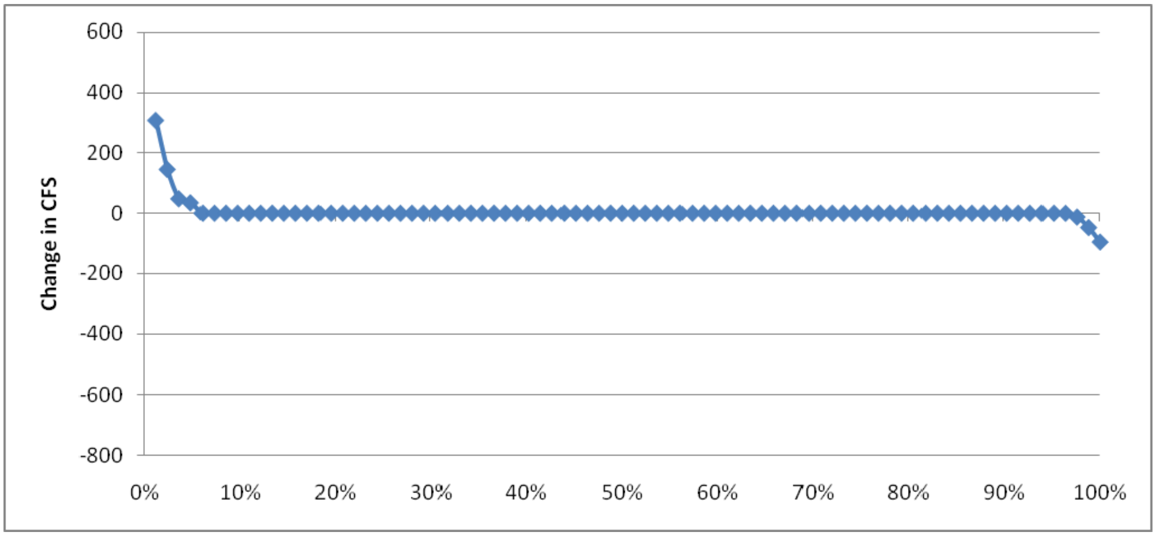

Figure 4-22.
Percent Exceedence of Changes in Tuolumne River Flows in March with WY 2010 Interim Flows

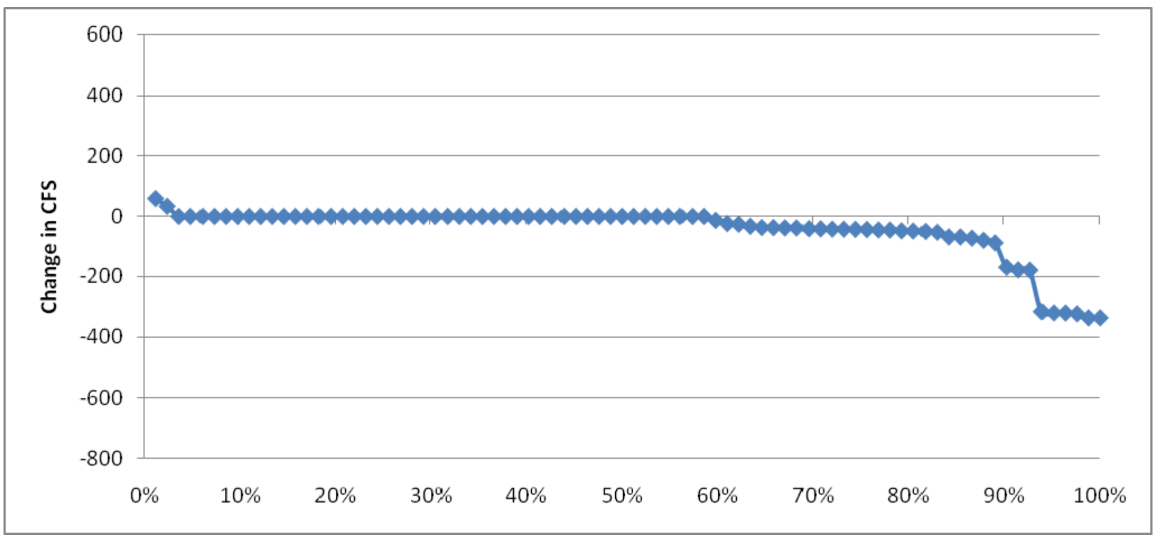

Figure 4-23.
Percent Exceedence of Changes in Tuolumne River Flows in April with WY 2010 Interim Flows

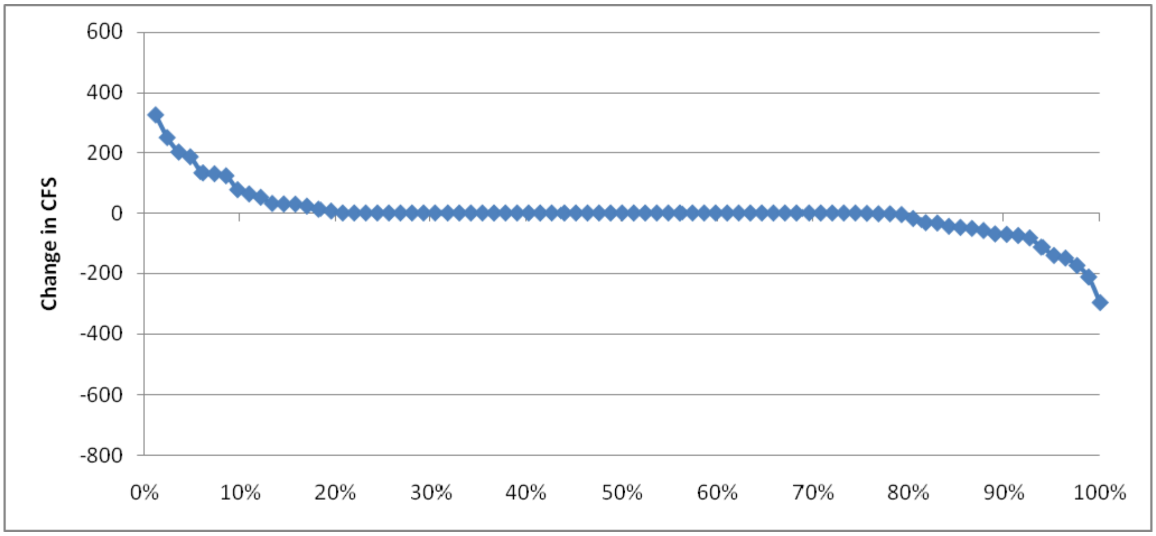

Figure 4-24.
Percent Exceedence of Changes in Tuolumne River Flows in May with WY 2010 Interim Flows

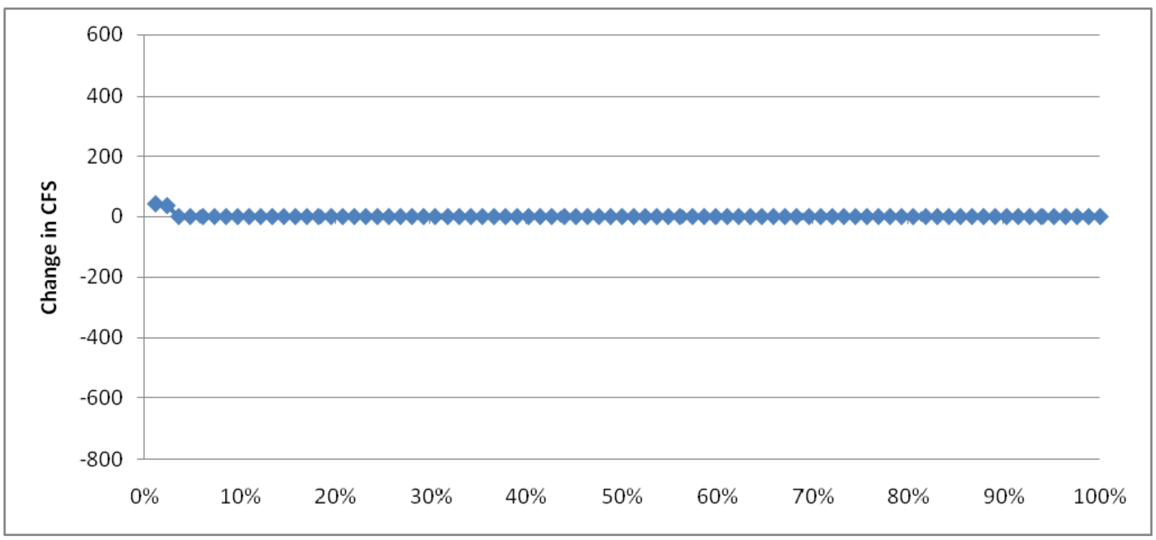

Figure 4-25.
Percent Exceedence of Changes in Merced River Flows in March with WY 2010 Interim Flows

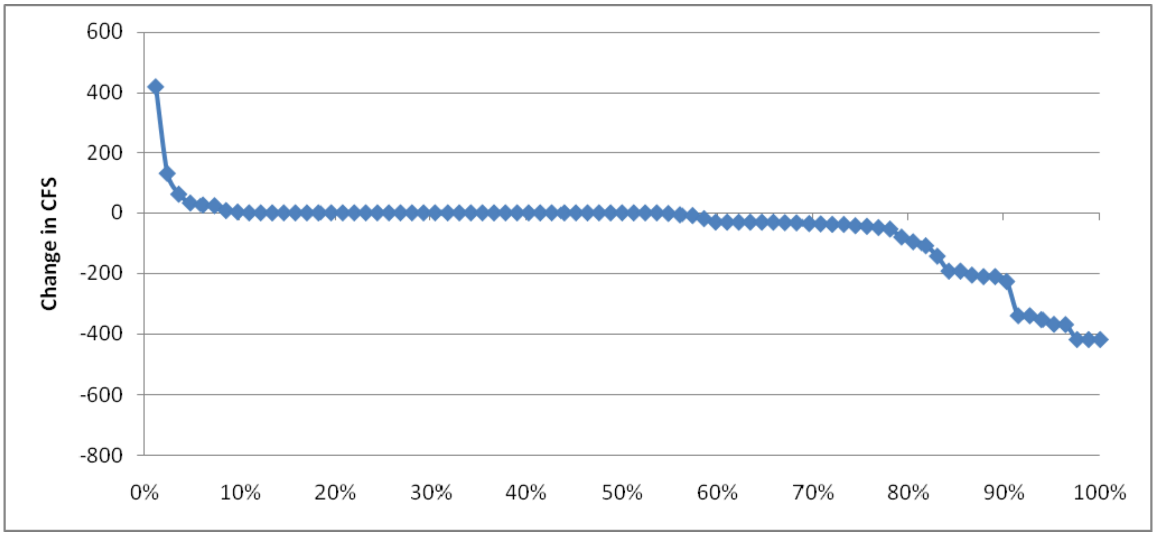

Figure 4-26.
Percent Exceedence of Changes in Merced River Flows in April with WY 2010 Interim Flows

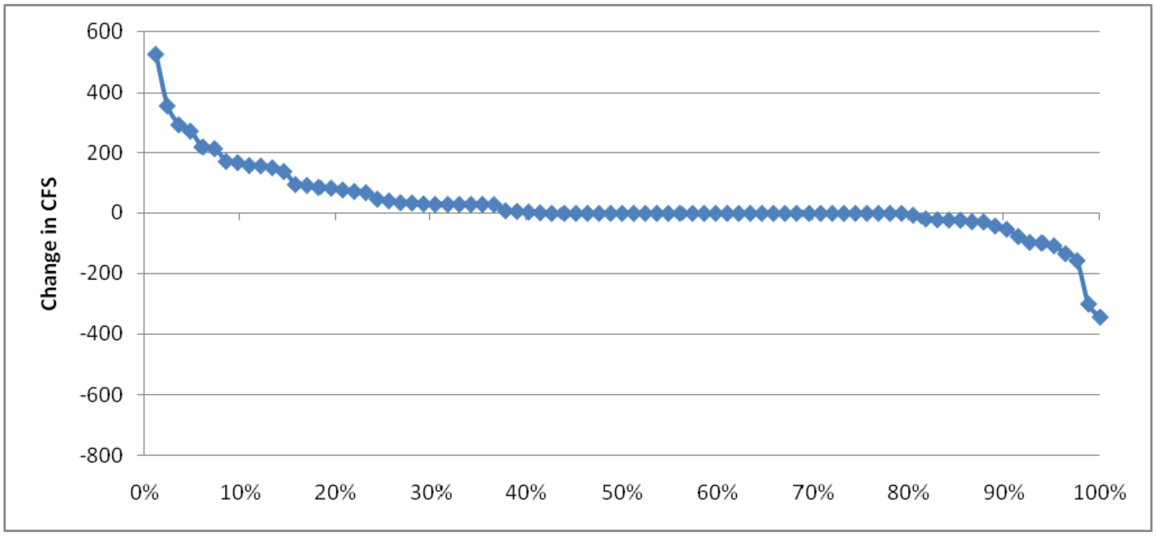

Figure 4-27.
Percent Exceedence of Changes in Merced River Flows in May with WY 2010 Interim Flows

Figures 4-22 through 4-24 show the percent exceedence of changes on the Tuolumne River. As shown in Figure 4-22, in March, there is about a 95 percent chance that WY 2010 Interim Flows would not reduce Tuolumne River flows. Because the Tuolumne River does not operate to meet the Vernalis Water Quality Standard requirement, this reduction is likely due to changes in local operations because of changes in reservoir storage from previous actions. In April, there is about a 60 percent chance of no reduction in Tuolumne River flows, and an 80 to 90 percent chance that only minor reductions in flows would occur (see Figure 4-23). As shown in Figure 4-24, in May there is about an 80 to 90 percent chance that Tuolumne River flows would not decrease. There is also about a 10 to 20 percent chance that the flows may actually be higher with WY 2010 Interim Flows.

