Appendix F. Existing Conditions

STATE OF CALIFORNIA
THE NATURAL RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

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1.0 Introduction

This appendix describes the existing conditions for the targets of the Central Valley Flood Protection Plan (CVFPP) Conservation Strategy (Conservation Strategy). It describes these existing conditions for the same geographic units used in the objectives of the Conservation Strategy: conservation planning areas (CPAs) and landscape units within CPAs.

This appendix is organized into the following sections:

- Section 1.0, "Introduction," describes the organization of this document and the geographic units and targets for which existing conditions are summarized.
- Section 2.0, "Methods," describes the information sources and analyses used to describe existing conditions.
- Sections 3.0 to 7.0, "Summary of Existing Conditions" by CPA and Major River Reach, summarize existing conditions for each CPA and the landscape units within it.
- Section 8.0, "References," provides the full reference for documents, databases, and personal communications cited in the text.
- Section 9.0, "Acronyms and Other Abbreviations," defines all abbreviations used in the text.

1.1 Geographic Units

1.1.1 Conservation Planning Areas

CPAs are subdivisions of the Systemwide Planning Area (SPA) that were established for use in the Conservation Strategy of the CVFPP. To be consistent with the Regional Flood Management Planning (RFMP) effort, these CPAs consist of one or more RFMP regions (Figure 1-1) and the adjoining upstream portions of the SPA (e.g., reservoirs and foothill tributaries). The CPAs are as follows:

- Upper Sacramento River CPA, which includes the Sacramento River and tributaries from Red Bluff to Fremont Weir (Upper and Mid-Sacramento River CVFPP RFMP Regions)
- Feather River CPA, which includes the Yuba and Bear Rivers and other tributaries (Feather River CVFPP RFMP Region)
- Lower Sacramento River CPA, which includes the Sacramento River and tributaries from Fremont Weir to Isleton (Lower Sacramento River and Delta-North CVFPP RFMP Regions)

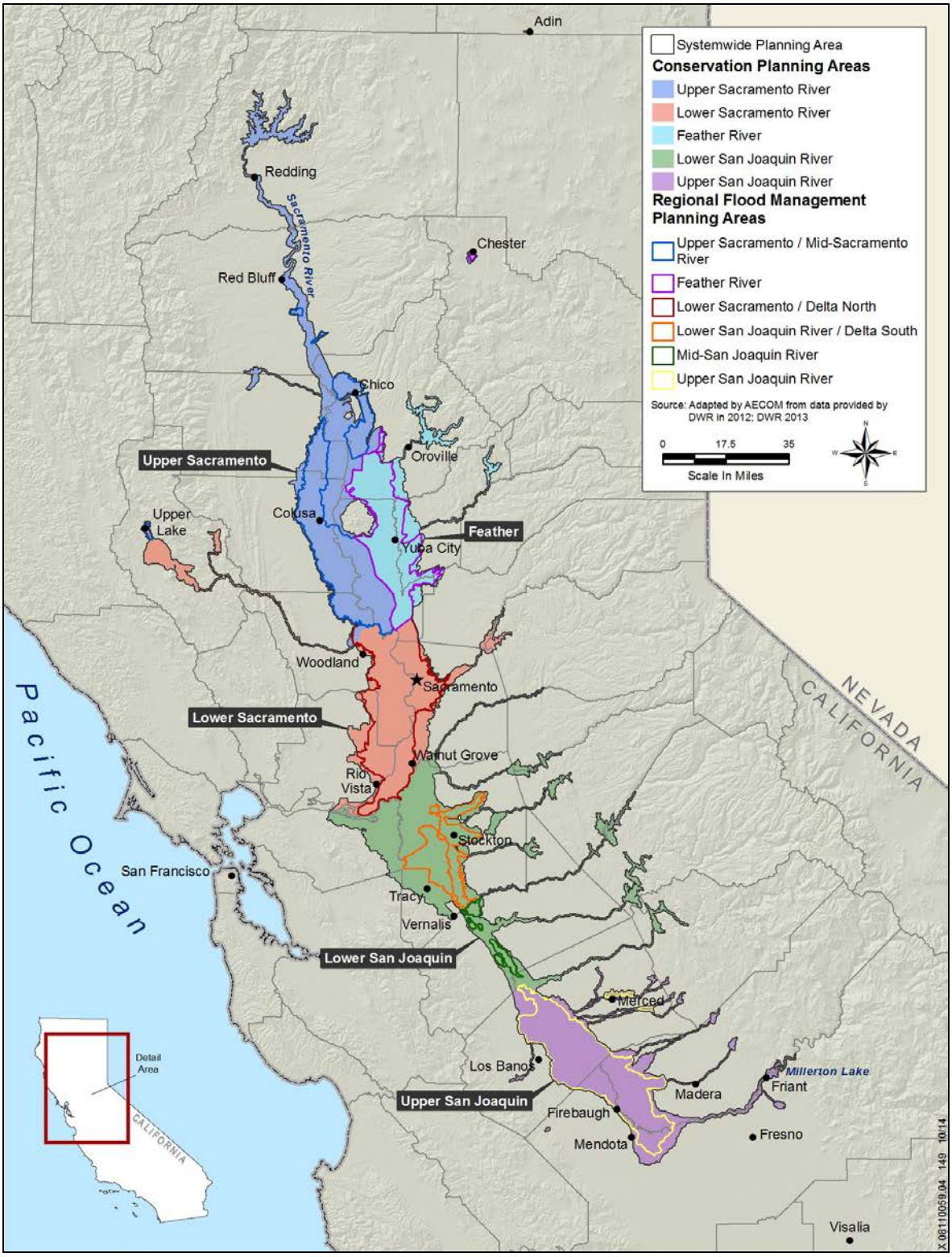

Figure 1-1. Conservation Planning Area and Regional Flood Management Planning Boundaries

- Upper San Joaquin River CPA, which includes the San Joaquin River and tributaries from Friant Dam to the Merced River (Upper San Joaquin River CVFPP RFMP Region)

- Lower San Joaquin River CPA, which includes the San Joaquin River and tributaries from the Merced River to Stockton (Lower and Mid-San Joaquin River and Delta-South CVFPP RFMP Regions)

1.1.2 Landscape Units in Conservation Planning Areas

Within the CPAs, most State Plan of Flood Control (SPFC) facilities and CVFPP actions are concentrated in corridors of land along major rivers, bypasses, and other waterways that encompass only a portion of each CPA and that differ in their natural resources. Therefore, for purposes of evaluating existing conditions and describing the objectives, each CPA is divided into landscape units that distinguish corridors with distinct combinations of habitats and SPFC facilities (Figure 1-2).

The classification consists of seven types of landscape units that can be grouped by their location on the floor of the Sacramento and San Joaquin Valleys or in the surrounding foothills and Inner Coast Ranges:

- Landscape units of the Sacramento and San Joaquin Valleys:

Major River Reach: Approximately 2-mile-wide corridors of land along the Sacramento and San Joaquin Rivers and the lower reaches of major tributaries (i.e., corridors extending 1 mile to each side of the river's centerline)[1]

Basin/Bypass: Land within a basin or bypass plus an adjacent 0.5-mile-wide buffer outside of the bordering levees

Other Facility/Waterway: One-mile-wide corridors of land along SPFC levees (and urban levee evaluation nonproject levees) in the Sacramento and San Joaquin Valleys that are not within any of the preceding types of landscape units (i.e., corridors extending 0.5 mile to each side of the facility's centerline)

Other Valley SPA: The remainder of the SPA in the Sacramento and San Joaquin Valleys that is not part of a corridor along a waterway or SPFC facility

- Landscape units of the foothills and Inner Coast Ranges:

Lake/Reservoir: Lakes and reservoirs behind dams in the foothills, which are the uppermost extent of the SPA

[1] The Major River Reaches used begin at Woodson Bridge Landing instead of Red Bluff. This is due to the modeling extent of the Floodplain Restoration Opportunity Analysis (FROA) an attachment to the 2012 CVFPP (DWR 2012b). The FROA was dependent on the CVFED (Central Valley Floodplain Evaluation and Delineation) Light Detection and Ranging flights data which was also limited in coverage, A description of the land cover from Red Bluff to Woodson Bridge Landing is forthcoming.

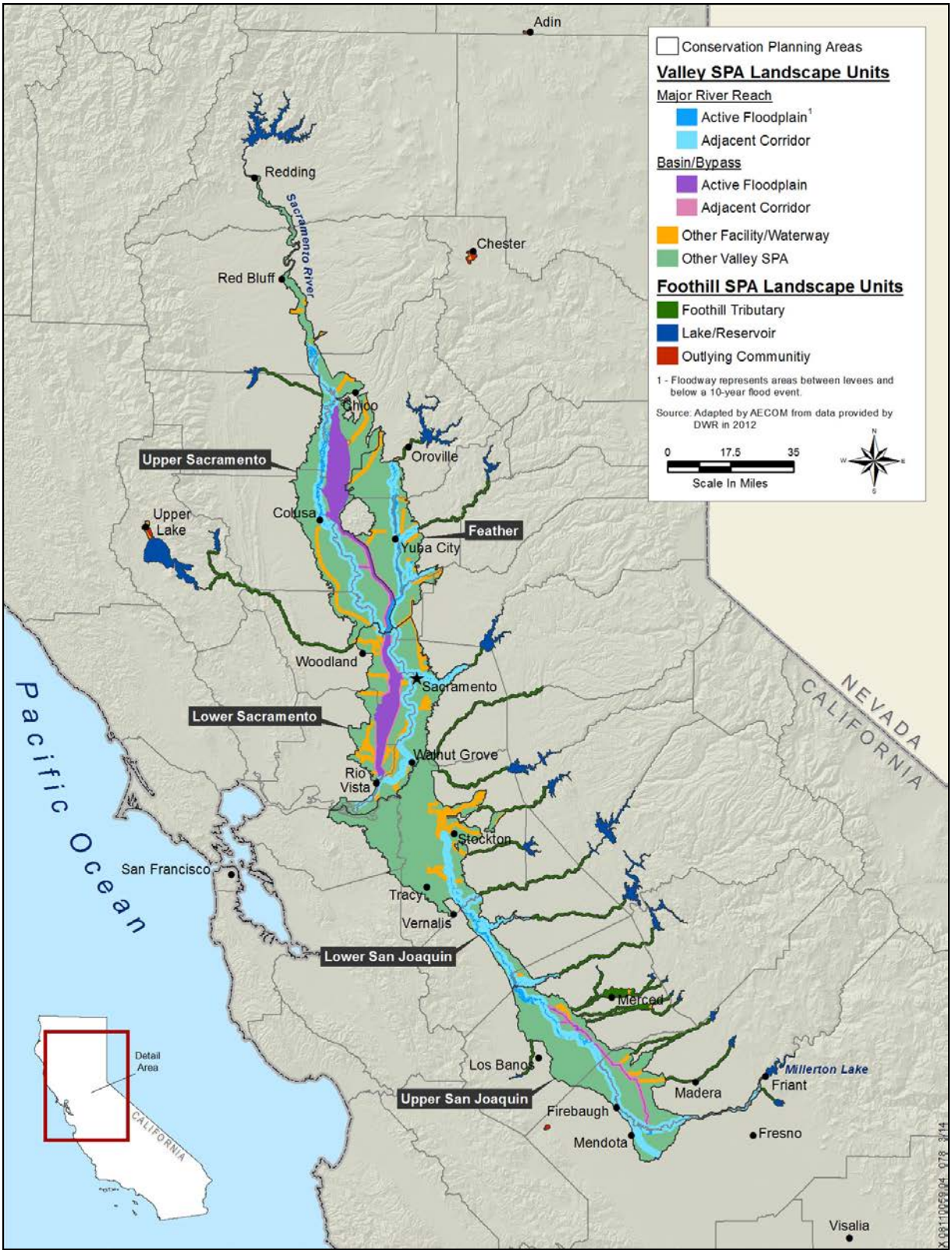

Figure 1-2. Landscape Units of the Conservation Planning Areas

Foothill Tributary: One-mile-wide corridors along tributaries extending from reservoirs in the foothills to major river reaches on the valley floor

Outlying Community: One-mile-wide corridors along SPFC facilities protecting communities located outside of the Sacramento and San Joaquin Valleys (e.g., at Clear Lake)

1.2 Targets

Pursuant to its goals, the Conservation Strategy focuses on the ecological processes, habitats, and species with the greatest potential to benefit from conservation actions integrated with flood management actions. It also focuses on stressors to these processes, habitats, and species that could be addressed by flood risk management. Ecosystem processes, habitats, species, and stressors are considered "targets" for the purposes of this Conservation Strategy. Measurable objectives for these targets, such as measurements of floodplain inundation, riparian habitat, or fish passage barriers, will inform the CVFPP and future State funding guidelines and grant programs (e.g., by providing a framework for measuring the accomplishment of ecosystem improvements). Table 1-1 shows the relationship of the Conservation Strategy's ecological goals and the targets. This section describes these targets (as does the Conservation Strategy, although in less detail than in this section). Sections 3 through 7 describe the existing baseline conditions (by CPA, major river reach, and other landscape units) for the Conservation Strategy based on these targets.

Table 1-1. Ecological Goals and Targeted Ecosystem Processes, Habitats, Species, and Stressors

Ecological Goal	Targeted Ecosystem Process, Habitat, Species, or Stressor
Ecosystem processes. Improve dynamic hydrologic and geomorphic processes.	Floodplain inundation
	Riverine geomorphic processes
Habitats. Increase and improve quantity, diversity, quality, and connectivity of riverine and floodplain habitats.	SRA cover
	Riparian
	Marshes and other wetlands
	Floodplain agriculture
Species. Contribute to the recovery and sustainability of native species populations and overall biotic community diversity.	Targeted species
Stressors. Reduce stressors related to the development and operation of the SPFC that negatively affect at-risk species.	Revetment
	Levees[1]
	Fish passage barriers
	Invasive plants

Key: SRA = shaded riverine aquatic

Note:

[1] In particular, levees are a stressor where located within river meander zones or if their design does not provide sufficient capacity for riparian habitat throughout the floodway.

1.2.1 Targeted Processes

The Conservation Strategy's targeted ecosystem processes are riverine geomorphic processes and floodplain inundation to improve ecological function. These are the natural, dynamic, hydrologic, and geomorphic processes that sustain targeted habitats and can promote flood management objectives. Their restoration can also promote flood risk management objectives, in particular improving flood system flexibility and reducing O&M regulatory requirements. These processes are described in the following sections.

The frequency, magnitude, duration, timing, and rate of change of river flows are the primary determinants of riverine geomorphic processes and floodplain inundation, influence aquatic habitat conditions, and serve as critical life history cues to riverine species. The Conservation Strategy does not include objectives for river flows because these flows are managed for other purposes in addition to flood risk management—in particular, water supply and hydroelectric power production. DWR is evaluating opportunities to improve the management of river flows. For example, DWR is evaluating forecast-based operations, coordinated among reservoirs, to optimize the use of reservoir storage and downstream channel capacity and thus benefit flood risk reduction and the ecosystem in ways that will not substantially affect water supply reliability, water deliveries, or power production.

Floodplain Inundation

Ecosystem processes that sustain both riverine and riparian ecosystems occur during floodplain inundation events (Opperman 2012). Floodplain inundation occurs when river flows exceed channel capacity and water overflows onto adjacent land.

During floodplain inundation, a variety of physical processes occur. The magnitude of ecosystem responses to these events depends on flow timing, frequency, magnitude, and duration. Overbank flows support the formation of side channels, sloughs, and oxbow lakes. In addition, scouring, erosion and deposition, and prolonged inundation disturb existing vegetation, creating opportunities for cottonwoods, willows, and other early successional riparian species to establish from seed.

For floodplains in the Sacramento–San Joaquin Delta (Delta) and the Sacramento and San Joaquin Valleys, a conceptual model has been developed that diagrams the relationships between hydrologic, geomorphic, and biological processes (Opperman 2012). Opperman (2012) provides a review of these relationships and the current understanding of them by the scientific community. The review concludes that many of these relationships are well understood, predictable, and strong. The text below describes some of the relationships that are particularly relevant to the Conservation Strategy's targeted habitats and species, as they relate to the process of floodplain inundation.

Typically, floodplain inundation is associated with storms occurring more frequently than once every 2 years (i.e., 50-percent-chance events) (Leopold et al. 1964), although the actual frequency of floodplain inundation is affected by watershed characteristics, channel morphology along a given river reach (including channel incision), and reservoir operations. In the Sacramento and San Joaquin Valleys, floodplain inundation can occur at any time during the

rainy season, roughly from October 1 through May 31. It lasts for a variable duration, from hours to days or weeks, and exhibits a variable rate of flow, depending on precipitation, snowmelt patterns, and reservoir storage capacity.

During floodplain inundation, a variety of physical processes occur. The magnitude of ecosystem responses to these events depends on flow timing, frequency, magnitude, and duration. Changes in channel dynamics and channel morphology resulting from scouring, erosion, and sediment deposition are typically associated with floodplain inundation. In addition, because the energy of floodplain inundation flow is dissipated over a larger area (i.e., the floodplain rather than the channel), floodplain inundation flows have a reduced capacity to carry suspended sediments and other debris. Sediments, debris, and seeds typically are deposited on the floodplain. Floodplain vegetation, which increases hydraulic roughness and further slows flow velocity, can increase the amount of sediment and organic matter that settles on the floodplain during an inundation flow. Historically, overbank flows were commonly observed in the Sacramento and San Joaquin Valleys during winter and spring in response to spring snowmelt, rain-on-snow events, and prolonged periods of heavy rainfall that are characteristic of the region (Kondolf et al. 2000).

Under existing conditions, the potential for floodplain areas to be inundated has been reduced by reservoir operations and channel incision, and most floodplain has been isolated from rivers by levees. This reduction has been quantified by analyses of floodplain inundation potential (FIP). FIP analysis identifies areas of floodplain, both directly connected to the river and disconnected from the river (e.g., behind natural or built levees or other flow obstructions), that could be inundated by particular floodplain flows. Generally, the flows selected for the analysis are those that would be sufficient to provide desired ecosystem functions (i.e., the selected flows would produce an "ecologically functional floodplain").

The description of FIP in this appendix is based on the California Department of Water Resources' (DWR) *Floodplain Restoration Opportunity Analysis* (DWR 2012b). This analysis evaluated FIP for corridors along the Sacramento and San Joaquin Rivers and the lower reaches of their major tributaries. To assess physical suitability for restoration actions, the FIP analysis adapted concepts from the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center (USACE-HEC) (2009), the frequently activated floodplain concept of Williams et al. (2009), and the Height Above River geographic information systems (GIS) tool of Dilts et al. (2010). The flows evaluated in the *Floodplain Restoration Opportunity Analysis* included a spring flow sustained for at least 7 days and occurring in 2 out of 3 years (a 67-percent-chance event) and 50- and 10-percent-chance peak flows. Floodplain inundated by such sustained-spring events provides a number of desired functions, including fish rearing habitat.

Floodplain inundation caused by overbank flows can result in widespread disturbances to existing riparian vegetation through scouring and removal of existing vegetation. Floodplain inundation may also result in death of plants from physiological stress related to prolonged inundation, root suffocation from the deposition of fine sediment, and similar factors (TNC 2007). These disturbances remove existing vegetation and may create suitable conditions for the germination and recruitment of early successional vegetation, leading to increased habitat diversity and increased wildlife diversity, as described in the section below entitled "Targeted Habitats."

Cottonwood and willows require moist, bare, mineral soil during periods of seed release. In the Sacramento and San Joaquin Valleys, this period of seed release lasts roughly from mid-March through July (see TNC 2007 and studies referenced therein) and may vary widely by species and geographic location within years and according to annual temperature and precipitation patterns among years. Flows leading to successful recruitment of cottonwoods and willows have been estimated to occur every 5–10 years on meandering alluvial rivers similar to those found in the Sacramento and San Joaquin Valleys, although recruitment events may occur much less frequently on rivers constrained by geology, bank revetment, or levees (see TNC 2007 and references cited therein).

The geomorphic process of gradual channel meander migration, coupled with overbank flows, may also result in the formation of side channels, sloughs, and oxbow lakes through the cutoff of meander bends and gradual separation of the flow in these locations from the river's mainstem. The formation and sustainability of off-channel habitats is important for species such as western pond turtle (*Actinemys marmorata*) that prefer slow-moving water. In many river reaches, these off-channel habitats provide substantial opportunities for recruitment of cottonwood and willows, particularly when in-channel recruitment zones (e.g., point bars) are lacking (TNC 2007).

Aside from effects on the successional processes of riparian vegetation through disturbance, vegetation recruitment, and the formation of off-channel habitats, overbank flows increase the amount and quality of rearing habitat for Chinook salmon (*Oncorhynchus tshawytscha*), as well as other native fish. The mechanisms by which seasonal floodplains positively affect salmonid rearing include increased primary production and food availability (Junk et al. 1989, cited in TNC 2007); lack of predation from nonnative fish, which generally are not found on seasonal floodplains; and improved habitat quality and food production relative to river channels (lower velocity flows, greater structural diversity) (Sommer et al. 2001, 2003). Studies have shown that juvenile Chinook salmon that have been reared on seasonal floodplains are much larger than salmon that have been reared in river channels (Sommer et al. 2001, 2003). Larger juvenile salmon are assumed to have a greater probability of successful outmigration to the Pacific Ocean (Sommer et al. 2001).

Three main races of Chinook salmon—fall-/late fall–run, winter-run, and spring-run—are found in the Sacramento River, and the San Joaquin River supports or historically supported fall-/late fall–run and spring-run fish. These races historically made extensive use of seasonal floodplains during winter and spring outmigration. Today, substantial areas of seasonal floodplain in the Delta and its vicinity are still found in the Yolo Bypass and along the lower Cosumnes River (Sommer et al. 2001, 2003). Researchers have made various estimates of the timing, duration, and frequency of floodplain flows that are optimal for salmon rearing (USACE 2002; Williams et al. 2009). Most information, however, indicates that the general consensus from these and other studies (TNC 2007) is that frequent floodplain inundation (i.e., inundation approximately every 2–4 years on average) of some duration during periods of salmon outmigration from January through May has a positive effect on outmigration success.

Riverine Geomorphic Processes

The fundamental geomorphic processes of alluvial floodplain rivers are lateral channel migration, channel cutoff and formation of multiple channels, bed mobility, and fine and coarse sediment transport. These interrelated processes influence channel, bank, and floodplain formation and other floodplain dynamics, which in turn create and sustain the targeted habitats described in the section below entitled "Targeted Habitats."

Channel migration (i.e., meander migration) is particularly important and is readily measured using aerial images taken at intervals. Channel migration is closely related to the transport of sediment, the creation of specialized habitat for bank swallows on cut banks, and the creation of new floodplain surfaces that serve as seedbeds for riparian plants of early successional habitats. When not constrained by erosion-resistant banks (e.g. banks lined with revetment), the channel of a large, alluvial river tends to migrate laterally (move side to side across the landscape) (Johannesson and Parker 1989). This meander migration is one of the primary processes sustaining floodplain habitats on large, single-channel alluvial rivers (Hughes 1997).

In bank erosion studies conducted on the Sacramento River, annual migration rates have been observed to vary between 0 and 129 feet per year (Larsen et al. 2006). Along the Sacramento River, the natural meander zone is generally within three channel widths of the river's centerline (1,650–3,300 feet) (Larsen et al. 2006), a width that also likely spans the natural meander zone of the other (smaller) alluvial rivers of the CPAs.

The summary of existing conditions in this appendix uses the concept of meander potential to quantify the reduction of the natural meander zone. Meander potential is the area of floodplain that has the potential to be reworked by the meandering channel because it is within the river's natural meander zone, is not underlain by substrates resistant to erosion, and is not isolated by revetment and/or levees (see Section 2.1.2., "Riverine Geomorphic Processes").

In actively meandering reaches, a characteristic chronosequence of floodplain surfaces results, with younger surfaces closest to the river and oldest surfaces farthest from the river. Over time, meandering channels naturally tend to maintain roughly constant dimensions as erosion of outside bends is balanced by deposition on point bars, a state known as dynamic equilibrium. Meander bends also may become unstable and form cutoffs. Channel migration of meandering rivers has been shown to establish and maintain riparian habitats, oxbow lakes, and riverbank ecosystems (Hupp and Osterkamp 1996; Scott et al. 1996; Ward et al. 2001).

Ongoing channel meandering and associated high flows are also important for the formation and sustainability of riparian habitats. Point bars formed on the inside of meander bends are common locations for recruitment of willow (*Salix* spp.) and cottonwood (*Populus* spp.), which establish on newly deposited surfaces in response to specific combinations of flow events (Mahoney and Rood 1998). Channel meandering creates point bar depositional surfaces of different ages, each of which supports riparian vegetation of a different age class (Greco et al. 2007). As channel migration continues, older depositional surfaces shift from cottonwood and willow dominance to dominance by other species less tolerant of flooding and disturbance, resulting in greater vegetation community structure and increased overall species diversity (Ward and Stanford

1995). Because riparian forest ecosystems mature relatively rapidly (e.g., within 100–300 years), they can transition to upland ecosystems without periodic disturbance related to channel meandering, sediment deposition, and point bar formation (Fremier 2003; Johnson et al. 1976; Sands and Howe 1977).

The recruitment of large woody material (LWM) is also tied to elevated flows and associated geomorphic processes of channel meander and erosion. As meander bends migrate during higher flows, banks are undercut and mature trees fall into the channel, becoming LWM. The importance of LWM for salmonids is well recognized (Harmon et al. 1986; Maser and Sedell 1994; Opperman et al. 2008), and the continual recruitment of LWM is important to the maintenance of salmonid habitat as existing LWM is transported downriver by flood flows.

1.2.2 Targeted Habitats

Targeted habitats encompass riverine and floodplain habitats. Under the Conservation Strategy, restoration of riverine habitats is accomplished by increasing floodplain inundation (which was described in the preceding section, "Targeted Ecosystem Processes"), restoring SRA cover (described below), and reducing the effects of stressors on riverine habitats (see "Targeted Stressors," below). The following riverine and floodplain habitats are considered targeted habitats for the Conservation Strategy: shaded riverine aquatic (SRA) cover, riparian, marsh/other wetlands, and floodplain agriculture. These habitats are described in the following sections.

Shaded Riverine Aquatic Cover

SRA cover is defined as follows (USFWS 1992):

> *[It is] the unique near-shore aquatic area occurring at the interface between a river (or stream) and adjacent woody riparian habitat. Key attributes of this aquatic area include (a) the adjacent bank being composed of natural, eroding substrates supporting riparian vegetation that either overhangs or protrudes into the water, and (b) the water containing variable amounts of woody debris, such as leaves, logs, branches and roots, often substantial detritus, and variable velocities, depths, and flows.*

Three attributes of SRA cover make it an important component of fish and wildlife species habitat (USFWS 1992): overhanging vegetation, natural eroding banks, and in-water cover.

- Overhanging riparian vegetation and (sometimes) riverbanks provide several types of habitat values to fish and wildlife species:
  - Shade moderates water temperatures, which is particularly important to salmonids.
  - Shade and cover also reduce visibility to predators.
  - Input of plant material provides instream cover for fish.

  - The terrestrial and aquatic invertebrates associated with vegetation and plant material provide food to birds and aquatic species.

  - Plant stems and branches serve as perches and as nesting and resting areas for bird species.

- Natural, eroding banks often have cavities, depressions, and vertical faces that support bank-dwelling species, including bank swallow (*Riparia riparia*), northern rough-winged swallow (*Stelgidopteryx serripennis*), belted kingfisher (*Megaceryle alcyon*), mink (*Mustela vison*), and river otter (*Lontra canadensis*), and that provide cover and shelter for fish. The bank-dwelling species may use these banks and their cavities as access points for the water or for nesting. Erosion of natural bank substrates provides instream spawning substrate for aquatic species, including salmonids. Instream cover, including overhanging or fallen trees or branches, aquatic vegetation, diversity of substrate sizes, and irregular banks—provides habitat complexity to fish and wildlife species, which supports a high diversity and abundance of invertebrate and fish species.

Many streambanks have some, but not all, of these attributes, and thus provide some, but not all, of these habitat elements. For example, natural banks that lack overhanging riparian vegetation may have an eroding surface with cavities and depressions; conversely, vegetated revetment that lacks eroding banks may have overhanging riparian vegetation that shades the water surface and provides inputs of plant material and insects. Near-shore LWM is part of the in-water cover component of SRA cover, but LWM may also be present away from the shore, in the river channel. LWM is critically important to aquatic species, contributing to habitat creation (e.g., habitat complexity and refuge habitat) and serving a role in storing sediment and organic matter. LWM is important to salmon populations in the Sacramento River; however, it is often removed from the river system to avoid damage to structures, such as weirs, downstream. LWM can often mobilize in flood events, contributing to habitat not only locally at the point of recruitment, but also downstream, whether within the channel, near the bank, or on the floodplain. Upstream inputs of LWM are the only significant source of LWM in river reaches that lack SRA and riparian forest, and these sources have been diminished by construction of dams and loss of upstream riparian vegetation.

Riparian Habitat

Riparian areas comprise the land between river and stream channel banks and adjacent uplands, which generally correspond to the floodplain. In the Conservation Strategy, "riparian habitats" refers to the forest and scrub vegetation characteristic of riparian areas in the Sacramento and San Joaquin Valleys (as described in Sawyer et al. 2009 and Vaghti and Greco 2007).

River flows and associated hydrologic and geomorphic processes are integral to riparian ecosystems. Most aspects of a flow regime—the magnitude, frequency, timing, duration, and sediment load of flows—affect a variety of riparian habitat processes. Two of the most important processes for riparian vegetation are plant recruitment and disturbance. The interaction of these processes across the landscape is primarily responsible for the pattern and distribution of riparian vegetation and for its species composition and habitat structure.

A conceptual model of Delta riparian vegetation diagrams and reviews the ecological relationships affecting this vegetation type (Fremier et al. 2008). Much of the content of this conceptual model and review is also applicable to riparian vegetation of the Sacramento and San Joaquin Valleys. Fremier et al. (2008) concluded that the relationships of riparian vegetation to floodplain topography and surface hydrology are of high importance, highly predictable, and moderately well understood. They also concluded that a number of the relationships to physical conditions, disturbance, and interactions among populations (e.g., groundwater hydrology and water chemistry, fire, and competition from invasive plants, respectively) are less well understood and not as predictable. Although many of these less well understood relationships are also of lesser importance, the lack of predictability and limited understanding further limits the ability to predict the mosaic of riparian vegetation that develops over time. The text below describes the aspects of the ecology of riparian habitats most relevant to the targeted ecosystem processes and species of the Conservation Strategy.

More than 15 native tree and shrub species occur in the riparian communities of the Sacramento and San Joaquin Valleys and foothills (Vaghti and Greco 2007). Most of these species are hydrophilic (water loving), but they differ in several key attributes, such as shade tolerance and longevity. These attributes, in combination with site conditions (e.g., soils and soil moisture) and disturbance events, determine the abundance of species and the structure of riparian vegetation.

The species composition and structure of riparian vegetation change with increasing distance from the river channel. In-channel islands, point bars, and areas adjacent to the channel are generally at lower elevation; thus, they are exposed to longer inundation periods and are more frequently disturbed by geomorphic processes, particularly lateral displacement of the river channel (channel migration). Consequently, these areas are dominated by species such as cottonwood and willows such as sandbar willow (*Salix exigua*) and arroyo willow (*Salix lasiolepis*), which have less shade tolerance, greater tolerance of inundation, and greater tolerance of disturbance than other shrubs and trees. For these species, recruitment (germination, establishment, and growth of new individuals) depends on conditions created by frequent flooding (e.g., exposed, moist mineral soil) and these species are relatively short lived (e.g., 50–150 years) (Strahan 1984). Higher floodplains farther from the channel are dominated by species that require less water and tolerate more shade but are less tolerant of disturbance, such as Oregon ash (*Fraxinus latifolia*), valley oak (*Quercus lobata*), and common buttonbush (*Cephalanthus occidentalis*) (Stuart and Sawyer 2001). These species are less dependent on recently disturbed sites for their recruitment and may live as long as 250 years.

As described earlier, the recruitment of cottonwood and willow especially depends on geomorphic processes that create bare mineral soil through erosion and deposition of sediment along river channels and on floodplains and depends on flow events that result in floodplain inundation. Receding flood flows that expose moist mineral soil create ideal conditions for germination of cottonwood and willow seedlings. After germination occurs, the water surface must decline gradually to enable seedling establishment. If the water surface declines too quickly, seedlings are prone to mortality by desiccation. For a river to supply seedlings with adequate water as their roots elongate toward the water table, the decline in the river's water surface should not exceed 1 to 1.5 inches per day (Mahoney and Rood 1998).

After germination, seedlings typically grow within a zone defined by the elevation of peak flows and elevation of low flows. Seedlings in this zone often succumb to drought or to subsequent high-flow events that either scour newly established seedlings or kill new seedlings via prolonged inundation (Sprenger et al. 2001). Those that persist through the first two growing seasons typically reach sapling size and persist in subsequent years.

Disturbance removes riparian vegetation and frequently alters the course of recruitment and succession within such vegetation. Disturbances include prolonged inundation, drought, fire, burial, and undercutting by eroding banks. Absent disturbance, larger trees and species less tolerant of frequent disturbance begin to dominate riparian woodlands. Large-flow events and associated scour, deposition, and prolonged inundation create openings in riparian communities. Early successional species, like cottonwood and willow that recruit into these openings, become more abundant in the landscape as vegetation grows within disturbed areas. As a result, structural and species diversity within riparian vegetation increases, as do overall wildlife habitat values. (Unfortunately, disturbances also create opportunities for invasive plants to establish. See Section 1.2.3, "Targeted Stressors," for a discussion of the impacts of invasive plants.)

In the Sacramento and San Joaquin Valleys and surrounding foothills, riparian vegetation supports a great diversity of wildlife, including sensitive invertebrates, amphibians, reptiles, birds, and mammals. Wildlife use these habitats for food, water, and cover during foraging, reproduction, and movement (e.g., dispersal and migration). In the semiarid western United States, riparian vegetation communities contain the most species-rich and abundant communities of birds and provide critically important habitat for many other wildlife taxa (Faber 2003). Large expanses of the valley lack substantial blocks of natural habitat that support native biodiversity or essential areas of connectivity among these blocks; therefore, the riparian corridors play a critical role in connecting wildlife to the few remaining natural areas of this geographic area (Spencer et al. 2010). The variety and abundance of wildlife species and the relative importance of riparian communities to wildlife are related to the diversity of vegetation types and physical habitat structure associated with riparian communities, the size and continuity of vegetation types on the landscape, and the seasonal migration of birds.