Figures 4-19 through 4-21 show the percent exceedence in changes in Stanislaus River flows. As shown in Figure 4-19, in March there is about a 70 percent chance that WY 2010 Interim Flows would not reduce Stanislaus River flows, but a 30 percent chance that flows would be reduced. Potential reductions in Stanislaus River flow in March are due to a reduction in water required to meet the Vernalis Water Quality Standard as a result of additional flow provided by WY 2010 Interim Flows. As shown in Figure 4-20, in April, there is about an 80 to 90 percent chance that Stanislaus River flows would not be reduced and about a 10 to 20 percent chance that flows on the Stanislaus River may actually be higher with WY 2010 Interim Flows. Similar changes are seen in Stanislaus River flows in May (see Figure 4-21). The computed additional water required to meet VAMP flow targets is provided in Table 4-46. In is important to note that these volumes would be different for different 31 day-periods during the allowable 61 day-period of April 1 to May 31. These volumes of water were then split between the tributary rivers and CVP Exchange Contractors for system operation purposes.

Table 4-46.
Additional Water Required to Meet VAMP Flow Targets

Year	Water Year-Type	Base Flow April TAF	Base Flow May TAF	Base Flow Total TAF	Interim Flow April TAF	Interim Flow May TAF	Interim Flow Total TAF
1922	Wet	0	0	0	0	0	0
1923	Above-Normal	3	13	16	0	14	14
1924	Critical	5	5	10	5	5	10
1925	Below-Normal	14	5	20	10	2	12
1926	Dry	10	16	26	9	17	26
1927	Above-Normal	19	20	39	0	21	21
1928	Below-Normal	41	15	57	40	18	58
1929	Critical	12	12	25	11	13	24
1930	Critical	16	12	29	15	13	27
1931	Critical	0	0	0	0	0	0
1932	Above-Normal	10	0	10	11	15	26
1933	Dry	11	7	18	10	6	16
1934	Critical	11	8	19	10	8	17
1935	Above-Normal	12	25	37	0	26	26
1936	Above-Normal	0	11	11	0	7	7
1937	Wet	0	0	0	0	0	0
1938	Wet	0	0	0	0	0	0
1939	Dry	36	21	58	35	25	60
1940	Above-Normal	0	6	6	0	6	6
1941	Wet	0	0	0	0	0	0
1942	Wet	0	0	0	0	0	0
1943	Wet	0	1	1	0	4	4
1944	Below-Normal	42	16	58	41	19	60
1945	Above-Normal	26	13	39	6	13	19
1946	Above-Normal	41	12	53	20	13	33
1947	Dry	0	1	1	20	19	38
1948	Below-Normal	12	10	22	10	9	19
1949	Below-Normal	8	3	12	7	3	10
1950	Below-Normal	20	20	39	16	19	35
1951	Above-Normal	15	15	30	0	15	15
1952	Wet	0	0	0	0	0	0
1953	Below-Normal	29	15	45	28	16	45
1954	Below-Normal	2	0	2	1	0	1
1955	Dry	4	3	6	2	1	4
1956	Wet	32	2	35	12	0	12
1957	Below-Normal	27	19	47	26	21	47
1958	Wet	0	0	0	0	0	0
1959	Dry	38	19	56	37	21	58
1960	Critical	16	13	29	15	13	28
1961	Critical	0	0	0	0	0	0
1962	Below-Normal	11	9	20	13	28	41
1963	Above-Normal	25	31	56	3	33	36

Table 4-46.
Additional Water Required to Meet VAMP Flow Targets (contd.)

Year	Water Year-Type	Base			Interim		
		April	May	April	May	April	May
		TAF	TAF	TAF	TAF	TAF	TAF
1964	Dry	11	9	20	10	9	19
1965	Wet	0	26	26	0	28	28
1966	Below-Normal	36	20	56	35	23	58
1967	Wet	0	0	0	0	0	0
1968	Dry	35	23	57	34	26	60
1969	Wet	0	0	0	0	0	0
1970	Above-Normal	37	21	58	36	24	60
1971	Below-Normal	32	23	55	31	26	58
1972	Dry	18	14	32	16	14	30
1973	Above-Normal	1	8	9	4	28	31
1974	Wet	10	17	27	0	13	13
1975	Wet	22	34	56	2	38	40
1976	Critical	6	6	12	6	6	13
1977	Critical	12	5	17	12	5	17
1978	Wet	0	0	0	0	0	0
1979	Above-Normal	22	0	22	2	0	2
1980	Wet	0	6	6	4	0	4
1981	Dry	34	21	56	33	25	58
1982	Wet	0	0	0	0	0	0
1983	Wet	0	0	0	0	0	0
1984	Above-Normal	16	23	39	0	24	24
1985	Dry	10	6	16	9	6	15
1986	Wet	0	0	0	0	0	0
1987	Critical	9	7	15	8	7	14
1988	Critical	2	2	4	0	2	2
1989	Critical	0	0	0	0	0	0
1990	Critical	0	0	0	0	0	0
1991	Critical	0	0	0	0	0	0
1992	Critical	0	0	0	0	0	0
1993	Wet	0	0	0	1	0	1
1994	Critical	8	0	8	6	0	6
1995	Wet	0	0	0	0	0	0
1996	Wet	5	0	5	0	0	0
1997	Wet	40	18	58	19	5	24
1998	Wet	0	0	0	0	0	0
1999	Above-Normal	30	25	55	9	27	36
2000	Above-Normal	37	19	56	17	21	38
2001	Dry	20	14	34	19	15	34
2002	Dry	17	6	23	15	6	21
2003	Below-Normal	21	11	33	21	30	51

Key:
TAF = thousand acre-feet
VAMP = Vernalis Adaptive Management Program

The simulated differences between existing conditions and potential conditions with WY 2010 Interim Flows can be compared with historical patterns and variability. Table 4-47 shows the mean and standard deviation for critical year mean monthly flows for the Merced, Tuolumne, and Stanislaus rivers.

Table 4-47.
Merced, Tuolumne, and Stanislaus River Mean Monthly Flow and Standard Deviation for Critical Years

Month	Merced River				Tuolumne River				Stanislaus River			
	Base Flow		Interim Flow		Base Flow		Interim Flow		Base Flow		Interim Flow	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
October	277	38	277	38	302	102	302	102	460	77	463	76
November	333	46	333	46	317	98	317	98	351	76	355	75
December	357	50	357	50	312	94	312	94	331	65	335	65
January	419	120	419	120	378	143	378	143	247	93	248	93
February	443	179	443	179	416	186	416	186	273	157	284	152
March	498	818	601	829	874	1,899	874	1,899	414	168	261	130
April	400	316	374	295	1,141	1,088	1,133	1,090	653	278	648	311
May	413	716	444	718	1,473	2,202	1,488	2,204	650	277	682	267
June	814	1,532	812	1,531	1,033	1,565	1,028	1,558	348	110	369	120
July	647	1,328	647	1,328	918	2,031	918	2,031	352	93	353	93
August	315	532	315	532	411	388	411	388	359	64	361	62
September	199	361	199	361	355	182	355	182	365	74	366	74

The data in Table 4-47 show little or no change in overall distribution of Merced, Tuolumne, and Stanislaus river flows as a result of WY 2010 Interim Flows because nearly all potential changes in flow are within one standard deviation of the base flow. This is also seen in Figures 4-19 through 4-27, which show both flow increases and decreases, with approximately an overall balancing of potential changes in flows.

Potential changes in flows in the tributaries as a result of WY 2010 Interim Flows vary by hydrologic conditions and time of year, and include potential increases and decreases in flows in the same tributary. While this approach results in changes to water supply and habitat conditions related to flow in the tributaries, these changes are within the simulated historical range of variability in flows in the tributaries. Overall, there is a 60 to 90 percent chance that flows would not be reduced in the tributaries as a result of the Proposed Action during the VAMP period.

Potential changes in flows in the tributaries as a result of WY 2010 Interim Flows range from flow increases as high as 6 percent and flow decreases as high as 11 percent during the VAMP period. Note that model results indicate a potential decrease in flow on the Stanislaus River of up to 37 percent during March. This is due to the potential that less flow may be needed from the Stanislaus River to maintain water quality at Vernalis (described above). The results of modeling showing the potential for flow decreases in

March are because modeling was performed before development of the RPAs as part of the 2008 USFWS and 2009 NMFS CVP/SWP Operations BO that were designed to provide fishery protection on the Stanislaus River. Thus, it is highly likely that the modeled decreases would not occur, and that the RPAs would avoid jeopardy of protected species on the Stanislaus River.

Percent changes are small because the basis-of-comparison flow in the San Joaquin River increases considerably as it nears the Delta (Table 4-48). As shown in Table 4-48, decreases in flows upstream from Vernalis in December, January, and February are due to decreases in flood flows from Millerton Lake. WY 2010 Interim Flows are assumed to be recognized under VAMP as part of the baseline conditions used to estimate unimpaired flow conditions, and affect the operations of reservoirs on tributary rivers and water quality operating requirements for New Melones Reservoir. New Melones Reservoir storage changes are shown in Table 4-49. Impacts as a result of the Proposed Action would be **less than significant**.

Table 4-48.
Monthly Averages of Simulated Flow Upstream from Vernalis

Month	Average of All Years			Dry and Critical Years		
	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)
Oct	2,498	2,575	76 (3%)	2,310	2,386	76 (3%)
Nov	2,556	2,746	190 (7%)	2,198	2,388	190 (9%)
Dec	3,366	3,275	-90 (-3%)	2,025	2,034	9 (0%)
Jan	4,793	4,667	-126 (-3%)	1,900	1,903	3 (0%)
Feb	6,459	6,324	-135 (-2%)	2,318	2,413	95 (4%)
Mar	6,343	6,838	495 (8%)	2,148	2,661	513 (24%)
Apr	6,101	6,559	457 (7%)	2,569	2,893	324 (13%)
May	6,076	6,120	43 (1%)	2,508	2,585	77 (3%)
Jun	4,696	4,786	90 (2%)	1,367	1,423	57 (4%)
Jul	3,349	3,360	11 (0%)	1,213	1,220	7 (1%)
Aug	2,198	2,205	8 (0%)	1,306	1,313	7 (1%)
Sep	2,412	2,451	39 (2%)	1,654	1,675	21 (1%)

Notes:
Summarized from CalSim-II operations model.
Simulation period: October 1921 – September 2003.
Year-type as defined by the Sacramento Valley Index year-type.
(%) indicates percent change from No-Action Alternative.
Key:
cfs = cubic feet per second

Table 4-49.
Monthly Averages of Simulated End-of-Month Storage in New Melones Reservoir

Month	Average of All Years			Dry and Critical Years		
	No-Action Alternative (TAF)	Proposed Action (TAF)	Change from No-Action Alternative (TAF)	No-Action Alternative (TAF)	Proposed Action (TAF)	Change from No-Action Alternative (TAF)
Oct	1,445	1,467	21 (1%)	1,344	1,370	26 (2%)
Nov	1,450	1,471	21 (1%)	1,341	1,366	25 (2%)
Dec	1,476	1,496	20 (1%)	1,350	1,374	25 (2%)
Jan	1,524	1,544	20 (1%)	1,361	1,386	24 (2%)
Feb	1,574	1,593	20 (1%)	1,379	1,404	26 (2%)
Mar	1,618	1,643	25 (2%)	1,378	1,415	37 (3%)
Apr	1,615	1,640	25 (2%)	1,334	1,373	38 (3%)
May	1,654	1,678	24 (1%)	1,285	1,322	37 (3%)
Jun	1,668	1,691	23 (1%)	1,254	1,290	36 (3%)
Jul	1,600	1,623	23 (1%)	1,192	1,228	35 (3%)
Aug	1,516	1,539	23 (1%)	1,129	1,164	35 (3%)
Sep	1,471	1,492	22 (1%)	1,099	1,134	35 (3%)

Notes:

Summarized from CalSim-II operations model.

Simulation period: October 1921 – September 2003.

Year-type as defined by the Sacramento Valley Index year-type.

(%) indicates percent change from No-Action Alternative.

Key:

TAF = thousand acre-feet

Sacramento-San Joaquin Delta

WY 2010 Interim Flows reaching the Delta, which would not exceed 1,300 cfs, could be diverted at existing CVP and SWP export facilities, as discussed in Section 2. Any additional diversion would be subject to existing regulatory requirements and institutional agreements, including water service contracts, VAMP, and D-1641. WY 2010 Interim Flows would not be released during December and January, but Banks and Jones pumping plants would still experience a change in exports during these months due to changes in operations resulting from a change in the previous month's flows. Table 4-50 shows potential changes in Delta pumping. Impacts as a result of the Proposed Action would be **less than significant**.

Table 4-50.
Monthly Averages of Simulated Exports Through Banks and Jones Pumping Plants

Month	Average of All Years			Dry and Critical Years		
	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)
Oct	8,546	8,618	72 (1%)	7,738	7,788	50 (1%)
Nov	8,863	8,986	123 (1%)	7,378	7,556	177 (2%)
Dec	9,987	10,054	67 (1%)	8,917	8,962	45 (1%)
Jan	10,563	10,577	14 (0%)	9,547	9,537	-10 (0%)
Feb	9,078	9,302	224 (2%)	7,202	7,498	296 (4%)
Mar	7,950	8,253	302 (4%)	6,041	6,247	206 (3%)
Apr	5,278	5,549	271 (5%)	2,727	2,863	136 (5%)
May	5,098	5,125	27 (1%)	2,914	2,938	24 (1%)
Jun	6,250	6,257	8 (0%)	4,046	4,039	-7 (0%)
Jul	8,927	8,956	29 (0%)	7,655	7,685	31 (0%)
Aug	8,765	8,752	-13 (0%)	5,733	5,738	5 (0%)
Sep	9,055	9,054	0 (0%)	6,427	6,429	2 (0%)

Notes:
Summarized from CalSim-II operations model.
Simulation period: October 1921 – September 2003.
Year-type as defined by the Sacramento Valley Index year-type.
(%) indicates percent change from No-Action Alternative.
Key:
cfs = cubic feet per second

Central Valley Project/State Water Project Water Service Areas

Table 4-51 shows changes in diversions from Millerton Lake between the Proposed Action and the No-Action Alternative. The diversion losses in Table 4-51 are averaged over the simulation record, whereas actual delivery decreases to Friant Division long-term contractors during the WY 2010 Interim Flows period would depend on year-type (e.g., up to 384 TAF in a Wet year if Friant Division long-term contractors do not develop exchange agreements to recapture diverted WY 2010 Interim Flows). Modeling results are based on 82 years of historical hydrology, and indicate that total annual deliveries to the Friant Division water service area would be reduced by 78 TAF on average, which corresponds to an approximate 9 percent reduction in annual deliveries. The maximum reduction estimated for 1 year in the 82-year simulation period is 234 TAF, which corresponds to a reduction of 28 percent. These results demonstrate that during wetter years (Wet and Normal-Wet), reductions in deliveries would result in changes in delivery of Section 215 water supplies, of which only a portion have historically been available to long-term contractors. These results support a finding that reductions in deliveries due to WY 2010 Interim Flows would result in less-than-significant impacts.

WY 2010 Interim Flows, however, could potentially be recaptured by CVP users downstream from Friant Dam, allowing for a possible exchange of water to the Friant Division. Available capacity within CVP storage and conveyance facilities could be used to facilitate exchanges and conveyance of water to the Friant Division, as discussed in Section 2. Recaptured water available to Friant Division long-term contractors would range from zero to the total amount of recaptured WY 2010 Interim Flows. Supplemental transfer, exchange, and conveyance agreements between Friant Division long-term contractors and south-of-Delta export water users would be required to convey recaptured water to the Friant Division. Reclamation would assist Friant Division long-term contractors in arranging agreements for the transfer or exchange of flows recaptured at these locations. As mentioned previously, a decrease in deliveries to Friant Division long-term contractors due to the Proposed Action could also result in an increase in groundwater pumping to offset any reductions. These impacts would be **less than significant.**

Table 4-51.
Monthly Averages of Simulated Friant-Kern Canal and Madera Canal Diversions

Month	Average of All Years			Dry and Critical Years		
	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)	No-Action Alternative (cfs)	Proposed Action (cfs)	Change from No-Action Alternative (cfs)
Mar	1,143	990	-153 (-13%)	613	385	-227 (-37%)
Apr	1,979	1,649	-331 (-17%)	858	550	-308 (-36%)
May	2,860	2,611	-249 (-9%)	1,241	921	-320 (-26%)
Jun	3,999	3,744	-255 (-6%)	2,301	1,940	-361 (-16%)
Jul	4,024	3,849	-175 (-4%)	2,647	2,338	-309 (-12%)
Aug	3,401	3,213	-189 (-6%)	1,987	1,564	-424 (-21%)
Sep	1,780	1,695	-85 (-5%)	922	748	-174 (-19%)
Oct	696	710	15 (2%)	417	432	15 (4%)
Nov	230	246	16 (7%)	156	164	9 (6%)
Dec	223	240	17 (8%)	43	25	-18 (-42%)
Jan	407	409	2 (1%)	190	231	41 (21%)
Feb	1,024	1,059	35 (3%)	540	622	82 (15%)

Notes:

Summarized from CalSim-II operations model.

Simulation period: October 1921 – September 2003.

Year-type as defined by the Restoration year-type.

(%) indicates percent change from No-Action Alternative.

Key:

cfs = cubic feet per second

WY 2010 Interim Flows diverted at existing CVP and SWP export facilities would be routed through San Luis Reservoir. Table 4-52 shows San Luis Reservoir storage changes if Delta diversion changes, shown in Table 4-50, are delivered to south-of-Delta CVP and SWP contractors. San Luis Reservoir changes, however, would be different under any potential water recapture scenario that returns water to the Friant Division. Impacts as a result of the Proposed Action would be **less than significant**.

Table 4-52.
Monthly Averages of Simulated End-of-Month San Luis Reservoir Storage

Month	Average of All Years			Dry and Critical Years		
	No-Action Alternative (TAF)	Proposed Action (TAF)	Change from No-Action Alternative (TAF)	No-Action Alternative (TAF)	Proposed Action (TAF)	Change from No-Action Alternative (TAF)
Oct	885	876	-8 (-1%)	812	818	6 (1%)
Nov	1,104	1,102	-2 (0%)	992	1,008	16 (2%)
Dec	1,419	1,417	-2 (0%)	1,306	1,323	17 (1%)
Jan	1,732	1,723	-9 (-1%)	1,634	1,642	8 (1%)
Feb	1,876	1,872	-4 (0%)	1,753	1,773	20 (1%)
Mar	1,940	1,947	7 (0%)	1,829	1,851	22 (1%)
Apr	1,846	1,868	22 (1%)	1,672	1,705	33 (2%)
May	1,621	1,633	12 (1%)	1,405	1,435	31 (2%)
Jun	1,257	1,257	0 (0%)	1,042	1,066	25 (2%)
Jul	981	977	-4 (0%)	850	869	20 (2%)
Aug	750	741	-9 (-1%)	608	620	12 (2%)
Sep	771	761	-9 (-1%)	591	602	11 (2%)

Notes:
Summarized from CalSim-II operations model.
Simulation period: October 1921 – September 2003.
Year-type as defined by the Sacramento Valley Index year-type.
(%) indicates percent change from No-Action Alternative.
Key:
TAF = thousand acre-feet

4.11 Land Use and Planning

Environmental Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IX. Land Use and Planning. Would the project:				
a) Physically divide an established community?	☐	☐	☒	☐
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, a general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

a) Physically divide an established community?

San Mateo Road and Dan MacNamara Road could be temporarily inundated with water with implementation of the Proposed Action. These roads are collectors and local roads and generally have light to moderate traffic. Although these roads are not important transportation corridors, WY 2010 Interim Flows could temporarily affect local circulation. To minimize disruption of local circulation, the Proposed Action includes preparing and implementing a detour plan that would provide convenient and parallel roadway access. Implementing the Proposed Action would not physically divide an established community and the impact on circulation would be **less than significant** because of the detour plan. This impact would be greater under the Proposed Action than under the No-Action Alternative because no WY 2010 Interim Flows would be released from Friant Dam under the No-Action Alternative; water releases from the dam would continue to vary based on time of year, water year-type, and system conditions as they currently do under existing conditions, and no changes to facilities connecting established communities would occur.

b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, a general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?

Implementing the Proposed Action would not conflict with any agency's land plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect. No physical changes to land or right-of-way acquisition would occur with the Proposed Action or interfere with property rights or long-term land use plans. Because WY 2010 Interim Flows would be temporary and periodic, and no physical changes to land would occur, implementing the Proposed Action would have **no impact**. Because implementing the No-Action Alternative also would not affect land use plans, policies, or regulations, there would be no impact under the No-Action Alternative.

c) Conflict with any applicable habitat conservation plan or natural community conservation plan?

There are no habitat conservation plans or natural community conservation plans in any of the geographic subareas of the study area. Therefore, both the Proposed Action and the No-Action Alternative would have **no impact**.

4.12 Mineral Resources

Environmental issues	Potentially Significant Adverse Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
X. Mineral Resources. Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	☐	☐	☐	☒

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?

Flows released under the Proposed Action would not be of a sufficient quantity to affect mining operations and reclamation activities. No change in flow releases would occur under the No-Action Alternative. Excavation in the Chowchilla Bypass sediment detention basin would not be impeded under the Proposed Action because WY 2010 Interim Flows would not be routed through this reach. No Conditional Use Permits for mining activities in Reach 2A or in Eastside Bypass Reach 2 are on record with the appropriate counties or Department of Fish and Game. Therefore, both the Proposed Action and the No-Action Alternative would have **no impact**.

b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?

For the same reasons presented in item a), the Proposed Action and the No-Action Alternative would have **no impact**.

4.13 Noise

Environmental Issues	Potentially Significant Adverse Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XI. Noise. Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or in other applicable local, state, or federal standards?	☐	☐	☒	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or in other applicable local, state, or federal standards?

Noise sources related to implementing the Proposed Action would be from plant survey and removal activities that are scheduled to begin in spring and fall 2011, respectively. Survey crews would consist of two to three workers and would create approximately one trip per day per surveying crew. The survey period is unknown at this time, but could last several months. Vegetation-removal crews would consist of six to seven workers with one heavy piece of equipment per crew (i.e., bobcat or backhoe). Other crew members would use hand tools, chainsaws, and weed whackers. Vegetation removal would result in approximately one haul truck trip per day per crew to move vegetation to an as-yet-undetermined waste or composting facility. Vegetation-removal activities are expected to last approximately 3 months and could occur for up to 3 consecutive years (2011–2013). Typically, traffic levels would need to be doubled to create a noticeable increase in noise (Caltrans 1998). The maximum of eight daily trips from the Proposed Action would not double traffic levels on any affected roadways (affected roadways have levels ranging from 1,900 to 67,000 average daily trips (Caltrans 2007) and therefore would not create an increase in existing noise levels).

As stated above, a doubling of traffic levels is required to create a noticeable increase in traffic noise. It is not anticipated that the increased activity resulting from additional recreationists would double existing traffic levels on roadways that access the study area. Because a doubling of traffic would not occur as a result of Proposed Action implementation, no increase in noise or violation of noise standards would occur.

Sources of noise emanating from vegetation-removal activities could include use of one bobcat or backhoe and hand-held power tools. Noise from backhoes and other equipment could reach 74 A-weighted decibels (dBA) at the nearest sensitive receptor, approximately 100 feet away (FTA 2006). Thus, noise levels resulting from these pieces of equipment could exceed applicable local noise standards at nearby sensitive receptors. However, construction equipment and activities are typically exempt when activities occur during daylight hours. Proposed Action activities would be limited to hours normally exempted for these types of activities; therefore, noise-related vegetation removal would not expose sensitive receptors to noise levels that exceed applicable noise standards. Increased recreation and vegetation surveys would not result in noise levels in excess of applicable standards; therefore, these impacts would be **less than significant**. Under the No-Action Alternative, no vegetation removal or increased recreation would occur. Therefore, noise-related impacts resulting from the Proposed Action would be greater than under the No-Action Alternative.

b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

Implementing the Proposed Action would not involve construction activities, transportation activities, or nontransportation activities that would generate groundborne vibration or noise levels. The No-Action Alternative also would not involve such activities. However, under the Proposed Action, vibration resulting from the operation of the bobcat or backhoe (48 vibration decibels (VdB) at 100 feet) and haul trucks during vegetation removal (67 VdB at 100 feet) could occur. Because these levels would be less than levels recommended by the Federal Transit Administration and California Department of Transportation for human annoyance and building destruction (FTA 2006), implementing the Proposed Action would not result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels. This impact would be **less than significant** and greater than under the No-Action Alternative**.**

c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

The Proposed Action is temporary in nature and would not result in any changes to transportation- or nontransportation-related noise sources. Noise resulting from vegetation removal, vegetation surveys, and minor increases in the number of recreationists under the Proposed Action would not result in a substantial permanent increase in noise levels (see item a) above). Thus, implementing the Proposed Action would not create a substantial permanent increase in ambient noise levels. This impact would be **less than significant.** Under the No-Action Alternative, existing noise levels would not change and would be less than under the Proposed Action.

d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

As discussed in item a), no noise sources related to construction and stationary source activities would be created under the Proposed Action or under the No-Action Alternative. Noise resulting from vegetation removal, vegetation surveys, and recreationists under the Proposed Action could result in a substantial increase in noise levels (see item a) above), but minimization commitments as part of the Proposed Action would reduce noise levels below applicable standards and limit noise to daylight hours. Thus, construction-, stationary-, and operational-source noise would not result in a temporary or periodic increase in noise levels in the Proposed Action vicinity above levels existing without the Proposed Action. This impact would be **less than significant** and greater than under the No-Action Alternative.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

Three airports located in or immediately adjacent to the Restoration Area have adopted an airport comprehensive land use plan. The Sierra Sky Park Airport, Firebaugh Municipal Airport, and Mendota Municipal Airport contribute to the background noise environment in Reaches 1A, 2B, and 3. Implementing the Proposed Action would not affect existing airport use or air traffic patterns. Therefore, implementing the Proposed Action would not result in the exposure of people residing or working in the study area to excessive airport- or air-traffic-related noise levels. These facilities and existing air traffic patterns also would not be affected under the No-Action Alternative. Both the Proposed Action and the No-Action Alternative would have **no impact**.

f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

Several private agricultural airstrips in the vicinity of the study area operate seasonal flights for crop spraying. Implementing the Proposed Action would not affect the use of these airstrips or crop-spraying operations. Therefore, implementing the Proposed Action would not result in the exposure of people residing or working in the study area to private-airstrip-related excessive noise levels. The No-Action Alternative also would not affect these activities. Both the No-Action Alternative and the Proposed Action would have **no impact**.

4.14 Population and Housing

Environmental Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XII. Population and Housing. Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing homes, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?

Implementing the Proposed Action would not induce direct or indirect population growth. No new housing or businesses and no new utilities infrastructure or roads are proposed. Under the No-Action Alternative, projected population growth would not change. Therefore, implementing either the Proposed Action or the No-Action Alternative would not be growth inducing and would not remove an existing impediment to growth. The Proposed Action and the No-Action Alternative would have **no impact**.

b) Displace substantial numbers of existing homes, necessitating the construction of replacement housing elsewhere?

Implementing the Proposed Action or the No-Action Alternative would not displace existing homes. Therefore, the Proposed Action and the No-Action Alternative would not require the construction of replacement housing and there would be **no impact**.

c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?