Riparian habitats that are diverse in both the composition of vegetation species and physical habitat structure are likely to accommodate a wider variety of wildlife (RHJV 2004). Wildlife species vary considerably in their habitat requirements and preferences for different structures (e.g., a dense shrub layer or large trees) in riparian vegetation. For example, nesting requirements for birds range from dense herbaceous vegetation to larger trees, tree cavities, and even eroding bluffs (for bank swallow). Most wildlife species also require several habitat features and use different vegetation types at various times during their life cycles, and in the Sacramento Valley, many riparian-associated species use, and often require, both riparian and other adjacent habitats for reproduction, cover, and/or foraging (Placer County Planning Department 2005).

As described above, the number of wildlife species in riparian corridors increases with corridor size, width, and continuity (e.g., Hagar 1999; Hannon et al. 2002; Heath and Ballard 2003). Large, mature stands of riparian forest support the most dense and diverse breeding bird communities in California (Gaines 1974). These dense stands provide high-quality nesting

habitat for raptors and cavity-nesting birds. Some species depend primarily on larger riparian patches and corridors; for example, small or narrow patches of riparian vegetation are unsuitable for reproduction of yellow-billed cuckoo (*Coccyzus americanus occidentalis*) (Laymon and Halterman 1987; USFS 1989). For more widely distributed species, the importance of wide, contiguous corridors may be related to increased habitat heterogeneity in larger corridors; the absence of interior habitats in narrower, fragmented corridors; and the ability of larger corridors to support species with larger home ranges.

The width and continuity of riparian corridors also affect the use of riparian and adjacent uplands for wildlife movement. Larger flows that inundate floodplains, basins, and bypasses create expanses of shallow water that provide seasonal habitat for wintering waterfowl, shorebirds, and wading birds. Conversely, narrow corridors—or corridors fragmented by developed or agricultural land, or lacking dense cover—may not be used by some species. In particular, if riparian and adjacent upland does not meet a species' habitat requirements, it may not be used for dispersal and hence will not provide a suitable corridor connecting habitat patches, particularly for smaller, less mobile animals (Noss et al. 1996; Rosenberg et al. 1997). Overall, there is a substantial increase in the variety of habitat features, and thus overall habitat value, as corridor width increases from a discontinuous band one to two trees wide (approximately 100 feet) to a continuous band (approximately 330 feet wide) with areas of forest interior and patches of varied structure.

Migrating and nesting neotropical migrant birds contribute substantially to the richness and abundance of the avian community during spring and summer. The Sacramento and San Joaquin Valleys lie within the Pacific Flyway, the major pathway for migratory bird species on the West Coast. During spring and summer, a large number of neotropical migratory birds (such as Bullock's oriole [*Icterus bullockii*] and black-headed grosbeak [*Pheucticus melanocephalus*]) forage and nest in riparian and wetland vegetation. In fall and winter, riparian habitat of the Sacramento and San Joaquin Valleys supports relatively high densities of resident and wintering raptors and songbirds.

Although there are similarities, the species composition and ecology of riparian habitats in the Delta differ in several important ways from those in the corresponding habitats in the Sacramento and San Joaquin Valleys. In particular, the disturbances that remove riparian vegetation, or create newly exposed surfaces where riparian vegetation can establish, differ somewhat. Disturbances related to meander migration are more limited in the Delta than upstream, but anthropogenic (human-made or -caused) disturbances, such as levee maintenance and trampling, are greater in the Delta. The close proximity of levees to the river's edge, the extensive placement of bank protection, and the greater density of human populations in this area are the primary reasons for this greater level of disturbance. In addition, riparian habitats in the Delta border waters influenced by the daily tides, whereas riparian habitats in the Sacramento and San Joaquin Valleys border nontidal waters.

Marsh and Other Wetland Habitat

This targeted habitat includes marshes, other wetlands, and associated uplands dominated by herbaceous plants.

In marshes, vegetation structure and the number of species are strongly influenced by disturbance, changes in water levels, and the range of elevations present at a site. Disturbances and water-level drawdowns that expose previously submerged surfaces enable annuals, short-lived perennials, and other species to establish, which creates diversity in species composition and vegetation structure.

Freshwater emergent wetlands, or marshes, are often dominated by large, perennial herbaceous plants, particularly tules (*Schoenoplectus* spp.) and cattails (*Typha* spp.). Tules and cattails have stems that grow horizontally beneath the substrate (rhizomes) and stems that emerge above the water surface (culms).

Seedlings can establish only on exposed surfaces, but growth from rhizomes allows them to subsequently occupy sites at lower elevations (i.e., in deeper water). Their growth is reduced by submergence and by damage to their culms (aerial stems of grasses, sedges, and similar plants) from animals, currents, and wave action (Coops et al. 1991, 1996). Thus, vegetation dominated by tules and cattails is restricted to shallow water, typically less than 2 feet deep (Atwater and Hedel 1976).

In addition, as with woody riparian plants, prolonged drought and prolonged inundation events can lead to death and loss of marsh plants (Seabloom et al. 2001; Touchette et al. 2008). However, herbaceous wetland plants have belowground parts adapted to anaerobic conditions and thus are more resistant than woody riparian plants to prolonged inundation of their root systems. For these species, submergence of aboveground parts is required to cause damage or death.

Marshes are among the most productive fish and wildlife habitat in California (Kramer 1988). Perennial freshwater wetlands provide food, cover, and water for numerous common and special-status species of fish and wildlife that rely on wetlands for all or part of their life cycle. In the Sacramento and San Joaquin Valleys, wetlands, including marshes, are especially important to migratory birds. During fall and winter, wintering waterfowl, shorebirds, wading birds, and raptors are conspicuous in their use of wetlands for foraging and cover. Waterfowl rely heavily on waste agricultural seeds and invertebrates in postharvest flooded fields (Fleskes et al. 2003). The combination of vegetation and open water in wetlands provides food, rearing areas, and cover for waterfowl and shorebirds. These wetlands are the primary waterfowl wintering area in the Pacific Flyway, providing wintering habitat for about 60 percent of the total migratory waterfowl population.

Although there are similarities, the species composition and ecology of marshes in the Delta differ in several important ways from the corresponding habitats in the Sacramento and San Joaquin Valleys. In particular, many marshes in the Delta are influenced by the daily tides, whereas all marshes upstream of the Delta in the Sacramento and San Joaquin Valleys are nontidal. Both nontidal and tidal marshes in the Delta have dense emergent vegetation that provides essential cover, resting, and foraging sites for a variety of wildlife species. Tidal marshes and associated mudflats are exposed at low tides and support a variety of foraging shorebirds and dabbling ducks. Adjacent upland habitats are also required for seasonal

hibernation and reproduction in some species; they serve as important resting, cover, and nesting sites for many birds and mammals that move into uplands during high tide. Canals, side channels, and backflow pools of the Delta that contain emergent vegetation provide forage and cover habitat. They also are dispersal corridors that link habitat areas for terrestrial and semiaquatic species as well as many bird species. A conceptual model (Kneib et al. 2008) summarizes the physical and biological processes affecting tidal marshes, their relative importance, their predictability, and our understanding of them.

In addition to marshes, floodplains support extensive areas of other wetlands (and interspersed uplands) dominated by herbaceous plants. Like other habitats of active floodplains, these areas are periodically inundated, and soils remain saturated during the growing season for prolonged periods.

These seasonal wetlands occur in a variety of physical settings, from low-lying areas with groundwater near the soil surface to areas with fine-textured soils and slowly impermeable layers (e.g., alkali sinks). Vernal pools also occur on floodplains, but they are not a targeted habitat in the Conservation Strategy because they are not closely associated with the SPFC and the ecosystem processes that it affects.

A wide variety of plant species dominate these seasonal wetlands, including native rushes (*Juncus arcticus* vars. *mexicanus* and *balticus*), smartweeds (*Polygonum* spp.), saltgrass (*Distichlis spicata*), alkali sacaton (*Sporobolus airoides*), and a number of nonnative grasses and forbs (Moise and Hendrickson 2002; Sawyer et al. 2009; USBR 2011; Vaghti and Greco 2007).

Although these seasonal wetlands may be inundated only intermittently or for a small portion of the year, and they often lack the tall, dense plant cover of a marsh, they provide important habitat for many target and other sensitive species associated with marsh or riparian habitats. In addition, the habitat values of seasonal wetlands and interspersed uplands (for foraging, basking, cover, and refuge during flood flows) complement those of riparian and marsh habitats (see Appendix G, "Identification of Target Species and Focused Conservation Plans," and RHJV 2004) and thus, at the landscape scale, increase habitat quality for target and other sensitive species.

Floodplain Agriculture

Substantial portions of native habitats within the Sacramento and San Joaquin Valleys have been converted to agricultural or urban uses or other intensive human uses. Compared to other new land uses, agricultural lands are better suited to providing habitat for fish and wildlife species; in fact, they can be managed to help support some of the Conservation Strategy's target species, particularly on periodically inundated floodplains.

Agricultural lands consist primarily of irrigated row and field crops (e.g., rice, beans, melons, and alfalfa) and orchards and vineyards (e.g., walnuts, almonds, and grapes). Agricultural lands go through frequent, often seasonal cycles of tillage, seedbed preparation, seeding, crop growth, and harvesting, with applications of irrigation water, fertilizers, pesticides, and herbicides.

The value of agricultural habitat for sensitive and common fish and wildlife species varies greatly among crop types and agricultural practices. Rice fields can provide relatively high-quality wildlife habitat (Brouder and Hill 1995). Rice cultivation with flood irrigation provides an important substitute for historical floodplain wetlands during summer, and most rice acreage provides good habitat for invertebrates, small mammals, and waterfowl. Brouder and Hill (1995) note that 177 animal species, including 21 special-status species, spend all or part of their life cycles in rice fields or associated berms and canals. Seasonal flooding creates surrogate wetlands that can be exploited by a variety of resident and migratory birds, and dry rice fields can attract rodents and their predators (e.g., raptors). Flooded rice fields and irrigation canals also provide important habitat for the giant garter snake (*Thamnophis gigas*), a state-listed and federally listed species that, like waterfowl and shorebirds, has had its preferred wetland habitat greatly reduced and now uses rice fields as surrogate habitat.

Other field crops and row crops provide forage for raptors, waterfowl, and small rodents at certain times of year. For example, pasture and irrigated hayfields provide valuable foraging habitat for raptors, particularly after mowing or grazing, when rodents may be especially available for these species. In particular, alfalfa fields provide the greatest foraging opportunities for Swainson's hawk (*Buteo swainsoni*) because of the fields' high rodent densities, low profile growth pattern and cultivation management (Estep 2009). Shorebirds and gulls may also make extensive use of these habitats, particularly when flood irrigation creates areas of shallow inundation and moist, bare soil that provide foraging opportunities for these species.

Agricultural lands that undergo intense management and frequent harvests and/or lack structural diversity and sources of water tend to have a lower value as wildlife habitat. Most monocultural row crops provide relatively poor wildlife habitat because of the intensity of management and lack of structural diversity. However, raptors and other birds still frequently use row crops for foraging. Like row crops, orchards and vineyards have relatively low value for most wildlife because understory vegetation that would provide food and cover typically is removed or maintained at a low height. However, the structural integrity and insect community associated with some vineyards and older orchards attracts bat species such as western red bat (*Lasiurus blossevillii)* that forage and roost in these habitat types (Pierson et al. 2006).

On floodplains, agricultural land is often close to natural land cover and can provide habitats that complement and increase the habitat value of natural land cover. For example, several raptors (such as Swainson's hawk) nest in riparian forests and woodlands but forage in grasslands and cropland (see the Swainson's hawk plan in Appendix G, "Identification of Target Species and Focused Conservation Plans"; Placer County Planning Department 2005; Zeiner et al. 1990). In addition, resident waterfowl forage in shallow open water, seasonal wetlands, and croplands but use dense cover in marshes for resting and reproduction. In marshes, rice fields, and associated waterways and uplands, giant garter snakes disperse and forage along canals and drainage ditches, as well as along the water's edge of marshes, bask on open banks, and use uplands to hibernate and as a refuge from floodwaters (see the giant garter snake plan in Appendix G, "Identification of Target Species and Focused Conservation Plans"). On ecologically functional floodplains, agricultural land also has aquatic habitat value when the floodplain is inundated for an adequate duration during the appropriate time of year. By managing the timing and duration

of flooding, agricultural land along rivers and within bypass channels can provide rearing habitat for juvenile salmonids (Sommer et al. 2001).

The habitat value of agricultural land can be increased through wildlife-friendly practices that reduce the chance of harm and harassment of sensitive species, reduce adverse effects on adjacent natural areas, and provide additional resources for wildlife. On active floodplains, agricultural uses that allow for periodic inundation and meander migration of adjacent river channels also support the ecosystem processes that sustain channel and floodplain habitats.

Agricultural land is a target of the Conservation Strategy despite these lands having less habitat value for the Strategy's target species than natural lands, and reducing some habitat values of adjacent natural vegetation. Agricultural land is nevertheless the most extensive land use in and adjacent to the SPFC, and can provide habitat for some target species. However, because agricultural practices strongly affect habitat values and can affect the habitat values of adjacent natural vegetation, the floodplain agriculture target is included to specifically support wildlife-friendly agricultural practices that benefit the target species.

1.2.3 Targeted Species

Restoring the ecosystem processes and habitats targeted by the Conservation Strategy would result in an overall improvement in environmental quality and broad benefits to many species. However, some sensitive species that could benefit from the restoration of ecosystem processes and habitats have specialized needs that may not be met without focused conservation measures, implemented as part of flood improvement projects. Therefore, this Conservation Strategy has targeted those sensitive species that could be most affected by implementation of the CVFPP, primarily because of their strong association with river and floodplain ecosystems of the Sacramento and San Joaquin Valleys. The habitat requirements of these species have guided the development of the Conservation Strategy's objectives and of specific project proposals described in Appendix B.

Table 1-2 presents the list of targeted plant and animal species that may benefit from the restoration of ecosystem processes and habitats. To identify target and other sensitive species, preliminary lists were developed and screening criteria applied. Appendix G, "Identification of Target Species and Focused Conservation Plans," provides the preliminary plant and animal lists and documents the screening process. In brief, highly sensitive species were selected if the flood system represented a large part of their statewide range, and if flood management actions could cause significant cumulative impacts on, or potentially make significant contributions to, the species' recovery. Although focused conservation plans have been prepared only for the targeted species, existing conditions species occurrences also reflect occurrences of riverine, riparian, and wetland habitat-dependent sensitive species that were potential targets for the Conservation Strategy.

Table 1-2. Targeted Species

Common Name[1] *Scientific Name*	Status FED/CA/CRPR[2]	Conservation Planning Area[3]					Habitats
		USR	FR	LSR	USJR	LSJR	
Plants							
Delta button-celery *Eryngium racemosum*	–/E/1B.1				✓	✓	Riparian scrub (vernally mesic clay depressions in floodplains)
Slough thistle *Cirsium crassicaule*	–/–/1B.1				✓[4]	✓	Chenopod scrub, riparian scrub, and freshwater emergent marsh in sloughs
Invertebrates							
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/–/–	✓	✓	✓	✓	✓	Elderberry shrubs in riparian habitat
Fish							
California Central Valley steelhead DPS *Oncorhynchus mykiss*	T/T/–	✓	✓	✓	✓[4]	✓	Riverine, estuarine, and oceanic waters; SRA cover; inundated floodplains[5]
Chinook salmon—Central Valley fall-/late fall–run ESU *Oncorhynchus tshawytscha*	–/CSC/–	✓	✓	✓	✓[4]	✓	Riverine, estuarine, and oceanic waters; SRA cover; inundated floodplains[5]
Chinook salmon—Central Valley spring-run ESU *Oncorhynchus tshawytscha*	T/T/–	✓	✓	✓	✓[4]	✓	Riverine, estuarine, and oceanic waters; SRA cover; inundated floodplains[5]
Chinook salmon—Sacramento River winter-run ESU *Oncorhynchus tshawytscha*	E/E/–	✓		✓			Riverine, estuarine, and oceanic waters; SRA cover; inundated floodplains[5]
Green sturgeon—southern DPS *Acipenser medirostris*	T/CSC/–	✓	✓	✓		✓	Riverine, estuarine, and oceanic waters; SRA cover; inundated floodplains[5]
Reptiles							
Giant garter snake *Thamnophis gigas*	T/T/–	✓	✓	✓	✓	✓	Freshwater emergent wetlands, floodplain agricultural land (drainage canals, irrigation ditches, rice fields, and adjacent vegetation)
Birds							
Bank swallow *Riparia*	–/T/–	✓	✓	✓			Natural banks and cliffs near aquatic habitat (nesting); riparian, grasslands, wetlands, open water, and croplands (foraging)
California black rail	–/T, FP/–			✓		✓	Marsh

Table 1-2. Targeted Species

Common Name[1] *Scientific Name*	Status FED/CA/CRPR[2]	Conservation Planning Area[3]					Habitats
		USR	FR	LSR	USJR	LSJR	
Laterallus jamaicensis coturniculus							
Greater sandhill crane *Grus canadensis tabida*	–/T, FP/–	✓	✓	✓	✓	✓	Open grasslands, agricultural land (grain fields), and open wetlands; inundated floodplains, including agriculture; does not breed in SPA
Least Bell's vireo *Vireo bellii pusillus*	E/E/–	✓[4]	✓[4]	✓[4]	✓[4]	✓	Riparian, adjacent to open water
Swainson's hawk *Buteo swainsoni*	–/T/–	✓	✓	✓	✓	✓	Riparian forest, larger trees (nesting); grasslands and croplands (foraging)
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	T/E/–	✓	✓	✓[4]	✓[4]	✓[4]	Riparian, inundated floodplains
Mammals							
Riparian brush rabbit *Sylvilagus bachmani riparius*	E/E/–					✓	Riparian
Riparian (= San Joaquin Valley) woodrat *Neotoma fuscipes riparia*	E/CSC/–					✓	Riparian

Sources: California Interagency Wildlife Task Group 2008; CNPS 2013; CNDDB 2013; Shuford and Gardali 2008

Notes:

[1] DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit

[2] Status FED/CA/CRPR

Federal

E = Listed as endangered under the federal Endangered Species Act (ESA)

T = Listed as threatened under ESA

C = Candidate for listing under ESA

California

E = Listed as endangered under the California Endangered Species Act (CESA)

T = Listed as threatened under CESA

CSC = California Species of Special Concern

FP = Fully protected under the California Fish and Game Code

California Rare Plant Rank (CRPR)

1B.1 = Plants, rare, threatened, or endangered in California and elsewhere. Seriously endangered in California

[3] Conservation Planning Area

FR = Feather River Conservation Planning Area (CPA)

LSJR = Lower San Joaquin River CPA

LSR = Lower Sacramento River CPA

USJR = Upper San Joaquin River CPA

USR = Upper Sacramento River CPA

[4] Potential distribution based on historical distribution or poorly known

[5] Inundated floodplain includes both natural and agricultural land covers.

1.2.4 Targeted Stressors

The targeted stressors in this Conservation Strategy are limited to those more closely related to flood risk management actions: erosion-resistant materials, generally referred to as revetment (used to reinforce and protect streambanks and levees and flood system encroachments, such as bridges, roads, docks and utility lines); narrowly confining levees, weirs and other structures that are barriers to fish passage; and invasive plants. The role of flood risk management actions or facilities in contributing to these stressors on ecosystem processes, habitats, and species are described in the following sections.

Revetment

River channel migration results in bank retreat in some areas and the creation of new lands elsewhere. Bank retreat can cause conflicts with adjacent land uses and infrastructure, particularly levees. Efforts to protect against bank retreat often involve lining the riverbank with revetment, which consists of large rocks that protect banks from erosion. Revetment is also commonly used to protect other structures near or adjacent to waterways.Where located within a river's natural meander zone, revetment reduces channel meander migration and thus the complexity of aquatic and riparian ecosystems (Lytle and Poff 2004; Naiman et al. 1993). In portions of the SPA, as in many places throughout the world, revetment and levees isolate most of this natural meander zone from river channels and thus have virtually halted natural river processes, such as river channel meander migration and meander cutoffs.

Installation of revetment has substantially reduced streamside wetlands, SRA cover, and LWM production (USFWS 2004). Revetment has also reduced habitat for several rare plant species that depend on open areas along the banks of the lower Sacramento and San Joaquin Rivers and along channels in the Delta. Among the species affected are delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), delta mudwort (*Limosella subulata*), Mason's lilaeopsis (*Lilaeopsis masonii*), woolly rose-mallow (*Hibiscus lasiocarpos* var. *occidentalis*), and Suisun marsh aster (*Symphyotrichum lentum*). Furthermore, the placement of revetment has precluded the use of the current habitat and the potential formation of new habitat (e.g., cut banks via channel migration, additional recruited trees) for many species of fish and wildlife, including threatened and endangered species such as Chinook salmon and bank swallow (USFWS 2004). However, riparian trees and shrubs can often be successfully planted in revetment, which can shade and add LWM to the nearshore environment.

Levees

Construction, operation, and maintenance of facilities to reduce flooding have contributed to the loss and alteration of the ecosystem processes and habitats of floodplains. Over 1,600 miles of levees, often protected by revetment, have been constructed as part of the SPFC (DWR 2010a). Many of these levees were located in close proximity to river channels to facilitate the flushing of hydraulic mining debris, to take advantage of the higher ground provided by natural river levees, and to maximize use of floodplain lands for agriculture and development. These levees have saved lives and protected property from floods, but have also isolated historic floodplains from natural geomorphic processes and inundation.

Channels that, over time, would naturally migrate laterally as a result of fluvial erosion and sediment deposition (see "Riverine Geomorphic Processes," above) have been constrained by revetment-protected levees within the meander zone. Such narrowly confining levees substantially impair riverine geomorphic processes.

Such confining levees, because they are subjected to strong erosive currents, are in chronic need of maintenance. Because more than 90 percent of SPFC levees along the Sacramento and San Joaquin Rivers and their major tributaries are within channel meander zones, the historical placement of levees in close proximity to river channels has created major conservation and maintenance issues.

For the Sacramento and San Joaquin Rivers and major tributaries, the floodplain that remains connected to rivers is often confined to levee slopes and a narrow waterside strip along the levee. Within this narrow band, levee maintenance activities affect habitats, simplifying their structure and reducing their diversity. These activities include removing downed and dying trees, trimming the lower limbs of large trees, and removing shrubs and small trees.

In confining flood flows, levees also alter the width, depth, gradient, and velocity of flows that without levees would spread out on the floodplain. Levees tend to increase the sediment-carrying capacity of the stream, which leads to deepening and widening of the channel. These channel alterations tend to reduce the habitat values of channels and floodplains (e.g., by reducing the frequency of floodplain inundation).

Fish Passage Barriers

Fish passage barriers are water management structures, such as dams, weirs, control structures, and water diversions, that block, delay, strand, or adversely influence anadromous fish as they migrate upstream or downstream. These structures can be total, temporal, or partial barriers depending on physical characteristics (e.g., height, hydraulic conditions affecting water depth and velocity, attraction flow, and physical deterioration), operation (e.g., diversion rate and timing and flashboard or gate operations), and relation to species' biological characteristics (e.g., mode of locomotion, species type, size, physical abilities, and fitness condition). Total barriers block all fish migration. Temporal and partial barriers may block fish passage for a certain life stage or only under certain flow conditions. See Appendix K, "Synthesis of Fish Passage Improvement Opportunities in the Central Valley Flood System" for a full discussion of fish passage barriers.

Passage barriers are a stressor to anadromous and other native fish species that use the Sacramento and San Joaquin River systems. These fish include the four runs of Chinook salmon in the Central Valley, Central Valley steelhead, the southern Distinct Population Segment (DPS) of green sturgeon, and Pacific lamprey (Appendix K) (DWR 2005; Lindley et al. 2006; TNC 2007). Fish migration is an inherent part of a fish's life history, from young life stages (e.g., juvenile fish) to mature adult fish. Fish migrate in search of food, to avoid predators, to avoid lethal environmental conditions, and to find refuge and suitable habitat for reproduction. Fish migrate upstream, downstream, and laterally into river floodplains. Fish passage barriers have greatly reduced the quality and quantity of available habitat and the amount of time in which

available habitat can be accessed. Barriers can also create lethal or sublethal conditions that affect survival and spawning success. The effects of passage barriers on salmonids differ by species and race, as described below.

Most races and species of salmonids have been adversely affected by the construction of dams and similar passage barriers, as have other native fish species. However, spring-run Chinook salmon and steelhead have likely been the most seriously affected, in terms of direct habitat loss, by the construction of passage barriers. These fish historically spawned in tributaries of the Sacramento and San Joaquin Rivers in the Sierra Nevada and Cascade Range. The vast majority of historical spring-run Chinook salmon habitat in the Sacramento River and all historical spring-run habitat in the San Joaquin River is now blocked by passage barriers, collectively reducing spring-run spawning and rearing habitat by 80 to 90 percent (DWR 2005).The only viable, naturally reproducing populations of spring-run Chinook salmon are found in Deer, Mill, and Butte Creeks (NMFS 2009). Steelhead spawning habitat loss from construction of passage barriers has been estimated at 80 percent (Lindley et al. 2006). The construction of passage barriers has also been a stressor on winter-run Chinook salmon and, to a lesser extent, fall- and late fall–run Chinook salmon (TNC 2007).

Spring-run Chinook salmon have also been subject to hybridization because their habitat overlaps with that of fall-run fish below passage barriers. Historically, the two races would have been both seasonally and spatially segregated, with spring-run fish spawning farther into the mountains and fall-run fish spawning on the valley floor and lower foothills. With construction of Shasta Dam and other passage barriers on the major rivers of the Sacramento and San Joaquin Valleys, the two races now use the same segments of these rivers for spawning. The larger, more vigorous fall-run fish typically outcompete spring-run fish for redd sites or construct their redds on top of spring-run redds, and extensive hybridization between fall-run and spring-run fish has been detrimental to the gene pool of the spring-run fish (Yoshiyama et al. 1998).

Spawning and rearing habitat for wild steelhead exists in Mill and Deer Creeks, tributaries of the Sacramento River, and the Yuba River (Moyle 2002). Incidental occurrences of steelhead have also been recorded in Cow, Battle, Clear, and Cottonwood Creeks. Opportunities exist for restoration in these creeks, as well as in Big Chico, Antelope, and Butte Creeks and the Yuba River. The distribution in the San Joaquin River system is limited to a small sport fishery in the Tuolumne River (DWR 2005). Steelhead are found in other parts of the Sacramento River watershed, but the presence of hatchery fish makes identifying the origin of the fish difficult (Moyle 2002).

In addition, unlike Chinook salmon juveniles, which spend up to several months in their natal rivers before migrating to the ocean and forming schools, juvenile steelhead spend up to 3 years in their natal streams and vigorously defend their territories from other juvenile steelhead. Historically, juveniles hatched in tributaries above present-day reservoirs could disperse throughout their natal streams in search of suitable and available rearing habitat. With construction of dams, available rearing habitat has been greatly reduced, and temperatures in some areas are too high for rearing. Competition for rearing habitat has been tied to numerous adverse effects on individual fish and steelhead populations (Keeley 2001), and competition for

suitable sites among 1- and 2-year-old fish is now likely to be at least as limiting on steelhead populations as the lack of spawning habitat (TNC 2007).

Adult winter-run Chinook salmon migrate into the Sacramento River during winter and spring. Historically, these fish held for several months in deeper pools to reach sexual maturity and then spawned during summer in cool-water reaches of streams in the upper watershed of the Sacramento River (e.g., McCloud River, Pit River, upper Sacramento River) and Battle Creek (Yoshiyama et al. 1998). Construction of Shasta Dam has almost completely eliminated historical holding and spawning grounds for winter-run fish.

Although historical spawning areas have been eliminated, winter-run Chinook salmon have adapted to holding and spawning in cool-water releases from Shasta Dam on the upper portion of the lower Sacramento River. Under current conditions, the total amount of suitable spawning habitat for winter-run fish may be equal to or greater than the amount of spawning habitat that was historically available (TNC 2007). However, loss of access to historical cold-water spawning habitat remains a major threat, because Keswick and Shasta Dams completely restrict the naturally spawning population to the mainstem Sacramento River downstream of the two dams, where cold-water releases from the reservoir behind Shasta Dam are managed specifically to create favorable temperatures for spawning and rearing in the reach between Keswick Dam and the Red Bluff Diversion Dam (NMFS 2011). The majority of spawning occurs in the upper 14 miles, from Keswick Dam to the Redding Water Treatment Plant (NMFS 2009a). However, the dam is degrading spawning habitat over time by causing bed coarsening, and has degraded juvenile rearing habitat by reducing floodplains and altering the timing and magnitude of flood peaks (NMFS 2009a; Stillwater Sciences 2007).

Relative to other salmonids, fall- and late fall–run fish historically spawned much lower in the Sacramento and San Joaquin Rivers, generally at elevations below 500–1,000 feet, as far south as the Kings River and as far north as the upper Sacramento, McCloud, and Pit Rivers (DWR 2005; Yoshiyama et al. 2000). Because of their larger size, fall- and late fall–run Chinook are capable of spawning in a wider range of gravel sizes. Therefore, although their historical spawning ranges have likely been reduced, the relative amount of habitat reduction caused by construction of passage barriers is likely less than for other salmonids, particularly steelhead and spring-run Chinook salmon. The current distribution of fall- and late fall–run Chinook salmon on the Sacramento River encompasses all historic habitats on lower foothill and Central Valley streams, and spawning occurs upstream as far as Keswick Dam. On the San Joaquin River, distribution reaches up to the Merced River.

Invasive Plants

Nationally, invasive species are the second greatest threat to endangered species, after habitat destruction (Cal-IPC 2011a). As of 2014, at least 68 plant species considered to be invasive by the Cal-IPC potentially occur within upland, riparian, wetland, and open water habitats in the Sacramento and San Joaquin Valleys (Cal-IPC 2014). These species degrade riverine and floodplain habitats by altering ecosystem processes and displacing native plants. In addition, some of these invasive species are stressors on the operation and maintenance of the SPFC, and invasive plant treatment actions would result in multiple benefits.

Invasive species can alter hydrology and sedimentation rates in riparian and aquatic systems (Cal-IPC 2011a), and can degrade flood system effectiveness. Recent studies have shown such invasive species to have relative effects on channel hydraulics that are greater than those of the native species adapted to the same areas (Stone et al. 2013). In addition, some of these invasive species are stressors on the operation and maintenance of the SPFC. Dense stands of invasive species can alter channel morphology by retaining sediments and increasing the hydraulic roughness of the channel, which restricts flows and reduces flood conveyance (Bossard et al. 2000). For example, saltcedar (*Tamarix* spp.) traps and stabilizes alluvial sediments, which results in the narrowing of stream channels and more frequent flooding (Bossard et al. 2000). Species with shallow root systems, such as giant reed (*Arundo donax*) and red sesbania (*Sesbania punicea*), promote bank undercutting, collapse, and erosion (Bossard et al. 2000; Cal-IPC 2011b). Invasive terrestrial plants can also reduce groundwater availability by transpiring large amounts of water, making less water available for native riparian vegetation (Bossard et al. 2000).

Invasive plants can also reduce the integrity of native riparian plant communities by outcompeting native plant species, reducing habitat quality and food supply for wildlife, and interfering with wildlife management (Bossard et al. 2000; Cal-IPC 2011a). Aquatic invasive plants can degrade aquatic habitat by reducing areas of open water used by waterfowl for resting, shading out algae in the water column that serve as the basis of the aquatic food web, and displacing native aquatic plants used for food or shelter by wildlife species (Bossard et al. 2000). Invasive aquatic plants often form dense mats that kill fish by lowering pH, dissolved oxygen, and light levels and increasing carbon dioxide and turbidity (Bossard et al. 2000).

An Invasive Plant Management Plan was developed as part of the Conservation Strategy (Appendix E). This plan provides the framework for a regional, coordinated approach to managing invasive plants. The Invasive Plant Management Plan categorizes 31 invasive species with potential to occur within the SPA based on their distribution; their relationship to Conservation Strategy targeted ecosystem processes, habitats, and species; and their potential to adversely affect SPFC operations and maintenance activities. Of the 13 Primary Invasive Plant Species and 18 Secondary Invasive Plant Species, four are identified as initial priority species for control: giant reed (*Arundo donax*), Himalayan blackberry (*Rubus armeniacus*), red sesbania (*Sesbania punicea*), and saltcedar (*Tamarix* sp.). Objectives for these species have been established in the Conservation Strategy.

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2.0 Methods

This section identifies the data sources used to describe existing conditions and the methods used to analyze and compile information from these sources. GIS data layers were the primary data sources used to describe targeted ecosystem processes, habitats, species, and stressors. The text of Sections 3.0 to 7.0, "Summary of Existing Conditions," present a general description of the landscape units in each CPA. Data sources for these characterizations also included GIS data layers and publications—in particular, the following sources:

- Status and Trends of the Riparian and Riverine Ecosystems of the Systemwide Planning Area (DWR 2012a)
- State Plan of Flood Control Descriptive Document (DWR 2010a)
- Senate Bill 1086 Sacramento River Conservation Area Forum Handbook (SRAC 2003)
- Draft Program Environmental Impact Statement/Environmental Impact Report: San Joaquin River Restoration Program (USBR 2011)
- GIS data layers with the locations of major infrastructure and protected areas (Caltrans 2008, 2010; DWR 2008, 2012b, 2012e; California Department of Conservation 2010; Cal/EPA 2010; California Energy Commission 2011; GIN 2010; U.S. Census Bureau 2007; USGS 2012; USFS 2012)
- California Natural Diversity Database (CNDDB 2013)

2.1 Targeted Processes

2.1.1 Floodplain Inundation

Data regarding floodplain inundation were derived from the Floodplain Restoration Opportunity Analysis (FROA), an attachment to the 2012 CVFPP (DWR 2012b). The FROA evaluated and mapped FIP for corridors along the Sacramento and San Joaquin Rivers and the lower reaches of their major tributaries. These corridors correspond to the major river reaches of this appendix.

The FIP analysis adapted concepts from the USACE-HEC (USACE-HEC 2009), the frequently activated floodplain concept of Williams et al. (2009), and the Height Above River GIS tool of Dilts et al. (2010). The FIP analysis identified floodplain areas that could be inundated by particular flood flows—both areas directly connected to the river and areas disconnected from the river by natural or built levees or other flow obstructions.