Implementing the Proposed Action or the No-Action Alternative would not displace any people. Therefore, the Proposed Action and the No-Action Alternative would not require the construction of replacement housing, and would have **no impact**.

4.15 Public Services

Environmental Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XIII. Public Services. Would the project:				
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☒	☐
Police protection?	☐	☐	☒	☐
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☒	☐
Other public facilities?	☐	☐	☒	☐

a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:

- **Fire protection?**
- **Police protection?**
- **Schools?**
- **Parks?**
- **Other public facilities?**

Implementing the Proposed Action has the potential for a negligible and temporary indirect effect on emergency rescue services by increasing recreation opportunities along the length of the San Joaquin River from Friant Dam to the Delta, and by lengthening the period in which people would use the river for recreation. The potential minor increase in the number of people using the river for recreation could in turn increase the number of accidents and emergencies in this area. The increased demand for emergency services resulting from increased recreational use would not result in the need to construct new emergency responder facilities or improve existing facilities to maintain an acceptable level of service. Although additional instream flows can attract recreationists, a substantial amount of the Restoration Area is privately owned, and river access is extremely limited. Reach 1, which has the greatest existing public access and instream flows, is not expected to experience significantly increased recreational use from WY 2010 Interim Flows. Similarly, the downstream reaches, some of which only have flows during limited high-flow periods, and all with limited or no public access, are not expected to experience significantly increased recreational use from WY 2010 Interim Flows. Consequently, additional fire protection services would not be needed. This impact would be **less than significant**.

The discussion for fire protection above also applies to Proposed Action effects on police protection. This impact would be **less than significant**.

Because the Proposed Action does not involve housing or indirectly cause housing to be built, implementing the Proposed Action would not change demands on schools. The Proposed Action would have **no impact**.

Reaches 1 and 2 provide substantial recreational opportunities, including several parks. Because these areas already receive instream flows, it is not expected that additional WY 2010 Interim Flows released as part of the Proposed Action would substantially increase the demands on parks. Only a small increase in recreational use would be expected. The impact would be **less than significant**.

Implementing the Proposed Action would not adversely affect other public facilities. A public boat launch is located near Friant Dam to provide boaters walk-in access to the San Joaquin River. The launch is designed to withstand flood flows that exceed potential WY 2010 Interim Flow releases. Because the boat launch would remain in place, no environmental effects would result from relocating a boat launch. The use of public facilities along the San Joaquin River is not expected to substantially change with the release of Interim Flows because the river already has flow at areas where public facilities exist. Only a small increase in recreational use would be expected. The impact would be **less than significant**.

The No-Action Alternative would not involve releases of WY 2010 Interim Flows; therefore, recreation use would not be affected. This alternative also would not involve housing or increase the demand for housing, schools, parks or other public facilities. Thus, the impacts on public services resulting from the Proposed Action would be greater than under the No-Action Alternative.

4.16 Recreation

Environmental Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XIV. Recreation. Would the project:				
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☒	☐
b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	☐	☐	☐	☒

a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

Under Proposed Action, there would be an effect on recreation physical, social, and managerial settings of the downstream reaches. This would occur through direct inundation, increased flows for fish, and/or by displacement of users or the environment. Increased flows under the Proposed Action would enhance the use of the river by boaters (primarily canoers and kayakers in Reach 1 by potentially increasing the time that flow would be in the ideal range of 200 to 1,000 cfs. With the exception of flood events that could occur, San Joaquin River flows at the head of Reach 1 would provide good flows for boating throughout Reach 1 between February 1 and March 15, 2010, and between July 1 and November 20, 2010. These flow increases would be considered beneficial because the flows would enhance boating conditions throughout those periods, totaling about 6 months.

Increased river flow during these fall, spring, and summer periods also could enhance use of the river by boaters through extending boatable flows in Reach 1B and into Reach 2A. Lack of flows below Gravelly Ford, at the end of Reach 1, currently prevents boating beyond Reach 1. Although some flow would be lost to infiltration, it is expected that boatable flows resulting from implementation of the Proposed Action could occur in Reach 2A. Some boaters likely would respond to the availability of increased flows in the river by continuing their boat outings in Reach 1B, beyond the most downstream takeout at SR 145, or launching from that location and possibly boating down Reach 2A beyond

Gravelly Ford and to the Chowchilla Bypass Bifurcation Structure, at the end of Reach 2A. However, the lack of public lands and river access below Gravelly Ford provides few opportunities for boaters to retrieve their boats from the river. As a result, it is anticipated that few boaters would attempt to use Reach 2 because of the flow provided by the Proposed Action. Similarly, the lack of public access to Reach 3 below Firebaugh and to Reach 4 is anticipated to prevent additional or new boating use from occurring.

The Chowchilla Bypass Bifurcation Structure would present a barrier to boat traffic, and there is no provision for boat passage or portaging of boats around the structure. Further, access to Reach 2B is minimal until the Mendota Pool, at the end of the reach. Therefore, it is not expected that many boaters would attempt to continue boating beyond Reach 2A.

Except during flood periods, flows in Reach 1 from mid-March through June typically are in the range of 100 to 300 cfs, at the lower end of the ideal range for boating. However, as recently as 2003 and 2005, spring and early summer flows in the range of 1,000 to 1,500 cfs have occurred in Reach 1. More experienced and skilled kayakers may be comfortable boating on the river at those flows and, indeed, may be attracted by increased flows. However, spring and early summer flows that could result under the Proposed Action would preclude nearly all boat use on the river; as described above, the river would become more hazardous because of the strength of the current and flows moving through brushy and wooded areas and through “strainers” created by standing and downed trees in the channel. For this reason, increased flows could reduce boating opportunities during spring and early summer. However, this reduction of boating opportunities, which could occur for up to a 3½-month period between mid-March and June, would be compensated for by enhanced boating that would occur during fall, early spring, and midsummer through late summer. In addition, boaters who could be displaced from the San Joaquin River because of high flows also would have available to them similar boating opportunities on the lower Kings River below Pine Flat Reservoir, approximately 20 miles east of Fresno. Increased recreation on the lower Kings River would not be substantial enough to have an impact on current recreational opportunities. Therefore, the overall effect of implementing the Proposed Action on the availability of boating opportunities of the type currently available in Reach 1 would be minimal and **less than significant**.

Although local boaters, swimmers, waders, and anglers are likely to be familiar with the occurrence of high flows in Reach 1 because of their natural occurrence, as described above, the increase in spring and early summer flows that could occur in Reach 1 under the Proposed Action could pose a hazard to unwary or uninformed recreationists. For this reason, the Proposed Action includes a commitment to implement an outreach program, the purpose of which would be to make the public aware of the increased flows and boating, swimming, and wading hazards that may result from WY 2010 Interim Flows. Given the active role of the San Joaquin River Parkway and Conservation Trust, the San Joaquin River Conservancy, and the Fresno County Parks Department in providing recreation facilities and services in Reach 1, cooperation with those organizations would be a priority for coordinated outreach efforts contained in the outreach program. Outreach would also extend to emergency response and law enforcement agencies to maintain public safety in response to new hazards and new recreation use patterns that may result from the Proposed Action.

The potential flow increases in Reach 1 from mid-March through June under the Proposed Action also would have impacts on angling opportunities. These increased flows would reduce the type of angling opportunities that currently exist by increasing the time that flow in the main channel would be above the range conducive to fishing. Fishing currently occurs year-round (except during flood periods) in Reach 1, where flow is generally between 100 and 300 cfs. In addition to the resident warm-water fishery, a particular attraction for anglers is weekly releases of catchable-size hatchery trout below Friant Dam by DFG. Anglers fish from the riverbank, wade into the river to fish, and fish from canoes and kayaks. The proposed flows above 1,500 cfs would be too high to allow most boat use on the river and wade fishing, and would eliminate access to portions of the riverbank used by anglers during low flows.

However, a large increase in inundated area would occur in Reaches 1A and 1B at flows above 1,500 cfs. Calculations indicate that flows greater than 1,500 cfs would result in an increase in river stage in Reach 1, which would increase the inundated area, and flow-through and connection of isolated gravel pit ponds and side channels with the main channel. This would provide new, accessible fishing opportunities at numerous locations at the margins of Reach 1. Therefore, the temporary reduction in angling opportunities on the main channel would be offset by increased opportunities in newly inundated areas at the margins of the main channel. Thus, the overall effect on angling opportunities would be minimal.

Enhanced use of the San Joaquin River at Millerton Lake, the San Joaquin River, and downstream areas at times as a result of the release of WY 2010 Interim Flows at Friant Dam under the Proposed Action would be adequately served by existing facilities. Fisheries data provided subsequent to preparation of this section indicated relatively small increases in habitat for black bass with changes at Millerton Lake resulting from Restoration Flows. However, it is not anticipated that WY 2010 Interim Flows would have a significant impact. For this reason and the reasons described above, this impact would be **less than significant**, and greater than under the No-Action Alternative, because recreational opportunities and annual use levels at Millerton Lake, the San Joaquin River, and downstream areas would not change from existing conditions under the No-Action Alternative.

b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?

No recreational facilities are included as part of the Proposed Action. The Proposed Action is only temporary and, as discussed in item a) above, would not result in, or require the construction or expansion of, recreational facilities. There would be **no impact** because no construction or expansion of recreational facilities would occur under either the Proposed Action or the No-Action Alternative.

4.17 Transportation/Traffic

Environmental Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XV. Transportation/Traffic. Would the project:				
a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	☐	☐	☒	☐
b) Exceed, individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☐	☐	☒	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☐	☒	☐
f) Result in inadequate parking capacity?	☐	☐	☐	☒
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☐	☒

a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?

The existing traffic capacity of the street systems in the study area is adequate to accommodate the light-to-medium existing traffic. Under the Proposed Action and the No-Action Alternative, existing traffic loads would increase similarly as land use plans are implemented and subsequently built. The potentially increased recreation opportunities that would result with implementation of the Proposed Action from flows that would extend longer down the river for a longer period could bring more people to the Restoration Area, but most of the San Joaquin River is located on private lands and is not accessible. For these reasons, and because the potential increase in the number of people visiting the area by car is not expected to be substantially more than the number visiting the area now, the impact on traffic resulting from implementing the Proposed Action would be **less than significant**. The No-Action Alternative would cause no change in the rate at which traffic is added as a result of development. Therefore, traffic impacts under the Proposed Action would be greater than under the No-Action Alternative.

b) Exceed, individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?

The discussion of traffic load and capacity above also is applicable to levels of service. The Proposed Action is short term and would not involve additional residential or commercial development that would increase traffic beyond that which is already planned. However, more people could be attracted to the area because of increased recreational opportunities. Therefore, impacts on the levels of service for roads, highways, and intersections would be **less than significant**. The No-Action Alternative would add no additional trips that would affect levels of service. Therefore, the Proposed Action would have slightly greater impacts than under the No-Action Alternative.

c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?

Implementing the Proposed Action or the No-Action Alternative would not change air traffic patterns; therefore, both would have **no impact.**

d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

The Proposed Action would not involve any changes to transportation infrastructure, the design of which would substantially increase hazards. The San Joaquin River is a compatible use with the existing transportation infrastructure. Therefore, implementing the Proposed Action would not increase road hazards, and there would be **no impact**. Implementing the No-Action Alternative would have no impact for the same reasons.

e) Result in inadequate emergency access?

San Mateo Road and Dan McNamara Road could be temporarily inundated by the introduction of WY 2010 Interim Flows with implementation of the Proposed Action. This condition is not substantially different from existing conditions. A number of crossings in the flood bypass system are unusable during high-flow conditions, including West El Nido Road, Headquarters Road, and several unnamed crossings. These roads are collectors and local roads and generally have light-to-moderate traffic. Under the Proposed Action, traffic could be redirected during WY 2010 Interim Flow periods to assist drivers with crossing the bypasses safely and to maintain emergency access. With implementation of the detours, inundation of San Mateo Road and Dan McNamara Road would not result in inadequate emergency access. The impact would be **less than significant** and similar to that of the No-Action Alternative.

f) Result in inadequate parking capacity?

Implementing the Proposed Action would not remove any existing parking facilities, and no construction is proposed that would introduce more parking demand. Parking conditions and demand would be the same as under the No-Action Alternative, and there would be **no impact**.

g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?

Implementing the Proposed Action would not conflict with adopted policies, plans, or programs supporting alternative transportation. Adopted policies, plans, or programs supporting alternative transportation would be the same under the No-Action Alternative There would be **no impact** in either case.

4.18 Utilities and Service Systems

Environmental Issues	Potentially Significant Adverse Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVI. Utilities and Service Systems. Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☒	☐
e) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand, in addition to the provider's existing commitments?	☐	☐	☐	☒
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☒
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?

Implementing the Proposed Action would not involve generation or reuse of wastewater and would not require modifications to existing wastewater treatment facilities in the study area that would result in exceedence of applicable wastewater treatment requirements. Wastewater conditions would be the same as under the No-Action Alternative, and there would be **no impact**.

b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?

Release of WY 2010 Interim Flows would not result in the need for water treatment or wastewater treatment facilities. Therefore, implementing the Proposed Action would not require construction of new water or wastewater treatment facilities or expansion of existing facilities. Demand for water and wastewater treatment facilities would be the same as under the No-Action Alternative. There would be **no impact**.

c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?

Flood flows during storms would not be affected by release of WY 2010 Interim Flows. WY 2010 Interim Flows would be temporary and periodic, beginning on October 1, 2009, and ending on September 30, 2010, and the volume and timing of WY 2010 Interim Flow releases would be constrained by existing channel capacity. Therefore, WY 2010 Interim Flows would not substantially affect stormwater drainage facilities in the vicinity of the Restoration Area or along the San Joaquin River downstream from the Merced River confluence to the Delta. Further, no physical changes to land or rights-of-way would be required with implementation of the Proposed Action that would interfere with existing storm drainage facilities. Because WY 2010 Interim Flows are temporary and periodic and no physical changes to land or rights-of-way would occur, implementing the Proposed Action would not require construction of new stormwater drainage facilities or expansion of existing facilities beyond that which would occur under existing conditions. Impacts related to construction of new stormwater drainage facilities would be the same as under the No-Action Alternative, and there would be **no impact**.

d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?

The Proposed Action is not a development project that increases demands on water supplies or requires new or expanded entitlements. Implementing the Proposed Action would involve reoperation of Friant Dam to release flows down the San Joaquin River that would otherwise be sent directly through canals at Friant Dam to Friant Division long-term contractors. The Proposed Action would not affect water delivery quantities to contractors and refuges outside the Friant Division, including the San Joaquin River Exchange Contractors. Millerton Lake water supply decisions consider available supply, downstream requirements, and Friant Division long-term contractor demands for water supply. For most hydrologic year-types that could occur in WY 2010, the Proposed Action would decrease deliveries to Friant Division contractors up to WY 2010 Interim Flow volumes (i.e., 384 TAF if no flood spills are captured and Friant Division long-term contractors do not develop exchange agreements to recapture diverted WY 2010 Interim Flows). WY 2010 Interim Flows, however, could potentially be recaptured by CVP users downstream from Friant Dam, allowing for a possible exchange of water to the Friant Division. Available capacity within CVP storage and conveyance facilities could be used to facilitate exchanges and conveyance of water to the Friant Division, as discussed in Section 2. Recaptured water available to Friant Division long-term contractors would range from zero to the total amount of recaptured WY 2010 Interim Flows. Supplemental transfer, exchange, and conveyance agreements between Friant Division long-term contractors and south-of-Delta export water users would be required to convey recaptured water to the Friant Division. Reclamation would assist Friant Division long-term contractors in arranging agreements for the transfer or exchange of flows recaptured at these locations. The potential reduction in water deliveries to the Friant Division long-term contractors from the Proposed Action would be limited to the 1-year duration of the Proposed Action. This impact would be **less than significant**, but greater than the No-Action Alternative, because reoperation of Friant Dam would not occur and water deliveries would not be affected under the No-Action Alternative.

e) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand, in addition to the provider's existing commitments?

Implementation of the Proposed Action or the No-Action Alternative would not involve generation of or an increased demand for treatment of wastewater. Therefore, implementing the Proposed Action or the No-Action Alternative would not affect wastewater treatment providers, and there would be **no impact**.

f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?

Release of Interim Flows would not generate any solid waste. Therefore, implementation of the Proposed Action would not result in an increase in the generation of solid waste above the level that would be projected to occur with planned growth; this would be the same as under the No-Action Alternative. Therefore, implementing either the Proposed Action or the No-Action Alternative would not affect solid waste disposal needs, and there would be **no impact**.

g) Comply with federal, state, and local statutes and regulations related to solid waste?

Federal, State, and local statutes and regulations related to solid waste would not apply to the Proposed Action because no solid waste would be generated by the release of WY 2010 Interim Flows and no additional disposal capacity would be required. Solid waste generation under the Proposed Action and the No-Action Alternative would be the same, and there would be **no impact**.

4.19 Mandatory Findings of Significance

Environmental Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVII. Mandatory Findings of Significance.				
a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☒	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☐	☒	☐
c) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☒	☐

Authority: Public Resources Code Sections 21083 and 21087.
Reference: Public Resources Code Sections 21080(c), 21080.1, 21080.3, 21082.1, 21083, 21083.3, 21093, 21094, 21151; *Sundstrom v. County of Mendocino*, 202 Cal.App.3d 296 (1988); *Leonoff v. Monterey Board of Supervisors*, 222 Cal.App.3d 1337 (1990).

a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?

As presented above in the "Biological Resources – Terrestrial Species" and "Biological Resources – Fish" sections, implementing the Proposed Action would not substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, or reduce the number or restrict the range of an endangered, rare, or threatened species. The impact would be **less than significant.** The Proposed Action would cause a significant adverse effect by accelerating the spread of several invasive plant species already present along the San Joaquin River, but this effect would be less than significant with mitigation.

b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)

CEQ regulations that implement NEPA provisions define "cumulative effects" as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative effects can result from individually minor, but collectively significant, actions over time, and can differ from indirect impacts (40 CFR 1508.8). Cumulative effects are caused by the incremental increase in total environmental effects when an evaluated project is added to other past, present, and reasonably foreseeable future actions. Cumulative effects can thus arise from causes that are totally unrelated to the project being evaluated, and the analysis of cumulative effects considers the life cycle of the effects, not the project at issue. These effects can be either adverse or beneficial.

Cumulative impacts are defined in the State CEQA Guidelines (14 CCR Section 15355) as "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts." A cumulative impact occurs from "the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time" (14 CCR Section 15355(b)). Consistent with the State CEQA Guidelines (14 CCR Section 15130(a)), the discussion of cumulative impacts in the PEIS/R will focus on significant and potentially significant cumulative impacts.

No past, current, or probable future projects were identified in the project vicinity that, when added to project-related impacts, would result in a significant cumulative impact, and that would be cumulatively considerable. Two future projects were considered herein: the Friant-Kern and Madera Canals Capacity Correction Project (FKMCCCP) and other components of the SJRRP.

The FKMCCCP involves removing conveyance restrictions so that the canals can carry water equal to their original design capacity. It would not overlap with the Proposed Action spatially or temporally. The only potential for cumulative effects is that the FKMCCCP, when completed, would increase diversions from Millerton Lake. However, the FKMCCCP would not be completed until after the Proposed Action is implemented. The Proposed Action would result in no net change in Millerton Lake water storage; therefore, there would be no cumulative effects between the Proposed Action and the FKMCCCP.

The Settlement and SJRRP are summarized in Section 1, "Introduction and Statement of Purpose and Need." The Settlement describes several physical and operational activities that would affect environmental conditions in Millerton Lake, the San Joaquin River, and the Friant Division. The SJRRP PEIS/R will evaluate the program-level and cumulative effects of the future potential implementation of the SJRRP, including the project-level and cumulative effects of both Interim Flows (beginning in WY 2011) and Restoration Flows. The PEIS/R is being developed and is not yet available; therefore, it would be speculative at present to identify the environmental impacts, and their significance, that will be addressed in the PEIS/R. The only resource area with the potential for cumulative effects would be Friant Division water supplies, but one of the SJRRP's two primary goals is "to reduce or avoid adverse water supply impacts on all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement." Again, it would be speculative to conclude that the Proposed Action, WY 2010 Interim Flows, would have a cumulatively considerable significant effect with other elements of the SJRRP.

The SJRRP PEIS/R should be completed before any other components of the SJRRP are implemented. Consequently, the PEIS/R is the appropriate document to evaluate the cumulative effects of the Proposed Action, along with all other SJRRP components, at either a program or project level. Any significant cumulative effects of the Proposed Action and other SJRRP components can be identified, addressed, and mitigated with the PEIS/R without the degree of speculation that would be required in this environmental document. The impact would be **less than significant.**

c) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?

No project-related environmental effects were identified that would cause substantial adverse effects on human beings, either directly or indirectly. The impact would be **less than significant**.

4.20 Indian Trust Assets

Evaluation of Indian Trust Assets is a NEPA requirement. The Proposed Action does not affect Indian Trust Assets. The nearest Indian Trust Asset is Table Mountain Rancheria, which is approximately 3 miles east-southeast of the Restoration Area at its closest point.

4.21 Socioeconomic Effects and Environmental Justice

Evaluation of socioeconomic effects is a NEPA requirement. Existing population and housing trends, employment and labor force trends, prominent business and industry types, and government and finance conditions within the study area would not be affected by the Proposed Action. As discussed above in the “Agricultural Resources,” “Hydrology and Water Quality,” and “Population and Housing” sections, the Proposed Action would have limited socioeconomic effects. Water supply availability to Friant Water Users is highly variable on an annual basis, and the amount of water used as WY 2010 Interim Flows is within this range of annual variability.

Executive Order 12898 requires Federal agencies to determine if the significant adverse effects of a Federal action under consideration would disproportionately burden minority groups, low-income populations, or Native American Tribes. Because of the limited duration (1 year) and extent of the Proposed Action, and the findings that all impacts to related resources areas are less than significant or have no effect whatsoever, it is concluded that the Federal action under consideration would not disproportionately burden minority groups, low-income populations, or Native American Tribes.

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5.0 Consultation and Coordination

This section reviews agency consultation and coordination that occurred before and during preparation of this EA/IS, and reviews the steps in the NEPA/CEQA review process that follow release of this EA/IS.

5.1 Past Efforts

The SJRRP Web site at www.restoresjr.net provides numerous opportunities for public involvement and information updates. Public outreach technical feedback meeting agendas and summaries are also posted on the SJRRP Web site. A public involvement/public outreach plan, adopted in April 2007, guides SJRRP public outreach using a single multiagency effort managed by the SJRRP Public Affairs Team (SJRRP 2007b). Comprising staff from each of the five SJRRP Implementing Agencies (Reclamation, USFWS, NMFS, DWR, and DFG) and consultant staff, the SJRRP Public Affairs Team coordinates consistent public outreach and involvement.

Public and agency consultation and coordination relating to the broader SJRRP have been extensive since mid-2007, and WY 2010 Interim Flows have been discussed as a component of the SJRRP. Reclamation published a Notice of Intent (NOI) to prepare the SJRRP PEIS in the Federal Register on August 2, 2007. DWR filed an NOP of the PEIR on August 22, 2007. Public scoping meetings for the SJRRP PEIS/R were held in 2007 on August 28 in Tulare, August 29 in Fresno, August 30 in Los Banos, and September 10 in Sacramento. A scoping report for the PEIS/R was published on December 14, 2007 (SJRRP 2007a). Local Native American interests were contacted early in the SJRRP scoping process. All input and feedback on implementing the Settlement was taken into consideration in preparing this EA/IS.

To implement the Settlement as specified, the Settling Parties established the TAC and conducted stakeholder meetings to discuss SJRRP objectives and listen to and consider public concerns in 2007. Technical Work Groups were established to share technical input and receive feedback from stakeholders. Seven stakeholder meetings were held in 2008 as part of the SJRRP Water Management Technical Work Group, and this group continues to meet regularly.

The Implementing Agencies initiated meetings in 2008 with the LSJLD, the Central Valley Flood Protection Board, USACE, SWRCB, and the San Joaquin River Exchange Contractors Water Authority to discuss WY 2010 Interim Flow releases. Representatives of The Bay Institute of San Francisco and Revive the San Joaquin have provided input on WY 2010 Interim Flow releases. Since mid-2008, representatives from all five Implementing Agencies and USACE have been attending or invited to attend regularly scheduled monthly meetings to discuss the EA/IS and other related issues involving SJRRP environmental compliance efforts. Additional planning activities, including ongoing stakeholder and landowner outreach, continue in 2009. Reclamation, USFWS, NMFS, USACE, DWR, and DFG staff have all been involved in preparing this EA/IS. No Federal cooperating agencies have been identified for this EA/IS.

As a stipulation to the Settlement, a Memorandum of Understanding (MOU) was entered into by Reclamation with several water districts, water authorities, and canal companies, all of which are organized water users under applicable Federal and State laws and regulations. These entities, while not parties to the Settlement, cooperate with Reclamation in implementing the Settlement as "third parties," and include the following:

- San Joaquin River Exchange Contractors Water Authority
- Central California Irrigation District
- Firebaugh Canal Water District
- San Luis Canal Company
- Columbia Canal Company
- Merced Irrigation District
- Turlock Irrigation District
- Modesto Irrigation District
- Oakdale Irrigation District
- South San Joaquin Irrigation District
- San Joaquin Tributaries Association
- Westlands Water District
- San Luis & Delta-Mendota Water Authority

The input and feedback of the above entities on implementing the Settlement was taken into consideration in preparing this EA/IS.

In accordance with NEPA/CEQA review requirements, the Draft EA/IS was distributed for agency and public review and written comment for a 30-day period, as specified in the NOI and the Notice of Availability at the beginning of this document. At the request of reviewers, the review period was extended to 44 days. Notice of release of the Draft EA/IS was provided to all individuals on the SJRRP public notification mailing list, which is updated automatically when individuals access the public Web site (sjrrp@restoresjr.net) and place themselves on the mailing list. The Draft EA/IS distribution provided interested parties with an opportunity to express their views regarding the significant environmental effects and other aspects of the Proposed Action, and also provided information pertinent to permits and approvals to decision makers at Reclamation, DWR, other Implementing Agencies, and CEQA responsible and trustee agencies. As required by Sections 15072 and 15073 in the CEQA Guidelines, the lead agency under CEQA, DWR, is performed the following public notifications regarding the Draft IS and the associated MND:

- Provided an NOI to adopt an MND to the public, responsible and trustee agencies, and the county clerk of each county within which the proposed project is located, sufficiently before adoption by the lead agency of the MND to allow the public and agencies a 30-day review period.

- Mailed an NOI to adopt an MND to the last known name and address of all organizations and individuals who had previously requested such notice in writing (the SJRRP mailing list, which is kept current, will be used for this noticing).

- Published an NOI at least one time in a newspaper of general circulation in the area affected by the Proposed Action (if more than one area is affected, the notice shall be published in the newspaper of largest circulation from among the newspapers of general circulation in those areas).

- Submitted the IS and associated MND to the State Clearinghouse for distribution to applicable State agencies.

5.2 Current Steps in the NEPA and CEQA Review Process

After the public comment period closed, Reclamation and DWR prepared written responses to comments, and these comment letters and responses are provided as Appendix I, “Responses to Comments.” Based on the Final EA and all public comments, Reclamation has determined that the impacts of the Proposed Action do not warrant preparation of an EIS, as documented in the FONSI. DWR considers the Final IS and associated MND and all comments received during the public review process, and responses to those comments, in making its decision on the project. DWR found, on the basis of the whole record before it (including the IS and any comments received), that there is no substantial evidence that the Proposed Action will have a significant effect on the environment, and that the MND reflects DWR’s independent judgment and analysis. Accordingly, DWR will issue a Notice of Determination and adopt the IS and associated MND.