The FROA mapped areas potentially inundated by four types of flows:

- Baseflows
- 67-percent-chance events
- 50-percent-chance peak flows
- 10-percent-chance peak flows

FIP was mapped based on the elevation of areas relative to these flows. Areas with a baseflow FIP are below or within 1 foot above the March 2008 water surface elevations used to determine areas that could be inundated during low-flow conditions. (The process used in the FROA to estimate water surface elevations resulted in elevations that varied within 1 foot of true elevations.) Areas with a 67-percent-chance sustained-spring FIP are those areas above baseflow elevations but no more than 1 foot above the water surface of a 67-percent-chance spring flow that is sustained for at least 7 days and occurs in 2 out of 3 years. Areas with a 50-percent-chance FIP are those areas more than 1 foot above the surface of the 67-percent-chance spring flow but at a lower elevation than the 50-percent-chance peak flows. Similarly, areas with a 10-percent-chance FIP are located 1 foot or more above the 50-percent-chance water surface but below the water surface of the 10-percent-chance peak flows. Figure 2-1 illustrates the relationship between these different water surfaces and the elevation zones corresponding to areas with a different FIP.

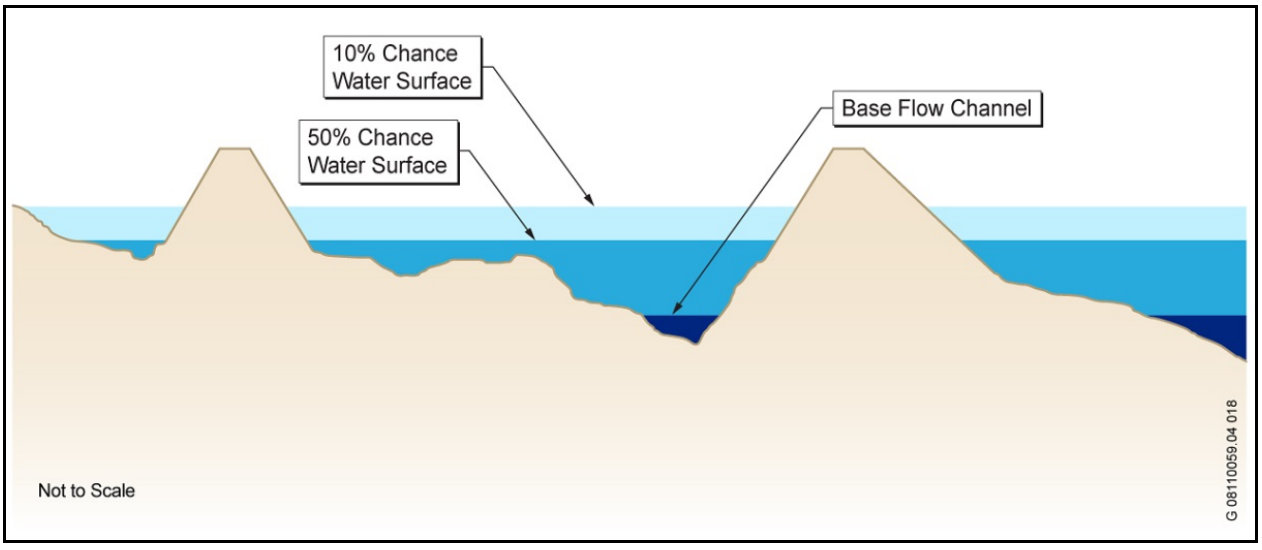

Figure 2-1. Hypothetical Cross-Section with Boundary Water Surfaces of FIP Categories

In the text and tables of Sections 3.0 to 7.0, "Summary of Existing Conditions," by CPA the acreage in these zones of FIP is identified for the major river reaches and primary tributaries covered by the FROA. Areas connected and disconnected from the river system during a 10-percent-chance event are tabulated separately.

2.1.2 Riverine Geomorphic Processes

For this appendix, the natural meander zone and the existing meander zone are described for major river reaches. The difference between the natural (potential) meander zone and existing meander zone represents the area of river meander potential that has been lost following the introduction of engineered, permanent features, such as levees, bank revetment, structures, and roads.

For major river reaches, a GIS file representing the natural meander zone was developed by buffering the river centerline with a reach-specific width. These widths were determined based on guidance presented in a technical memorandum prepared for DWR by AECOM (AECOM 2013). That memorandum identified meander zone widths for most major river reaches. It did not identify the width of a natural meander zone for the lowermost reaches of the Sacramento River in the Delta, where the concept may no longer be applicable because of the substantial physical changes to this subsided landscape.

From the GIS file of the natural meander zone, a GIS file of the existing meander zone was created by removing areas where channel migration is constrained by resistant geology or human-made structures. To identify geologic and human-made constraints to channel migration, geology data for the Sacramento River basin (DWR 2013a) were combined with geology data for the San Joaquin River basin (DWR 2011a). Where gaps in coverage were identified, information was digitized using the California regional geologic map series (CGS 2013). Resistant formations were overlain with meander zone polygons to identify areas of geologic constraint. Areas previously identified as being behind levees or other human-made structures were also overlain to incorporate areas of human-made constraint (see Sections 2.3.1 and 2.3.2 below). The final GIS file depicting river constraints was used to calculate acreages of landcover connected and disconnected from the floodplain in conjunction with FIP.

In the text and tables of Sections 3.0 to 7.0, “Summary of Existing Conditions,” by CPA, the width of the meander zone and the portions of that zone where channel meander is restricted and unrestricted are identified for major river reaches.

2.2 Targeted Habitats

2.2.1 Land Cover

Land cover data were derived from the map developed for the CVRMP (DWR 2011b). The CVRMP map is a medium-scale vegetation map developed in 2010 and 2011, using 2009 National Agricultural Imagery Program (NAIP) imagery. It was developed to provide baseline vegetation data for the systemwide and regional planning efforts of the CVFPP. This data layer has 1-acre minimum mapping unit (MMU) in wetland and riparian areas, and a 10-acre MMU for all other land cover types. Polygons were delineated on top of 2009 NAIP photographs and assigned to a category in a classification used by the California Department of Fish and Wildlife (CDFW) Vegetation Classification and Mapping Program and the National Vegetation Classification System. This method is less accurate (and substantially less expensive) than

professional surveying, but the accuracy is sufficient for regional planning. At a sample of locations, the vegetation types were verified in the field in an accuracy assessment procedure.

Land cover types in the CVRMP data map were grouped into a smaller number of categories. Table 2-1 shows a crosswalk between the CVRMP classifications and those used in the results section of this appendix. This smaller set of classifications corresponds more closely to those referenced in the Conservation Framework (DWR 2012d) and subsequently in development of the Conservation Strategy for the 2017 CVFPP.

In the text and tables of Section 3.0 to Section 7.0, "Summary of Existing Conditions" by CPA, the acreages of land cover types are tabulated for major river reaches and the other landscape units of each CPA. For areas along major river reaches, these acreages are also tabulated for areas in the active floodplain and in potential meander zones. In some instances there is overlap between landscape units, primarily where major river reaches overlap with bypasses. Acreages are represented in the major river reaches and not as part of the bypasses.

2.2.2 SRA Cover

For the Upper Sacramento River Feather River, and Lower San Joaquin River CPAs, descriptions of SRA cover were based on 2014 river bank inventory data (DWR 2014a). In the Feather River CPA, these data were not available for the Bear River, Dry Creek, and Union Pacific Interceptor. In the Lower Sacramento River CPA, descriptions of SRA cover were based on data provided in the *2007 Bank Revetment Inventory: Sacramento River Bank Protection Project* (USACE 2007).

For the Upper San Joaquin River CPA, field-based inventory of SRA cover is unavailable. Consequently, the distribution of revetment and riparian vegetation was used to indicate the extent of SRA cover. Areas of open water were identified along major rivers and tributaries in the model reaches using land cover data derived from a map developed for the Central Valley Riparian Mapping Project (CVRMP) (described in Section 2.2.2). Where gaps mapped as open water occurred, FIP baseflow was used as a surrogate. This approach was necessary in only a few places, particularly in the Upper San Joaquin River CPA. These channel polygons were merged and converted to linear features to best represent riverbanks in the absence of sufficient data. A spatial analysis was then performed, taking the linear riverbank features and overlaying those with riparian vegetation polygons, thereby attributing segments adjacent to riparian as riverbanks with SRA. Areas of revetment identified in the Conservation Strategy (DWR 2012c) were then overlain to attribute those bank features with revetment status.

In the text and tables of Section 3.0 to 7.0, "Summary of Existing Conditions" by CPA, SRA cover is summarized for the banks of major river reaches, primary tributaries, and distributaries of the Sacramento and San Joaquin Rivers where SRA occurs (USFWS 1992). Estimates of the number of miles of bank with different components of SRA cover are provided (e.g., natural bank, riparian vegetation).

Table 2-1. Crosswalk of Existing Conditions and CVRMP Land Cover Classifications

Summary Classifications	CVRMP Classifications
Marsh (tidal and nontidal)[a]	Tidal Salt and Brackish Meadow Southwestern Salt Basin Wetland Temperate Marsh Freshwater Emergent Saline Emergent Wetland
Seasonal Wetland	Naturalized Riparian Wetlands Vernal Pool Basin
Riparian Forest	Riparian Woodland Forest Restoration Site Temporarily Flooded Deciduous Forests Vancouverian Riparian Forest Western Deciduous Forest
Riparian Scrub	Coast-Like Scrubs Riparian Introduced Scrub Riparian Wash Scrub Temporarily Flooded Deciduous Shrublands
Other Natural	Annual Introduced Grassland California Native Forb Grassland California Broadleaf Forest and Woodland Western Dogwood Thicket Introduced North American Mediterranean Woodland and Forest Bare Gravel and Sand
Rice	Rice
Cropland and Pasture	Alfalfa Field Crops Grain and Hay Crops Irrigated Pasture Other Cultivated Crops Pasture Tilled Lands Truck, Nursery & Berry Crops
Orchard and Vineyard	Deciduous Orchards Evergreen Orchards Vineyards
Other Agricultural	Idle/Fallow Semiagricultural
Water	Water
Developed	Urban
Not Mapped	No Data

Sources: DWR 2010b, 2011b

Note: [a] Marsh types are further divided into tidal and nontidal categories based on Delta compilation vegetation.

2.2.3 Riparian

The percent composition of riparian habitat within each landscape unit was calculated. In addition, a characterization of the connectivity and relative abundance of the riparian habitat was provided. The median patch size of riparian habitat per landscape unit was calculated. Median patch size was calculated to include any riparian polygon intersecting with the landscape unit (i.e. if only 2 acres of a 20 acre riparian patch intersected with the landscape unit, the median calculation included the 20 acre polygon).

2.2.4 Marsh or Other Wetland Habitat

The composition of wetland habitat, by type, within each landscape unit was calculated based on the land cover (Section 2.2.1). The size range of wetlands that intersect the landscape unit was identified. Similar to riparian median patch size calculations, although only a portion of the wetland may intersect the landscape unit, the wetland sizes represented are the acreages of the complete polygon.

2.2.5 Targeted and Other Sensitive Species

For terrestrial target and other sensitive species, the California Natural Diversity Database (CNDDB) (Version 5) (CNDDB 2013) was used to depict species distribution. Although more detailed data are available for some species in some parts of the state, the CNDDB provides data that are consistently compiled for a large number of sensitive species throughout the Sacramento and San Joaquin Valleys. The CNDDB was reviewed for occurrence records of target species and other sensitive species.

For aquatic target and other sensitive species, the current distribution was analyzed using the Chinook and Steelhead Distribution GIS (NOAA Fisheries 2005). This dataset was compiled by the National Marine Fisheries Service Southwest Regional Office in an effort to designate critical habitat for Chinook salmon and steelhead in the Sacramento and San Joaquin Valleys. The data represent an approximation of Chinook salmon and steelhead occupancy in the region. Critical habitat (USFWS 2013) described for green sturgeon and delta smelt was also evaluated.

The text of Sections 3.0 to 7.0, “Summary of Existing Conditions” by CPA, lists the sensitive species documented along each major river reach and other landscape units for each CPA. Species occurrences described include both the target and other sensitive species and occurrences of riverine, riparian, and wetland habitat dependent sensitive species (“other sensitive species”) that were potential targets for the Conservation Strategy.

Species were included in these lists if they occurred within the footprint of the landscape unit described. Critical habitat in landscape units was also described.

2.3 Targeted Stressors

2.3.1 Levees

As described in Section 1.2.1 above, the location of major infrastructure, including levees, are important considerations for current and future conservation and restoration planning. Levees in close proximity to river channels can considerably impact natural geomorphic processes, and in turn the supported habitats and species. The condition of levees presented in this Appendix is provided as a consideration for the prioritization of future potential restoration sites.

The location and attributes of SPFC levees were derived from the Urban and Non-Urban Levee Evaluations (DWR 2014b). Non-project levees were derived from the California Levee Database (DWR 2012e). The distance of the levee from the riverbank was calculated using GIS and the centerline of the river. The riverbanks were not delineated using GIS. The condition of the SPFC levees was described based on the levee condition information provided by DWR (2012e), and as shown in the Flood Control System Status Report (FCSSR) (DWR 2011c). In the FCSSR, levee condition was classified based on several factors. Urban levees were evaluated based on USACE and DWR design criteria for four failure modes (freeboard, levee geometry, steady state seepage, steady state stability). Non-urban levees were classified using four geotechnical failure modes (under-seepage, through-seepage, slope stability, and erosion) based on the potential for levee failure at the assessment water surface elevation. Different approaches were applied based on the availability of data for each of the levee types. For the purposes of this Appendix, these classifications were simplified into corresponding level of concern as high, medium, or low (see Table 2-2).

Table 2-2. Crosswalk of Levee Condition Classification

Summary Classifications	Urban Levee Classification	Non-urban Levee Classification
High	Does not meet criteria	High
Medium	Marginal	Moderate
Low	Meets criteria	Low
Lacking sufficient data	Lacking sufficient data	Lacking sufficient data

Sources: DWR 2012e and 2011c

In Sections 3.0 to 7.0, “Summary of Existing Conditions” by CPA, the length of project (i.e., SPFC) and nonproject levees, the approximate distance between the levees and the riverbank, and the levee condition classification is summarized for each major river reach and other landscape units.

2.3.2 Revetment

Along the major river reaches of the Upper Sacramento, and Feather Rivers the extent of revetted banks was determined based on 2014 river bank inventory data (DWR 2014a). For major river reaches along the Lower Sacramento River and other areas in the Upper Sacramento River

Lower Sacramento River, and Feather River CPAs (e.g., tributaries and bypasses), the extent of revetted banks was determined based on the *2007 Bank Revetment Inventory Sacramento River Bank Protection Project* (USACE 2007) and additional revetment and riprap information provided by DWR (2012c).

Along major river reaches of the Lower San Joaquin River from the Tuolumne River to Stockton, the extent of revetted banks was determined based on 2014 river bank inventory data (DWR 2014a).For the remaining areas in the Lower San Joaquin CPA (i.e. tributaries), and all of the Upper San Joaquin River CPA, the extent of revetment areas was determined using revetment and riprap data layers for the San Joaquin River, its major tributaries, and associated bypasses (DWR 2012c). This inventory of revetment represents different levels of accuracy compiled by DWR but is the best representation of revetment along the San Joaquin River model reaches.

In Sections 3.0 to 7.0, "Summary of Existing Conditions " by CPA, the length of revetment is summarized for each major river reach and other landscape units.

2.3.3 Fish Passage

Information regarding fish passage barriers was taken from Appendix K, "Synthesis of Fish Migration Improvement Opportunities in the Central Valley Flood System." For major river reaches and other landscape units, these barriers are described in Sections 3.0 through 6.0. Fish passage barriers in the Sacramento River Basin have been prioritized for removal by DWR using a score and rank method to define a structure's impact on fish migration and the potential benefit of remediation to those species. Barriers are identified as being either priority (Priority 1 or 2) or nonpriority barriers in Sections 3.0 through 5.0. Fish passage barriers in the San Joaquin River Basin were only identified for the Upper San Joaquin River CPA due to the limited available data related to fish movement, distribution, and migration impediments (see Appendix K). Barrier prioritization for the Upper San Joaquin River barriers is currently under development by the San Joaquin River Restoration Program, and is therefore not available for inclusion at this time. Also, gravel and aggregate mines in each major river reach were identified (DWR 2012f).

2.3.4 Invasive Plants

To characterize the distribution of targeted invasive plants in each CPA, the following data sources, which depict the spatial extent of each species, were compiled:

- CVRMP vegetation mapping described in Section 2.2.2, "Land Cover," prepared to support development of the Conservation Strategy (DWR 2012g)

- Maps depicting the extent of red sesbania and giant reed in the Central Valley obtained from the California Department of Fish and Game (now CDFW) (CDFG 2008)

- Maps from the California Invasive Plant Council (Cal-IPC) depicting the distribution of invasive plants (Cal-IPC 2013)

Because these maps were prepared for different purposes using varied data sources and mapping techniques, the species of invasive plants captured by each map and the spatial resolution with which invasive plants are mapped vary among them as follows:

- CVRMP vegetation mapping captures selected invasive species that were readily visible on aerial photography. Discrete infestations of the following species were mapped as polygons: giant reed, perennial pepperweed (*Lepidium latofolium*), Himalayan blackberry, red sesbania, and saltcedar (*Tamarix ramosissima*).

- CDFW mapping captures infestations of giant reed and red sesbania based on extensive field mapping and aerial photography interpretation. Discrete infestations were mapped as polygons, lines, or points.

- Cal-IPC mapping depicts the amount of infested area, rate of spread, and extent of treatment efforts in individual 7.5-minute U.S. Geological Survey (USGS) quadrangles based on a variety of spatially explicit data sources combined with expert opinion. Discrete infestations were not mapped; data were aggregated into single values for each USGS quadrangle.

From these three data sources, GIS was used either to calculate the acreage of infestation in each CPA for the four priority species mapped as polygons or to qualitatively assess the extent of each species' distribution (using data provided by Cal-IPC). Cal-IPC data were aggregated and analyzed in GIS to determine the abundance (ranked as high, medium, or low) of each species in each quadrangle and throughout the CPA.

Invasive plant distribution data are summarized in Sections 3.0 to 7.0, "Summary of Existing Conditions" by CPA. Although these data likely underrepresent the true distribution and abundance of invasive plants, they provide a relative indicator of the degree of invasion for each CPA and the landscape units in them.

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3.0 Summary of Existing Conditions for the Upper Sacramento River Conservation Planning Area

From Red Bluff to Colusa, the Sacramento River is a broadly meandering river bordered by natural levees of deposited sediment, beyond which lowland basins cover much of the valley floor. The basins in the Sacramento Valley are lower in elevation than the floodplains directly along the river. Historically, the river flowed through openings in the natural levees during overbank events (James and Singer 2008). Currently, the Butte Basin is connected to the Sutter Bypass, which conveys flow from the Sacramento River to the bypass's junction with the Feather River. Downstream, the Feather River joins the Sacramento River.

Figure 3-1 shows the Upper Sacramento River CPA. The predominant facilities of the SPFC in the Upper Sacramento River CPA, in addition to the Moulton, Colusa, and Tisdale Weirs and Sutter Bypass, are the levees along the river and associated revetment. Downstream from Colusa, these levees are often less than 0.25 mile apart, preventing the river from using the entire meander zone.

Riverine and floodplain ecosystems have been substantially altered in the Upper Sacramento River CPA (although less so than in other CPAs). For example, along the upper Sacramento River, approximately two-thirds of the floodplain potentially inundated by a 50-percent-chance event (2-year recurrence interval) is disconnected from the river, primarily by levees. Also, the rearing habitat for Chinook salmon provided by inundated floodplains has been reduced by approximately 96 percent (see Appendix H). Similarly, the potential area across which the channel could meander (i.e., the meander potential) has been reduced to roughly one-half of the meander potential under unconstrained conditions.

There is, however, a large difference in the floodplain's connectivity and the channel's potential to meander upstream and downstream from Colusa. Upstream from Colusa, approximately 45 percent of the floodplain with a 50-percent-chance FIP is disconnected from the Sacramento River; downstream from Colusa, over 80 percent is disconnected. Similarly, meander potential is 76 percent upstream from Colusa, but only 23 percent downstream from Colusa.

The extent of riparian and marsh habitats on floodplains has been substantially reduced in the Upper Sacramento River CPA. Riparian vegetation occupies only a small portion of floodplains that historically were predominantly covered by riparian vegetation. Along the upper Sacramento River, riparian vegetation accounts for nearly 15 percent of land cover within 1 mile of the river and for one-third of the active (10-year) floodplain. Natural banks with riparian vegetation still account for one-third of the channel bank.

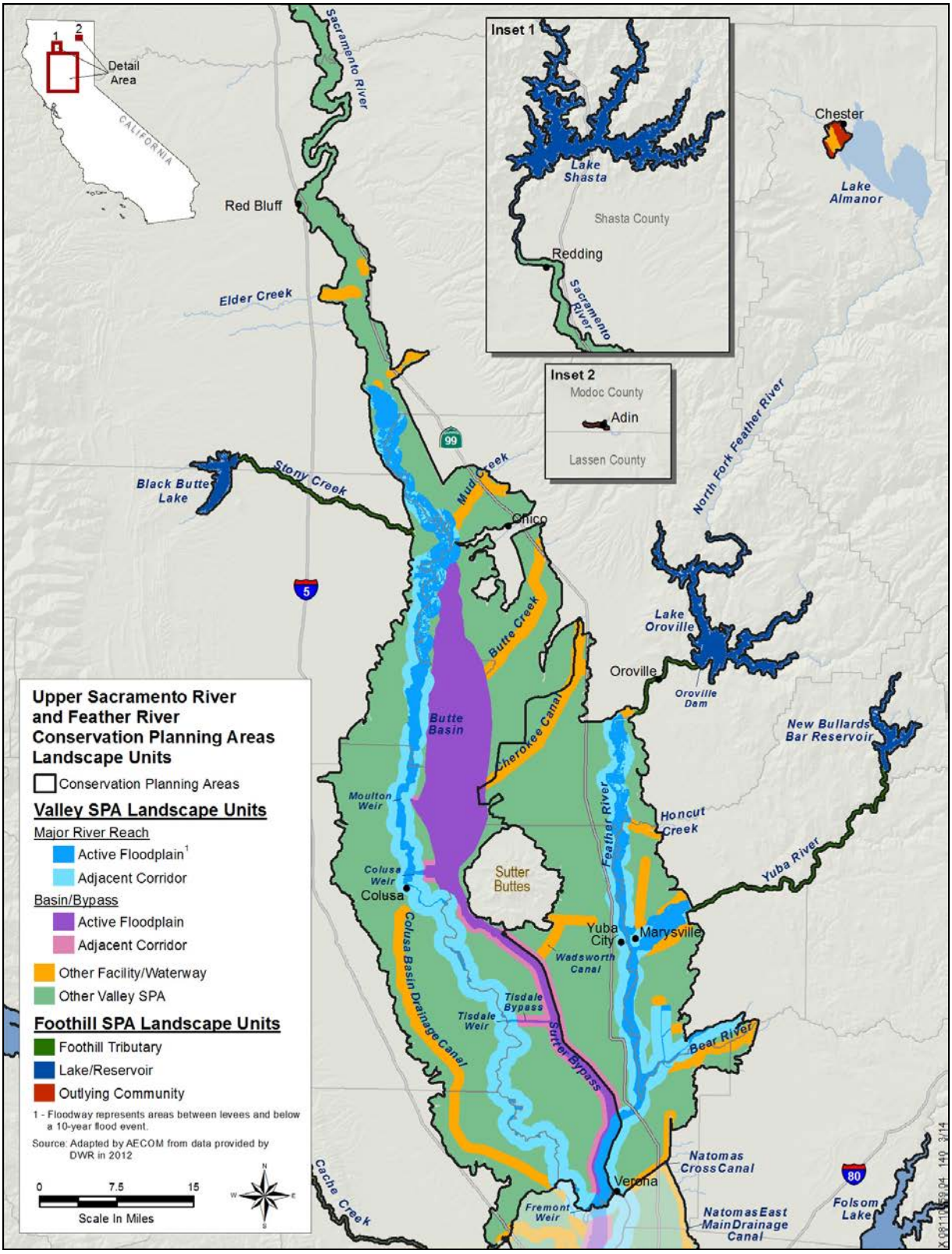

Figure 3-1. Upper Sacramento and Feather River Conservation Planning Areas

Marsh and other wetlands were the predominant habitat of flood basins historically. Most wetlands were drained and converted to other land covers, primarily for agricultural use. Marshes and other wetlands now occupy less than 1 percent of land within 1 mile of the upper Sacramento River and approximately 1 percent of the active (10-year) floodplain. Within lands in the Butte Slough, Butte Basin, and the Sutter Bypass, marsh and other wetlands represent approximately 23 percent of the landcover.

These alterations of ecosystem processes and habitats have contributed to the population declines of 11 species that are targets of this Conservation Strategy (not including those known only from historic records or whose distribution in this CPA is poorly documented) (CDFG 2005 and DWR 2011c):

- Valley elderberry longhorn beetle (VELB)
- Steelhead, California Central Valley distinct population segment (DPS)
- Chinook salmon, Central Valley fall-/late fall–run evolutionarily significant unit (ESU)
- Chinook salmon, Central Valley spring-run ESU
- Chinook salmon, Sacramento River winter-run ESU
- Green sturgeon, Southern DPS
- Giant garter snake
- Bank swallow
- Greater sandhill crane
- Swainson's hawk
- Western yellow-billed cuckoo

To recover these and other species, multiple conservation plans include objectives and actions calling for the restoration of ecosystem processes and habitats in the Upper Sacramento River CPA. These objectives include establishment of more continuous corridors of riparian vegetation and SRA cover along the upper Sacramento River, creating a river meander zone upstream from Colusa, and improving fish passage (CDFG 1992; NMFS 2014; SRAC 2003; CVJV 2006; BANS-TAC 2013).

Furthermore, to support the Anadromous Fish Restoration Program's (AFRP) "doubling goal" for Chinook salmon, more than 20,000 acres of additional rearing habitat on inundated floodplains are required (see Appendix H). Public agencies (including DWR) and nonprofit organizations have been investing substantially in restoration actions to attain these objectives,

particularly north of Colusa. This restoration has made a substantial contribution toward overall conservation needs for aquatic and riparian habitats in this CPA.

However, substantial SPFC-related constraints related to flood management complicate implementation of conservation plans. A particularly problematic constraint is the 112 miles of revetment present along major river reaches in the Upper Sacramento River CPA, much of it necessary to protect SPFC and other levees. This revetment blocks the formation of cut banks, which are an attribute of SRA cover for salmonids and provide nesting habitat for bank swallows. Thus, revetment directly contributes to the decline of these species. Similarly, the flood management system and the need for flood protection currently constrains the establishment of continuous corridors of riparian vegetation along the upper Sacramento River.

Furthermore, several SPFC and non-SPFC structures have been impeding fish passage. In addition to dams at multipurpose reservoirs, these structures include:

- Tisdale Weir in the Tisdale Bypass
- Moulton Weir in the Butte Basin Overflow Area
- Weir No 1 (Parks Weir) in the West Canal of the Sutter Bypass
- One Mile Dam and Sycamore Pool in the lower Big Chico Creek
- Lindo Channel Diversion Structure at Lindo Channel

These structures have been identified as high priorities for remediation (Priority 1 or 2, see Appendix K).

3.1 Major River Reaches

Detailed descriptions by river reach (Figure 3-2) for the Upper Sacramento River CPA are provided below.

3.1.1 Woodson Bridge State Recreation Area to Chico Landing

From Woodson Bridge State Recreation Area to Chico Landing, the Sacramento River actively meanders through the valley floor along much of this reach. Most of the banks along this reach are natural (i.e., without revetment) (DWR 2011d). The active channel is fairly wide in some stretches, and the river splits into multiple forks at many different locations, creating gravel islands, often with riparian vegetation. Historic bends in the river are visible throughout this reach, and the riparian corridor and oxbow lakes associated with historical channel locations are still present in many locations.

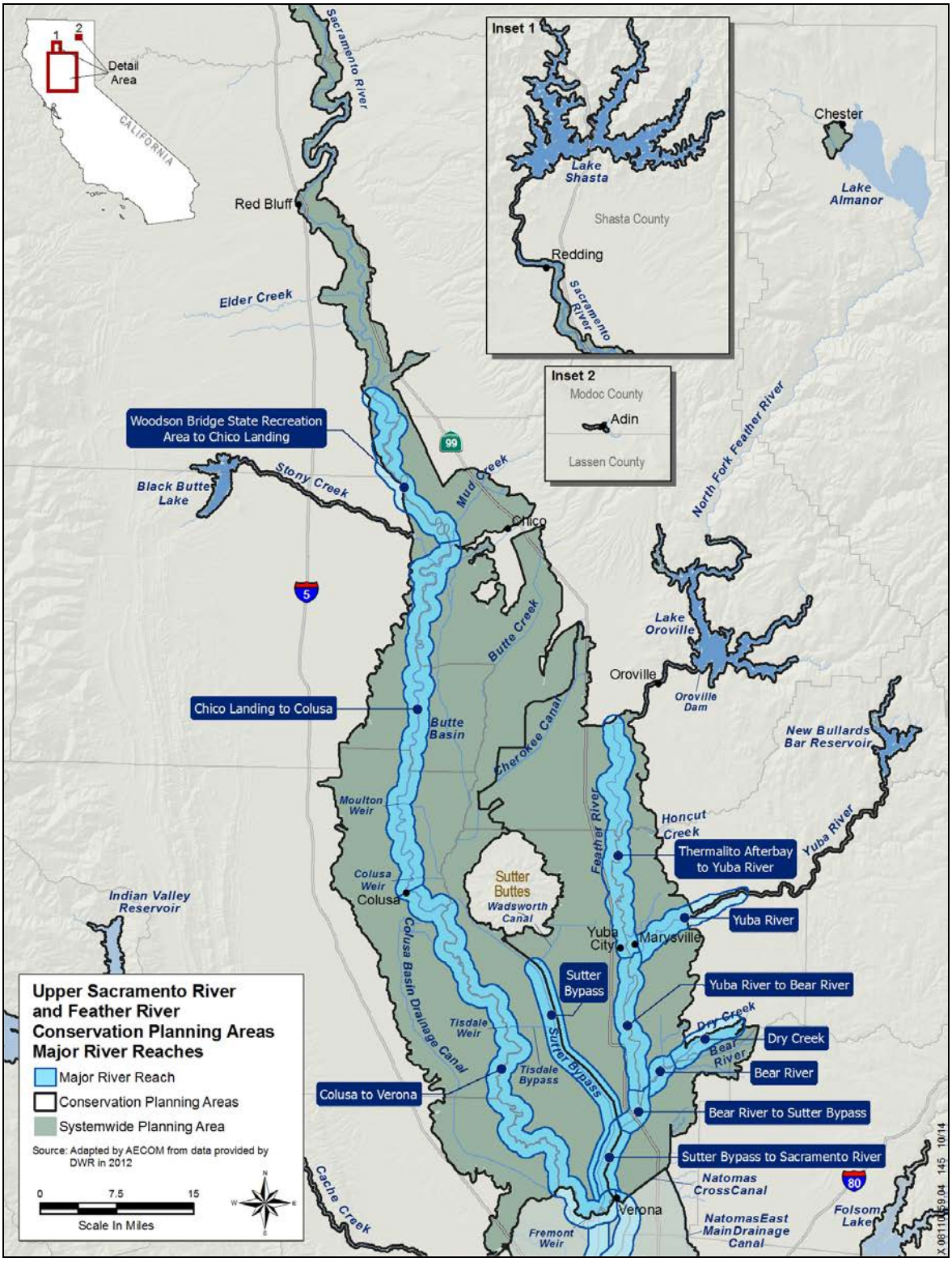

Figure 3-2. River Reach Extent for the Upper Sacramento River Conservation Planning Area

The tributaries that join the Sacramento River along this reach are Kopta Slough (at River Mile [RM] 218), Jewett Creek (at RM 215), Hoag Slough (at RM 214), Dicus Slough (at RM 209), Snaden Slough (at RM 208), and Pine Creek (at RM 196).

Within this reach of the Sacramento River, the 2-mile-wide floodway corridor covers approximately 22,000 acres, and over one-quarter of that corridor has been conserved (Figure F1-1 of Attachment F1). Conserved areas include portions of the Sacramento River National Wildlife Refuge and Butte Sink Wildlife Management Area, which are managed by the U.S. Fish and Wildlife Service (USFWS); Sacramento River Wildlife Area and Merrill's Landing Wildlife Area, which are managed by CDFW; Bidwell-Sacramento River State Park and the Woodson Bridge State Recreation Area, which are managed by California Department of Parks and Recreation (State Parks); and eight preserves managed by The Nature Conservancy.

Ecosystem Processes

Floodplain Inundation. In this reach, over three-quarters of the corridor along the river is relatively evenly distributed among areas with a 50-percent-chance, and a 10-percent-chance FIP (Table 3-1 and Figure F1-2 of Attachment F1). Almost all of these areas are connected to the river. Approximately 16 percent of the area has a greater than 10-percent-chance FIP, and all of this is disconnected from the river. Only a small percentage of the floodplain has Below Baseflow FIP, and there are almost no areas with a 67-percent-chance Sustained Spring FIP.

Riverine Geomorphic Processes. In this reach, the average channel width is 753 feet, ranging between 342 feet and 2,353 feet. The meander corridor is an estimated 6,216 feet wide (Table 3-2) and the meander amplitude is 3,942 feet. Of the total meander zone (14,084 acres), the vast majority, 86 percent, is unrestricted within this reach. Natural geology limits 9 percent of the meander zone (1,200 acres). Approximately 5 percent is constrained by revetment, levees, and other infrastructure. Less than 1 percent of the meander potential is constrained by both infrastructure and natural geology.

Habitats

Land cover along this reach of the Sacramento River is predominantly agriculture and natural vegetation, with little development (Table 3-3 and Figure F1-3 of Attachment F1). Agriculture represents slightly more than half of the corridor land cover. Natural vegetation, primarily riparian and wetland vegetation, accounts for one-third of the land cover. Riparian vegetation is widespread, particularly close to the river.

Shaded Riverine Aquatic Cover. Along this reach of the Sacramento River, the percentage of banks with potential SRA habitat is moderate compared other major river reaches. This reach has 61 miles of bank, 52 miles of which have natural bank conditions (Table 3-4). Of the 52 miles with natural conditions, riparian vegetation lines 18 miles of bank, representing approximately one-third of the total banks in this reach. Riparian vegetation lines 6 miles of revetted bank.

Riparian Habitat. Along this reach, riparian vegetation covers approximately 22 percent of the corridor land area within 1 mile of the Sacramento River (4,925 acres) (Table 3-3). Most of this habitat is close to the river; riparian vegetation occupies 53 percent of the 330-foot-wide

corridors along the riverbanks (Table 3-5) and 30 percent of the 10-year floodplain connected to the river. Levee vegetation management zones (VMZs) are generally more than 330 feet from the riverbanks.

The connectivity of riparian habitats along this reach is greater than along most major river reaches. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of a patch of riparian vegetation, which is approximately 12.8 acres along this reach (Table 3-5). This habitat is found in comparatively wide swaths and is most continuous between RM 202 and RM 219. It is most fragmented between RM 199 and RM 202.

Riparian vegetation consists primarily of forest, which accounts for 82 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Comparatively few acres of marsh or other wetland are present along this reach. Approximately 286 acres of marsh, or slightly more than 1 percent of the land area, and only 39 acres of seasonal wetland are present along this reach (Table 3-3). Of the total 325 acres of wetland, approximately 273 acres are protected as federal, State, or private conservancy lands. The marshes range in size from less than 1 acre to 155 acres, but most are small, and the seasonal wetlands range from less than 1 acre to approximately 3 acres. Most of these features are associated with oxbow lakes or other floodplain features associated with historic meander migration.

A substantial portion of these features (60 percent of marsh and 92 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 3-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river, and occupies 56 percent (12,400 acres) of the reach corridor (Table 3-3). Very little of the agricultural lands within the reach corridor (19 percent, 2,360 acres) are situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the Sacramento River (18,210 acres), over one-half (10,040 acres or 55 percent) is agricultural land. Orchard and vineyard covers the majority of this floodplain agricultural land (84 percent), with the remainder split between cropland and pasture, and other agricultural land. Nine percent of the total agricultural land in the corridor is conserved as federal, State, regional, or private conservancy lands.

Targeted and Other Sensitive Species

The target and other sensitive species documented along this reach are VELB, colonies of bank swallow, Swainson's hawk, and western yellow-billed cuckoo. Active bank swallow colonies have been documented consistently throughout the reach in steep, eroding banks.

This reach also provides habitat for several sensitive fish: migrating, holding, and rearing steelhead and fall-/late fall– and winter-run Chinook salmon; migrating and rearing spring-run Chinook salmon; and foraging adult green sturgeon. The reach contains critical habitat for steelhead, Chinook salmon, and green sturgeon.

Stressors

Developed land uses occupy a small portion (less than 1 percent) of the corridor along this reach, primarily in the vicinity of Hamilton City (at RMs 199 and 200). Other than levees, major infrastructure is limited along this reach of the Sacramento River except between RMs 196 and 197, where State Route (SR) 32, a natural gas pipeline, and an electrical transmission line cross the river (Figure F1-4 of Attachment F1). Just above RM 205, a pump station diverts water from the Sacramento River into the Glenn-Colusa Canal, which flows south, parallel to the river. The canal flows west of Hamilton City and then continues to the southwest, outside of the reach.

Levees. This reach has 2.0 miles of SPFC levees and 23.3 miles of non-SPFC levees (Table 3-7; Figure F1-4 of Attachment F1). The SPFC levees are located along tributaries to the Sacramento River. The non-SPFC levees are set back from the river's banks throughout much of this reach, allowing the river to meander broadly. The channel actively meanders through the valley floor and is fairly wide in some stretches. The physical condition of the SPFC levees along is primarily of medium concern. The physical condition of the non-SPFC levees in this reach has not been evaluated.

Revetment. There are 10.7 miles of revetment within this reach (Table 3-7). Of this revetment, 9.1 miles are located along the Sacramento River armoring approximately 15 percent of the total bank length (Table 3-4). The revetment is distributed throughout the reach, with less continuous sections of revetment between RM 212-214 and 194-195.

Fish Passage Barriers. No priority fish passage barriers have been documented along this reach of the Sacramento River (Figure F1-5 of Attachment F1). No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 19 of the 31 target invasive plants are known to occur, based on information provided by Cal-IPC (Cal-IPC 2013). Of these 19 species, seven are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 3-8. Within DWR channel and levee maintenance areas along this reach, approximately 7 acres of initial priority species occurs; all 7 acres are Himalayan blackberry. Within other areas maintained by LMAs, no acreages of initial priority species are recorded. Occurrences of Himalayan blackberry are spread throughout this reach.

3.1.2 Chico Landing to Colusa

From Chico Landing to Colusa, the Sacramento River actively meanders through the valley floor, actively eroding banks, producing oxbows and meander scrolls on the floodplain along much of this reach. Most of the banks along this reach are natural (i.e., without revetment) (DWR 2011d). In this reach, the Sacramento River historically overflowed into flood basins. Currently, during flood flows, water from the Sacramento River enters the Butte Basin at the 3 B's natural overflow, the M&T and Goose Lake Flood relief structures, and at Moulton and Colusa Weirs.

The tributaries that join the Sacramento River along this reach are Big Chico Creek (at RM 193) and Stony Creek (at RM 190).

Within this reach of the Sacramento River, the 2-mile-wide floodway corridor covers approximately 56,000 acres, and over one-third of that corridor has been conserved (Figure F1-1 of Attachment F1). Conserved areas along this reach include portions of the Sacramento River National Wildlife Refuge and Butte Sink Wildlife Management Area, which are managed by USFWS; Bidwell-Sacramento River State Park and Colusa-Sacramento River State Recreation Area, which are managed by State Parks; the Sacramento River Wildlife Area and the Colusa Bypass Wildlife Area, which are managed by CDFW; and six preserves managed by The Nature Conservancy.

Ecosystem Processes

Floodplain Inundation. In this reach, more than two-thirds of the corridor along the river has a 50-percent-chance FIP, and a little less than half of this area is connected to the river (Table 3-1 and Figure F1-2 of Attachment F1). Only a small area has a 67-percent-chance Sustained Spring FIP.

Riverine Geomorphic Processes. In this reach, the average channel width is 841 feet, ranging between 287 feet and 1,579 feet. The meander corridor is an estimated 7,041 feet wide (Table 3-2), and the meander amplitude is 4,456 feet. Of the total meander zone (38,992 acres), slightly more than half is unrestricted in this reach. Approximately one–quarter is constrained by revetment, levees, and other infrastructure. Natural geology limits another 4 percent of the meander zone (1,513 acres). Approximately 6,100 acres, 16 percent, of the meander zone is constrained by both infrastructure and natural geology.

Habitats

Land cover along this reach of the Sacramento River is predominantly agriculture and natural vegetation, with little development (Table 3-3 and Figure F1-3 of Attachment F1). Agriculture represents approximately two-thirds of the corridor land cover, with approximately half of this area in orchard and vineyard. Natural vegetation, primarily riparian, accounts for one-quarter of the land cover. Riparian vegetation is well distributed along the river throughout this reach.

Shaded Riverine Aquatic Cover. Along this reach of the Sacramento River, the percentage of banks with potential SRA habitat is moderate compared to most major river reaches. There are 125 miles of bank, of which approximately 105 miles have natural bank conditions (Table 3-4). Riparian vegetation lines 50 miles of bank, of which 37 miles have natural bank conditions, representing 30 percent of the total banks along this reach.

Riparian Habitat. Along this reach, riparian vegetation covers approximately 19 percent of the corridor land area (10,414 acres) within 1 mile of the Sacramento River (Table 3-3). Most of this habitat is close to the river. Riparian vegetation occupies 52 percent of the 330-foot-wide corridors along the riverbanks (Table 3-5) and 38 percent of the 10-year floodplain that is connected to the river. Levee VMZs are more than 330 feet from the river banks except in a few

locations on one side of the river. At the south end of the reach, the levee VMZ is less than 330 feet from both banks in a very short section near RM 144.

The connectivity of riparian habitats along this reach is greater than along most major river reaches. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation but also in the median size of a patch of riparian vegetation, which is approximately 11.6 acres along this reach (Table 3-5). This habitat is found in fairly broad swaths throughout the corridor and is most continuous between RM 178 and RM 193; it is almost absent between RM 148 and RM 155.

Riparian vegetation consists primarily of forest, which accounts for 84 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Comparatively few acres of marsh or other wetland are present along this reach. Just under 1 percent of the land area in this reach is represented by marsh and seasonal wetland, with 137 acres of marsh and 173 acres of seasonal wetland (Table 3-3). Of the total 311 acres of wetland, approximately 75 acres (24 percent) are protected as federal, State, or private conservancy lands. The marshes range in size from less than 1 acre to 14 acres, but most are small. The seasonal wetlands range from less than 1 acre to 13 acres. Most of these features are associated with oxbow lakes or other floodplain features associated with historic meander migration.

A substantial portion of these features (78 percent of marsh and 94 percent of seasonal wetland) is connected to the river system in the potential meander zone (Table 3-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies two-thirds (36,910 acres) of the reach corridor (Table 3-3). The majority (73 percent) of the agricultural lands are situated above the 10-year floodplain or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the Sacramento River (27,170 acres), a little over one-third (9,880 acres or 36 percent) of the lands are occupied by agriculture. Orchard and vineyard covers the majority of this floodplain agricultural land (67 percent), with the remainder in other agricultural land (18 percent) and cropland and pasture (15 percent). Five percent of the total agricultural land is conserved as federal, State, or private conservancy lands.

Targeted and Other Sensitive Species

The target and other sensitive species documented along this reach are woolly rose-mallow, VELB, giant garter snake, colonies of bank swallow, Swainson's hawk, colonies of tricolored blackbirds, and western yellow-billed cuckoo. Active bank swallow colonies have been documented consistently throughout the reach in steep eroding banks.

This reach also provides habitat for the following sensitive fish species: migrating, holding, and rearing steelhead and winter- and fall-/late fall–run Chinook salmon; migrating and rearing spring-run Chinook salmon; foraging adult green sturgeon; and longfin smelt. The reach contains critical habitat for steelhead, Chinook salmon, and green sturgeon.

Stressors

Developed land uses occupy only a small portion (about 1 percent) of the corridor along this reach, primarily at Colusa. Other than levees, major infrastructure is limited along this reach of the Sacramento River. Natural gas pipelines cross near RMs 162, 174, and 184. SR 162 crosses the river near RM 166, and natural gas pipelines and electrical transmission lines are located along the river corridor at several hundred to several thousand feet from the river (Figure F1-4 of Attachment F1).

Levees. This reach has 63.3 miles of SPFC levees and 11.9 miles of non–SPFC levees (Table 3-7; Figure F1-4 of Attachment F1). At Ord Ferry on the west bank and 7.5 miles downstream from Ord Ferry on the east bank, SPFC levees border the river downstream along this reach but are often set back as much as 1 mile. The physical condition of these levees is primarily of medium concern, with some exceptions including a 19-mile-long stretch upstream from Colusa where levee physical condition is of higher concern. The non-SPFC levees are located upstream from these SPFC levees.

Revetment. There are 25.1 miles of revetment along this reach (Table 3-7). Of this revetment, 19.6 miles are located along the Sacramento River armoring approximately 16 percent of the total bank length (Table 3-4). Revetment is found throughout this reach, but is most extensive in the northern and southern portions of this reach, between RMs 144–155 and 174–192.

Fish Passage Barriers. One priority fish passage barrier, Moulton Weir, has been documented along this reach (Figure F1-5 of Attachment F1). In addition, the Gould Road Quarry is located in this reach near RM 158 (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 19 of the 31 target invasive plants are known to occur, based on information provided by Cal-IPC (Cal-IPC 2013). Of the 19 species, seven are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 3-8. Within DWR channel and levee maintenance areas along this reach, approximately 150 acres of initial priority species occurs, with 73 acres of giant reed and 77 acres of Himalayan blackberry. Within other areas maintained by LMAs, no recorded acreages of initial priority species occur. Giant reed and Himalayan blackberry occurrences are concentrated in the northern half of this reach.

3.1.3 Colusa to Verona

The general character of the Sacramento River changes downstream from Colusa from a dynamic and active meandering channel to a confined, narrow channel generally restricted from migration along most of its length (DWR 2011d). Although levees are present along portions of the river upstream from Colusa, they are located much closer to the river's edge as the river continues south to the Delta. The channel width is fairly uniform. and river bends are static as a result of levee confinement.

The tributaries that join the Sacramento River along this reach are Butte Slough (at RM 138), Sycamore Slough (at RM 132), Wilkins Slough (at RM 118), Colusa Basin Drainage (at RM 90), and Sacramento Slough (at RM 80).

Within this reach of the Sacramento River, the 2-mile-wide floodway corridor covers approximately 71,000 acres, the largest corridor reach in this CPA. However, less than 2 percent of the corridor in this reach has been conserved (Figure F1-1 of Attachment F1). Conserved areas along this reach include the Collins Eddy Wildlife Area, the Sutter Bypass Wildlife Area, and the Fremont Weir Wildlife Area, which are managed by CDFW, and a Nature Conservancy preserve.

Ecosystem Processes

Floodplain Inundation. From Colusa to Verona, approximately two–thirds of the corridor along the river has a 50-percent-chance FIP, but only a small portion of this area remains connected to the river (Table 3-1 and Figure F1-2 of Attachment F1). There also are large areas with Below Baseflow FIP. Most of these areas represent historical flood basins that are disconnected from the river. Along this reach, about 10 percent of evaluated floodplain has a 67-percent-chance Sustained Spring FIP, almost all of which is disconnected from the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 380 feet, ranging between 216 feet and 894 feet. The meander corridor is an estimated 2,894 feet wide (Table 3-2), and the meander amplitude is 1,861 feet. Of the total meander zone (22,475 acres), 83 percent is constrained by revetment, levees, and other infrastructure. The remaining meander zone (3,714 acres) is unconstrained.

Habitats

Land cover along this reach of the Sacramento River is predominantly agriculture with some natural vegetation (Table 3-3 and Figure F1-3 of Attachment F1). Development represents 2 percent of the land cover in this reach. Although a small portion, it is more than twice that of other reaches in the Upper Sacramento River CPA. Agriculture represents more than three-quarters of the corridor land cover. Natural vegetation, primarily riparian and nonwetland, accounts for less than 10 percent of the land cover. Riparian vegetation is limited along this reach and located primarily adjacent to the river.

Shaded Riverine Aquatic Cover. Along this reach of the Upper Sacramento River, the percentage of banks with potential SRA habitat is moderate compared to other major river reaches, but it is present in a much narrower corridor than along other major river reaches. There are 135 miles of bank, of which approximately 55 miles have natural bank conditions (Table 3-4). Riparian vegetation lines 77 miles of bank, of which 45 have natural bank conditions, representing 33 percent of the total banks in this reach.

Riparian Habitat. Along this reach, slightly more than 3,000 acres of riparian vegetation, approximately 4 percent of the corridor land area, are located within 1 mile of the Sacramento River (Table 3-3). Most of this habitat is close to the river; riparian vegetation occupies 27 percent of the 330-foot-wide corridors along the riverbanks (Table 3-5) and 29 percent of the 10-year floodplain connected to the river. Levee VMZs are less than 330 feet from both river banks through most of this reach. There are two short sections, from RM 128 to RM 130 and from RM 80 to RM 84, where the corridor is greater than 330 feet on at least one side of the river, and for some of that length on both sides.

The connectivity of riparian habitats along this reach of the upper Sacramento River is moderate. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation but also in the median size of a patch of riparian vegetation, which is 7.2 acres along this reach (Table 3-5). This habitat is generally in narrow patches, and it is most continuous and widest between RM 126 and RM 132 and most fragmented and narrow between RM 85 and RM 119.

Riparian vegetation consists primarily of forest, which accounts for 91 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. The total acreage of seasonal wetlands present along this reach (398 acres) is greater than along reaches to the north (Table 3-3). However, this acreage is still less than 1 percent of the total land area along this reach. Only 179 acres of marsh are present along this reach. Of the total 577 acres of wetland, approximately 58 acres (10 percent) are protected as State, city, or private conservancy lands. The marshes range in size from 1 acre to 18 acres, but most are small, and the seasonal wetlands range from 1 acre to 7 acres. As in the other reaches, most of these features appear to be associated with oxbow lakes or other floodplain features associated with historic meander migration.

Only a small portion of these features (7 percent of marsh and 10 percent of seasonal wetland) is connected to the river system in the potential meander zone (Table 3-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river along this reach, and occupies 84 percent (59,760 acres) of the reach corridor (Table 3-3). Almost all of the agricultural lands within the reach corridor (97 percent, 57,870 acres) are situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the Sacramento River (8,040 acres), close to one-quarter (1,850 acres or 23 percent) is agricultural land. Cropland and pasture cover the majority (87 percent) of these floodplain agricultural lands. The remainder is composed of other agricultural land (9 percent), and orchard and vineyard (4 percent). Less than 1 percent of the total agricultural land is conserved as private conservancy lands.

Targeted and Other Sensitive Species

The target and other sensitive documented along this reach are woolly rose-mallow, VELB, giant garter snake, colonies of bank swallows, Swainson's hawk, colonies of tricolored blackbirds, and western yellow-billed cuckoo. Populations of woolly rose-mallow have been documented at Yolo Bypass on the north side of Old River, just north of Sutter/Yolo county line, the only location in this reach. Active bank swallow colonies have been documented consistently throughout the reach in steep eroding banks.

This reach also provides habitat for the following sensitive fish species: migrating, holding, and rearing steelhead and fall-/late fall– and winter-run Chinook salmon; migrating and rearing spring-run Chinook salmon; foraging adult green sturgeon; longfin smelt; and Sacramento splittail. The reach contains critical habitat for steelhead, Chinook salmon, and green sturgeon.

Stressors

Developed land uses occupy only a small portion (about 2 percent) of the corridor along this reach, primarily in the vicinity of Colusa. However, there is more major infrastructure along this reach of the Sacramento River than along upstream reaches. The Colusa Highway crosses the river between RM 133 and RM 134, and SR 113 crosses near RM 90. Natural gas pipelines cross the river near RMs 126, 127, and 140, and electrical transmission lines cross the river near RMs 134, 121, 92, 86, and 80 (Figure F1-4 of Attachment F1). In addition, major roads, natural gas pipelines, and electrical transmission lines are located within 1 mile of the river at several locations.

Levees. This reach has 131.2 miles of SPFC levees and 7.3 miles of non-SPFC levees (Table 3-7; Figure F1-4 of Attachment F1). SPFC levees are located along both riverbanks in this reach, and they vary from approximately 250 feet to 0.3 mile from the river. The physical condition of these levees is of higher concern, except for several miles of levee east of the river downstream from Colusa, which are of medium concern.

Revetment. There are 81.8 miles of revetment along this reach (Table 3-7). Of this revetment, 79.7 miles are located along the Sacramento River armoring 59 percent of the total bank length (Table 3-4). The revetment is distributed throughout this reach, except for RMs 131–129 and RMs 83-84, where the revetment is limited.

Fish Passage Barriers. Two fish passage barriers have been documented along this reach. One of these barriers, Tisdale Weir, has been identified as being a priority barrier for improving fish passage (see Appendix K) (Figure F1-5 of Attachment F1). No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 19 of the 31 target invasive plants are known to occur, based on information provided by Cal-IPC (Cal-IPC 2013). Of the 19 species, six are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 3-8. Within DWR channel and levee maintenance areas along this reach, approximately 26 acres of initial priority species occurs; all 26 acres are Himalayan blackberry. Within other areas maintained by LMAs, approximately 7 acres of initial priority species occurs, which is also made up exclusively of Himalayan blackberry. Occurrences of Himalayan blackberry are scattered throughout this reach, with a large concentration in the midsection.

3.1.4 Sutter Bypass to Sacramento River

In this reach, the Feather River has a relatively straight channel located along the eastern edge of the Sutter Bypass. The river is primarily a confined, narrow channel generally restricted from migration along most of its length. Levees are located close to the river in this reach. The channel width is fairly uniform, and river bends are static as a result of confinement by levees.

No tributaries to the Feather River occur in this reach.

Within this reach of the Feather River, the 2-mile-wide floodway corridor covers approximately 8,700 acres, and less than 1 percent of that corridor has been conserved. Conserved land within this reach is limited to a small portion of the Sutter Bypass Wildlife Area, which is located on the northern boundary of this reach (Figure F1-1 of Attachment F1). The Sutter Bypass Wildlife Area is managed by CDFW.

Ecosystem Processes

Floodplain Inundation. Similar to upstream reaches, from the Sutter Bypass to the Sacramento River, most of the corridor along the Feather River has a 50-percent-chance FIP (Table 3-1 and Figure F1-2 of Attachment F1). Along this reach, about 10 percent of evaluated floodplain has a 67-percent-chance Sustained Spring FIP, half of which is disconnected from the river..

Riverine Geomorphic Processes. In this reach, the average channel width is 691 feet, ranging between 492 and 1,112 feet. The meander corridor is an estimated 5,645 feet wide (Table 3-2) and the meander amplitude is 3,587 feet. Of the total meander zone within this reach (4,536 acres), the majority (55 percent) is unrestricted. Approximately 44 percent of the reach is constrained by revetment, levees, or other infrastructure. The remaining meander zone potential (37 acres or less than 1 percent) is constrained by both natural geology and infrastructure.

Habitats

Land cover along this reach of the Feather River is primarily agriculture (Table 3-3 and Figure F1-3 of Attachment F1). Agriculture represents more than three-quarters of the corridor's land cover. Natural vegetation accounts for less than one-quarter of the land cover, and wetland/riparian vegetation accounts for less than one-tenth. Riparian vegetation is present in two large complexes in the north end of this reach, and narrowly edging the river to the south.

Shaded Riverine Aquatic Cover. The percentage of banks with potential SRA habitat is one of the highest among the major river reaches. Of the 13 miles of river bank, 10 miles have natural bank conditions (Table 3-4). Riparian vegetation lines 10 miles of bank, of which 8 miles have natural bank conditions, representing 61 percent of the total banks along this reach.

Riparian Habitat. Along this reach, 578 acres of riparian vegetation are located within 1 mile of the Feather River, approximately 7 percent of the corridor land area (Table 3-3). Most of this habitat is very close to the river: Riparian vegetation occupies 42 percent of the 330-foot-wide corridors along the river banks and 17 percent of the 10-year floodplain that is connected to the river (Table 3-5). Levee VMZs are more than 330 feet from the bank on the west side of the river and less than 330 feet from the bank on the east side throughout this reach.

The connectivity of riparian habitats along this reach is moderate. This level of connectivity is reflected in the percent of 330-foot-wide corridors occupied by riparian vegetation. The median size of a patch of riparian vegetation, which is 10.3 acres, is deceptively high due to two large natural areas in the north of this reach (Table 3-5). This habitat is mostly found in narrow corridors and is most continuous between RM 2 and RM 4, and least continuous between RM 4 and RM 6.

Riparian vegetation consists primarily of forest, which accounts for 82 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Only three wetlands are present along this reach. Seasonal wetland covers 14 acres and nontidal marsh covers 5 acres, comprising less than 0.5 percent of the land cover in this reach (Table 3-3). None of the total 19 acres are protected. The marshes are between 1 acre and 4 acres, and the seasonal wetland is 14 acres. These floodplain features appear to be associated with historical meander migration.

A substantial portion of these features (70 percent of marsh and all of the seasonal wetland) is connected to the river system within the potential meander zone (Table 3-6).

Floodplain Agriculture. Agricultural land is distributed throughout both sides of the river, although orchard and vineyard production is only on the east side. Agricultural land occupies 79 percent (6,870 acres) of the reach corridor (Table 3-3). Approximately one-half (49 percent) of the agricultural land within the reach corridor is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the Feather River (4,970 acres), more than two-thirds (70 percent) are agricultural lands. Within these floodplain agricultural lands, 65 percent is cropland and pasture, 24 percent is rice production, and 12 percent is identified as other agricultural land. Less than 1 acre of the total agricultural land is conserved (as State land).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are giant garter snake, Swainson's hawk, and colonies of bank swallows.

This reach also provides habitat for several sensitive fish: migrating, holding, and rearing steelhead; migrating, holding, and rearing fall-run Chinook salmon; migrating and rearing spring-run Chinook salmon; Sacramento splittail; and foraging adult green sturgeon. The reach contains critical habitat for steelhead, Chinook salmon, and green sturgeon.

Stressors

This reach has only a small amount (less than 2 percent) of developed land, and no major infrastructure crosses the river, although an electrical transmission line is located near the east river bank, where SR 99 runs adjacent to the levee (Figure F1-4 of Attachment F1).

Levees. There are 6.8 miles of SPFC levees and 2.6 miles of non-SPFC levees within this reach (Table 3-7; Figure F1-4 of Attachment F1). SPFC levees are on both river banks along this reach. Levees along the south bank of the river are adjacent to the river bank (approximately 300 feet), and the levees along the north bank are set back more than 1 mile in some locations. The physical condition of these levees is primarily of higher concern.

Revetment. This reach has 3.1 miles of revetment (Table 3-7). All of this revetment is located along the Feather River (armoring 24 percent of bank length) (Table 3-4). Revetment is concentrated in the northern and southern portions of this reach near RMs 1 and 2, and RMs 5 through 7. No revetment occurs in the middle section of this reach.

Fish Passage Barriers. No priority fish passage barriers have been documented along this reach. No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 19 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 19 species, six are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 4-8. Within DWR channel and levee maintenance areas along this reach there is approximately 1 acre of initial priority species, made up exclusively of Himalayan blackberry. Within other areas maintained by LMAs approximately 2 acres of initial priority species occurs, also made up exclusively of Himalayan blackberry. Occurrences of these species are scattered throughout this reach.

3.2 Basins/Bypasses

The only large bypass within the Upper Sacramento CPA is Sutter Bypass. The Upper Sacramento CPA also includes Butte Slough, Butte Basin, the Colusa Bypass, and the Tisdale Bypass. Detailed habitat descriptions of the Colusa, Tisdale and Sutter Bypasses are provided below.

3.2.1 Colusa Bypass

The Colusa Bypass ranges in width from approximately 1,800 feet at the Colusa Weir on the Sacramento River to approximately 7,000 feet where the bypass meets the Butte Basin. The Colusa Bypass is inundated in most years by water diverted from the Sacramento River (DWR 2010c).

The entire Colusa Bypass has been conserved (Figure F1-1 of Attachment F1) as part of the Colusa Bypass Wildlife Area, which is managed by CDFW.

Ecosystem Processes

Floodplain Inundation. The entire bypass has the potential to serve as floodplain.

Habitats

Natural vegetation accounts for more approximately 80 percent of the Colusa Bypass. The remaining area is in agriculture, identified as other agricultural lands (Figure F1-3 of Attachment F1).

Shaded Riverine Aquatic Cover. There is no shaded riverine aquatic habitat within the Colusa Bypass corridor.

Riparian Habitat. Along the Colusa Bypass, approximately 5 percent of the land cover (40 acres) is riparian forest. Riparian vegetation is generally restricted to the eastern portion of the bypass where it meets the Butte Basin.

Marsh and Other Wetland Habitat. There are 11 acres of wetlands within the Colusa Bypass, representing approximately 1 percent of the land cover; all of this acreage is seasonal wetlands. All are protected as State or federal lands. Two wetland polygons intersect the bypass; one occupies 2 acres, and the other occupies 40 acres**.**

Floodplain Agriculture. Agriculture occupies 18 percent of the land cover (134 acres) in the Colusa Bypass. It is located in two areas, approximately equal in size, on the north and south sides of the bypass. All of this land is conserved as State or federal lands.

Targeted and Other Sensitive Species

No target and other sensitive species have been documented within the Colusa Bypass corridor. However, this bypass contains critical habitat for steelhead and Chinook salmon.

Stressors

No developed land is located in the Colusa Bypass corridor, and major infrastructure is limited to the Colusa Weir Dam on the western boundary of the bypass.

Levees. The approximately 2.8 miles of levees along the Colusa Bypass are SPFC levees (Figure F1-4 of Attachment F1); they extend the entire length of both sides of the bypass. The physical condition of the northern bypass levee is of higher concern, the southern bypass levee is of low concern.

Revetment. There is 0.43 miles of revetment within the Colusa Bypass (Table 3-10), primarily on the western boundary and on the northern side halfway along the bypass.

Fish Passage Barriers. There are no priority fish passage barriers in the Colusa Bypass (see Appendix K).

Invasive Plants. Within the bypass corridor, six of the 31 target invasive plants are known to occur, based on information provided by Cal-IPC (2013). Of the six species, two are ranked as being highly abundant in at least one quadrangle within the bypass. No acreages of initial priority species have been recorded within DWR channel and levee maintenance areas along this reach. No acreages have been recorded of initial priority species in other areas maintained by LMAs.

3.2.2 Tisdale Bypass

The approximately 1,000-foot-wide Tisdale Bypass is located approximately 10 miles southeast of the town of Meridian. The Tisdale Bypass channel carries floodwater diverted from the Sacramento River over approximately 4 miles where it is discharged into the Sutter Bypass, just north of Gilsizer Slough. The Tisdale Bypass is inundated in most years by water diverted from the Sacramento River. Of the five weirs in the Sacramento River Flood Control System, the Tisdale Weir overtops most frequently (DWR 2010c)

Almost 90 percent of the 440-acre Tisdale Bypass is conserved as part of the Sutter Bypass Wildlife Area (Figure F1-1 of Attachment F1). These lands are managed by CDFW.

Ecosystem Processes

Floodplain Inundation. The entire bypass has the potential to serve as floodplain.

Habitats

Land cover within the Tisdale Bypass is composed of natural vegetation: approximately one-third riparian vegetation, one-third wetlands, and one-third upland natural vegetation (Figure F1-3 of Attachment F1).

Shaded Riverine Aquatic Cover. There is no shaded riverine aquatic habitat within the Tisdale Bypass corridor.

Riparian Habitat. Along the Tisdale Bypass, 35 percent of the land cover (155 acres) is riparian vegetation, and almost all (153 acres) is riparian forest. The riparian vegetation is distributed throughout the bypass in narrow, linear patches.

Marsh and Other Wetland Habitat. There are 134 acres of wetlands within the Tisdale Bypass, representing approximately 30 percent of the land cover; all is nontidal marsh. All of these wetlands are protected as State or federal lands. There are two wetlands that intersect the Tisdale Bypass footprint, they are 55 and 131 acres in size.

Floodplain Agriculture. No agriculture occurs within the Tisdale Bypass.

Targeted and Other Sensitive Species

The target and other sensitive species documented within the Tisdale Bypass corridor are giant garter snake and Swainson's hawk. This bypass contains critical habitat for green sturgeon, steelhead, and Chinook salmon.

Stressors

No developed land is located in the Tisdale Bypass corridor, and major infrastructure is limited to the diversion dam on the western boundary of the bypass along the Sacramento River.

Levees. The approximately 7.0 miles of levees along the Tisdale Bypass are SPFC levees (Figure F1-4 of Attachment F1); they extend the entire length of both sides of the bypass. The physical condition of the northern bypass levee is of medium concern, and the southern bypass levee is of higher concern.

Revetment. There is no revetment within the Tisdale Bypass.

Fish Passage Barriers. There is one first-priority fish passage barrier in the Tisdale Bypass, the Tisdale Weir Dam (see Appendix K).

Invasive Plants. Within the bypass corridor, nine of the 31 target invasive plants are known to occur, based on information provided by Cal-IPC (2013). Of the nine species, two are ranked as being highly abundant in at least one quadrangle within the bypass. No acreages of initial priority species have been recorded within DWR channel and levee maintenance areas along this reach, nor have they been recorded in other areas maintained by LMAs.

3.2.3 Sutter Bypass

The Sutter Bypass is a wide flood channel, approximately 4,000 feet in width, that carries floodwater diverted from the Sacramento River. The bypass begins north of the Sutter Buttes where Butte Creek (Butte Slough) carries discharge from Butte Basin into the Sutter Bypass. Approximately 10 miles down the bypass, the Wadsworth Canal enters from the east, and further down on the west side, flows from the Tisdale Bypass enter Sutter Bypass. The bypass continues to the confluence of the Feather and Sacramento rivers and then on to the Yolo Bypass. The Sutter Bypass is inundated in most years by water diverted out of the Sacramento River.

The tributaries that join the Sutter Bypass are the Butte Basin, Sacramento River, and Feather River.

Approximately 43 percent of the 11,900-acre Sutter Bypass has been conserved (Figure F1-1 of Attachment F1). Conserved areas in the Sutter Bypass include the Sutter National Wildlife Refuge, which is managed by USFWS and extends throughout this reach, and the Sutter Bypass Wildlife Area, which is managed by CDFW.

Ecosystem Processes

Floodplain Inundation. The entire bypass has the potential to serve as floodplain.

Habitats

The Sutter Bypass is used mainly for agriculture, primarily rice production, and moderate amounts of natural vegetation are also present in the bypass (Figure F1-3 of Attachment F1). Natural vegetation accounts for more than one-third of the land cover in the bypass corridor, and riparian/wetland vegetation occupies slightly less than one-third of the corridor land area.

The Sutter Bypass also provides extremely productive inundated floodplain habitat that exports nutrients and food items to the downstream river system (Sommer et al. 2001). Inundated floodplain also provides rearing habitat for steelhead and Chinook salmon and spawning habitat for Sacramento splittail (*Pogonichthys macrolepidotus*).

Shaded Riverine Aquatic Cover. There is no shaded riverine aquatic habitat within the bypass corridor.

Riparian Habitat. Along this corridor, approximately 17 percent of the land area is in riparian vegetation (1,955 acres). All riparian vegetation is located within the bypass levees, and most of this habitat is close proximity to the channels in the bypass. The connectivity of riparian habitats in the bypass is relatively high, but overall the riparian corridor is narrow.

Riparian vegetation consists primarily of forest, which accounts for more than 90 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Little marsh or seasonal wetland is present along the bypass corridor. Approximately 13 percent of the land cover in this corridor is seasonal wetland (1,518 acres). There are 390 acres of marsh. Wetlands are present both within and outside of the

bypass levees. Of the total 1,908 acres of wetland, almost 80 percent are protected as State or federal lands. The marshes range in size from approximately 1 acre to slightly more than 175 acres, but most are small. The seasonal wetlands range from less than 1 acre to 402 acres and are fairly divided between small and large**.**

Floodplain Agriculture. Agriculture is distributed throughout the bypass corridor, and occupies slightly more than half (6,080 acres) of the area. Most of this agricultural land (81 percent) is in rice production, 17 percent is used for pasture and row crops, and 2 percent is identified as other agricultural land. Two-thirds of these agricultural lands are conserved as State or federal lands.

Targeted and Other Sensitive Species

The target and other sensitive species documented within the bypass corridor are woolly rose-mallow, giant garter snake, western pond turtle, California black rail, Swainson's hawk, and colonies of tricolored blackbirds. Western pond turtles were observed only in the East Water Channel of Sutter National Wildlife Refuge, just south of Hughes Road Bridge. A California black rail individual was identified just east of Sutter Bypass Wildlife Area.

Stressors

No developed land is located in the Sutter Bypass corridor, and major infrastructure is limited to several road crossings (most notably SR 113), several interconnected electrical transmission lines, and two major water supply canals (Figure F1-4 of Attachment F1). The West Borrow Canal and East Borrow Canal are located immediately adjacent to the waterside toes of the western and eastern Sutter Bypass levees, respectively.