Additional information related to compliance with specific regulatory requirements is presented in Section 6.0.

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6.0 Compliance with Environmental Statutes, and Other Relevant Laws, Programs, and Agreements

The following sections describe relevant environmental statutes (environmental laws, executive orders, and plans that apply to the Proposed Action) and compliance of the Proposed Action with those statutes. Consultation that has occurred to date to achieve compliance is also described, where applicable. Environmental statutes that are not relevant to the Proposed Action are not discussed herein.

6.1 National Environmental Policy Act

This EA/IS has been prepared pursuant to NEPA, which was signed into law in 1969 (42 United States Code (USC) Section 4321 et seq.). In addition, it was prepared in accordance with CEQ regulations for implementing NEPA, 40 CFR Parts 1500–1508, and General Services Administration (GSA) Order ADM 1095.1F. NEPA provides a commitment that Federal agencies will consider the environmental effects of their proposed actions and adhere to regulations, policies, and programs to the fullest extent possible, in accordance with NEPA's policies of environmental protection. This EA/IS assesses whether the proposed WY 2010 Interim Flows would cause any significant environmental effects. If it is determined that the Proposed Action would have no significant environmental effects, a FONSI will be signed by Reclamation and filed with USEPA.

6.2 Endangered Species Act of 1973, as Amended

The Federal ESA of 1973, as amended (16 USC 1531 et seq.), establishes a National program for the conservation of threatened and endangered species of fish, wildlife, and plants, and preservation of the ecosystems on which they depend. Section 7(a) of the ESA requires Federal agencies or Federally funded actions to consult with USFWS and NMFS on any activities that may affect any species under their jurisdiction that are listed as threatened or endangered, are proposed for listing, or for which designated critical habitat occurs.

As part of the ESA Section 7 requirements for the Proposed Action, a list of Federal threatened and endangered species, species proposed for listing, and species that potentially occur within the study area was obtained from USFWS and NMFS. Reclamation is engaging in informal consultation with USFWS and NMFS on the WY 2010 Interim Flows. A Biological Assessment was prepared by Reclamation and delivered to USFWS and NMFS on May 22, 2009.

6.3 Fish and Wildlife Coordination Act of 1934, as Amended

The Fish and Wildlife Coordination Act (FWCA) (16, USC 661 et seq.) provides for the equal consideration and coordination of wildlife conservation with other project features of Federally funded or permitted water resource development projects. Whenever any water body is proposed to be controlled or modified “for any purpose whatever” by a Federal agency or by any “public or private agency” under a Federal permit or license, that agency is required first to consult with the appropriate wildlife agencies with a view to the conservation of fish and wildlife resources in connection with the project. For the Proposed Action, Reclamation is required to fully consider recommendations made by USFWS, NMFS, and DFG in project reports, and include in project plans measures to reduce impacts on fish and wildlife. Reclamation has been meeting regularly with these three resource agencies to comply with FWCA requirements.

6.4 Bald and Golden Eagle Protection Act of 1940, as Amended

The Bald and Golden Eagle Protection Act (Eagle Act), first enacted in 1940 and amended several times since, prohibits the taking or possession of, and commerce in, bald and golden eagles, including their parts, nests, or eggs, with limited exceptions.
The Eagle Act defines “take” as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb” (16 USC 668–668d). USFWS has defined “disturb” under the Eagle Act as follows (72 Federal Register (FR) 31132–31140, June 5, 2007):

> *Disturb means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle; (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.*

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present if, on the eagle’s return, such alterations agitate or bother an eagle to a degree that injures the eagle or substantially interferes with normal breeding, feeding, or sheltering habits, and causes, or is likely to cause, a loss of productivity or nest abandonment. USFWS has proposed new permit regulations to authorize the take of bald and golden eagles under the Eagle Act, generally when the take to be authorized is associated with otherwise lawful activities (72 FR 31141–31155, June 5, 2007). With delisting of the bald eagle in 2007, the Eagle Act is the primary law protecting bald eagles, as well as golden eagles. The Proposed Action would not adversely affect or disturb bald or golden eagles.

6.5 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act is designed for taking immediate action to conserve and manage the fishery resources found off the coasts of the United States, and the anadromous species and continental shelf fishery resources of the United States. Consultation with NMFS is required when any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, may adversely affect any essential fish habitat (EFH). Within the study area, EFH is found in the San Joaquin River downstream from the Merced River confluence, in three major San Joaquin River tributaries (Merced, Tuolumne, and Stanislaus rivers), and in the Delta. A Biological Assessment that incorporates the EFH assessment was submitted by Reclamation to NMFS on May 22, 2009 and consultation is ongoing.

6.6 Migratory Bird Treaty Act of 1918

The Migratory Bird Treaty Act of 1918 (MBTA) is the domestic law that affirms, or implements, the United States' commitment to four international conventions (with Canada, Japan, Mexico, and Russia) for protecting shared migratory bird resources. Each of the conventions protects selected species of birds that are common to both countries (i.e., the birds occur in both the United States and Canada, Japan, Mexico, or Russia at some point during their annual life cycle). The Proposed Action would have no adverse effect on migratory birds. Therefore, the Proposed Action would be in compliance with the MBTA.

6.7 Comprehensive Conservation Plans for National Wildlife Refuges

USFWS is directed to develop comprehensive conservation plans (CCP) to guide the management and resource use for each refuge of the National Wildlife Refuge System under requirements of the National Wildlife Refuge Improvement Act of 1997. Refuge planning policy also directs the process and development of CCPs. A CCP describes the desired future conditions and long-range guidance necessary to meet refuge purposes. It also guides management decisions and sets forth strategies for achieving refuge goals and objectives within a 15-year time frame. Reclamation is partnering with the San Luis and Merced NWRs, and are actively involved in the CCP process for these refuges. Several important NWRs, described below, are present along the San Joaquin River.

6.7.1 San Luis National Wildlife Refuge

The San Luis NWR does not have an approved CCP; however, planning was initiated in 2002 (USFWS 2009). Primary goals of the refuge are as follows:

- Provide feeding and resting habitat for migrating and wintering waterfowl and other waterbirds
- Provide habitat and manage for endangered species, threatened species, and/or species of special concern
- Preserve the natural diversity of the flora and fauna representative of the lower San Joaquin Valley, and the natural processes that maintain that diversity
- Provide high-quality wildlife-dependent recreation and environmental education programs

6.7.2 Merced National Wildlife Refuge

The Merced NWR does not have an approved CCP; however, planning was initiated in 2002 (USFWS 2009). Primary goals of the refuge are the same four goals described for the San Luis NWR, along with an additional goal of alleviating crop depredation.

6.7.3 San Joaquin River National Wildlife Refuge

The San Joaquin River NWR has prepared a final CCP (USFWS 2006). The primary goals of the refuge are as follows:

- Conserve and protect the natural diversity of migratory birds, resident wildlife, fish, and plants through restoration and management of riparian, upland, and wetland habitats on refuge lands
- Contribute to the recovery of threatened and endangered species, as well as the protection of populations of special-status wildlife and plant species and their habitats
- Provide optimum wintering habitat for Aleutian Canada geese for their continued recovery from threatened and endangered species status
- Coordinate the natural resource management of the San Joaquin River NWR in the context of the larger Central Valley/San Francisco ecoregion
- Provide the public with opportunities for compatible, wildlife-dependent visitor services to enhance understanding, appreciation, and enjoyment of natural resources at the San Joaquin River NWR

6.8 National Historic Preservation Act

The NHPA of 1966, as amended (16 USC 470 et seq.), is the primary Federal legislation that outlines the Federal Government's responsibility for preservation of cultural resources. Section 106 of the NHPA requires the Federal Government to take into consideration the effects of an undertaking on historic properties. Historic properties are defined as those cultural resources listed, or eligible for listing, on the National Register of Historic Places. Section 106 compliance is triggered by Federal undertakings, as defined at 36 CFR Part 800.16(y). Federal undertakings that trigger the need to satisfy Section 106 include, but are not necessarily limited to, Reclamation's release of WY 2010 Interim Flows (the Proposed Action), permitting for the Proposed Action under Section 7 of the Federal ESA, and authorization under Section 10 of the Rivers and Harbors Act.

Compliance with Section 106, outlined in 36 CFR Part 800, follows a series of steps designed to identify interested parties, determine the area of potential effect (APE), conduct cultural resource inventories, determine if historic properties are present within the APE, and assess effects on any identified historic properties. As part of compliance with 36 CFR Part 800, Reclamation conducted a records search for the APE to assess which portions of the study area have been previously inventoried, and to identify all previously recorded cultural resources. Although only a small portion of the study area has been inventoried, numerous cultural resources have been previously documented.

Native American tribes were invited to participate in the Section 106 process for the SJRRP. Regulations require Federal agencies to consult with Federally recognized tribes to determine if sites of religious or cultural significance are present within the APE for a specific action. Non-Federally recognized tribes may also have concerns, and Reclamation involves such tribes as interested members of the public pursuant to 36 CFR Part 800.2(d).

The State Historic Preservation Officer (SHPO) is also consulted, pursuant to 36 CFR Part 800.4(d)(1). Federal agencies are required to seek the SHPO's concurrence that historic properties are taken into consideration at all levels of project planning and development. The Native American Heritage Commission, in an August 2008 letter, stated that it has no listing of sacred lands in the study area, as described. Native American experts who supplied information for the Proposed Action were generally unwilling to provide precise locations of traditional cultural properties/areas of concern within the study area for the Proposed Action.

6.9 Clean Water Act (Section 404)

Section 404 of the Clean Water Act (33 USC 1344) requires that a permit from USACE be obtained for the discharge of dredged or fill material into "waters of the United States," including wetlands that have a “significant nexus” with a water of the United States. This EA/IS describes the potential temporary hydrological effects of the Proposed Action on wetlands and other waters. The Proposed Action would release flows from Millerton Lake through Friant Dam to the San Joaquin River and would result in the release and transport of a *de minimis* quantity of sediment for the reasons described below.

Under wet hydrologic conditions, releases from Friant Dam for flood control purposes would exceed the Interim Flows included in the Proposed Action, and would be exempt from Section 404 permit requirements. During drier hydrologic conditions, the Proposed Action would include releases of up to 1,660 cfs for a duration of up to 4 weeks. The magnitude and duration of these releases is substantially less than recent operational actions at Friant Dam. For example, in 2005, flood control releases up to 8,000 cfs were made over a 1-month period. In 2006, continuous releases of greater than 5,000 cfs (maximum of 9,000 cfs) were made from Friant Dam over a 3-month period.

In addition, the watershed upstream from Friant Dam has been highly developed for hydropower generation since the early 1900s. Currently, a series of dams is located upstream from Friant Dam on the mainstem San Joaquin River and all major tributaries, that includes Kerckhoff, Redinger, Florence, Huntington, Shaver, Thomas Edison, and Mammoth Pool dams. Most of these dams and corresponding reservoirs were constructed before Friant Dam and limit sediment transport downstream into Millerton Lake.

The combined effect of reduced sediment inflow into Millerton Lake due to upstream reservoirs and regular and recent flood releases through the outlet works substantially reduce the potential for the presence of sediment that could be mobilized by the Proposed Action. Therefore, WY 2010 Interim Flow releases are expected to result in the transport of a *de minimis* quantity of sediment from Friant Dam to the San Joaquin River.

In addition, release of WY 2010 Interim Flows from Friant Dam to Reach 2 could result in localized bedload movement during spring flows in WY 2010 if that year is relatively wet, similar to the existing conditions. Under existing conditions, Reach 2A experiences net erosion, and Reach 2B experiences net deposition. Sediment mobilization under the Proposed Action would be localized within these reaches, and would not be anticipated to change the overall bottom elevation of any given reach; therefore, the Proposed Action would only result in the movement of a *de minimis* quantity of sediment.

USACE has determined that the Proposed Action would not result in the discharge of dredge or fill material and thus, no Section 404 is needed for the Proposed Action.

6.10 Rivers and Harbors Act of 1899, as Amended (Sections 14 and 10)

Under Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403), USACE regulates work in, over, or under, excavation of material from, or deposition of material into, navigable waters. Navigable waters of the United States are defined as those waters subject to the ebb and flow of the tide shoreward to the mean high-water mark, and those that are currently used, have been used in the past, or may be susceptible to use, to transport interstate or foreign commerce. The Proposed Action does not propose any discharge of dredged or fill material into any navigable waters of the United States. No further compliance with this section of the act is required; no permit is needed from USACE.

Under Section 14 of the Rivers and Harbors Act of 1899 (33 USC 408), referred to as Section 408, the Secretary of the Army, on the recommendation of the Chief of Engineers, may grant permission for the alteration, temporary occupation, or use of any seawall, bulkhead jetty, dike, levee, wharf, pier, or other work built by the United States. Reclamation has consulted with USACE, and USACE has determined that Section 408 does not apply to the WY 2010 Interim Flows.

6.11 CALFED Bay-Delta Program

The CALFED Bay-Delta Program (CALFED) is a cooperative effort of more than 24 Federal and State agencies with regulatory and management responsibilities in the San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) to develop and implement a long-term comprehensive plan to restore ecological health and improve water management for beneficial uses of the Bay-Delta system. The Federal agencies involved in the program are Reclamation, USFWS, NMFS, USACE, and USEPA. State agencies involved in the program are DWR, DFG, and SWRCB.