Levees. All the levees in the Sutter Bypass are SPFC levees (Figure F1-4 of Attachment F1). The levees protect both banks and have a total length of 52.8 miles. Of this total length, 13.9 miles are in the Feather River planning area, and 39.0 miles are in the Upper Sacramento River CPA. The physical condition of these levees is generally of higher concern.

Revetment. There is approximately 8 miles of revetment in the Sutter Bypass, primarily along the narrower segment to the south and extending a few miles north-northwest from Tisdale Bypass.

Fish Passage Barriers. Six fish passage barriers have been documented along this reach, none of which are associated with SPFC facilities (see Appendix K). One of the barriers, Weir No. 1 (Parks Weir), has been identified as a priority barrier for improving fish passage (Figure F1-5 of Attachment F1). No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the bypass corridor, 20 of the 31 target invasive plants are known to occur, based on information provided by Cal-IPC (Cal-IPC 2013). Of the 20 species, six are ranked as being highly abundant in at least one quad within the bypass. Cal-IPC abundance ratings for all species occurring within this bypass are shown in Table 3-8. No acreages of initial priority species have been recorded within DWR channel and levee maintenance areas along this reach, nor have they been recorded in other areas maintained by LMAs.

3.3 Other Valley Landscape Units

3.3.1 Other Valley Systemwide Planning Area

The Other Valley SPA in the Upper Sacramento River CPA generally extends from Redding in the north to Fremont Weir in the south and covers approximately 408,870 acres (Figure 3-1). North of Woodson Bridge Landing this landscape unit includes the Sacramento River and its floodplain, and south of Woodson Bridge Landing it includes areas generally outside of the Sacramento River floodplain. Agricultural land totaling 319,900 acres is the predominant land cover type in this landscape unit (Table 3-9; Figure F1-3 of Attachment F1). Agricultural lands are found throughout this unit but are located primarily from Red Bluff to the southern border of the unit. Most of the agricultural lands (approximately 163,740 acres spread throughout the landscape unit) are in rice production.

Natural land cover represents approximately 13 percent of the Other Valley Landscape Unit. Almost half of this area (24,624 acres) is represented by seasonal wetland, which is concentrated in the midsection of the landscape unit just north of the Sutter Buttes. Seasonal wetlands are located along the west side of this landscape unit near the Colusa Basin Drainage Canal. Riparian scrub and nontidal marsh are the two land cover types with the least coverage in this landscape unit, covering 1,348 acres and 1,424 acres, respectively. Riparian forest represents approximately 20 percent of the natural land cover (10,619 acres). Riparian scrub and riparian forest are concentrated along the northern portion of the Sacramento River, and a small amount of riparian habitat is found in the southern portion of this landscape unit.

The target and other sensitive species documented in this landscape unit are woolly rose-mallow, VELB, giant garter snake, western pond turtle, colonies of bank swallows, greater sandhill crane, Swainson's hawk, colonies of tricolored blackbirds, western yellow-billed cuckoo, yellow-breasted chat, and yellow warbler. Active bank swallow colonies have been documented throughout the area in natural banks. The only documented occurrences of yellow-breasted chat and yellow warbler in this region have been observed on Todd Island in the Sacramento River, approximately 3 miles southeast of Red Bluff.

This landscape unit also provides habitat for the following sensitive fish species: migrating, holding, and rearing steelhead and fall-/late fall– and winter-run Chinook salmon and migrating and rearing spring-run Chinook salmon. The area contains critical habitat for steelhead, Chinook salmon, and green sturgeon.

Developed land uses occupy a small portion of this landscape unit (approximately 3 percent), primarily in the vicinity of Redding, Red Bluff, and Colusa. Major infrastructure crossing through this landscape unit includes SRs 32, 45, 99, and 162, and a small portion of Interstate (I) 5 (Figure F1-4 of Attachment F1).

No SPFC levees and 141 miles of non-SPFC levees are located along waterways in this landscape unit (Table 3-10). In addition, 13.5 miles of revetment (armoring along 9 percent of bank length) are located along the waterways in this landscape unit. Revetment is most extensive along the Sacramento River north of Woodson Bridge.

Three fish passage barriers are located in this landscape unit. Two of these barriers, One Mile Dam and Sycamore Pool and Lindo Channel Diversion Structure, have been identified as priority barriers for improving fish passage (Figure F1-5 of Attachment F1).

3.3.2 Other Facilities and Waterways

From north to south, the other facilities in the Upper Sacramento CPA include levees, channel clearing projects, and/or diversions along Salt Creek, Elder Creek, McClure Creek, Deer Creek, Big Chico Creek, and Butte Creek. In the Colusa basin, SPFC facilities include the left bank levee along the Colusa Basin Drainage Canal, outfall gates to the Sacramento River, and an excavated channel and levees to the Yolo Bypass (DWR 2010a). The southwestern end of the Cherokee Canal also falls within the Upper Sacramento CPA.

Approximately 73 percent of the 47,270 acres in the Other Facilities and Waterways portion of the Upper Sacramento River CPA is in agricultural use, and almost half of this amount is cultivated in rice (Table 3-9; Figure F1-3 of Attachment F1). Natural land cover makes up 19 percent of the total area (9,040 acres) with the majority (approximately 78 percent) split almost evenly between seasonal wetlands (3,600 acres) and natural upland vegetation (3,460 acres). Riparian vegetation covers approximately 4 percent of the total land cover. Less than 1 percent of this portion of the CPA is nontidal perennial marsh.

The target and other sensitive species documented in Other Facilities and Waterways are woolly rose-mallow, VELB, giant garter snake, western pond turtle, colonies of bank swallows, greater sandhill crane, Swainson's hawk, colonies of tricolored blackbirds, and western yellow-billed cuckoo. Generally, these occurrences are found only in a single facility footprint, not multiple facilities.

These waterways also provide habitat for the following sensitive fish: migrating, holding, and rearing steelhead; winter- and fall-/late fall–run Chinook salmon; migrating and rearing spring-run Chinook salmon; green sturgeon; and longfin smelt. These areas contains critical habitat for steelhead, Chinook salmon, and green sturgeon.

Developed land use makes up only 4 percent of the land cover. Developed lands include the city of Chico and the Chico Airport within the Big Chico Creek footprint. Major infrastructure includes pipelines and transmission lines that pass through most of the facility footprints. SR 99 passes through the Deer Creek, Big Chico Creek, and Butte Creek footprints (Figure F1-4 of Attachment F1).

The facilities described above have a total of 103.3 miles of SPFC levees and 29.7 miles of non-SPFC levees (Table 3-10). Revetment covers 5 miles generally along the levees. Levees along Elder Creek, Big Chico Creek, and much of Butte Creek are of medium or lower concern or lack sufficient data to characterize. All others are of higher concern.

No priority fish passage barriers have been documented along this unit.

3.4 Foothill Landscape Units

The reservoirs in the Foothill Landscape Unit portion of the Upper Sacramento River CPA are Shasta Lake on the Sacramento River, Black Butte Lake on Stony Creek, and Indian Valley Reservoir on Cache Creek.

From Shasta Lake, the Sacramento River flows southward to Colusa and continues to the southwest. Shasta Lake is the largest reservoir in California and provides flood management storage for the Upper Sacramento River and water supply as part of the Central Valley Project. The other main purposes of Shasta Lake are irrigation development, power generation, recreation, fish and wildlife conservation, and protection of the Delta from intrusion of saline ocean water.

On Stony Creek, Black Butte Lake is operated to manage flood flows on the Sacramento River and to provide irrigation, water supply, and recreational opportunities.

On the North Fork Cache Creek, flow is regulated by Indian Valley Reservoir. This reservoir is operated for the purposes of flood management, water supply, recreation, and downstream fishery releases.

The outlying communities of Adin and Chester are also within the Foothill Landscape Units of the Upper Sacramento River CPA. A flood control project was authorized by the federal government for Ash and Dry creeks at Adin in Modoc County in 1937 to reduce local flood risk. Ash and Dry Creeks are tributary streams to the Pit River above Shasta Dam. In addition, SPFC channel improvements and levees were made near the town of Chester to reduce flood risk. These improvements consist of a diversion structure, an excavated rock-lined diversion channel, approximately 3 miles of levees along the channel, and seven drop structures.

Landcover was not mapped for the CVFPP in the majority, over 99 percent, of lands within the Other Foothill Landscape Unit (Table 3-11 and Figure F1-3 of Attachment F1).

The target and other sensitive species documented in the Foothill Landscape Units are VELB, western pond turtle, and greater sandhill crane. VELB has only been observed east of Black Butte Dam, between Stony Creek and Newville Road. Greater sandhill crane were only known along Ash Creek and in the Ash Creek State Wildlife Area.

The Foothill Landscape Units also provides habitat for migrating, holding, and rearing steelhead and winter- and fall-/late fall–run Chinook salmon. The area contains critical habitat for steelhead and Chinook salmon.

Thus, a detailed description of land cover is not provided. There are no levees or revetted banks within this landscape unit.

3.5 Tables of Results

Table 3-1. Acreages of Connected and Disconnected Floodplain Inundation Potential Zones along Major River Reaches of the Upper Sacramento River Conservation Planning Area[a]

FIP Zone	Woodson Bridge State Recreation Area to Chico Landing	Chico Landing to Colusa	Colusa to Verona	Sutter Bypass to Sacramento River	Total Acres
Connected					
Baseflow FIP	1,736	3,312	2,293	330	7,671
67 Percent Sustained Spring FIP	5	225	511	587	1,329
50 Percent FIP	8,400	18,001	5,050	4,002	35,453
10 Percent FIP	8,067	5,628	183	51	13,930
Less than 10 Percent FIP	0	591	452	8	1,052
Subtotal	*18,209*	*27,757*	*8,489*	*4,977*	*59,434*
Disconnected					
Baseflow FIP	1	7	16,858	0	16,866
67 Percent Sustained Spring FIP	0	6	6,369	450	6,825
50 Percent FIP	88	21,744	38,833	3,158	63,823
10 Percent FIP	194	1,094	146	13	1,447
Less than 10 Percent FIP	3,591	5,414	708	49	9,762
Subtotal	*3,873*	*28,265*	*62,914*	*3,670*	*98,722*
Total	**22,082**	**56,022**	**71,403**	**8,647**	**158,154**

Source: DWR 2012b

Key:

FIP = floodplain inundation potential

Note:

[a] Values may not sum exactly because of rounding.

Table 3-2. Meander Zone Width, Area, and Constraints along Major River Reaches of the Upper Sacramento River Conservation Planning Area[a]

Meander Zone Attribute	Woodson Bridge State Recreation Area to Chico Landing	Chico Landing to Colusa	Colusa to Verona	Sutter Bypass to Sacramento River	Total
Width (feet)	6,216	7,041	2,894	5,645	n/a
Meander Zone Area (acres)					
Unconstrained	12,119	21,327	3,714	2,514	39,674
Constrained by Resistant Geology Only	1,200	1,513	0	0	2,713
Constrained by Revetment/Levees Only	731	10,049	18,761	1,985	31,526
Constrained by Both	34	6,102	0	37	6,173
Total	**14,084**	**38,992**	**22,475**	**4,536**	**80,086**

Source: AECOM 2013, CGS 2013, DWR 2011a, and DWR 2013a

Note:

[a] Values may not sum exactly because of rounding and because of overlap between geology constraints and levee/revetment constraints.

Table 3-3. Acreage of Land Cover Types in the Floodway Corridor along Major River Reaches of the Upper Sacramento River Conservation Planning Area[a,b]

Land Cover Type	Woodson Bridge State Recreation Area to Chico Landing	Chico Landing to Colusa	Colusa to Verona	Sutter Bypass to Sacramento River	Total Acres
Agricultural					
Rice	0	3,870	11,240	1,030	16,140
Cropland and Pasture	1,470	10,480	36,850	3,740	52,540
Orchard and Vineyard	9,900	16,830	7,690	1,470	35,890
Other Agricultural	1,030	5,730	3,980	640	11,380
Subtotal	*12,400*	*36,910*	*59,760*	*6,880*	*115,950*
					Natural
Marsh – Tidal	0	0	0	0	0
Marsh – Nontidal	286	137	179	5	607
Riparian – Forest	4,050	8,748	2,796	465	16,059
Riparian – Scrub	875	1,666	243	113	2,896
Seasonal Wetland	39	173	398	14	624
Other Natural	1,950	4,820	3,830	630	11,230
Subtotal	*7,200*	*15,540*	*7,450*	*1,230*	*31,420*
					Other
Water	1,470	3,090	2,830	370	7,760
Developed	40	480	1,370	180	2,070
Not Mapped	970	0	0	0	970
Total	**22,080**	**56,020**	**71,410**	**8,660**	**158,170**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

Table 3-4. Miles of the Shaded Riverine Aquatic Habitat Attributes along Major River Reaches of the Upper Sacramento River Conservation Planning Area[a]

Bank and Vegetation Type	Woodson Bridge State Recreation Area to Chico Landing	Chico Landing to Colusa	Colusa to Verona	Sutter Bypass to Sacramento River	Total Miles
Natural Bank (Miles)					
With Riparian Vegetation	18.1	37.4	44.5	7.9	107.9
Without Riparian Vegetation	33.7	68	10.4	1.9	114.0
Subtotal	*51.8*	*105.4*	*54.9*	*9.8*	*221.9*
Revetted Bank (Miles)					
With Riparian Vegetation	5.9	12.7	32.8	2.5	53.9
Without Riparian Vegetation	3.2	6.9	46.9	0.7	57.7
Subtotal	*9.1*	*19.6*	*79.7*	*3.1*	*111.5*
Total	**60.9**	**125.1**	**134.6**	**13.0**	**333.5**

Sources: DWR 2012c, USACE 2007, and USFWS 1992

Notes:

[a] Values may not sum exactly because of rounding.

Table 3-5. Indicators of Riparian Continuity along Major River Reaches of the Upper Sacramento River Conservation Planning Area[a]

Attribute	Woodson Bridge State Recreation Area to Chico Landing	Chico Landing to Colusa	Colusa to Verona	Sutter Bypass to Sacramento River	Total
Area of 100- to 330-Foot-Wide Corridor (acres)	2,360	4,990	5,100	350	12,800
Percent of 100- to 330-Foot-Wide Corridor in Riparian Vegetation	50	50	30	60	40
Median Patch Size (acres)	12.8	11.6	7.2	10.3	9.3

Source: DWR 2011b

Note:

[a] Values may not sum exactly because of rounding.

Table 3-6. Acreage of Land Cover Types of Floodplain in Potential Meander Zone along Major River Reaches of the Upper Sacramento River Conservation Planning Area[a,b]

Land Cover Type	Woodson Bridge State Recreation Area to Chico Landing	Chico Landing to Colusa	Colusa to Verona	Sutter Bypass to Sacramento River	Total Acres
Agricultural					
Rice	0	0	0	240	240
Cropland and Pasture	560	980	810	1,050	3,390
Orchard and Vineyard	4,230	5,160	70	0	9,460
Other Agricultural	290	1,450	170	150	2,050
Subtotal	*5,080*	*7,580*	*1,050*	*1,430*	*15,140*
Natural					
Marsh – Tidal	0	0	0	0	0
Marsh – Nontidal	169	107	13	4	293
Riparian – Forest	2,967	7,514	1,696	354	12,531
Riparian – Scrub	654	1,436	185	88	2,362
Seasonal Wetland	36	164	41	14	255
Other Natural	1,310	3,666	1,295	389	6,660
Subtotal	*5,140*	*12,890*	*3,230*	*850*	*22,100*
Other					
Water	1,420	2,970	2,200	350	6,940
Developed	20	20	20	20	80
Not Mapped	290	0	0	0	290
Total	**11,930**	**23,450**	**6,500**	**2,650**	**44,530**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

Table 3-7. Levee and Revetment Length (Miles) along Major River Reaches of the Upper Sacramento River Conservation Planning Area[a]

Facility Type	Woodson Bridge State Recreation Area to Chico Landing	Chico Landing to Colusa	Colusa to Verona	Sutter Bypass to Sacramento River	Total Miles
Miles of Levees					
SPFC	1.9	63.3	131.2	6.8	203.3
Non-SPFC	23.2	11.9	7.3	2.6	45.1
Total	**25.2**	**75.3**	**138.5**	**9.4**	**248.4**
Miles of Revetment					
Revetment	10.7	25.1	81.8	3.1	120.7

Source: DWR 2012c, DWR 2012e, and USACE 2007
Key:
SPFC = State Plan of Flood Control
Note:
[a] Values may not sum exactly because of rounding.

Table 3-8. Abundance[a] of Targeted Weed Species[b] within Major River Reaches, Tributaries, and Bypasses along the Upper Sacramento Conservation Planning Area

Reach		Red Bluff to Chico Landing					Chico Landing to Colusa										Colusa to Verona										Sutter Bypass					
USGS Quad Name		Foster Island	Hamilton City	Nord	Ord Ferry	Vina	Butte City	Colusa	Glenn	Hamilton City	Llano Seco	Meridian	Moulton Weir	Ord Ferry	Princeton	Sanborn Slough	Colusa	El Dorado Bend	Grays Bend	Grimes	Kirkville	Knights Landing	Meridian	Sutter Causeway	Tisdale Weir	Verona	Gilsizer Slough	Knights Landing	Nicolaus	Sutter Buttes	Sutter Causeway	Tisdale Weir
Percentage of Reach[c]		53	2	3	21	21	11	4	9	3	16	3	21	18	11	4	1	7	<1	9	23	24	19	1	14	1	21	8	2	11	39	20
Species																																
Common Name	Scientific Name																															
Barbed goat grass	*Aegilops triuncialis*					L																						H				
Tree of heaven	*Ailanthus altissima*	L	L	L	L	L	L		L	L	L			L	L	L		H			H	H				H						
Alligator weed	*Alternanthera philoxeroides*																															
Giant reed[d]	*Arundo donax*	H	H	L	H	H	M			H	M			H	L	L		L			L	H		L		L	L	H			L	
Yellow star-thistle	*Centaurea solstitialis*	H	H	M	H	H	H		H	H	H	H		H	H	H		M		H	H	M	H	H	H	M	H	M	L	H	H	H
Pampas grass	*Cortaderia selloana*	L	L	L	L	L	L			L	L			L		L		L			L	L				L		L				
Scotch broom	*Cytisus scoparius*																															
Stinkwort	*Dittrichia graveolens*										L							M			L	L				M		L	M			
Brazilian waterweed	*Egeria densa*	L																H			H	H			L	H		H	H			L
Medusa head	*Elymus caput-medusae*	H		H	H	H	H		H		H	L		H		H							L							L		
Blue gum	*Eucalyptus globulus*	L		L	L	L	L		L		L			L		L																
Edible fig	*Ficus carica*	L		L	L	L	L	L	L		L		L	L	L	L	L	H			H	H		L	L	L		H	L		L	L
Fennel	*Foeniculum vulgare*			L							L										L	L				L		L	L			
French broom	*Genista monspessulana*																															
Shortpod mustard	*Hirschfeldia incana*	H		H	H	H	L		H		H	L		H		L		L		L	L	L	L	L	L	L	L	L	L	L	L	L
Hydrilla	*Hydrilla verticillata*																															
Perennial pepperweed	*Lepidium latifolium*	L		L	L						L	L	L	L				M		L	L		L	L	L	M	L	M	L	L	L	L
American frogbit	*Limnobium spongia*																															
Water primrose	*Ludwigia* sp.				H		L	L			L			H	L	L	L				M			M	M		M		M	M	M	M
Purple loosestrife	*Lythrum salicaria*																									L			L			

Table 3-8. Abundance[a] of Targeted Weed Species[b] within Major River Reaches, Tributaries, and Bypasses along the Upper Sacramento Conservation Planning Area

Reach		Red Bluff to Chico Landing					Chico Landing to Colusa										Colusa to Verona										Sutter Bypass					
USGS Quad Name		Foster Island	Hamilton City	Nord	Ord Ferry	Vina	Butte City	Colusa	Glenn	Hamilton City	Llano Seco	Meridian	Moulton Weir	Ord Ferry	Princeton	Sanborn Slough	Colusa	El Dorado Bend	Grays Bend	Grimes	Kirkville	Knights Landing	Meridian	Sutter Causeway	Tisdale Weir	Verona	Gilsizer Slough	Knights Landing	Nicolaus	Sutter Buttes	Sutter Causeway	Tisdale Weir
Percentage of Reach[c]		53	2	3	21	21	11	4	9	3	16	3	21	18	11	4	1	7	<1	9	23	24	19	1	14	1	21	8	2	11	39	20
Species																																
Common Name	Scientific Name																															
Parrot's feather	*Myriophyllum aquaticum*	L			H							M		H		L		L		M	M	L	M	M	M	L	M	L	M	M	M	M
Tree tobacco	*Nicotiana glauca*	L	L	L	L	L	L			L	L			L		L		L			L	L						L		L		
Scotch thistle	*Onopordum acanthium* ssp. *acanthium*																															
Crisp-leaved pondweed	*Potamogeton crispus*	L		L	L	L	L		L		L			L		L																
Himalayan blackberry[d]	*Rubus armeniacus*	H		H	H	H	H		H		H	H		H		H		H		H	H	H	H	H	H	H	H	H	H	H	H	H
Ravenna grass	*Saccharum ravennae*																															
Russian thistle	*Salsola tragus*				L						L	L		L				L		L	L	L	L	L	L	L	L	L	L	L	L	L
Red sesbania[d]	*Sesbania punicea*	L			L	L	L				L			L								L				L		L	L			
Milk thistle	*Silybum marianum*																															
Saltcedar[d]	*Tamarix* sp.		L		L					L	L			L				L			L	L				L		L	L			
Chinese tallowtree	*Triadica sebifera*																												L			

Source: Cal-IPC 2013
Key: USGS= United States Geological Survey
Notes:
[a] Abundance rated by Cal-IPC as either H = High; M = Medium; L = Low; blank cells show no occurrences
[b] Of the 31 target weed species, no data are available for American frogbit or milk thistle
[c] Values may not sum to 100 because of rounding
[d] Indicates initial priority species

Table 3-9. Acreage of Land Cover Types of Valley Landscape Units in the Upper Sacramento River Conservation Planning Area[a, b]

Land Cover	Landscape Unit Type				Total Acres
	Major River Reach	Basin-Bypass[c]	Other Facility-Waterway	Other Valley SPA	
Agricultural					
Rice	16,140	46,680	15,170	163,740	238,180
Cropland and Pasture	52,540	20,270	7,720	85,460	159,640
Orchard and Vineyard	35,890	3,830	7,220	44,720	89,540
Other Agricultural	11,380	6,890	4,320	25,980	47,560
Subtotal	*115,950*	*77,660*	*34,440*	*319,900*	*534,930*
Natural					
Marsh – Tidal	0	0	0	0	0
Marsh – Nontidal	607	2,339	83	1,424	4,420
Riparian – Forest	16,059	7,380	1,641	10,619	35,280
Riparian – Scrub	2,896	655	266	1,348	5,150
Seasonal Wetland	624	27,807	3,599	24,624	55,220
Other Natural	11,230	9,980	3,460	14,590	37,570
Subtotal	*31,420*	*48,160*	*9,040*	*52,600*	*137,630*
Other					
Water	7,760	2,650	1,090	6,340	17,560
Developed	2,070	80	1,850	13,990	17,620
Not Mapped	970	0	850	16,050	17,880
Total	**158,170**	**128,550**	**47,270**	**408,880**	**725,603**

Source: DWR 2011b

Key:

SPA = Systemwide Planning Area

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

[c] Basin-Bypass acreages include the Sutter Bypass, Butte Basin, and Butte Slough

Table 3-10. Levee and Revetment Length (Miles) in Valley Landscape Units of the Upper Sacramento River Conservation Planning Area[a]

Facility Type	Landscape Unit Type				Total Miles
	Major River Reach	Basin-Bypass	Other Facility-Waterway	Other Valley SPA[b]	
Miles of Levees					
SPFC	188.6	55.6	103.3	0	347.5
Non-SPFC	45.2	31.7	29.7	141.1	247.8
Total	**233.8**	**87.3**	**133.1**	**141.1**	**595.3**
Miles of Revetment					
Revetment	120.7	11.2	5.0	13.5	150.4

Source: DWR 2012c, DWR 2012e, and USACE 2007

Key:

SPA = Systemwide Planning Area, SPFC = State Plan of Flood Control

Notes:

[a] Values may not sum exactly because of rounding.

[b] State Plan of Flood Control (SPFC) levees extend beyond the model extent in the "Other Valley SPA" column. However, because the "Other Valley SPA" is defined as being outside of the State Plan of Flood Control facilities, the 4.8 miles of SPFC levees have been included in the total miles of SPFC levees found in the major river reaches.

Table 3-11. Acreage of Land Cover Types of Foothill Landscape Units in the Upper Sacramento River Conservation Planning Area[a, b]

Land Cover	Landscape Unit Type			Total Acres
	Foothill Tributaries	Lake-Reservoir	Outlying Community	
Agricultural				
Rice	0	0	0	0
Cropland and Pasture	<10	0	0	<10
Orchard and Vineyard	<10	0	0	<10
Other Agricultural	<10	0	0	<10
Subtotal	*<10*	*0*	*0*	*<10*
Natural				
Marsh – Tidal	0	0	0	0
Marsh – Nontidal	0	0	0	0
Riparian – Forest	6	0	0	6
Riparian – Scrub	49	0	0	49
Seasonal Wetland	0	0	0	0
Other Natural	150	0	0	150
Subtotal	*210*	*0*	*0*	*210*
Other				
Water	60	0	0	60
Developed	<10	0	0	<10
Not Mapped	<10	34,320	60	34,380
Total	**270**	**34,320**	**60**	**34,645**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

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4.0 Summary of Existing Conditions for the Feather River Conservation Planning Area

The Feather River CPA encompasses the lower Feather River from the Oroville Dam to its confluence with the Sutter Bypass (Figure 4-1). Its major tributaries are Honcut Creek, the Yuba River, the Bear River, and the Sutter Bypass. The Feather River and lower reaches of the Bear and Yuba Rivers have sinuous channels (although reduced from historical conditions due to mining). Floodplain features include remnant channels, some of which have become seasonal or perennial lakes or wetlands. SPFC facilities in the Feather River CPA include the levees along the lower Feather River, along lower Honcut Creek, surrounding Marysville, the downstream reaches of the Yuba River and Bear River, the West Intercepting Canal, the East Intercepting Canal, Wadsworth Canal, and the east levee of the Sutter Bypass.

Riverine and floodplain ecosystems have been substantially degraded in the Feather River CPA. Massive sediment deposition from hydraulic mining in the upper watersheds, dredging of cutoff channels, and post-mining incision have reduced the channel's width and sinuosity, and have resulted in floodplains that are relatively high above the channel compared to the pre-mining era (James et al. 2009). Along the Feather River and lower reaches of the Bear and Yuba Rivers, approximately one-half of the floodplain potentially inundated by a 50-percent-chance event (2-year recurrence interval) is disconnected from the river by levees. Furthermore, only a very small portion (less than 1 percent) of the floodplain experiences sustained winter or spring inundation, and the rearing habitat for Chinook salmon provided by inundated floodplains has been reduced by roughly 98 percent (see Appendix H).

Channel migration has also been reduced in the Feather River CPA, particularly along the Feather River, because river flows that erode banks and the length of natural bank have been reduced, and levees and revetment isolate about one-quarter of the natural meander zone from the river channel.

In addition to reductions in floodplain inundation and channel migration, the extent of riparian habitat has been substantially reduced. In the Feather River CPA, riparian vegetation historically covered roughly one-third of land within 1 mile of rivers and waterways (The Bay Institute 1998), but today it accounts for a much smaller portion (approximately 10 percent) of land within 1 mile of rivers and waterways. Along the Feather, Yuba, and Bear Rivers, riparian vegetation covers approximately 27 percent of the active (10-year) floodplain. However, two-thirds of channel banks have riparian vegetation (DWR 2014a). In contrast to conditions in other CPAs, most banks in the Feather River CPA that lack riparian vegetation are not protected by revetment; rather, revetment covers only 10 percent of banks.

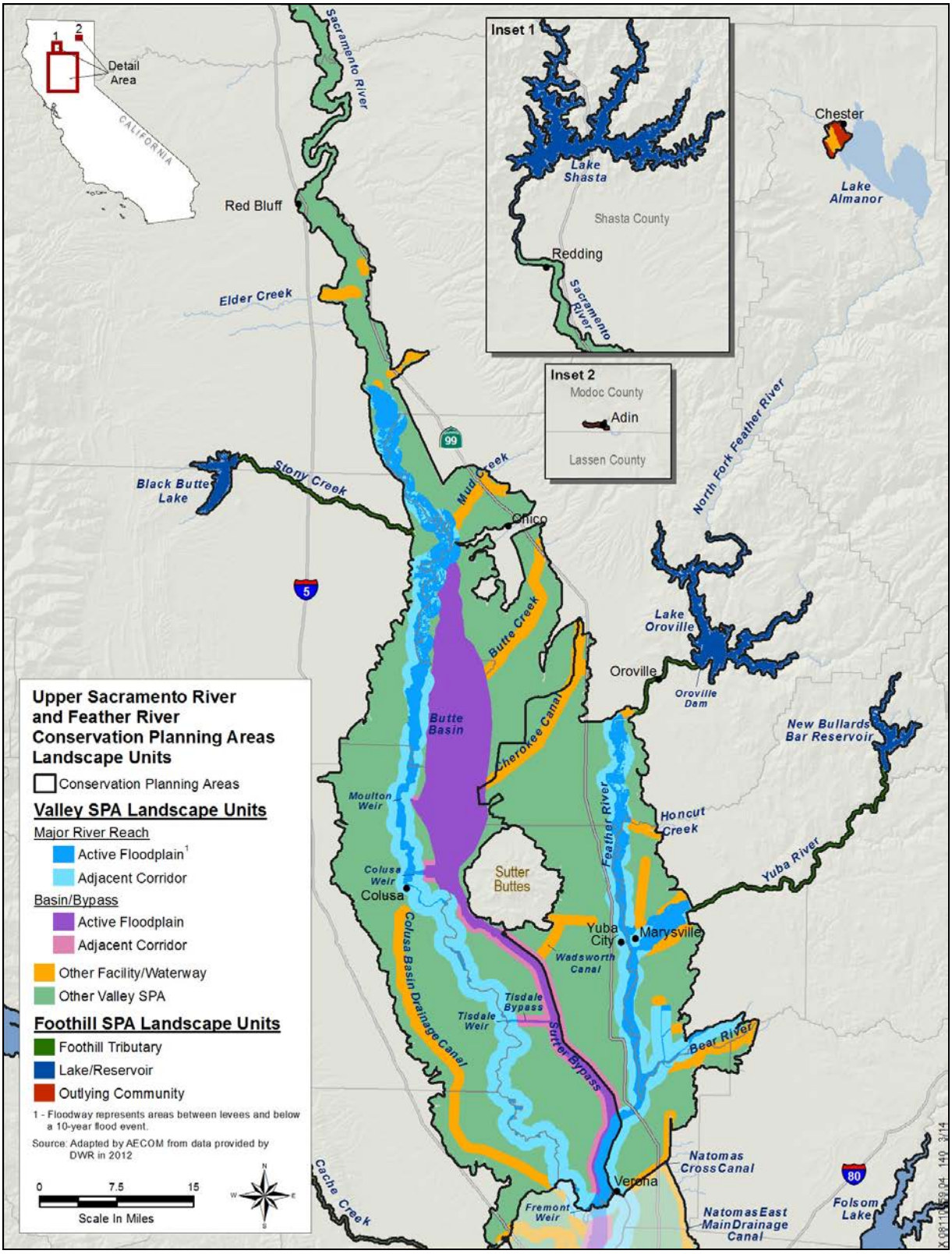

Figure 4-1. Upper Sacramento and Feather River Conservation Planning Areas

These alterations of ecosystem processes and riparian habitat have contributed to the population declines of sensitive species, including 10 species that are targets of this Conservation Strategy (not including those known only from historical records or whose distribution in this CPA is poorly documented) (CDFG 2005 and DWR 2011c):

- Valley elderberry longhorn beetle
- Steelhead, California Central Valley DPS
- Chinook salmon, Central Valley fall-/late fall-run ESU
- Chinook salmon, Central Valley spring-run ESU
- Green sturgeon, Southern DPS
- Giant garter snake
- Bank swallow
- Greater sandhill crane
- Swainson's hawk
- Western yellow-billed cuckoo

To recover these and other species, multiple conservation plans include objectives and actions calling for establishment of more continuous corridors of riparian vegetation and SRA habitat along the Feather River, increases in river meander and floodplain inundation, and improvement of fish passage (e.g., USFWS 2001; CVJV 2006; BANS-TAC 2013; NMFS 2014). Restoring these processes and habitats supports objectives for recovery of multiple aquatic and terrestrial species. For example, to support the AFRP "doubling goal" for Chinook salmon, approximately 10,000 acres of additional rearing habitat on inundated floodplains are required (see Appendix H).

The presence of 238 miles of SPFC levees (and 91 miles of non-SPFC levees) and 15 miles of associated revetment in this CPA constrains the attainment of these objectives. However, public agencies (including DWR) have been investing in actions that support conservation. In particular, setback levees have been constructed in this CPA (the Three Rivers Levee Improvement Authority's Feather and Bear Rivers, and Star Bend setback levees), creating additional flood capacity, and increasing the area of active floodplain, and providing opportunities for restoration of riparian and floodplain habitat.

These setback levees allow for the removal of revetment and the addition of considerable SRA cover, riparian forest, woodland, scrub, and other floodplain habitats without significant hydraulic impacts. More than 1,000 acres of habitat could be restored through potential restoration projects identified in regional plans, including the Lower Feather River Corridor Management Plan (DWR 2014c) and Feather River Region Regional Flood Management Plan

(Yuba County Water Agency, Three Rivers Levee Improvement Authority, Marysville Levee Commission, and Sutter Butte Flood Control Agency 2013). Even more restoration may be feasible, particularly if the amount of inundated floodplain is further increased. To accomplish this, inundation could be increased on floodplains that are already connected to the river (e.g., by lowering the floodplain) and additional levees could be set back. Through such actions, the CVFPP could substantially contribute to conservation needs in this CPA.

Furthermore, the Sunset Pumps Diversion Dam has been impeding fish passage in the lower Feather River. However, this structure is not part of the SPFC (see Appendix K).

4.1 Major River Reaches

Detailed descriptions by river reach (Figure 4-2) for the Feather River CPA are provided below.

4.1.1 Feather River – Thermalito Afterbay to Yuba River

The northern portions of the Feather River in this reach actively meanders. The river has a braided channel, and splits into multiple forks at many locations, creating gravel islands, often with riparian vegetation. The river corridor becomes more constrained and narrower in the southern portion of the reach as it nears the towns of Yuba City and Marysville.