CALFED will develop long-term measures to address problems affecting the Bay-Delta estuary. The program focuses on four objectives:

- Provide optimal water quality (water quality objective)
- Improve and increase aquatic and terrestrial habitats, and improve ecological functions in the Bay-Delta estuary to support sustainable populations of diverse plant and animal species (ecosystem restoration objective)
- Reduce shortages between water supplies and current and projected demands on the system (water supply reliability objective)
- Reduce the risk of failure of levees that protect land use and associated economic activities, water supply, and other infrastructure and ecosystems (Delta levee system reliability objective)

On the upper portion of the San Joaquin River, from Friant Dam to the Merced River, CALFED sponsors the San Joaquin River Riparian Habitat Restoration Program Pilot Project. The purpose of this project is to establish and maintain riparian habitat along the river where little or none existed before, using releases from Friant Dam to disperse and germinate native tree seed in spring. The Proposed Action is consistent with CALFED, but CALFED is not a regulatory entity over any aspect of the Proposed Action or the SJRRP.

6.12 Central Valley Flood Control Act of 2008

In 2007, the Governor signed five interrelated bills (flood legislation) aimed at addressing the problems of flood protection and liability and helping to direct use of the voter-approved bond funds provided by 2006 Propositions 1E and 84. These included Senate Bills (SB) 5 and 17, and AB 5, 70, and 156. A sixth bill passed in 2007, AB 162, required additional consideration of flood risk in local land use planning throughout California. These bills, effective January 1, 2008, collectively added or amended sections in the California Government Code, Health and Safety Code, Public Resources Code, and Water Code. Together, these bills outline a comprehensive approach to improving flood management at the State and local levels, with elements to address both the chance of flooding and the consequences when flooding does occur.

The major piece of the flood legislation is the Central Valley Flood Protection Act of 2008, introduced as SB 5. This legislation seeks to address flood management problems in the Sacramento and San Joaquin valleys by directing DWR to prepare for the Central Valley Flood Protection Board to adopt a Central Valley Flood Protection Plan (CVFPP) by mid-2012. The CVFPP is to establish a system-wide approach to improving flood management in areas currently receiving some amount of flood protection from existing facilities of the Federal-State flood management system. This flood legislation also establishes the 200-year flood event (flood with a 1-in-200 chance of occurring in any year) as the minimum level of flood protection to be provided in urban and urbanizing areas in the Sacramento and San Joaquin valleys.

The flood legislation also requires DWR and the Central Valley Flood Protection Board to adopt a schedule for mapping flood risk areas in the Central Valley, and sets deadlines for cities and counties in the Central Valley to amend their general plans and zoning ordinances to conform to the CVFPP within 24 months and 36 months, respectively, of its adoption by the Central Valley Flood Protection Board. Once the general plan and zoning ordinance amendments are enacted, the approval of development agreements and subdivision maps is subject to restrictions in flood hazard zones. Central Valley counties are obligated to develop flood emergency plans within 24 months of Central Valley Flood Protection Board adoption.

Reclamation and DWR have jointly developed the Proposed Action in a manner that is consistent with the Central Valley Flood Control Act, and which would not inhibit development of the CVFPP.

6.13 Central Valley Flood Protection Board Encroachment Permit

The California Central Valley Flood Protection Board (formerly The Reclamation Board) requires an encroachment permit for any non-Federal activity along or near Federal flood damage reduction project levees and floodways or in Central Valley Flood Protection Board-designated floodways, to prevent proposed local actions or projects from impairing the integrity of existing flood damage reduction systems to withstand flood conditions. Reclamation and DWR have met with the Central Valley Flood Protection Board regarding the Proposed Action.

6.14 State Water Resources Control Board Temporary Water Transfer Approval

Pursuant to Section 1725 et seq. of the California State Water Code, a permittee or licensee who proposes a temporary transfer of water (less than 1 year) shall submit to the SWRCB a petition to change the terms of the permit or license, as required, to accomplish the proposed temporary change. Such a petition will be filed, with a petition pursuant to Section 1707, to add a purpose of use, to add points of rediversion, and to add the San Joaquin River for the place of use for instream flows. SWRCB requires approval of a petition for the purpose of use due to a transfer or exchange of water, and will approve a petition under section 1725-only rights if the transfer would only involve the amount of water that would have been consumptively used or stored by the permittee or licensee in the absence of the proposed temporary change; would not injure any legal user of the water; and would not unreasonably affect fish, wildlife, or other instream beneficial uses. Reclamation submitted a petition to SWRCB for the temporary transfer of water to add a purpose of use; to add points of rediversion; and to add the San Joaquin River for the place of use for instream flows for the WY 2010 Interim Flows.

6.15 Central Valley Project Improvement Act

Reclamation's evolving mission was written into law on October 30, 1992, in the form of Public Law 102-575, the Reclamation Projects Authorization and Adjustment Act of 1992. Included in the law was Title 34, the CVPIA. The CVPIA amended previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic water supply uses, and fish and wildlife enhancement as having equal priority with power generation. Section 3406(c)1 of the CVPIA authorized planning and environmental review for the SJRRP. The Proposed Action is consistent with the CVPIA.

6.16 Central Valley Project Long-Term Water Service Contracts

In accordance with CVPIA Section 3404c, Reclamation is renegotiating long-term water service contracts. As many as 113 CVP water service contracts located within the Central Valley of California may be renewed during this process. The Proposed Action is consistent with CVP long-term water service contracts.

6.17 San Joaquin River Agreement

The SJRA, adopted in 2000, is a water supply program to provide increased instream flows in the San Joaquin River. Parties to the agreement include Reclamation, USFWS, DWR, DFG, SJRGA, and CVP/SWP export interests. The increased instream flow provides protective measures for fall-run Chinook salmon in the San Joaquin River under VAMP. In response to WY 2010 Interim Flows, tributary releases to meet VAMP water quality objectives at Vernalis would be affected in one of two ways. In conditions when WY 2010 Interim Flows contribute toward meeting the same VAMP flow threshold that would have been in place in the No-Action Alterative, required releases from tributary reservoirs could be reduced. In conditions when WY 2010 Interim Flows cause a higher VAMP flow target than would have been in place in the No-Action Alterative, required releases from tributary reservoirs would be made to achieve the higher threshold. Changes in VAMP contribution releases from tributary reservoirs would not affect the ability to meet instream fish and water quality flow requirements in the Merced, Tuolumne, or Stanislaus rivers.

6.18 Executive Order 11988 – Floodplain Management

Executive Order 11988 requires that all Federal agencies take action to reduce the risk of flood loss, to restore and preserve the natural and beneficial values served by floodplains, and to minimize the impact of floods on human safety, health, and welfare. Constraints of the amount of flows that may be released from Friant Dam reoperation under WY 2010 Interim Flows include existing floodplain structures such as levees, diversion structures, and bypass canals. The existing floodplain management program supersedes flow requirements identified in the Settlement. The Proposed Action would not impede or redirect flood flows. Therefore, the Proposed Action is in compliance with this executive order.

6.19 Executive Order 11990 – Protection of Wetlands

Executive Order 11990 requires Federal agencies to follow avoidance, mitigation, and preservation procedures with public input before proposing new construction in wetlands. As described in this EA/IS, the Proposed Action would not result in the permanent net loss of any wetlands; therefore, Reclamation is in compliance with this executive order.

6.20 Executive Order 11312 – National Invasive Species Management Plan

Executive Order 11312 directs all Federal agencies to prevent and control introduction of invasive nonnative species in a cost-effective and environmentally sound manner to minimize their economic, ecological, and human health impacts. Executive Order 11312 established a National Invasive Species Council made up of Federal agencies and departments and a supporting Invasive Species Advisory Committee composed of State, local, and private entities. The National Invasive Species Council and the Invasive Species Advisory Committee oversee and facilitate implementation of the executive order, including preparation of a National Invasive Species Management Plan. The Proposed Action includes an Invasive Species Monitoring and Management Plan for WY 2010 Interim Flows (Appendix F) as mitigation to minimize the introduction and further spread of five invasive plant species that could result from WY 2010 Interim Flows. Preparation, adoption, and implementation of the Invasive Species Monitoring and Management Plan for WY 2010 Interim Flows demonstrates compliance with this executive order.

6.21 Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds

Executive Order 13186 (January 10, 2001) directs Federal agencies that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement an MOU with USFWS promoting the conservation of migratory bird populations. Implementation actions and reporting procedures identified in the MOU should be included in each agency's formal planning process, such as resource management plans and fisheries management plans. The Proposed Action would not adversely affect migratory birds; therefore, Reclamation is in compliance with this executive order.

6.22 Executive Order 13443 – Facilitation of Hunting Heritage and Wildlife Conservation

The purpose of Executive Order 13443 (August 16, 2007) is to direct Federal agencies that have programs and activities with a measurable effect on public land management, outdoor recreation, and wildlife management to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat. The Proposed Action would benefit outdoor recreation and wildlife habitat; therefore, Reclamation is in compliance with this executive order.

6.23 Executive Order 12898 – Environmental Justice in Minority and Low-Income Populations

Executive Order 12898 requires Federal agencies to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies, and activities on minority and low-income populations. The Proposed Action has been assessed for potential environmental, social, and economic impacts on minority and low-income populations. No significant adverse human health effects were identified. Minority and low-income populations would not be disproportionately exposed to adverse effects relative to the benefits of the action. No further compliance with this executive order is required.

6.24 Executive Order 113007 and American Indian Religious Freedom Act of 1978 – Indian Trust Assets and Sacred Sites on Federal Lands

Executive Order 113007 and the American Indian Religious Freedom Act of 1978 are designed to protect Indian Trust Assets, accommodate access and ceremonial use of Native American sacred sites by Native American religious practitioners, avoid adversely affecting the physical integrity of such sacred sites, and protect and preserve the observance of traditional Native American religions. The Proposed Action would not violate these protections.

6.25 Clean Air Act of 1963, as Amended

The Federal Clean Air Act required USEPA to establish National Ambient Air Quality Standards (NAAQS). USEPA has established primary and secondary NAAQSs for the following criteria air pollutants: ozone, PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, and lead. The primary standards protect public health, and the secondary standards protect public welfare. The Clean Air Act also requires each state to prepare an air quality control plan referred to as a State Implementation Plan.

Under the Clean Air Act, the primary responsibility for planning to attain and maintain the NAAQSs rests with the State and local agencies. Accordingly, State and local air quality agencies are also designated as the primary permitting and enforcement authorities for most Clean Air Act requirements. The portion of the study area where air quality could be adversely affected by the Proposed Action is under SJVAPCD's jurisdiction. As described in the Air Quality Modeling Attachment in Appendix G, the Proposed Action (including implementation of environmental commitments), would not exceed USEPA's general conformity *de minimis* thresholds or hinder the attainment of air quality objectives in the local air basin.

6.26 Farmland Protection Policy Act

NRCS is the agency primarily responsible for implementing the Federal Farmland Protection Policy Act (FPPA). The purpose of the FPPA is to minimize Federal contributions to the conversion of farmland to nonagricultural uses by causing Federal programs to be administered in a manner compatible with State government, local government, and private programs designed to protect farmland. The Proposed Action does not convert agricultural land to nonagricultural uses and, therefore, complies with the FPPA.

6.27 Resource Conservation and Recovery Act and Federal Emergency Planning and Community Right-to-Know Act of 1986

Hazardous substances may exist within the study area or may be brought in and used for chemical treatment of invasive nonnative plant species. At the Federal level, the principal agency regulating the generation, transport, and disposal of hazardous substances is the USEPA, under the authority of the Resource Conservation and Recovery Act (RCRA). RCRA established an all-encompassing Federal regulatory program for hazardous substances that is administered in California by the Department of Toxic Substances Control (DTSC). Under RCRA, DTSC regulates the generation, transportation, treatment, storage, and disposal of hazardous substances. RCRA was amended in 1984 by the Hazardous and Solid Waste Amendments of 1984, which specifically prohibit the use of certain techniques for disposing of various hazardous substances. The Federal Emergency Planning and Community Right-to-Know Act of 1986 imposes hazardous materials planning requirements to help protect local communities in the event of accidental release. Reclamation would comply with these acts in implementing the Proposed Action.

6.28 San Joaquin River Restoration Settlement Act

The Act (Appendix B) authorizes and directs the Secretary of the Interior to implement the Settlement, including implementation of the Proposed Action. Sections of the Act are described below with a focus on their relation, where applicable, to the Proposed Action:

- Section 10001. Short title
- Section 10002. Purpose
- Section 10003. Definitions
- Section 10004. Implementation of Settlement
- Section 10005. Acquisition and disposal of property; title to facilities
- Section 10006. Compliance with applicable law
- Section 10007. Compliance with CVPIA
- Section 10008. No private right of action

- Section 10009. Appropriations; Settlement Fund
- Section 10010. Repayment contracts and acceleration of repayment of construction
- Section 10011. California Central Valley spring-run Chinook salmon

Section 10001 – Short Title

This section is administrative in nature and does not apply to implementation of the Proposed Action.

Section 10002 – Purpose

This section states that the purpose of the Act is to authorize implementation of the Settlement.

Section 10003 – Definitions

This section is administrative in nature and does not apply to implementation of the Proposed Action.

Section 10004 – Implementation of Settlement

This section addresses agreements between the Secretary of the Interior and other parties; funding, mitigation of impacts, design and engineering studies: water contracts, including the San Joaquin River Exchange Contract; water contract allocations, and study of Interim Flows. Specific subsections are described below.

Section 10004(a). Section 10004(a) authorizes and directs the Secretary of the Interior to implement the terms of the Settlement. Section 10004(a)(1) authorizes the design and construction of high-priority channel and structural improvement actions outlined in Paragraph 11 of the Settlement. The Paragraph 11 actions are outside the scope of the Proposed Action, and will be addressed in the PEIS/R.

Section 10004(a)(2) authorizes and directs the reoperation of Friant Dam for release of Interim Flows. This is the main component of the Proposed Action, as described in Section 2 of this EA/IS. Section 10004(a)(3) authorizes and directs the acquisition of water, as described in Paragraph 13 of the Settlement; however, the acquisition of water is not necessary to implement WY 2010 Interim Flows, and therefore Section 10004(a)(3) does not apply to the Proposed Action.

Section 10004(a)(4) authorizes and directs implementation of Paragraph 16 of the Settlement related to recirculation, recapture, reuse, exchange or transfer of Interim and Restoration flows for accomplishing the Water Management goal in the Settlement. Consistent with Paragraph 16 and in compliance with the Act, the Proposed Action includes the recapture of WY 2010 Interim Flows consistent with applicable laws, including California water law and federal Reclamation Law, and applicable agreements with downstream agencies, entities, and landowners. This would include the use of CVP facilities to deliver CVP water (other than Interim or Restoration flows) or CVP transfers to existing south-of-Delta CVP contractors, and the Secretary's ability to fulfill the conditions of the Agreement of November 24, 1986, between the United States of America and DWR for the coordinated operation of CVP and SWP Coordinated

Operation Agreement (COA), as authorized by Congress in Section 2(d) of the Act of August 26, 1937 (50 Statute 850, 100 Statute 3051).

Section 10004(a)(5) authorizes and directs the Secretary to develop and implement the Recovered Water Account (RWA). Reclamation, in consultation with the Settling Parties, is developing and will implement the RWA. This process is not part of the Proposed Action and is not described in detail in this EA/IS.

Section 10004(b). Section 10004(b) authorizes and directs the Secretary to enter into any agreements with State, tribal, or local governments, or private parties deemed necessary to achieve the Settlement. Such agreements could include contracts, memoranda of understanding, financial assistance agreements, cost sharing agreements, or other appropriate agreements. The Proposed Action may require one or more such agreements, as described in Section 2 of the EA/IS.

Section 10004(c). This section authorizes the Secretary to accept and expend non-Federal funds to facilitate implementation of the Settlement. No non-federal funds are being accepted or expended to implement the Proposed Action.

Section 10004(d). This section states that the Secretary shall identify the impacts associated with actions to construct, improve, operate, or maintain facilities to implement the Settlement. This section also states that the Secretary shall identify the measures necessary to mitigate impacts on adjacent and downstream water users and landowners. The EA/IS identifies all impacts associated with the Proposed Action, and presents mitigation measures where appropriate. This information is presented in Section 4 of the EA/IS. The FONSI will identify the mitigation measures which shall be implemented as part of the Proposed Action.

Section 10004(e). This section authorizes the Secretary to conduct any design or engineering studies that are necessary to implement the Settlement. No such studies are necessary to implement the Proposed Action; therefore, this section does not apply to the Proposed Action.

Sections 10004(f) and 10004(g). These sections prohibit involuntary reduction in water contract allocations to CVP long-term contractors other than Friant Division long-term contractors, as well as modification or amendment of water rights and obligations to any existing water service, repayment, purchase, or exchange contract, except as provided in the Settlement or in other sections of the Act. Specifically, as described in Section 2 of the EA/IS, release, recapture, and recirculation of WY 2010 Interim Flows would be subject to available capacity within CVP/SWP storage and conveyance facilities; available capacity is defined as capacity that is available after all statutory and contractual obligations are satisfied to existing water service or supply contracts, exchange contracts, settlement contracts, transfers, or other agreements involving or intended to benefit CVP/SWP contractors served water through CVP/SWP facilities. All other provisions of the Proposed Action are consistent with this section of the Act.

Section 10004(h). This section requires the Secretary to conduct an analysis consistent with NEPA, and discusses actions associated with seepage impacts and the Hills Ferry Barrier for the release of WY 2010 Interim Flows. This section also includes several subsections discussed below: Required Studies, Conditions for Interim Flow Release, Seepage Impacts, and Temporary Fish Barrier Program.

Required Studies. The EA is prepared consistent with NEPA and this section of the Act. Section 10004(h) requires several elements be included in the EA, including the following:

- **Analysis of channel conveyance capacities and potential for levee or groundwater seepage –** Channel conveyance capacities and the potential for levee or groundwater seepage have been estimated for each reach based on analytical modeling, review of previous studies, and/or landowner feedback. The sources used to identify channel capacity by reach are identified in Section 2 of this EA/IS.

- **Description of the seepage monitoring program –** The Seepage Monitoring and Management Plan for WY 2010 Interim Flows is summarized in Section 2 of this EA/IS and provided in its entirety in Appendix D.

- **Evaluation of possible impacts associated with release of Interim Flows and mitigation measures for impacts determined to be significant –** Section 4 of this EA/IS describes potential impacts of release of WY 2010 Interim Flows, and presents mitigation measures for significant impacts such that those impacts would be reduced to less than significant.

- **Description of the flow monitoring program –** The Flow Monitoring and Management Plan for WY 2010 Interim Flows is provided in its entirety in Appendix E to this EA/IS.

- **Analysis of the Federal costs of any fish screens, fish bypass facilities, fish salvage facilities, and related operations on the San Joaquin River south of the confluence with the Merced River required under the Federal ESA (16 USC 1531 et seq.) as a result of the Interim Flows –** Except with respect to operations related to the Hills Ferry Barrier, described below under *Temporary Fish Barrier Program*, the Proposed Action does not include any fish screens, fish bypass facilities, fish salvage facilities, or related operations on the San Joaquin River south of the confluence with the Merced River. Therefore, no Federal cost expenditures for these purposes are proposed. Although no fish screens, fish bypass facilities, or fish salvage facilities are anticipated to be necessary at this time, if such facilities are determined to be necessary under the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.) as a result of the Proposed Action, Reclamation would comply with the terms of the Act, including those terms in Section 10004(h)(4), *Temporary Fish Barrier Program*, described below.

Conditions for Interim Flow Release. This section of the Act authorizes the Secretary to release Interim Flows to the extent that flows would not impede or delay completion of Paragraph 11 actions or exceed existing downstream channel capacities. The Proposed Action is designed to comply with this section of the Act and related sections of the Settlement, as described in Section 2 of this EA/IS. The quantity of water to be released from Friant Dam as WY 2010 Interim Flows in the Proposed Action is defined by the hydrologic year type classifications provided in Exhibit B, consistent with the Restoration Flow Guidelines (see Appendix C), and reduced, as appropriate, within the limits of channel capacity, anticipated infiltration losses, and diversion capacities. Additional reductions in flow could be made, in consideration of water supply demands, presence of special-status species, and potential seepage effects, as described in Sections 2.2.2 and 2.2.3 and in the Seepage Monitoring and Management Plan (Appendix D), or to accommodate completion of Paragraph 11 actions not included in the Proposed Action.

Seepage Impact. This section of the Act states that the Secretary shall reduce Interim Flows to address material seepage impacts as identified through the monitoring program. As described in Section 2 and Appendix D of this EA/IS, WY 2010 Interim Flows would be reduced to avoid seepage impacts as necessary.

Temporary Fish Barrier Program. This section of the Act states that the Secretary, in consultation with DFG, shall evaluate the effectiveness of the Hills Ferry Barrier in preventing unintended upstream migration of anadromous fish in the San Joaquin River and any false migratory pathways. This section further authorizes the Secretary to assist DFG in making any improvements to the Hills Ferry Barrier, if necessary to avoid imposing additional regulatory actions against third parties. In addition, if third parties are required to install fish screens or bypass facilities to comply with the Federal ESA (16 USC 1531 et seq.), this section states that the Federal Government shall bear the costs of installing such screens or facilities, except to the extent that such costs are already or willingly borne by others.

Reclamation has consulted with DFG and NMFS on the use of the Hills Ferry Barrier and potential need for other temporary barriers. The Proposed Action includes measures to be consistent with this section of the Act, as described in Section 2 of the EA/IS. Fall WY 2010 Interim Flows would not affect the operation of the Hills Ferry Barrier for fall-run Chinook salmon. Reclamation and DWR are developing a plan to evaluate the effectiveness of the Hills Ferry Barrier. No additional screens or facilities were found necessary for implementation of the Proposed Action.

Consistent with this section of the Act (10004(h)(4)), if it is determined that any unintended upstream migration of anadromous fish upstream from the Merced River confluence occurs and is caused by the WY 2010 Interim Flows, and such migration would result in regulatory action against third parties, the Secretary would comply with the conditions of the Act including assisting DFG in making any necessary improvements to the Hills Ferry Barrier, and bearing the costs of installing any fish screens or fish facilities necessary to comply with the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.), except to the extent that such costs are already or willingly borne by others.

Section 10004(i). This section describes the availability of funding for the purpose of implementing the Settlement and the Act. This section applies to implementation of the Proposed Action and to development of the EA/IS, but is not specifically addressed through this EA/IS.

Section 10004(j). This section clarifies that nothing in the Act "…shall modify or amend the rights and obligations under the Purchase Contract between Miller and Lux and the United States and the Second Amended Exchange Contract between the United States, Department of the Interior, Bureau of Reclamation and Central California Irrigation District, San Luis Canal Company, Firebaugh Canal Water District and Columbia Canal Company." As described in Section 2 of this EA/IS, implementation of the Proposed Action would be consistent with existing operating criteria, and prevailing and relevant laws, regulations, BOs, and court orders in place at the time of implementation. Specifically, if Reclamation must make deliveries to the San Joaquin River Exchange Contractors via the San Joaquin River, these water deliveries would have a higher priority to channel capacity over WY 2010 Interim Flows, as described in Section 2 of this EA/IS. Therefore WY 2010 Interim Flows would be reduced, if necessary to provide channel capacity for water delivery to the San Joaquin River Exchange Contractors via the San Joaquin River.

Section 10005 – Acquisition and Disposal of Property; Title to Facilities

This section addresses the acquisition and disposal of properties or title to facilities modified or improved by implementation of the Settlement, along with the operation of any groundwater bank along or adjacent to the San Joaquin River upstream from the confluence of the Merced River. Potential modifications to facilities, such as installing seals on the Chowchilla Bypass Bifurcation Structure, are described in Section 2 of this EA/IS. The Proposed Action does not include a change in ownership of any facilities, in compliance with Section 10005(a) of the Act. No acquisition of property or operation of a groundwater bank is included in the Proposed Action; therefore, Sections 10005(a), 10005(b), 10005(c), and 10006(d) of the Act do not apply to the Proposed Action.

Section 10006 – Compliance with Applicable Law

This section describes implementation of the Settlement in compliance with existing Federal and State laws, rules, and regulations, and describes the use of funds to complete environmental reviews or otherwise implement the Act. As described in Section 2 of this EA/IS, implementation of the Proposed Action would be conducted in a manner that is consistent with existing operating criteria, and prevailing and relevant laws, regulations, BOs, and court orders in place at the time of implementation.

Section 10007 – Compliance with Central Valley Project Improvement Act

This section describes implementation of the Settlement in compliance with the CVPIA, including the collection and use of certain funds. No provisions in the Proposed Action would impede the obligations of the Secretary contained in Section 3406(c)(1) of the Reclamation Projects Authorization and Adjustment Act of 1992 (Public Law 102–575; 106 Stat. 4721).

Section 10008 – No Private Right of Action

This section is administrative in nature and does not apply to implementation of the Proposed Action.

Section 10009 – Appropriations; Settlement Fund

This section describes and limits sources of funds to implement the Settlement, authorizes appropriation of funds to implement the Settlement, establishes the San Joaquin River Restoration Fund, and directs the Secretary of the Interior to conduct a study of modifications to Reach 4B, as described in the Settlement. This section applies to the implementation of the Proposed Action, but addresses administrative and funding considerations that are outside of the scope of this EA/IS.

Section 10010 – Repayment Contracts and Acceleration of Repayment of Construction

This section describes the conversion and alteration of CVP contracts; the provisions for arranging transfers or exchanges to reduce, avoid, or mitigate impacts to water deliveries caused by Interim or Restoration Flows; the accounting of such transfers or exchanges; and State law regarding place of use of transferred or exchanged water. As described in Section 2 of this EA/IS, recirculation of recaptured water to the Friant Division could require mutual agreements between Reclamation, DWR, Friant Division long-term contractors, and other south-of-Delta CVP/SWP contractors. Reclamation would assist in developing these agreements; however, the Proposed Action does not address the recirculation (e.g. conveyance, storage, or transfer or exchange agreements after recapture) of WY 2010 Interim Flows because the specific recirculation actions are not known at this time. Specific recirculation activities will be the subject of subsequent, separate NEPA analysis, as needed, once the specific actions have been identified.

In particular, Section 10010(e) states that, pursuant to Paragraphs 13 or 15 of the Settlement, any short- or long-term agreement, to which one or more long-term Friant Division, Hidden Unit, or Buchanan Unit contractors enters into for the purpose of recirculation, "…shall be deemed to satisfy the provisions of subsection 3405(a)(1)(A) and (I) of the Reclamation Projects Authorization and Adjustment Act of 1992 (Public Law 102–575) without the further concurrence of the Secretary as to compliance with said subsections if the contractor provides… not later than 30 days before commencement of any proposed transfer or exchange with duration of less than 1 year, written notice to the Secretary stating how the proposed transfer or exchange is intended to reduce, avoid, or mitigate impacts to water deliveries caused by the Interim Flows or Restoration Flows or is intended to otherwise facilitate the Water Management Goal, as described in the Settlement. The Secretary shall promptly make such notice publicly available." No such short- or long-term agreements are included under the Proposed Action; however, the Proposed Action would not impede actions under this section of the Act.

Section 10011 – California Central Valley Spring Run Chinook Salmon

This section addresses the reintroduction of spring-run Chinook salmon consistent with the Settlement. The Proposed Action does not include the reintroduction of spring-run Chinook salmon; therefore, this section does not apply to the Proposed Action.

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2010 FONSI Appendices

Appendices to this document are located on the San Joaquin River Restoration Program website at http://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=3612

Water Year 2011 Interim Flows Project

Administrative Draft Supplemental Environmental Assessment/Initial Study

SAN JOAQUIN RIVER
RESTORATION PROGRAM

May 2010