Tributaries to the Feather River within this reach are Honcut Creek (at RM 44), Jack Slough (at RM 29), and Yuba River (at RM 27).

Within this reach of the Feather River, the 2-mile-wide floodway corridor covers approximately 35,200 acres, and approximately 10 percent of that corridor along this reach has been conserved (Figure F1-1 of Attachment F1). Unlike most other reaches, most of the conserved area is disconnected from the river. Conserved areas in this reach include the Oroville Wildlife Area and a portion of the Feather River Wildlife Area, which are both managed by CDFW. There are also multiple city parks, the City of Marysville Open Space, and a county park.

Ecosystem Processes

Floodplain Inundation. Along the Feather River from Thermalito Afterbay to the Yuba River, the floodplain has almost no areas with a 67-percent-chance Sustained Spring FIP (Table 4-1and Figure F1-2 of Attachment F1). Areas with a 50-percent-chance FIP, however, account for more than 40 percent of the corridor along the river, with the remainder evenly divided between a 10-percent-chance and greater than a 10-percent-chance FIP. More than two-thirds of areas with a 50-percent-chance FIP are connected to the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 768 feet, ranging between 160 feet and 1,700 feet. The meander corridor is an estimated 6,357 feet wide (Table 4-2) and the meander amplitude is 4,030 feet. Of the total meander zone (22,538 acres), approximately 19 percent is constrained by geology; 20 percent is constrained by revetment, levees, and other infrastructure; and an additional 25 percent is constrained by both. The remainder (8,078 acres or 36 percent) of the reach is unrestricted.

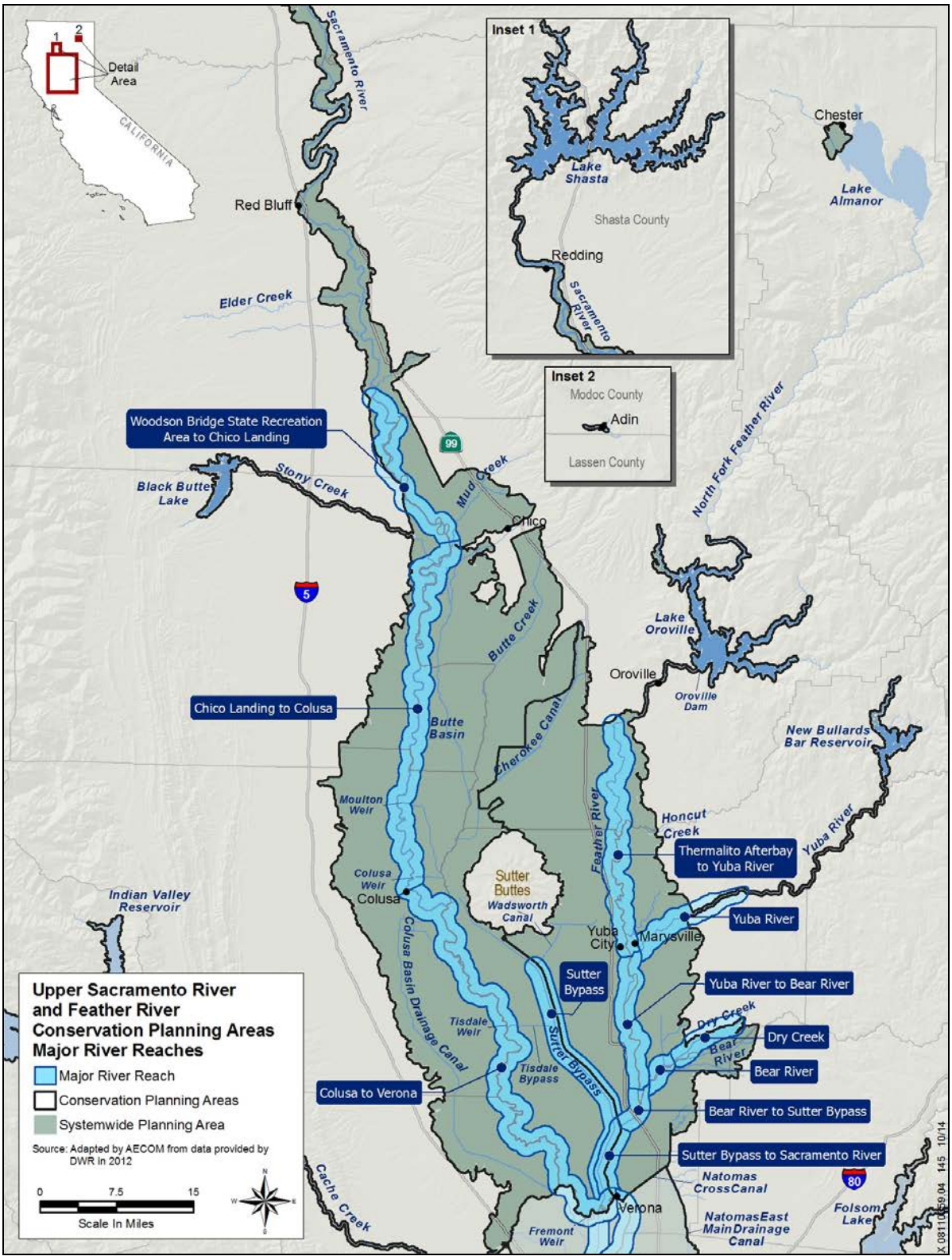

Figure 4-2. River Reach Extent for the Feather River Conservation Planning Area

Habitats

Land cover along this reach of the Feather River is primarily agriculture (Table 4-3 and Figure F1-3 of Attachment F1). Agriculture represents more than one-half of the corridor's land cover. Natural vegetation comprises a little more than one-eighth of the land cover and wetland/riparian vegetation comprises one-tenth of the land cover. Riparian vegetation is extensive in the north end of the reach, and patchy but distributed throughout the remainder.

Shaded Riverine Aquatic Cover. The percentage of banks with potential SRA habitat is high along this reach of the Feather River compared to other major river reaches. Of the 85 miles of river bank within this reach, 74 miles have natural bank conditions (Table 4-4). Riparian vegetation lines 59 miles of bank, of which 50 have natural bank conditions, representing 59 percent of the total banks along this reach.

Riparian Habitat. Along this reach, approximately 3,240 acres of riparian vegetation is located within 1 mile of the Feather River, which is approximately 9 percent of the corridor land area (Table 4-3). Most of this habitat is very close to the river: Riparian vegetation occupies 45 percent of the 330-foot-wide corridors along the river banks and 20 percent of the 10-year floodplain that is connected to the river (Table 4-5). Levee VMZs are generally more than 330 feet from the river banks, with some very short sections throughout where the VMZs are less than 330 feet from the bank on one side of the river.

The connectivity of riparian habitats along this reach is very high. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 7.4 acres along this reach (Table 4-5). Riparian habitat in this reach is fairly continuous throughout, but is most narrow between RM 35 and RM 47, and widest between RM 53 and RM 59.

Riparian vegetation consists primarily of forest, which accounts for 88 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Very few wetlands are present along this reach. The 214 acres of seasonal wetland accounts for less than 1 percent of the land area; 109 acres of nontidal marsh is present along this reach (Table 4-3). Of the total 323 acres of wetlands, 245 are protected as State or county lands. The marshes range in size from less than 1 acre to 50 acres, and most are small. The seasonal wetlands are located in one complex at the afterbay area and range from less than 1 acre to 37 acres. Most of the marsh features appear to be associated with floodplain features related to historical meander migration.

A substantial portion of these features (94 percent of marsh and 87 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 4-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach and occupies 68 percent (23,780 acres) of the reach corridor (Table 4-3). Approximately two-thirds (66 percent) of the agricultural lands within the reach corridor are situated above the 10-year flood level or protected by levees. Of the total area within the 10-year

(10-percent-chance) floodplain connected to the Feather River (14,590 acres), a little more than one-half (56 percent) is agricultural land. Orchard and vineyard covers the majority (92 percent) of these floodplain agricultural lands. The remainder is composed of other agricultural land (7 percent) and cropland and pasture (2 percent). Only 20 acres, less than 1 percent, of the total agricultural land is conserved as State lands.

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are VELB, giant garter snake, colonies of bank swallows, Swainson's hawk, and western yellow-billed cuckoo. Active bank swallow colonies have been documented consistently throughout the reach along steep banks.

This reach also provides habitat for several sensitive fish species such as migrating, holding, and rearing steelhead; migrating, holding, spawning, and rearing fall-run Chinook salmon; migrating and rearing spring-run Chinook salmon; and foraging adult green sturgeon. The reach contains critical habitat for steelhead, Chinook salmon, and green sturgeon.

Stressors

Less than 10 percent of the corridor along this reach has developed land uses, and most of this reach has only small amounts of developed land uses and major infrastructure. A low, notched rock dam spans the river near RM 39. However, Yuba City and Marysville are at the downstream end of this reach, and along the river, developed land uses are extensive from about RM 27 to RM 31. A number of pipelines, roads, and electrical transmission lines cross the river in this area (Figure F1-4 of Attachment F1). Also, there is a community airport at Yuba City within 1 mile of the river. Canal and drainage infrastructure in this reach includes Sutter Butte Canal and Sunset Avenue Lateral, both of which run parallel to the river.

Levees. There are 44.9 miles of SPFC levees and 14.2 miles of non-SPFC levees within this reach (Table 4-7 and Figure F1-4 of Attachment F1). The levees in this reach vary from approximately 200 feet to 3,700 feet from the river. SPFC facilities in this reach consist of a levee throughout the reach on the west bank, the Sutter-Butte Canal Headgate, a levee extending downstream from Honcut Creek on the east side of the river, and a ring levee around Marysville. The physical condition of these levees is primarily of higher concern.

Revetment. There is 10.6 miles of revetment within this reach (Table 4-7). All of this revetment is located along the banks of the Feather River armoring 13 percent of the bank length (Table 4-4). Revetment is primarily located along the mid-section of this reach near RMs 28-31, 35-45, and 48 through 51.

Fish Passage Barriers. One fish passage barrier, Sunset Pumps Diversion Dam, has been documented along this reach and has been identified as a priority for improved fish passage (Figure F1-5 of Attachment F1). Also, four gravel mines are located within this reach: Vance Avenue Pit #1 (near RM 58), Almond Avenue Mine, Mathews Ready Mix, and Robinson Pit within the Oroville Wildlife Area (near RM 55). In addition, a series of remnant gravel pit pools/ponds connect to the main channel in this reach.

Invasive Plants. Within the floodway corridor along this reach, 25 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 25 species, six are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 4-8. Within DWR channel and levee maintenance areas along this reach, approximately 104 acres of initial priority species occurs, with 1 acre of giant reed and 103 acres of Himalayan blackberry. Within other areas maintained by LMAs, approximately 5 acres of initial priority species occurs, made up exclusively of Himalayan blackberry. Occurrences of Himalayan blackberry are spread throughout this reach.

4.1.2 Feather River – Yuba River to Bear River

The Feather River is constrained along most of this reach, except for a couple of areas that are allowed to meander. The distance of the river from the levees varies, and there is very little revetment in this reach.

The only tributary to the Feather River within this reach is Bear River (at RM 12).

Within this reach of the Feather River, the 2-mile-wide floodway corridor covers approximately 18,700 acres, and nearly 15 percent of that corridor has been conserved (Figure F1-1 of Attachment F1). Conserved areas along this reach include a portion of the Feather River Wildlife Area, which is managed by CDFW, and several city parks.

Ecosystem Processes

Floodplain Inundation. Between the Yuba and Bear Rivers, most of the corridor along the Feather River has a 50-percent-chance FIP (Table 4-1 and Figure F1-2 of Attachment F1). More than two-thirds of these areas are disconnected from the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 472 feet, ranging between 210 feet and 1,170 feet. The meander corridor is an estimated 3,687 feet wide (Table 4-2) and the meander amplitude is 2,360 feet. Of the total meander zone within this reach (7,291 acres), the majority (73 percent) is unrestricted. Approximately 10 percent is constrained by revetment, levees, and other infrastructure, and 1 percent of the reach is constrained by natural geology. The remainder of the reach (1,087 acres or 15 percent) is constrained by both geology and infrastructure.

Habitats

Land cover along this reach of the Feather River is primarily agriculture (Table 4-3 and Figure F1-3 of Attachment F1). Agriculture represents more than one-half of the corridor's land cover. Natural vegetation, primarily riparian, comprises a little more than one-quarter of the land cover, and wetland/riparian vegetation comprises just under one-fifth. Riparian vegetation is most extensive in this reach of the CPA, and is somewhat more prevalent on the eastern side of the corridor.

Shaded Riverine Aquatic Cover. The percentage of banks with potential SRA habitat along this reach of the Feather River is high among the major river reaches. Of the 34 miles of river bank,

33 miles have natural bank conditions (Table 4-4). Riparian vegetation lines 19 miles of bank, of which 18 miles have natural bank conditions representing 54 percent of the total banks along this reach.

Riparian Habitat. Along this reach, just less than 3,200 acres of riparian vegetation are located within 1 mile of the Feather River, approximately 17 percent of the corridor's land area (Table 4-3). Much of this habitat is close to the river: Riparian vegetation occupies 66 percent of the 330-foot-wide corridor along the river banks and 39 percent of the 10-year floodplain that is connected to the river (Table 4-5). Levee VMZs are generally more than 330 feet from the river banks along this reach. On the west side between RM 21 to RM 24, the VMZs are less than 330 feet from the river banks.

The connectivity of riparian habitats along this reach is very high. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 5.1 acres (Table 4-5). Riparian habitat in this reach is nearly continuous throughout the reach, but is most narrow between RM 25 and RM 27 and widest between RM 12 and RM 18.

Riparian vegetation consists primarily of forest, which accounts for 78 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Very few wetlands are present along this reach. The 56 acres of nontidal marsh account for less than 0.5 percent of the land area. In addition, 54 acres of seasonal wetland is present along this reach (Table 4-3). Of the total 110 acres, 77 acres are protected as State and regional lands. The marshes range in size from less than 1 acre to 10 acres, and most are moderate in size. Seasonal wetlands range from just more than 1 acre to 42 acres, and most are small. Most of these features appear to be associated with floodplain features related to historical meander migration.

A substantial portion of these features (38 percent of marsh and all of the seasonal wetland) is connected to the river system within the potential meander zone (Table 4-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 60 percent (11,090 acres) of the reach corridor (Table 4-3). Approximately three-quarters (76 percent) of the agricultural lands within the reach corridor are situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the Feather River (7,960 acres), approximately one-third (34 percent) is agricultural land. Orchard and vineyard covers the majority (79 percent) of these floodplain agricultural lands, 4 percent is cropland and pasture, and 17 percent is identified as other agricultural land. Two percent of the total agricultural land in this reach is conserved as State, regional, or city land.

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are Sanford's arrowhead, VELB, giant garter snake, colonies of bank swallows, Swainson's hawk, and western yellow-billed

cuckoo. VELB individuals were only observed at Star Bend boat ramp, approximately 2 miles east-northeast of Tudor. Active bank swallow colonies have been documented consistently throughout the reach in steep banks. Western yellow-billed cuckoos have been sighted at two locations: the confluence to the Yuba and Feather Rivers near Marysville and Yuba City, and at the Bobelaine Sanctuary on the Feather River, approximately 2 miles north of Nicolaus.

This reach also provides habitat for several sensitive fish species: migrating, holding, and rearing steelhead; migrating, holding, and rearing fall-run Chinook salmon; migrating and rearing spring-run Chinook salmon; and foraging adult green sturgeon. The reach contains critical habitat for steelhead, Chinook salmon, and green sturgeon.

Stressors

Developed land uses occupy approximately 10 percent of the corridor along this reach. The Yuba City and Marysville areas extend along the upstream end of this reach (RMs 24 to 27), and developed land uses are extensive in these areas. An electrical transmission line and a natural gas pipeline cross the river, and a power plant is adjacent to the river. Also, both the Yuba City and Yuba County airports are within 2 miles of the river. However, downstream from Yuba City and Marysville, developed land and major infrastructure is limited except for an electrical transmission line that crosses the river near RM 23 and levees that extend along both banks (Figure F1-4 of Attachment F1).

Levees. There are 27.4 miles of SPFC levees and 3.9 miles of non-SPFC levees within this reach (Table 4-7; Figure F1-4 of Attachment F1). SPFC levees are on both sides of the river. Levees along the west bank are closer to the river (approximately 430 feet) and are set back more than 1 mile along the east bank. The physical condition of most of the west levee is of higher concern; the physical condition of the east bank levee is of lower concern.

Revetment. There is 1.1 miles of revetment (armoring 3 percent of bank length) along the Feather River in this reach (Table 4-4 and Table 4-7). Revetment is scattered throughout this reach in small portions at RMs 21, 18, and 15, and is concentrated between RMs 24 to 26.

Fish Passage Barriers. No priority fish passage barriers have been documented along this reach. No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 18 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 18 species, three are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 4-8. Within DWR channel and levee maintenance areas along this reach, approximately 38 acres of initial priority species occurs, with 2 acres of giant reed and 36 acres of Himalayan blackberry. Within other areas maintained by LMAs, roughly 5 acres of initial priority species occur, which are made up exclusively of Himalayan blackberry. Occurrences of Himalayan blackberry are concentrated in the southern half of this reach; occurrences of giant reed are isolated.

4.1.3 Feather River – Bear River to Sutter Bypass

Meandering of the Feather River in this reach is limited; however, large levee setbacks occur in this reach, particularly on the east side of the river.

No tributaries to the Feather River occur in this reach.

Within this reach of the Feather River, the 2-mile-wide floodway corridor covers approximately 5,800 acres, and nearly 15 percent of that corridor has been conserved (Figure F1-1 of Attachment F1). Conserved areas along this reach include a portion of the Feather River Wildlife Area and a portion of the Sutter Bypass Wildlife Area, which are both managed by CDFW.

Ecosystem Processes

Floodplain Inundation. From Bear River to the Sutter Bypass, most of the corridor along the Feather River has a 50-percent-chance FIP (Table 4-1 and Figure F1-2 of Attachment F1). Approximately two-thirds of these areas are disconnected from the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 827 feet, ranging between 332 feet and 1,551 feet. The meander corridor is an estimated 6,908 feet wide (Table 4-2), and the meander amplitude is 4,373 feet. Of the total meander zone within this reach (3,936 acres), the majority (54 percent) is unrestricted. Approximately 38 percent is constrained by revetment, levees, and other infrastructure, and less than 1 percent of the reach is constrained by natural geology. The remainder of the reach (282 acres or 7 percent) is constrained by both geology and infrastructure.

Habitats

Land cover along this reach of the Feather River is primarily agriculture (Table 4-3 and Figure F1-3 of Attachment F1). Agriculture represents more than one-half of the corridor's land cover. Natural vegetation, primarily nonwetland/riparian, accounts for one-third of the land cover, and wetland/riparian vegetation accounts for one-eighth. Riparian vegetation is fairly extensive in this reach, particularly in the north half of the corridor.

Riparian Habitat. Along this reach, approximately 820 acres of riparian vegetation is located within 1 mile of the Feather River, which is approximately 14 percent of the corridor land area (Table 4-3). Much of this habitat is close to the river: Riparian vegetation occupies 51 percent of the 330-foot-wide corridors along the river banks and 35 percent of the 10-year floodplain that is connected to the river (Table 4-5). Levee VMZs are generally more than 330 feet from the river banks, with the exception of two stretches near RM 8 and RM 9 where the VMZs are less than 330 feet from the river banks on the southeast side.

The connectivity of riparian habitats along this reach is relatively high. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of the patches of riparian vegetation, which is 3.5 acres along this reach (Table 4-5). Riparian habitat in this reach is found in a mix of broad patches and narrow corridors, and is most continuous between RM 10 and RM 12, and least continuous between RM 8 and RM 10.

Riparian vegetation consists primarily of forest, which accounts for 90 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Very few wetlands are present along this reach. The 12 acres of seasonal wetland and 2 acres of nontidal marsh comprise less than 0.5 percent of land cover along this reach (Table 4-3). None of the total 14 acres are protected. The single marsh is 2 acres and located along the river channel. The seasonal wetlands range from less than 1 acre to just more than 5 acres. These floodplain features appear to be associated with historical meander migration.

All of these features are connected to the river system within the potential meander zone (Table 4-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach and occupies 57 percent (3,320 acres) of the reach corridor (Table 4-3). Almost all (97 percent) of the agricultural lands within the reach corridor are situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the Feather River (2,310 acres), only 5 percent is agricultural land. Within these floodplain agricultural lands, 45 percent is for rice production, 32 percent is other agricultural land, and 24 percent is cropland and pasture. Of the total agricultural land, 60 acres, or less than 2 percent, is conserved (as State land).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are VELB, giant garter snake, western pond turtle, colonies of bank swallows, Swainson's hawk, and western yellow-billed cuckoo. VELB exit holes have been observed only at Bobelaine Sanctuary, approximately 2 miles north of Nicolaus. Active bank swallow colonies have been documented consistently throughout the reach in steep banks.

This reach also provides habitat for several sensitive fish: migrating, holding, and rearing steelhead; migrating, holding, and rearing fall-run Chinook salmon; migrating and rearing spring-run Chinook salmon; Sacramento splittail; and foraging adult green sturgeon. The reach contains critical habitat for steelhead, Chinook salmon, and green sturgeon.

Stressors

This reach has only a small amount (less than 2 percent) of developed land, primarily near Nicolaus (RM 10). SR 99 crosses the river near RM 9, and electrical transmission lines cross the river near RMs 9 and 10 (Figure F1-4 of Attachment F1).

Levees. There are 10.3 miles of SPFC levees and 0.5 mile of non-SPFC levees within this reach (Table 4-7; Figure F1-4 of Attachment F1). Levees in this reach are fairly uniform and are setback between 0.2 mile and 0.8 mile from the river. The physical condition of these levees is of higher concern, except for approximately 2 miles of the north levee (from RM 10 to the junction with the Sutter Bypass) that are of medium concern.

Revetment. There is 1.1 miles of revetment (armoring 10 percent of bank length) along the Feather River in this reach (Table 4-4 and Table 4-7). All revetment in this reach is located in the southwest portion of the reach near RMs 8 and 9.

Fish Passage Barriers. No priority fish passage barriers have been documented along this reach. No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 15 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 15 species, two are ranked as being highly abundant. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 4-8. Within DWR channel and levee maintenance areas along this reach, approximately 12 acres of initial priority species occurs, made up exclusively of Himalayan blackberry. Within other areas maintained by LMAs, approximately 4 acres of initial priority species occurs, also made up exclusively of Himalayan blackberry. Occurrences of these species are spread throughout this reach.

4.1.4 Yuba River

The lower reach of the Yuba River is a relatively narrow floodplain constrained by nearby terraces and other uplands. South of the river, a portion of the Yuba Goldfields is within the corridor. This extensive disturbed area contains numerous small water features and patches of riparian vegetation.

The only tributary to the Yuba River within this reach is Dry Creek (at RM 13).

Along the Yuba River, the 2-mile-wide floodway corridor covers approximately 8,300 acres, and less than 1 percent of that corridor has been conserved (Figure F1-1 of Attachment F1). Conserved areas along this reach of the Yuba River are limited to multiple city parks, several parcels managed by the U.S. Bureau of Land Management (mostly upstream from RM 10), and City of Marysville open space that is approximately 1 mile upstream from the junction with the Feather River.

Ecosystem Processes

Floodplain Inundation. More than one-half of the corridor along the river has a greater than a 10-percent-chance FIP (Table 4-1 and Figure F1-2 of Attachment F1). More than 10 percent of the floodplain corridor had a 50-percent-chance FIP, approximately one-half of which is connected to the river. Very little floodplain has a 67-percent-chance Sustained Spring FIP.

Riverine Geomorphic Processes. In this reach, the average channel width is 625 feet, ranging between 220 feet and 1,526 feet. The meander corridor is an estimated 5,674 feet wide (Table 4-2) and the meander amplitude is 3,605 feet. Of the total meander zone within this reach (4,663 acres), the majority (78 percent or 3,642 acres) is unrestricted. Approximately 7 percent (335 acres) is constrained by revetment, levees, and other infrastructure. Natural geology limits 6 percent of the meander zone (261 acres). The remaining meander zone (9 percent) is constrained by both infrastructure and natural geology.

Habitats

Land cover along this lower reach of the Yuba River is primarily agriculture (Table 4-3 and Figure F1-3 of Attachment F1). Agriculture represents more than one-half of the corridor's land cover. Natural vegetation accounts for one-fifth of the land cover, and wetland/riparian vegetation accounts for less than one-eighth. Riparian vegetation is moderate in this reach of the CPA, and is located some distance from the river in many areas.

Shaded Riverine Aquatic Cover. There are no banks with potential SRA habitat within the Yuba River. Of the 6 miles of river bank, approximately 5 miles have natural bank conditions (Table 4-4). However, there is no riparian vegetation mapped along these 6 miles of river bank. (Some SRA cover is likely provided by small, unmapped patches of riparian vegetation and where riparian vegetation has been misclassified.)

Riparian Habitat. Along this reach, just less than 690 acres of riparian vegetation is located within 1 mile of the Yuba River, approximately 8 percent of the corridor land area (Table 4-3). Most of this habitat is very close to the river: Riparian vegetation occupies 41 percent of the 330-foot-wide corridor along the river banks and 14 percent of the 10-year floodplain that is connected to the river (Table 4-5). Levee VMZs are generally more than 330 feet from the river banks in this reach.

The connectivity of riparian habitats along this reach is relatively low. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of a patch of riparian vegetation, which is 1.2 acre along this reach (Table 4-5). This habitat is found in broad but small patches, and is most continuous between RM 1 and RM 5, and nearly absent between RM 9 and RM 13.

Riparian vegetation consists primarily of forest, which accounts for 69 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Very few wetlands are present along this reach of the Yuba River. Six acres of seasonal wetland and 5 acres of nontidal marsh, less than 0.5 percent of the land area, are present along this reach (Table 4-3). None of the total 11 acres is protected. Three of the marshes present are 1 acre and two are 2 acres; the two seasonal wetlands present are 1 acre and 5 acres. The marsh features appear to be associated with a tributary from the northern Yuba Goldfields area, and the seasonal wetlands are closely associated with the river.

A substantial portion of these features (60 percent of marsh and all of the seasonal wetland) is connected to the river system within the potential meander zone (Table 4-6).

Floodplain Agriculture. Agricultural land is distributed throughout both sides of the river, but development in the northwestern portion of the corridor limits distribution; agriculture occupies 59 percent (4,890 acres) of the reach corridor (Table 4-3). Approximately one-half (55 percent) of the agricultural lands within the reach corridor are situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the Yuba River (3,440 acres), almost two-thirds (64 percent) is agriculture. Within

these floodplain agricultural lands, 78 percent is orchard and vineyard, 14 percent is rice, 3 percent is cropland and pasture, and 5 percent is other agricultural land. None of the agricultural land is protected.

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are Swainson's hawk, tricolored blackbirds, and western yellow-billed cuckoo. A single Swainson's hawk occurrence within this reach was a nest observed on the south bank of the Yuba River, approximately 1 mile west of Dantoni and 3 miles east-northeast of Marysville. Tricolored blackbird colonies have been documented in this reach, approximately 1 mile northeast of Marysville, approximately 1 mile north of Marigold and near Hammonton. The only western yellow-billed cuckoo in this reach was observed at the confluence of the Yuba and Feather Rivers near Marysville and Yuba City.

This reach also provides habitat for several sensitive fish: migrating, holding, and rearing steelhead and fall-run Chinook, and migrating and rearing spring-run Chinook. The reach contains critical habitat for steelhead, Chinook salmon, and green sturgeon.

Stressors

Developed land uses occupy less than 10 percent of the corridor along this reach. However, Marysville is at the downstream end of this reach where developed land uses are extensive. Upstream from Marysville, developed land and major infrastructure is limited. From about RM 8 to RM 10, two gravel mines and two electrical transmission lines cross the river, and farther upstream is Daguerre Point Dam (Figure F1-4 of Attachment F1).

Levees. There are 7.3 miles of SPFC levees and 4.2 miles of non-SPFC levees within this reach (Table 4-7; Figure F1-4 of Attachment F1). SPFC levees are set back between approximately 300 feet and 1 mile along the Yuba River. The non-SPFC levee is located near RMs 6 to 8. The physical condition of segments of these levees varies from medium to higher concern.

Revetment. There is 1.5 miles of revetment (armoring 23 percent of bank length) along the Yuba River in this reach (Table 4-4 and Table 4-7). Revetment in this reach is all located between RMs 1 and 4.

Fish Passage Barriers. No priority fish passage barriers have been documented along this reach, but two gravel mines occur: Hallwood Plant and Dantoni Pit, located between RM 8 and RM 10 (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 17 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 17 species, two are ranked as being highly abundant in at least one quad within the tributary. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 4-8. Within DWR channel and levee maintenance areas along this reach, approximately 15 acres of initial priority species occurs, with 3 acres of giant reed and 12 acres of Himalayan blackberry. Within other areas maintained by LMAs, approximately 18 acres of initial priority species occurs, made up

exclusively of Himalayan blackberry. Occurrences of Himalayan blackberry are spread throughout this reach; occurrences of giant reed are limited to the northern portion of the reach.

4.1.5 Bear River

The Bear River is a relatively narrow floodplain constrained by nearby terraces and other uplands. Although levees in this reach are set back from the river, limited meandering occurs.

Tributaries to the Bear River within this reach are Yankee Slough (at RM 8) and the Union Pacific (UP) Interceptor (at RM 4).

Along the Bear River, the 2-mile-wide floodway corridor covers approximately 4,400 acres, and only a small portion,approximately 4 percent, of that corridor is conserved (Figure F1-1 of Attachment F1). Conserved areas along this reach are limited to a few regional parks and several water-district-owned parcels.

Ecosystem Processes

Floodplain Inundation. Along the lowest reach of the Bear River, almost one-half of the corridor along the river had a 67-percent-chance Sustained Spring FIP or a 50-percent-chance FIP (Table 4-1 and Figure F1-2 of Attachment F1). Most of this area (85 percent or more) is disconnected from the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 441 feet, ranging between 150 feet and 1,100 feet. The meander corridor is an estimated 3,417 feet wide (Table 5_2), and the meander amplitude is 2,190 feet. Of the total meander zone within this reach (1,552 acres), approximately 42 percent is unrestricted. Approximately 19 percent (297 acres) is constrained by revetment, levees, and other infrastructure.

Habitats

Land cover along this reach of the Bear River is primarily agriculture (Table 4-3 and Figure F1-3 of Attachment F1). Agriculture represents more than one-half of the corridor's land cover. Natural vegetation accounts for one-quarter of the land cover, and wetland/riparian vegetation accounts for one-eighth. Riparian vegetation is fairly extensive in the west end of this reach and is moderate overall.

Shaded Riverine Aquatic Cover. Data for the attributes of shaded riverine aquatic habitat were not available for this reach.

Riparian Habitat. Along this reach, just more than 490 acres of riparian vegetation are located within 1 mile of the Bear River, approximately 11 percent of the corridor's land area (Table 4-3). Much of this habitat is close to the river: Riparian vegetation occupies 27 percent of the 330-foot-wide corridors along the river banks and 51 percent of the 10-year floodplain that is connected to the river (Table 4-5). Levee VMZs are generally more than 330 feet from the bank on the northwest side, and generally less than 330 feet from the bank on the southeast side of the river. A short section near RM 4 is less than 330 feet from the banks on both sides.

The connectivity of riparian habitats along this reach is moderate. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 4.2 acres along this reach (Table 4-5). This habitat is found in broad swaths along the river, and is most continuous between RM 1 and RM 3 and least continuous between RM 3 and RM 4.

Riparian vegetation consists primarily of forest, which accounts for 97 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Marsh and other wetlands are nearly absent in this reach, and none are in proximity to the river (Table 4-3). Forty-four acres of nontidal marsh, or about 1 percent of the land area, and no seasonal wetlands are present along this reach. Of the total 44 acres of wetland, 4 acres, or 10 percent, is protected (as regional lands). The marshes range in size from less than 1 acre to 23 acres, but most are small. Most of these features are associated with a small tributary to the south and the UP Interceptor to the north.

None of these features are connected to the river system within the potential meander zone (Table 4-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout the reach, and occupies 61 percent (2,700 acres) of the reach corridor (Table 4-3). Almost all of the agricultural lands within the reach corridor are situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the Bear River (860 acres), less than 1 percent is agricultural land. Almost all of this floodplain agricultural land (97 percent) is orchard and vineyard, 1 percent is cropland and pasture, and 1 percent is identified as other agricultural land. Less than 1 acre of the total agricultural land is conserved (as regional land).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are giant garter snake and Swainson's hawk.

This reach also provides habitat for migrating, holding, and rearing steelhead, and opportunistic/intermittent migrating, holding, spawning, and rearing fall-run Chinook salmon. The reach contains critical habitat for steelhead and Chinook salmon.

Stressors

Developed land uses occupy less than 5 percent of the corridor along this reach, and are concentrated near Wheatland (near RMs 9 to 11). Major infrastructure includes river crossings by SRs 65 and 70 (near RMs 4 and 10, respectively), and crossings by electrical transmission lines and natural gas pipelines near those major road crossings (Figure F1-4 of Attachment F1).

Levees. There are 10.6 miles of SPFC levees and 1.1 miles of non-SPFC levees within this reach (Table 4-7; Figure 4 of Attachment F1). Levees along the Bear River are set back between approximately 100 feet and 2,600 feet. SPFC levees occur on both banks for approximately the first 7 miles of this reach, and the south bank levee continues along Dry Creek. The physical

condition of the north levee is of lower and medium concern; the physical condition of the south levee is of generally of higher concern.

Revetment. There is 0.8 mile of revetment along the Bear River in this reach (Table 4-7). Revetment in this reach is concentrated between RMs 1 to 2 and at RM 3 and 4. .

Fish Passage Barriers. No priority fish passage barriers have been identified along this reach. No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 15 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 15 species, two are ranked as being highly abundant. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 4-8. Within DWR channel and levee maintenance areas along this reach, approximately 5 acres of initial priority species occurs, made up exclusively of Himalayan blackberry. Within other areas maintained by LMAs, roughly 5 acres of initial priority species occurs, also made up exclusively of Himalayan blackberry. Occurrences of these species are spread throughout this reach.

4.1.6 Dry Creek

The upper portion of Dry Creek has some natural meander, but levees are fairly close to the creek. The middle portion of this creek is the most constrained by levees protecting agricultural lands. The levees are set back and the floodplain is the widest along the lower portion of the creek near its confluence with the Bear River.

No tributaries to Dry Creek occur in this reach.

Along Dry Creek, the 2-mile-wide floodway corridor covers approximately 6,200 acres, and only a small portion (less than 1 percent) of that corridor is conserved (Figure F1-1 of Attachment F1). Conserved areas along this reach are limited to city open space and a few city parks.

Ecosystem Processes

Floodplain Inundation. Along Dry Creek, more than one-half of the corridor has a 10-percent-chance Sustained Spring FIP or greater than 10-percent-chance FIP (Table 4-1 and Figure F1-2 of Attachment F1). Most of this area (91 percent or more) is disconnected from the river.

Riverine Geomorphic Processes. The meander corridors were not calculated for this tributary.

Habitats

Land cover along this reach of Dry Creek is primarily agriculture (Table 4-3 and Figure F1-3 of Attachment F1). Agriculture represents more than three-quarters of the corridor land cover. Natural vegetation accounts for one-eighth of the land cover and wetland/riparian vegetation accounts for one-tenth. Riparian vegetation becomes less extensive with distance from the confluence with the Bear River.

Shaded Riverine Aquatic Cover. Data for the attributes of shaded riverine aquatic habitat were not available for this reach.

Riparian Habitat. Along this reach, just under 200 acres of riparian vegetation are located within 1 mile of Dry Creek, approximately 3 percent of the corridor land area (Table 4-3). Much of this habitat is close to the river: Riparian vegetation occupies 21 percent of the 330-foot-wide corridors along the river banks (Table 4-5) and 25 percent of the 10-year floodplain that is connected to the river. Levee VMZs are less than 330 feet from the bank on the south side of the river. A short section from RM 1 to RM 2 is less than 330 feet from the banks on both sides.

The connectivity of riparian habitats along this reach is moderately low. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 6.3 acres along this reach (Table 4-5). This habitat is found in broad swaths along the river and is most continuous between RM 1 and RM 3, and least continuous between RM 3 and RM 4.

Riparian vegetation consists primarily of forest, which accounts for 77 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. There is little Marsh and other wetlands in this reach, and few are in proximity to the river. Sixty-seven acres of nontidal marsh, or about 1 percent of the land area, and only 1 acre of seasonal wetland is present along this reach (Table 4-3). Of the total 68 acres of wetland, none is protected. The marshes range in size from less than 1 acre to 15 acres, and most are small. Many of these features are associated with Dry Creek though some are associated with the UP Interceptor to the west.

Only the seasonal wetland is connected to the river system within the potential meander zone (Table 4-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the creek throughout this reach and occupies 81 percent (5,060 acres) of the reach corridor (Table 4-3). Almost all (95 percent) of the agricultural lands within the reach corridor are situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to Dry Creek (760 acres), close to one-third is agricultural land (31 percent). Of this floodplain agricultural land, 68 percent is identified as other agricultural land, 14 percent is cropland and pasture, and less than 1 percent is orchard and vineyard. Less than 1 acre of the total agricultural land is conserved.

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are VELB, western pond turtle, and Swainson's hawk. VELB in this reach has only been found along the Bear River, approximately 1.5 miles southwest of Wheatland. Western pond turtles have been observed only in Dry Creek, approximately 2.5 miles west of Wheatland.

This reach also provides habitat for migrating, holding, and rearing steelhead and fall-run Chinook salmon. The reach contains critical habitat for steelhead.

Stressors

Developed land uses occupy less than 5 percent of the corridor along this reach, and are concentrated near Wheatland (near RMs 9 to 11). Major infrastructure includes river crossings by SRs 65 and 70 (near RMs 4 and 10, respectively), and crossings by electrical transmission lines and natural gas pipelines near those major road crossings (Figure F1-4 of Attachment F1).

Levees. There are 12.7 miles of SPFC levees and 0.6 mile of non-SPFC levees within this reach (Table 4-7; Figure F1-4 of Attachment F1). Levees along Dry Creek are set back between approximately 100 feet and 1,100 feet. SPFC levees occur on the south bank of Dry Creek. The physical condition of a portion of the south levee is primarily of higher concern; there is insufficient data on the physical condition of the south levee near the confluence with Bear River.

Revetment. No revetment occurs along Dry Creek (Table 4-7).

Fish Passage Barriers. No priority fish passage barriers have been identified along this reach. No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 21 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 21 species, three are ranked as being highly abundant in at least one quad within the tributary. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 4-8. Within DWR channel and levee maintenance areas along this reach, approximately 16 acres of initial priority species occurs, with 15 acres of giant reed and 1 acre of Himalayan blackberry. Within other areas maintained by LMAs, no acreages of initial priority species are recorded. Occurrences of Himalayan blackberry and giant reed are spread throughout this reach.

4.1.7 Union Pacific Interceptor

The UP Interceptor has a very uniform floodplain. Although levees along the east bank are set back from the waterway, there is limited meandering.

Tributaries to the UP Interceptor are Reeds Creek (at RM 5) and Best Slough (at RM 2).

Along the UP Interceptor, the 2-mile-wide floodway corridor covers approximately 5,500 acres, and only a small portion (approximately 1 percent) of that corridor is conserved (Figure F1-1 of Attachment F1). Conserved areas along this reach are limited to city and regional parks and several water-district-owned parcels.

Ecosystem Processes

Floodplain Inundation. Along the UP Interceptor, more than one-half of the corridor has a 67-percent-chance Sustained Spring FIP or a 50-percent-chance FIP (Table 4-1 and Figure F1-2 of Attachment F1). Most of this area (85 percent or more) is disconnected from the river.

Riverine Geomorphic Processes. The meander corridors were not calculated for this tributary.

Habitats

Land cover along the UP Interceptor is primarily agriculture (Table 4-3 and Figure F1-3 of Attachment F1). Agriculture represents slightly more than one-half of the corridor land cover. Natural vegetation accounts for less than one-fifth of the land cover and wetland/riparian vegetation less than one-tenth. Riparian vegetation is fairly limited in this reach and primarily associated with Best Slough.

Shaded Riverine Aquatic Cover. Data for the attributes of shaded riverine aquatic habitat were not available for the UP Interceptor (Table 4-4).

Riparian Habitat. Along this reach, just over 180 acres of riparian vegetation are located within 1 mile of the UP Interceptor, approximately 3 percent of the corridor land area (Table 4-3). Little of this habitat is close to the river: riparian vegetation occupies 8 percent of the 330 foot-wide corridors along the river banks (Table 4-5) and 8 percent of the 10-year floodplain that is connected to the river. Levee VMZs are less than 330 feet from the bank on the west side and generally more than 330 feet from the bank on the east side where they are present up to and along Best Slough.

The connectivity of riparian habitats along this reach is low. This level of connectivity is reflected not only in the percent of 330 foot-wide corridors occupied by riparian vegetation, but also in the median size of a patch of riparian vegetation, which is 3.9 acres along this reach (Table 4-5). Most of this habitat is found in narrow patches associated with Algodon Slough and the old railroad grade to the west of the UP Interceptor and Best Slough to the east. Along the UP Interceptor this habitat is most continuous between RM 1 and RM 2, and nearly absent from RM 2 north.

Riparian vegetation consists primarily of forest, which accounts for 63 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Marsh and other wetlands are minimal in this reach and none are in proximity to the river (Table 4-3). There are 114 acres of nontidal marsh, or about 2 percent of the land area, and no seasonal wetlands are present along this reach. Of the total 114 acres of wetland, less than 1 acre is protected as water district lands. The marshes range in size from less than 1 acre to 19 acres, and most are small. Most of these features are associated with Reeds Creek and Best Slough.

Floodplain Agriculture. Agricultural land is distributed on both sides of the canal throughout this reach, and occupies 52 percent (2,870 acres) of the reach corridor (Table 4-3). The majority (87 percent) of the agricultural lands within the reach corridor are situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the UP Interceptor (610 acres), almost two-thirds (62 percent) of the land is agriculture. Almost one-half of this floodplain agricultural land (46 percent) is in rice production. The reminder is split between other agricultural land (39 percent) and cropland and pasture (15 percent). Two acres, or less than 1 percent, of the total agricultural land is conserved.

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are Sanford's arrowhead, Swainson's hawk, and colonies of tricolored blackbirds.

This reach does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

Developed land uses occupy approximately 28 percent of the corridor along this reach, and are concentrated within the Plumas Lakes development immediately west of the UP Interceptor. Major infrastructure is SR 70 and crossings by electrical transmission lines (Figure F1-4 of Attachment F1).

Levees. There are 6.7 miles of SPFC levees and 8.0 miles of non-SPFC levees within this reach (Table 4-7; Figure F1-4 of Attachment F1). Levees along the UP Interceptor are set back between approximately 100 and 500 feet. SPFC levees occur along both banks. The physical condition of the levees are predominantly of lower concern, with approximately 2 miles of medium concern.

Revetment. No revetment occurs along the UP Interceptor (Table 4-7). **Fish Passage Barriers.** No priority fish passage barriers (Appendix K) or gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 17 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 17 species, two are ranked as being highly abundant in at least one quad within the tributary. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 4-8. Within DWR channel and levee maintenance areas along this reach, approximately 16 acres of initial priority species occurs, made up exclusively of Himalayan blackberry. Within other areas maintained by LMAs, approximately 14 acres of initial priority species occurs, also made up exclusively of Himalayan blackberry. Occurrences of Himalayan blackberry are spread throughout this reach.

4.2 Basins/Bypasses

No bypasses occur within the Feather River CPA. For a discussion of the Sutter Bypass, refer to the Upper Sacramento River CPA section.

4.3 Other Valley Landscape Units

The Other Valley Landscape Unit within the Feather River CPA generally extends from just north of Cherokee Canal to the Natomas Cross Canal in the south, and covers approximately 227,980 acres (Figure 4-1). This landscape unit includes the land that surrounds the Feather River to the east of the Sutter Bypass. Agricultural land is the predominant land cover type

within this landscape unit, totaling 179,760 acres (Table 4-9; Figure F1-3 of Attachment F1). Agricultural lands are found throughout this unit, the majority of which (approximately 89,890 acres) is in rice production. The orchard and vineyard land cover type is concentrated along the east side of the landscape unit adjacent to the Feather River.

Natural land cover only represents approximately 8 percent of the Other Valley Landscape Unit. Almost one-half of this area (9,280 acres) is represented by seasonal wetland, which is concentrated immediately north of the Sutter Buttes. Riparian scrub is the land cover type with the least coverage within this landscape unit, covering 190 acres. Other land cover types in this unit are other natural (7,180 acres), riparian forest (1,010 acres), and nontidal marsh (1,000 acres). Riparian forest is concentrated along the northern portion of the Feather River; very little riparian habitat is found in the southern portion of this landscape unit.

Target and other sensitive species documented within this landscape unit are Sanford's arrowhead, woolly rose-mallow, VELB, giant garter snake, western pond turtle, California black rail, greater sandhill crane, Swainson's hawk, and colonies of tricolored blackbirds. VELB exit holes and individuals have only been sighted on Wildlands Mitigation Bank, south-southwest of Bear River. Western pond turtles have only been found at Gray Lodge Wildlife Area. California black rail have only been observed just east of the Sutter Bypass Wildlife Area.

This landscape unit also provides habitat for several sensitive fish: migrating, holding, and rearing steelhead and fall-/late fall–run Chinook salmon; migrating and rearing spring-run Chinook salmon; and foraging adult green sturgeon. It is probable that spring-run Chinook salmon has hybridized with fall-run fish because of spawning overlap and the straying of hatchery fish. These fish have been documented only in the Feather River from the Thermalito Afterbay outlet upstream to the fish barrier at Feather River Hatchery. The area contains critical habitat for steelhead and green sturgeon and Chinook salmon only in the Feather River from the Thermalito Afterbay outlet upstream to the fish barrier at Feather River Hatchery.

Developed land uses occupy approximately 11 percent of this landscape unit, primarily in the vicinity of Yuba City, Marysville, and Olivehurst. Major infrastructure crossing through this landscape unit are SRs 20, 70, 99, 113, and 162 (Figure F1-4 of Attachment F1).

There are 40.4 miles of non-SPFC levees along waterways within this landscape unit and no SPFC levees (Table 4-10). No revetment is present along the waterways within this landscape unit.

No priority fish passage barriers occur within this landscape unit.

4.4 Other Facilities and Waterways

From north to south, the other facilities in the Feather River CPA are levees, channel clearing projects, and/or diversions along Cherokee Canal, the northeast corner of the Feather River, Honcut Creek, East Intercept Canal, West Intercept Canal, Wadsworth Canal, the Bear River, Best Slough, Yankee Slough, East Side Canal, and the north levee of Natomas Cross Canal.

Approximately 78 percent of the 41,470 acres in the Other Facilities and Waterways portion of the Feather River CPA is in agricultural use, and approximately one-half of this amount is in rice cultivation (Table 4-9; Figure F1-3 of Attachment F1). Natural land cover makes up 12 percent of the total area (4,940 acres), and almost one-half of this area (approximately 48 percent) is natural upland vegetation (2,390 acres). Riparian vegetation and seasonal wetland each cover approximately 25 percent of the total natural land cover. Approximately 5 percent of this portion of the CPA is nontidal perennial marsh.

Target and other sensitive species documented within Other Facilities and Waterways are giant garter snake, greater sandhill crane, Swainson's hawk, and colonies of tricolored blackbirds. A population of greater sandhill cranes has been observed just north of Cherokee Canal.

This landscape unit also provides habitat for several sensitive fish: migrating, holding, and rearing steelhead, and fall-/late fall–run Chinook salmon. The area contains critical habitat for steelhead.

Developed land use makes up only 5 percent of the land cover within Other Facilities and Waterways. Developed lands are limited to major infrastructure such as pipelines and transmission lines that pass through most of the facility footprints, and SR 99, which passes through the Natomas Cross Canal footprint (Figure F1-4 of Attachment F1).

The facilities described above have a total of 102.2 miles of SPFC levees and 17.6 miles of non-SPFC levees (Table 4-10). Revetment covers 0.2 miles generally along the levees. Levees along the Bear River, Natomas Cross Canal, and portions of Cherokee Canal and Wadsworth Canal are of higher concern. The majority of Cherokee Canal, the northeast corner of the Feather River, and portions of the Bear River lack sufficient data to characterize. All of the remaining levees are of lower or medium concern.

Three fish passage barriers are present within this landscape unit. None of them have been identified as priority barriers.

4.5 Foothill Landscape Units

Reservoirs within the Foothill Landscape Unit portion of the Feather River CPA are Lake Oroville on the Feather River and New Bullards Bar Reservoir on the North Fork of the Yuba River.

Lake Oroville, located on the Feather River, is the largest State Water Project reservoir. Lake Oroville is operated in coordination with five associated dams: two saddle dams on Lake Oroville, Thermalito Diversion Dam, Thermalito Forebay Dam, and Thermalito Afterbay Dam. The reservoir and associated facilities provide flood control, water supply, power generation, recreation, and fish and wildlife enhancement (DWR 2012h).

New Bullards Bar Reservoir on the North Fork of the Yuba River is the only reservoir in the watershed with reserved flood management capacity; this reservoir regulates only one-third of

the flow in the Yuba River watershed. The reservoir also serves water supply, power, fish and wildlife, and recreational purposes (DWR 2012h).

No outlying communities exist within the Feather River CPA.

Landcover was not mapped for the CVFPP for the majority, over 99 percent, of lands within the Other Foothill Landscape Unit (Table 4-11 and Figure F1-3 of Attachment F1). Thus, a detailed description of land cover is not provided.

The only target or other sensitive species documented within this Foothill Landscape Unit are California black rail and tricolored blackbird.

This landscape unit also provides habitat for several sensitive fish: migrating, holding, and rearing steelhead and fall-/late fall–run Chinook salmon; migrating and rearing spring-run Chinook salmon; and foraging adult green sturgeon. The area contains critical habitat for steelhead, Chinook salmon, and green sturgeon.

There are no levees or revetment within the Foothill Landscape Unit.

No priority fish passage barriers occur within this landscape unit.

4.6 Tables of Results

Table 4-1. Acreages of Connected and Disconnected Floodplain Inundation Potential Zones along Major River Reaches of, and Major Tributaries to, the Feather River Conservation Planning Area[a]

FIP Zone	Thermalito Afterbay to Yuba River	Yuba River to Bear River	Bear River to Sutter Bypass	Yuba River	Bear River	Dry Creek	UP Interceptor	Total Acres
Connected								
Baseflow FIP	1,436	885	366	165	76	60	189	3,177
67 Percent Sustained Spring FIP	97	194	60	49	91	122	217	830
50 Percent FIP	10,273	6,116	1,818	617	656	163	204	19,846
10 Percent FIP	2,786	761	61	2,610	40	418	2	6,678
Less than 10 Percent FIP	860	238	32	3,621	22	13	23	4,809
Subtotal	*15,452*	*8,193*	*2,337*	*7,063*	*884*	*776*	*635*	*35,340*
Disconnected								
Baseflow FIP	<1	0	2	<1	193	56	1,546	1,799
67 Percent Sustained Spring FIP	0	68	9	0	755	821	878	2,531
50 Percent FIP	4,358	9,969	3,398	419	2,502	2,047	2,058	24,755
10 Percent FIP	7,161	297	24	617	22	2,320	44	10,487
Less than 10 Percent FIP	8,265	118	59	174	56	201	374	9,248
Subtotal	*19,784*	*10,453*	*3,492*	*1,210*	*3,528*	*5,447*	*4,899*	*48,820*
Total	**35,236**	**18,646**	**5,829**	**8,272**	**4,412**	**6,223**	**5,534**	**84,160**

Source: DWR 2012b

Key:

FIP = floodplain inundation potential

Note:

[a] Values may not sum exactly because of rounding.

Table 4-2. Meander Zone Width, Area, and Constraints along Major River Reaches of, and Major Tributaries to, the Feather River Conservation Planning Area[a, b]

Meander Zone Attribute	Thermalito Afterbay to Yuba River	Yuba River to Bear River	Bear River to Sutter Bypass	Yuba River	Bear River	Dry Creek	Total
Width (feet)	6,357	3,687	6,908	5,674	3,417	–[b]	NA
Meander Zone Area (acres)							
Unconstrained	8,078	5,351	2,141	3,642	657	242	20,112
Constrained by Resistant Geology Only	4,256	99	8	261	40	6	4,670
Constrained by Revetment/Levees Only	4,486	755	1,504	335	297	629	8,006
Constrained by Both	5,716	1,086	282	425	559	75	8,144
Total	**22,536**	**7,291**	**3,936**	**4,663**	**1,552**	**952**	**40,932**

Source: AECOM 2013, CGS 2013, DWR 2011a, and DWR 2013a

Note:

[a] Values may not sum exactly because of rounding and because of overlap between geology constraints and levee/revetment constraints.

[b] Meander width was not calculated for this tributary.

Table 4-3. Acreage of Land Cover Types in the Floodway Corridor along Major River Reaches of, and Major Tributaries to, the Feather River Conservation Planning Area[a,b]

Land Cover Type	Thermalito Afterbay to Yuba River	Yuba River to Bear River	Bear River to Sutter Bypass	Yuba River	Bear River	Dry Creek	UP Interceptor	Total Acres
Agricultural								
Rice	0	80	150	300	220	550	1,100	2,400
Cropland and Pasture	650	980	1,010	170	310	830	910	4,860
Orchard – Vineyard	20,880	8,850	1,590	4,020	1,850	2,970	60	40,220
Other Agricultural	2,250	1,190	570	400	310	710	800	6,230
Subtotal	*23,780*	*11,100*	*3,320*	*4,890*	*2,690*	*5,060*	*2,870*	*53,710*
Natural								
Marsh – Tidal	0	0	0	0	0	0	0	0
Marsh – Nontidal	109	56	2	5	44	67	114	397
Riparian – Forest	2,866	2,506	738	475	474	154	114	7326
Riparian – Scrub	373	693	81	211	17	45	66	1486
Seasonal Wetland	214	54	12	6	0	1	0	288
Other Natural	1,660	1,420	1,140	920	600	540	650	6930
Subtotal	*5,220*	*4,730*	*1,970*	*1,620*	*1,140*	*810*	*940*	*16,430*
Other								
Water	1,910	1,020	450	230	50	40	150	3,850
Developed	4,330	1,810	90	1,540	520	310	1,580	10,190
Not Mapped	0	0	0	0	0	0	0	0
Total	**35,240**	**18,660**	**5,830**	**8,280**	**4,400**	**6,220**	**5,540**	**84,170**

Source: DWR 2011b

Note:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre

Table 4-4. Miles of the Shaded Riverine Aquatic Habitat Attributes along Major River Reaches of, and Major Tributaries to, the Feather River Conservation Planning Area[a,b]

Bank and Vegetation Type	Thermalito Afterbay to Yuba River	Yuba River to Bear River	Bear River to Sutter Bypass	Yuba River	Bear River	Dry Creek	UP Interceptor	Total Miles
Natural Bank (Miles)								
With Riparian Vegetation	50.1	18.4	4.1	0.0	NA	NA	NA	72.6
Without Riparian Vegetation	23.9	14.9	5.7	4.8	NA	NA	NA	49.2
Subtotal	*74*	*33.2*	*9.9*	*4.8*	*NA*	*NA*	*NA*	*121.8*
Revetted Bank (Miles)								
With Riparian Vegetation	8.5	1.0	0.9	0.0	NA	NA	NA	10.4
Without Riparian Vegetation	2.1	0.1	0.2	1.5	NA	NA	NA	3.9
Subtotal	*10.6*	*1.10*	*1.1*	*1.5*	*NA*	*NA*	*NA*	*14.3*
Total	**84.6**	**34.3**	**10.9**	**6.3**	**NA**	**NA**	**NA**	**136.1**

Sources: DWR 2012c, USACE 2007, and USFWS 1992

Key:

NA = not available

Notes:

[a] Values may not sum exactly because of rounding.

[b] Assuming presence of in-water cover, the acreages of shaded riverine aquatic (SRA) cover are represented by these acreages of eroding, natural banks with riparian vegetation.

Table 4-5. Indicators of Riparian Continuity along Major River Reaches of, and Major Tributaries to, the Feather River Conservation Planning Area[a]

Attribute	Thermalito Afterbay to Yuba River	Yuba River to Bear River	Bear River to Sutter Bypass	Yuba River	Bear River	Dry Creek	UP Interceptor	Total
Area of 100- to 330-Foot-Wide Corridor (acres)	3,230	1,353	459	634	559	670	502	7,401
Percent of 100- to 330-Foot-Wide Corridor in Riparian Vegetation	45	66	51	41	27	21	8	43
Median Patch Size (Acres)	7.4	5.1	3.5	1.2	4.2	6.3	3.9	4.2

Source: DWR 2011b

Note:

[a] Values may not sum exactly because of rounding.

Table 4-6. Acreage of Land Cover Types of Floodplain in Potential Meander Zone along Major River Reaches of, and Major Tributaries to, the Feather River Conservation Planning Area[a,b]

Land Cover Type	Thermalito Afterbay to Yuba River	Yuba River to Bear River	Bear River to Sutter Bypass	Yuba River	Bear River	Dry Creek	Total Acres
Agricultural							
Rice	0	0	50	20	0	0	70
Cropland and Pasture	90	50	30	30	0	0	200
Orchard – Vineyard	6,630	760	0	2,400	0	0	9,790
Other Agricultural	500	330	50	200	0	0	1,080
Subtotal	*7,210*	*1,140*	*130*	*2,650*	*0*	*0*	*11,140*
Natural							
Marsh – Tidal	0	0	0	0	0	0	0
Marsh – Nontidal	102	21	2	3	0	0	128
Riparian – Forest	2,453	1,887	685	358	355	125	5,863
Riparian – Scrub	310	584	77	162	10	35	1,178
Seasonal Wetland	187	54	12	6	0	1	260
Other Natural	790	880	960	580	320	80	3,610
Subtotal	*3,840*	*3,430*	*1,730*	*1,110*	*690*	*240*	*11,050*
Other							
Water	1,770	980	390	190	20	20	3,370
Developed	810	40	0	130	10	0	990
Not Mapped	0	0	0	0	0	0	0
Total	**13,630**	**5,590**	**2,250**	**4,080**	**720**	**260**	**26,520**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre

Table 4-7. Levee and Revetment Length (Miles) along Major River Reaches of, and Major Tributaries to, the Feather River Conservation Planning Area[a]

Facility Type	Thermalito Afterbay to Yuba River	Yuba River to Bear River	Bear River to Sutter Bypass	Yuba River	Bear River	Dry Creek	UP Interceptor	Total Miles
Levees								
SPFC	44.9	27.4	10.3	7.3	10.6	12.7	6.7	120.0
Non-SPFC	14.2	3.9	0.5	4.2	1.1	0.6	8.0	32.4
Total	**59.1**	**31.3**	**10.8**	**11.5**	**11.7**	**13.3**	**14.7**	**152.4**
Revetment								
Revetment	10.6	1.1	1.1	1.5	0.8	0.0	0.0	15.1

Sources: DWR 2012c, DWR 2012e, and USACE 2007
Key:
SPFC = State Plan of Flood Control
Note:
[a] Values may not sum exactly because of rounding.

Table 4-8. Abundance[a] of Targeted Weed Species[b] within Major River Reaches, Tributaries, and Bypasses along the Feather River Conservation Planning Area

Reach		Thermalito Afterbay to Yuba River						Yuba River to Bear River				Bear River to Sutter Bypass	Sutter Bypass to Sacramento River				Yuba River			Bear River	Dry Creek				UP Interceptor	
USGS Quad Name		Biggs	Gridley	Honcut	Palermo	Sutter	Yuba City	Gilsizer Slough	Nicolaus	Olivehurst	Yuba City	Nicolaus	Knight's Landing	Nicolaus	Sutter Causeway	Verona	Browns Valley	Olivehurst	Yuba City	Nicolaus	Nicolaus	Olivehurst	Sheridan	Wheatland	Nicolaus	Olivehurst
Percentage of Reach[c]		16	22	16	10	10	25	1	29	68	3	100	56	11	4	29	48	1	51	100	12	2	14	72	17	83
Species																										
Common Name	Scientific Name																									
Barbed goat grass	*Aegilops triuncialis*	L			L												L						L	L		
Tree of heaven	*Ailanthus altissima*	M	L	M	L	L	L			L	L		H			H		L	L			L	L	L		L
Alligator weed	*Alternanthera philoxeroides*																									
Giant reed[d]	*Arundo donax*	M	L	L	M	L		L					H		L	L								L		
Yellow star-thistle	*Centaurea solstitialis*	M	H	L	M	H	L	H	L	L	L	L	M	L	H	M	L	L	L	L	L	L	M	M	L	L
Pampas grass	*Cortaderia selloana*	L	L		L								L			L							L	L		
Scotch broom	*Cytisus scoparius*			L	L																					
Stinkwort	*Dittrichia graveolens*	L		L	L				M			M	L	M		M				M	M				M	
Brazilian waterweed	*Egeria densa*	L		H			H		H	H	H	H	H	H		H	H	H	H	H	H	H		H	H	H
Medusa head	*Elymus caput-medusae*	H	H	H	H	L											L						H	H		
Blue gum	*Eucalyptus globulus*	L	L	L	L																					
Edible fig	*Ficus carica*	L	L	L	L	L	L		L	L	L	L	H	L	L	L		L	L	L	L	L			L	L
Fennel	*Foeniculum vulgare*	L			L				L			L	L	L		L				L	L				L	
French broom	*Genista monspessulana*	L	L	L	L																					
Shortpod mustard	*Hirschfeldia incana*	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L		L	L	L	L	L			L	L
Hydrilla	*Hydrilla verticillata*																									
Perennial pepperweed	*Lepidium latifolium*			L			L	L	L	L	L	L	M	L	L	M		L	L	L	L	L		L	L	L
American frogbit	*Limnobium spongia*																									
Water primrose	*Ludwigia* sp.	L		M	L	M	M	M	M	M	M	M		M	M		M	M	M	M	M	M		M	M	M
Purple loosestrife	*Lythrum salicaria*	M	L	L	M	L	L		L	L	L	L		L		L		L	L	L	L	L			L	L

Table 4-8. Abundance[a] of Targeted Weed Species[b] within Major River Reaches, Tributaries, and Bypasses along the Feather River Conservation Planning Area

Reach		Thermalito Afterbay to Yuba River						Yuba River to Bear River				Bear River to Sutter Bypass	Sutter Bypass to Sacramento River				Yuba River			Bear River	Dry Creek				UP Interceptor	
USGS Quad Name		Biggs	Gridley	Honcut	Palermo	Sutter	Yuba City	Gilsizer Slough	Nicolaus	Olivehurst	Yuba City	Nicolaus	Knight's Landing	Nicolaus	Sutter Causeway	Verona	Browns Valley	Olivehurst	Yuba City	Nicolaus	Nicolaus	Olivehurst	Sheridan	Wheatland	Nicolaus	Olivehurst
Percentage of Reach[c]		16	22	16	10	10	25	1	29	68	3	100	56	11	4	29	48	1	51	100	12	2	14	72	17	83
Species																										
Common Name	Scientific Name																									
Parrot's feather	*Myriophyllum aquaticum*	L	M	M	M	M	M	M	M	M	M	M	L	M	L	L	M	M	M	M	M	M	L	M	M	M
Tree tobacco	*Nicotiana glauca*	L	L	L	L		L			L	L		L					L	L			L				L
Scotch thistle	*Onopordum acanthium* ssp. *acanthium*																									
Crisp-leaved pondweed	*Potamogeton crispus*	H	L	L	H																					
Himalayan blackberry[d]	*Rubus armeniacus*	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	L	H	H
Ravenna grass	*Saccharum ravennae*																									
Russian thistle	*Salsola tragus*		L	L		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Red sesbania[d]	*Sesbania punicea*	M	M	M	M	L	L		L	L	L	L	L	L		L		L	L	L	L	L	L	L	L	L
Milk thistle	*Silybum marianum*																									
Saltcedar[d]	*Tamarix* sp.					L	L		L		L	L	L	L		L			L	L	L				L	
Chinese tallowtree	*Triadica sebifera*			L			L		L	L	L	L		L			L	L	L	L	L	L	L	L	L	L

Source: Cal-IPC 2013

Key:

USGS = United States Geological Survey

Notes:

[a] Abundance rated by Cal-IPC as either H = High; M = Medium; L = Low; blank cells show no occurrences.

[b] Of the 31 target weed species, no data are available for American frogbit or milk thistle.

[c] Values may not sum to 100 because of rounding.

[d] Indicates initial priority species.

Table 4-9. Acreage of Land Cover Types of Valley Landscape Units in the Feather River Conservation Planning Area[a, b]

Land Cover	Landscape Unit Type				Total Acres
	Major River Reach	Basin-Bypass	Other Facility-Waterway	Other Valley SPA	
Agricultural					
Rice	2,400	0	16,440	89,890	108,730
Cropland and Pasture	4,860	0	2,840	20,290	27,980
Orchard – Vineyard	40,220	0	10,010	53,490	103,720
Other Agricultural	6,230	0	3,060	16,100	25,380
Subtotal	*53,710*	*0*	*32,350*	*179,760*	*265,810*
Natural					
Marsh – Tidal	0	0	0	0	0
Marsh – Nontidal	397	0	260	1,002	1,660
Riparian – Forest	7,326	0	894	1,011	9,232
Riparian – Scrub	1,486	0	296	193	1,974
Seasonal Wetland	288	0	1,104	9,282	10,674
Other Natural	6,930	0	2,390	7,180	16,500
Subtotal	*16,430*	*0*	*4,944*	*18,668*	*40,040*
Other					
Water	3,850	0	320	700	4,870
Developed	10,190	0	2,080	24,340	36,620
Not Mapped	0	0	1,780	4,510	6,290
Total	**84,170**	**0**	**41,470**	**227,980**	**353,620**

Source: DWR 2011b

Note: Values may not sum exactly because of rounding.

Key:

SPA = Systemwide Planning Area

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

Table 4-10. Levee and Revetment Length (Miles) in Valley Landscape Units of the Feather River Conservation Planning Area[a]

Facility Type	Landscape Unit Type				Total Miles
	Major River Reach	Basin-Bypass	Other facility-Waterway	Other Valley SPA	
Levees					
SPFC	120.0	15.6	102.2	0.0	237.8
Non-SPFC	32.4	0.6	17.6	40.4	91.0
Total	**152.4**	**16.2**	**119.8**	**40.4**	**328.8**
Revetment					
Revetment	15.1	0.0	0.2	0.0	15.4

Sources: DWR 2012c, DWR 2012e, and USACE 2007
Key:
SPA = Systemwide Planning Area
SPFC = State Plan of Flood Control
Note:
[a] Values may not sum exactly because of rounding.

Table 4-11. Acreage of Land Cover Types of Foothill Landscape Units in the Feather River Conservation Planning Area[a, b]

Land Cover	Landscape Unit Type			Total Acres
	Foothill Tributaries	Lake-Reservoir	Outlying Community	
Agricultural				
Rice	0	0	0	0
Cropland and Pasture	0	0	0	0
Orchard – Vineyard	0	0	0	0
Other Agricultural	0	0	0	0
Subtotal	0	0	0	0
Natural				
Marsh – Tidal	0	0	0	0
Marsh – Nontidal	0	0	0	0
Riparian – Forest	9	0	0	9
Riparian – Scrub	9	0	0	9
Seasonal Wetland	<1	0	0	<1
Other Natural	20	0	0	20
Subtotal	38	0	0	38
Other				
Water	130	0	0	130
Developed	0	0	0	0
Not Mapped	360	19,870	1,250	21,480
Total	**528**	**19,870**	**1,250**	**21,648**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre

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5.0 Summary of Existing Conditions for the Lower Sacramento River Conservation Planning Area

In the Lower Sacramento River CPA, the Sutter Bypass and American River join the Sacramento River, which flows between the Yolo and Natomas Basins and between the cities of West Sacramento and Sacramento (Figure 5-1). Flood flows enter the Yolo Basin at the Sacramento and Fremont Weirs. Downstream, the Sacramento River and the Yolo Bypass enter the tidally influenced Delta, where the river flows through a network of channels separating islands.

The area's geomorphology transitions from a sinuous Sacramento River with a historically migrating channel to stable channels between islands bordered by natural levees of deposited sediment. Historically, these islands were "reclaimed" by constructing higher levees and draining the interiors of the islands (CBDP 2000). After reclamation, island interiors began to subside, primarily because organic material in the marsh soils began to oxidize more rapidly. Much of the interior Delta now lies below sea level, with subsidence from these causes continuing where peat soils remain. In combination with sea level rise, subsidence is increasing stress on Delta levees. To reduce these deleterious effects, DWR and Delta LMAs have worked cooperatively since 1972 to raise and strengthen Delta levees under the Delta Levees Subventions Program. Also, the Delta Special Levees Program, initiated in 1988, has allowed DWR to accelerate levee and habitat improvements, focusing on portions of the levee system that are most important for the protection of State water supplies, water quality, populations and infrastructure, and environmental quality. The result has been substantial improvements in Delta levee integrity, resulting in a reduction in the frequency of levee failures, despite the deleterious effects of subsidence and sea level rise.

In addition to reclamation, other substantial changes to the Delta's physical conditions have occurred. Many new channels have been excavated and lined with levees in the Delta to serve various purposes, most notably the Stockton Deep Water Ship Channel, the Sacramento River Deep Water Ship Channel, Paradise Cut, and Grant Line Canal. Also, State and federal water export facilities, water intakes for Delta communities, and over 1,800 agricultural water diversions have altered the hydrology of the Delta.

As a result, downstream and relatively developed CPA, riverine and floodplain ecosystems have been substantially degraded by this island subsidence, flow alteration by numerous upstream dams and diversions, bank protection with revetment, and disconnection of floodplains from rivers by levees. Although it is inundated less than 2 out of 3 years, the Yolo Bypass accounts for most floodplain inundation that now occurs in the Lower Sacramento River CPA. Of the land within 1 mile of the lower Sacramento River and American River that could be inundated by a 50-percent-chance event (2-year recurrence interval), only 9 percent remains connected to the rivers; the remainder is disconnected from these rivers by levees. As a result, the rearing habitat

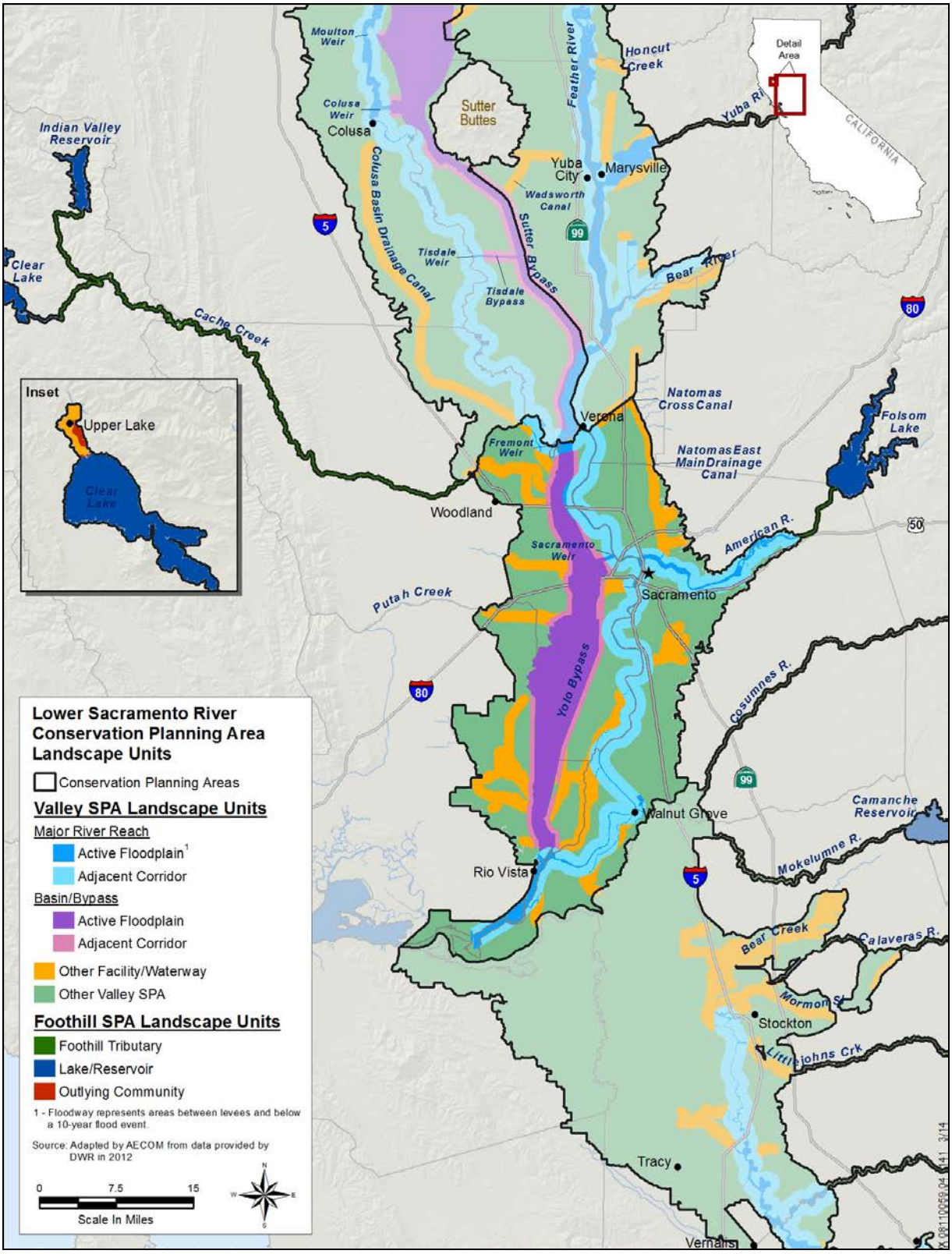

Figure 5-1. Lower Sacramento River Conservation Planning Area

for Chinook salmon provided by inundated floodplains has been reduced by nearly 98 percent (not including the Yolo Bypass, see Appendix H). Because of the presence of these levees and associated revetment, channel meander (although historically limited) has now essentially ceased.

Historically, corridors of riparian vegetation lined the banks of the lower Sacramento River and American River, and extensive marshes existed in the Yolo and Natomas Basins and on Delta islands (The Bay Institute 1998; San Francisco Estuary Institute [SFEI] 2012). The extent of these habitats has been reduced substantially. Riparian vegetation now occupies approximately 17 percent of floodplain that remains connected to the lower Sacramento River and American River. Areas of riparian corridor and associated SRA cover have been reduced to disconnected remnants along river channels that are generally lined by revetment and confined by narrowly spaced levees. Consequently, along the lower Sacramento River and American River, natural banks with riparian vegetation account for less than one-quarter of riverbank length (USACE 2007).

Most marshes and other wetlands in the Lower Sacramento River CPA has been leveed, drained, and converted to other land cover, predominantly for agricultural use and development. Marshes and other wetlands account for less than 2 percent of the active floodplain along the lower Sacramento and American Rivers and for approximately 14 percent of the Yolo Bypass and Cache Slough.

These alterations of ecosystem processes and habitats have contributed to population declines of sensitive species, including 12 species that are targets of this Conservation Strategy (not including those known only from historical records or whose distribution in this CPA is poorly documented) (CDFG 2005 and DWR 2011c):

- Valley elderberry longhorn beetle
- Steelhead, California Central Valley DPS
- Chinook salmon, Central Valley fall-/late fall–run ESU
- Chinook salmon, Central Valley spring-run ESU
- Chinook salmon, Sacramento River winter-run ESU
- Green sturgeon, Southern DPS
- Giant garter snake
- Bank swallow
- California black rail
- Greater sandhill crane

- Swainson's hawk

To recover these and other species, multiple conservation plans include objectives and actions calling for establishment of continuous corridors of riparian vegetation and SRA cover along the lower Sacramento River, an increase in the frequency of inundation and improvement of fish passage through the Yolo Bypass, and restoration of nontidal and tidal marsh (CVJV 2006; NMFS 2014; USFWS 1999; USFWS 2001). Restoring these processes and habitats supports objectives for recovery of multiple aquatic and terrestrial species. For example, to support the AFRP "doubling goal" for Chinook salmon, from 10,000 to 12,000 acres of additional rearing habitat on inundated floodplains is required (see Appendix H).

In the Lower Sacramento River CPA, there are major opportunities to collaborate with others on habitat restoration, particularly with the development and implementation of HCPs and HCP/NCCPs for this planning area. Such plans already include the Natomas Basin HCP, the Yolo County Natural Heritage Program HCP/NCCP, the South Sacramento HCP, and the BDCP.

Most of the Lower Sacramento River CPA is within the plan area for California EcoRestore (EcoRestore). In this area, Conservation Strategy actions would be consistent with EcoRestore and support attainment of its goals, in particular the goal for floodplain restoration.

Planning efforts are also underway to implement reasonable and prudent measures to mitigate the long-term effects of operating the federal Central Valley Project and State Water Project on fisheries and other resources, as required under ESA Section 7 by the National Oceanic and Atmospheric Administration (NOAA) Fisheries and USFWS. Improved fisheries habitat in the Yolo Bypass and fish passage facilities for the Fremont Weir and the Sacramento Bypass are among the high-priority actions.

Collaboration of Conservation Strategy actions under the CVFPP with these other conservation efforts will increase the efficiency and effectiveness of restoration actions. However, in this extensively developed CPA, substantial SPFC-related constraints complicate attainment of these objectives. Among these constraints is the presence of 483 miles of SPFC levees (and 390 miles of non-SPFC levees) and 206 miles of revetment. Additional constraints apply to most of the land protected by these levees, particularly the extensive developed land cover and associated major infrastructure. Elevations below river baseflows preclude restoration of seasonally inundated floodplain. Furthermore, where the Sacramento River flows between subsided Delta islands, elevations below base flows preclude restoration of seasonally inundated floodplain, because they would remain inundated year-round.

The establishment of continuous corridors of riparian vegetation and SRA cover along the lower Sacramento River is also constrained by the flow capacity of the SPFC and its limited ability to accommodate additional roughness without causing considerable increases in flood-stage elevations or altering flows in a way that would substantially and adversely affect the opposite bank.

Furthermore, several SPFC and non-SPFC structures have been impeding fish passage. In addition to dams at multipurpose reservoirs, these impeding structures are as follows:

- Sacramento Weir in the Sacramento Bypass
- Fremont Weir in the Yolo Bypass
- Lisbon Weir in the Yolo Bypass
- Tule Canal crossings (five) in the Yolo Bypass

These structures have been identified as high priorities for remediation (Priority 1 or 2, see Appendix K).

5.1 Major River Reaches

Detailed descriptions by river reach (Figure 5-2) for the Lower Sacramento River CPA are provided below.

5.1.1 Verona to American River

The general character of the Sacramento River changes downstream from Verona and is primarily a confined, narrow channel generally restricted from migration along most of its length. Levees are located close to the river's edge in this reach. The channel width is fairly uniform, and river bends are static as a result of confinement by levees.

Tributaries to the Sacramento River within this reach are primarily drainage canals, including Natomas Cross Canal (at RM 79), North Drainage Canal (at RM 75), West Drainage Canal (at RM 71), Natomas Main Drainage Canal (at RM 61), and Natomas East Main Drain (at RM 61).

Within this reach of the Sacramento River, the 2-mile-wide floodway corridor covers approximately 25,000 acres; less than 10 percent of the corridor has been conserved (Figure F2-1 of Attachment F2). Conserved areas along this reach include the Sacramento Bypass Wildlife Area, managed by CDFW, and several reserves managed by Natomas Basin Conservancy. There are also several smaller city and county parks such as Elkhorn Regional County Park and Discovery Park, located at the downstream end of the American River Parkway.

Ecosystem Processes

Floodplain Inundation. From Verona to the American River, approximately two-thirds of the corridor along the river has a 50-percent-chance FIP, and approximately one-quarter has a 67-percent-chance Sustained Spring FIP. Almost all of this floodplain is disconnected from the river (Table 5-1 and Figure F2-2 of Attachment F2).

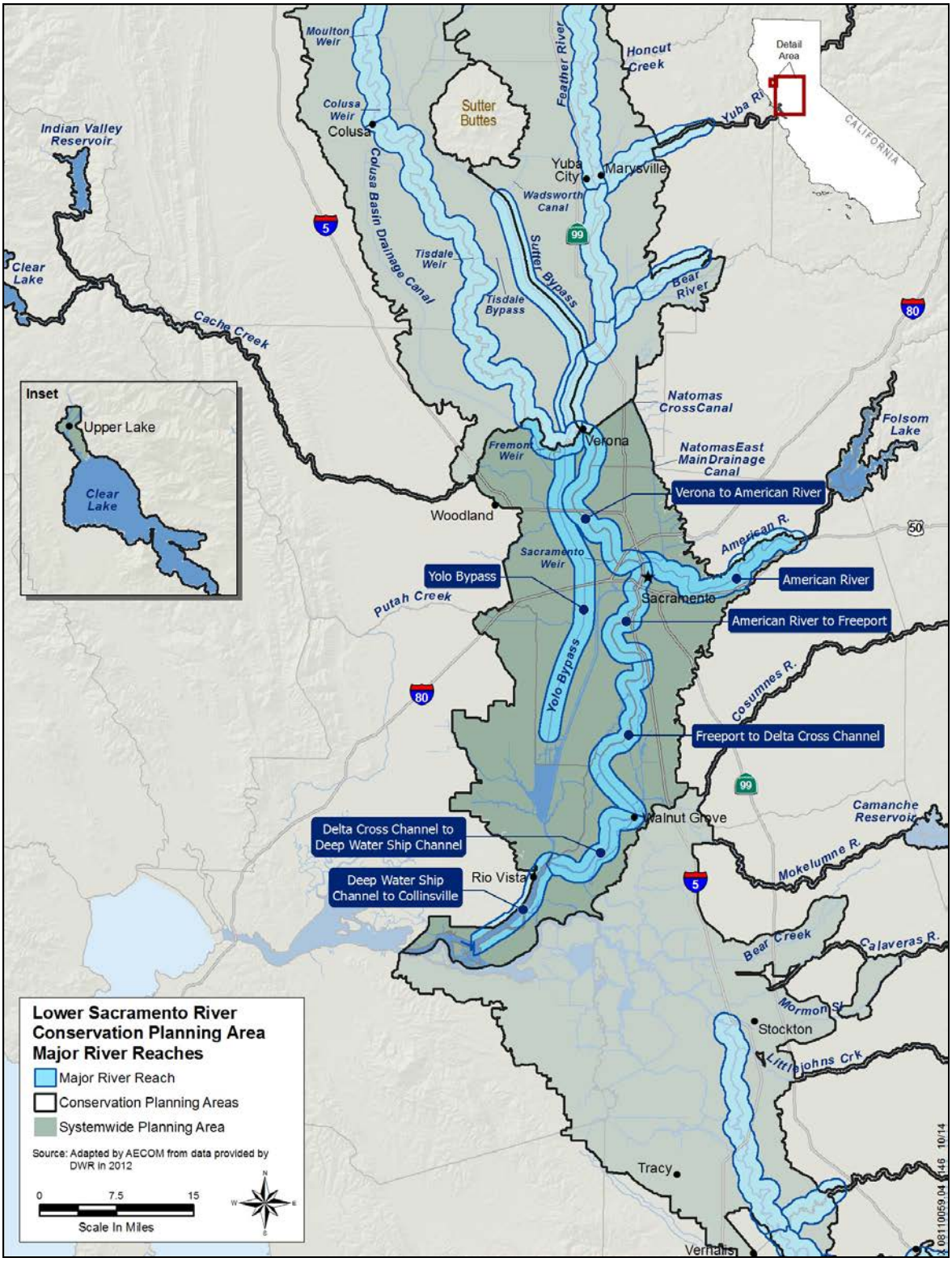

Figure 5-2. River Reach Extent for the Lower Sacramento River Conservation Planning Area

Riverine Geomorphic Processes. In this reach, the average channel width is 624 feet, ranging between 408 feet and 1,021 feet. The meander corridor is an estimated 5,036 feet wide (Table 5-2), and the meander amplitude is 3,206 feet. Of the total meander zone (12,101 acres), the majority (88 percent) is constrained by revetment, levees, and other infrastructure. Less than 1 percent of the reach is constrained by both geology and infrastructure. The remainder (1,447 acres or 12 percent) of the reach is unconstrained.

Habitats

Land cover along this reach of the Sacramento River is predominantly agriculture, with more development than natural vegetation (Table 5-3 and Figure F2-3 of Attachment F2). Agriculture represents more than two-thirds of the corridor's land cover. Natural vegetation, primarily riparian, accounts for almost one-eighth of the land cover, and wetland/riparian accounts for less than one-tenth of the land cover. Riparian vegetation is more distributed on the eastern side of the river and limited to linear corridors on the west side.

Shaded Riverine Aquatic Cover. The percentage of banks with potential SRA habitat along this reach of the Sacramento River is high compared to other major river reaches. Of the 43 miles of river bank within this reach, 23 miles have natural bank conditions (Table 5-4). Riparian vegetation lines 38 miles of bank, of which 21 miles have natural bank conditions, representing approximately one-half of the banks within this reach.

Riparian Habitat. Along this reach, just more than 1,628 acres of riparian vegetation is located within 1 mile of the Sacramento River, approximately 7 percent of the corridor's land area (Table 5-3). Most of this habitat is very close to the river: Riparian vegetation occupies 43 percent of the 330-foot-wide corridors along the river banks (Table 5-5) and 4 percent of the 10-year floodplain that is connected to the river. Levee VMZs are less than 330 feet from both river banks throughout nearly all of this reach. A very short section of the corridor between the levee VMZ and river bank at each end of the reach is greater than 330 feet wide on both banks, and a few short sections along the reach are greater than 330 feet wide on at least one river bank.

The connectivity of riparian habitats along this reach is comparatively moderate. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of a patch of riparian vegetation (4.7 acres) along this reach (Table 5-5). This habitat is generally in narrow patches, and extends away from the river in a few places. The habitat is most continuous between RM 63 and RM 76, and most fragmented between RM 85 to RM 119.

Riparian vegetation consists primarily of forest, which accounts for 94 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. More wetlands are present along this reach than in reaches farther south. The 174 acres of seasonal wetlands account for less than 1 percent of the land area along this reach, and only 68 acres of nontidal marsh are present along this reach (Table 5-3). Of the total 242 acres of wetland, 103 acres (43 percent) are protected as State or regional lands. The marshes range in size from 1 acre to 30 acres, and the seasonal wetlands range similarly

from 1 acre to 31 acres. Most of these features appear to be associated with agriculture, predominately rice production.

Almost none of these features (none of the marsh and less than 1 percent of seasonal wetland) are connected to the river system within the potential meander zone (Table 5-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 68 percent (16,860 acres) of the reach corridor (Table 5-3). Almost all of the agricultural lands within the reach corridor (16,280 acres or 97 percent) are situated above the 10-year flood level or is protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the Sacramento River (3,440 acres), less than one-quarter (570 acres or 17 percent) is agricultural land. Rice covers a little more than one-half (54 percent) of these floodplain agricultural lands. The remainder is composed of cropland and pasture (26 percent), other agricultural land (19 percent), and orchard and vineyard (1 percent). Seven percent of the total agricultural land is conserved as State, regional, or city lands.

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach include woolly rose-mallow, VELB, giant garter snake, western pond turtle, Swainson's hawk, and colonies of tricolored blackbird. Western pond turtles were only observed just west of the Sacramento River at the Elkhorn pumping station. Colonies of tricolored blackbirds are all near Verona and considered to be extirpated or possibly extirpated. This reach also provides habitat for several sensitive fish, such as foraging adult green sturgeon; longfin smelt; Sacramento splittail; migrating, holding, and rearing steelhead and winter- and fall-/late fall–run Chinook salmon; and migrating and rearing spring-run Chinook salmon. Longfin smelt were found by beach seining throughout approximately 31 miles of the Sacramento River from the I-5 crossing (RM 70.5) near Sacramento airport, south to Hood (RM 38), mapped at all USFWS beach seine stations except SR055M. The reach contains critical habitat for delta smelt, green sturgeon, steelhead, and Chinook salmon.

Stressors

Developed land uses occupy approximately 15 percent of the corridor along this reach. However, at the southern end of this reach, where the river enters Sacramento and West Sacramento, developed land uses occupy most of the 2-mile-wide corridor. Along this reach of the Sacramento River, I-5 crosses the river near RM 71 and crosses the American River at its junction with the Sacramento River; I-80 crosses the river near RM 63 (Figure F2-4 of Attachment F2). Natural gas pipelines cross the Sacramento River near RMs 67 and 64, and an electrical transmission line crosses near RM 63. In addition to major infrastructure facilities crossing the river, the Sacramento International Airport is within 2 miles of this reach of the river, and is an important constraint on the restoration of habitat. Canals and drainage infrastructure in this reach include Natomas Cross Canal, North Drainage Canal, West Drainage Canal, Natomas Main Drainage Canal, and Natomas East Main Drain.

Levees. There are 48.3 miles of SPFC levees and 9.6 miles of non-SPFC levees within this reach (Table 5-7 and Figure F2-4 of Attachment F2). SPFC levees occur along both banks, and the

river is constrained by levees that are adjacent to the river throughout this reach. The physical condition of these levees varies. Sections of the Natomas levees that have recently been improved are of lower concern, approximately 3.5 miles of the west levee south of the I-5 crossing is medium concern and the remaining areas are generally of higher concern elsewhere.

Revetment. There is 23.3 miles of revetment within this reach (Table 5-7). Of this revetment, 20.6 miles are located along the Sacramento River armoring 48 percent of bank length in this reach (Table 5-4). Revetment is most extensive between RMs 61 and 68 and between RMs 70 and 79 less extensive revetment occurs between RMs 68 and 70.

Fish Passage Barriers. One fish passage barrier, Sacramento Weir, has been documented in this reach (see Appendix K) (Figure F2-5 of Attachment F2), identified as a priority barrier for improving fish passage. No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 22 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of the 22 species, seven are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 5-8. Within DWR channel and levee maintenance areas along this reach, approximately 8 acres of initial priority species occurs, and all 8 acres are Himalayan blackberry. Within other areas maintained by LMAs, roughly 44 acres of initial priority species occurs, which are also made up exclusively of Himalayan blackberry. Occurrences of Himalayan blackberry are scattered throughout this reach.

5.1.2 American River to Freeport

This FIP distribution reflects the varied landforms along this reach, which include historical floodbasins and natural levees along the river channel. Almost all of this floodplain is disconnected from the river. In this tidally influenced reach, the Sacramento River enters the legal Delta.

No tributaries to the Sacramento River occur in this reach.

Within this reach of the Sacramento River, the 2-mile-wide floodway corridor covers approximately 17,000 acres, and only a small amount (less than 5 percent) of land has been conserved (Figure F2-1 of Attachment F2). Conserved areas along this reach are limited to sections of the American River Parkway, smaller city and county parks such as William Land Park and Capitol Park, and several other publicly owned parcels.

Ecosystem Processes

Floodplain Inundation. From the American River to Freeport, approximately 20 percent of the corridor along the river has Below Baseflow FIP, nearly 30 percent has a 67-percent-chance Sustained Spring FIP, and more than 40 percent has a 50-percent-chance FIP (Table 5-1 and Figure F2-2 of Attachment F2).

Riverine Geomorphic Processes. In this reach, the average channel width is 807 feet, ranging from between 524 feet and 1,409 feet. The meander corridor is an estimated 6,716 feet wide

(Table 5-2), and the meander amplitude is 4,254 feet. Of the total meander zone within this reach (11,040 acres), the majority (91 percent) is constrained by revetment, levees, and other infrastructure. Approximately 4 percent of the reach is constrained by both geology and infrastructure. The remainder (530 acres or 5 percent) of the reach is unconstrained.

Habitats

Land cover along this reach of the Sacramento River is predominantly developed, with more agriculture than natural vegetation (Table 5-3 and Figure F2-3 of Attachment F2). Development represents more than one-half of the corridor's land cover. Natural vegetation, primarily nonwetland/riparian, accounts for one-eighth of the land cover, and wetland/riparian accounts for considerably less than that. Riparian vegetation is present mostly in a narrow corridor adjacent to the river.

Shaded Riverine Aquatic Cover. The percentage of banks with potential SRA habitat along this reach of the Sacramento River is moderate compared to other major river reaches. Of the 29 miles of river bank, 10 miles have natural bank conditions (Table 5-4). Riparian vegetation lines 21 miles of bank, of which 9 miles have natural bank conditions, representing 31 percent of the banks within this reach.

Riparian Habitat. Along this reach, just more than 373 acres of riparian vegetation is located within 1 mile of the Sacramento River, approximately 2 percent of the corridor land area (Table 5-3). Most of this habitat is very close to the river: Riparian vegetation occupies 19 percent of the 330-foot-wide corridors along the river banks (Table 5-5) and only 4 percent of the 10-year floodplain that is connected to the river. Levee VMZs are less than 330 feet from both river banks throughout this reach, with one very short section at the north end that is less than 330 feet on the east bank.

The connectivity of riparian habitats along this reach is generally poor. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of a patch of riparian vegetation, which is 2.4 acres along this reach (Table 5-5). This habitat is very narrow overall, and is most continuous between RM 52 and RM 57 and most fragmented between RM 57 and RM 59.

Riparian vegetation consists primarily of forest, which accounts for 85 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Very few wetlands are present along this reach, the least of the reaches in this CPA. The 15 acres of marsh (2 acres nontidal, 13 acres tidal) are much less than 1 percent of the land area. Only 12 acres of seasonal wetlands are present along this reach (Table 5-3). Of the total 27 acres of wetland, just over 1 acre (0.5 percent) is protected as city lands. The marshes are all small, and range in size from 1 acre to 6 acres; seasonal wetlands also range from 1 acre to 6 acres. Most of these features appear to be associated with agricultural ditches and canals.

None of these features are connected to the river system within the potential meander zone.

Floodplain Agriculture. Agricultural land is located almost entirely on the west side of the river along this reach, and occupies 28 percent (4,690 acres) of the reach corridor (Table 5-3). Almost all of the agricultural land within the reach corridor (over 99 percent or 4,690 acres) is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the Sacramento River (1,370 acres), less than 1 percent is agricultural land, and all of this land is cropland and pasture. Less than 1 percent of the total agricultural land is conserved (as city lands).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are Sanford's arrowhead, VELB, and Swainson's hawk. The only population of Sanford's arrowhead in this reach, located just east of I-5 and a ½ mile south of Meadowview Road is possibly extirpated due to development.

This reach also provides habitat for several sensitive fish: foraging adult green sturgeon; longfin smelt; Sacramento splittail; migrating, holding, and rearing steelhead and winter- and fall-/late fall–run Chinook salmon; and migrating and rearing spring-run Chinook salmon. The reach contains critical habitat for delta smelt, green sturgeon, steelhead, and Chinook salmon.

Stressors

Developed land uses occupy nearly two-thirds of the floodplain along this reach. Because this reach of the Sacramento River passes through the city of Sacramento, the corridor along the river has a high density of infrastructure, particularly from RMs 57 to 60 (Figure F2-4 of Attachment F2). In addition to multiple major road, pipeline, and transmission line crossings, there are a number of Cortese sites and refineries. In addition, Sacramento Executive Airport is within 2 miles of this reach of the river. The Sacramento Drainage Canal is also within this reach, and runs parallel to the river.

Levees. There are 29.8 miles of project levees and 7.8 miles of non-SPFC levees within this reach (Table 5-7; Figure F2-4 of Attachment F2). SPFC levees along both banks of the river vary from approximately 200 feet to 1,600 feet from the river. The physical condition of these levees is generally of higher concern, but the physical condition of several sections of the west levee is of lower concern.

Revetment. There is 19.3 miles of revetment armoring 66 percent of bank length along the Sacramento River in this reach (Table 5-4 and Table 5-7). Revetment is located throughout this reach, with a lesser extent around RM 50.

Fish Passage Barriers. No priority fish passage barriers have been documented along this reach. No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 23 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of the 23 species, six are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 5-8. Within DWR channel and levee maintenance areas along this reach, approximately 2 acres of initial

priority species occurs, and all 2 acres are Himalayan blackberry. Within other areas maintained by LMAs, approximately 10 acres of initial priority species occurs, which are also made up exclusively of Himalayan blackberry. Occurrences of Himalayan blackberry are spread throughout this reach.

5.1.3 Freeport to Delta Cross Channel

The Sacramento River changes downstream from Freeport and is primarily a confined, narrow channel, generally restricted from migration along most of its length. Levees are located close to the river's edge in this reach. Channel width is fairly uniform, and river bends are static as a result of confinement by levees.

Tributaries to the Sacramento River in this reach are Morrison Creek (at RM 45), Elk Slough (at RM 42), and Sutter Slough (at RM 34).

Within this reach of the Sacramento River, the 2-mile-wide floodway corridor covers approximately 25,000 acres; less than 10 percent of the corridor along this reach of the Sacramento River is conserved (Figure F2-1 of Attachment F2). Conserved areas along this reach include Bufferlands, which is open space managed by the Sacramento Regional County Sanitation District; a section of the McCormack-Williamson Tract, which is managed by The Nature Conservancy; Delta Meadows River Park, which was managed by State Parks but is now closed; and a portion of Stone Lakes National Wildlife Refuge, which is managed by USFWS.

Ecosystem Processes

Floodplain Inundation. From Freeport to the Delta Cross Channel, approximately 60 percent of the corridor along the river has a Below Baseflow FIP. Of the remainder, most has a 67-percent-chance Sustained Spring FIP (Table 5-1 and Figure F2-2 of Attachment F2). This FIP distribution reflects both historical landforms and historical and ongoing changes to landforms (e.g., subsidence of areas with drained, organic soils). Almost all of this floodplain is isolated from the river. This Delta reach of the Sacramento River is tidally influenced.

Riverine Geomorphic Processes. In this reach, the average channel width is 591 feet, ranging between 336 feet and 887 feet. The meander corridor is an estimated 4,741 feet wide (Table 5-2), and the meander amplitude is 3,021 feet. Of the total meander zone within this reach (11,327 acres), 99 percent is constrained by revetment, levees, and other infrastructure. Less than 1 percent of the reach is constrained by both geology and infrastructure. The remainder (110 acres or 1 percent) of the reach is unconstrained.

Habitats

Land cover along this reach of the Sacramento River is predominantly agriculture, with some natural vegetation present (Table 5-3 and Figure F2-3 of Attachment F2). Agriculture represents three-quarters of the corridor land cover. Natural vegetation, primarily non-wetland/riparian, accounts for less than one-sixth of the land cover, and wetland/riparian accounts for considerably less than that. Riparian vegetation is present mostly in a narrow corridor adjacent to the river, except where the reach boundaries intercept Stone Lakes National Wildlife Refuge properties.

Shaded Riverine Aquatic Cover. The percentage of banks with potential SRA habitat along this reach of the Sacramento River is very low compared to other major river reaches. Of the 46 miles of river bank, 3 miles have natural bank conditions (Table 5-4). Riparian vegetation lines 13 miles of bank, of which 3 miles (representing only 7 percent of the reach) have natural bank conditions.

Riparian Habitat. Along this reach, just more than 772 acres of riparian vegetation is located within 1 mile of the Sacramento River, which is approximately 3 percent of the corridor land area (Table 5-3). Most of this habitat is very close to the river: Riparian vegetation occupies 13 percent of the 330-foot-wide corridors along the river banks (Table 5-5) and only 1 percent of the 10-year floodplain that is connected to the river. Levee VMZs are less than 330 feet from both river banks throughout this reach, with one very short section at the north end less than 330 feet on the east bank.

The connectivity of riparian habitats along this reach is the most fragmented of the reaches in this CPA. This low level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of a patch of riparian vegetation, which is 3.0 acres along this reach (Table 5-5). This habitat is found in extremely narrow strips along the river, except for where the reach intersects the Stone Lakes National Wildlife Refuge or The Meadows Slough. The habitat is most continuous between RM 32 and RM 36, and most fragmented between RM 28 and RM 32.

Riparian vegetation consists primarily of forest, which accounts for 77 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. This reach contains more marsh than all but the Deep Water Ship Channel to Collinsville reach. There are 91 acres of tidal marsh (less than 1 percent of the land area) and 17 acres of nontidal marsh present along this reach (Table 5-3). Only 13 acres of seasonal wetland is present. Of the total 121 acres of wetland, 84 acres (69 percent) is protected as federal, State, regional, or private conservancy land. The marshes range in size from less than 1 acre to 43 acres, and the seasonal wetlands range from less than 1 acre to 3 acres. Most of these features are associated with Stone Lakes National Wildlife Refuge and The Meadows Slough.

Very few of these features (3 percent of marsh and none of the seasonal wetland) are connected to the river system within the potential meander zone (Table 5-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 75 percent (18,650 acres) of the reach corridor (Table 5-3). Almost all of the agricultural land within the reach corridor (99 percent or 18,640 acres) is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the Sacramento River (1,930 acres), less than 1 percent is agricultural land, and all of this land is orchard and vineyard. Only 400 acres, 2 percent of the total agricultural land, is conserved as State, regional, county, or private conservancy land.

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach consist of several plants that are characteristic of sloughs and tidal marshes (e.g., delta tule pea, Mason's lilaeopsis, and Suisun Marsh aster), Sanford's arrowhead, woolly rose-mallow, giant garter snake, western pond turtle, Swainson's hawk, and yellow-headed blackbird. The only population of Mason's lilaeopsis was documented at Delta Meadows State Park at the north end of the levee that runs northeast from the town of Locke, and the only population of Suisun Marsh aster was observed on both sides of the Delta Cross Channel, between Locke and Walnut Grove. Yellow-headed blackbirds in this reach have only been documented 0.5 mile south of Freeport.

This reach also provides habitat for several sensitive fish: delta smelt; foraging adult green sturgeon; longfin smelt; Sacramento splittail; migrating, holding, and rearing steelhead and winter- and fall-/late fall–run Chinook salmon; and migrating and rearing spring-run Chinook salmon. The reach contains critical habitat for delta smelt, green sturgeon, steelhead, and Chinook salmon.

Stressors

Along this reach, small areas of developed land uses occur at Courtland and near Walnut Grove, but developed land uses only occupy a small percentage of the total land along this reach. Besides levees, major infrastructure is limited along this reach. SR 160 runs along the east bank of the river, and an electrical transmission line crosses the river between RMs 31 and 32 (Figure F2-4 of Attachment F2). There is also one canal, Reclamation District 551 Borrow Canal, in this reach, which runs east to west.

Levees. There are 53.8 miles of SPFC levees and 18.1 miles of non-SPFC levees within this reach (Table 5-7; Figure F2-4 of Attachment F2). SPFC levees are along both river banks, and the river is constrained within this reach (approximately 250 feet from the river). In the upstream half of this reach, the physical condition of the levees is generally of higher concern, but in the downstream half of this reach, their physical condition is generally of medium concern.

Revetment. There is 42.5 miles of revetment (armoring 93 percent of bank length) along the Sacramento River in this reach (Table 5-4 and Table 5-7). Revetment is located throughout this reach.

Fish Passage Barriers. No priority fish passage barriers have been documented along this reach. No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 25 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 25 species, eight are ranked as being highly abundant. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 5-8. Within DWR channel and levee maintenance areas along this reach, approximately 5 acres of initial priority species occurs, and all 5 acres are Himalayan blackberry. Within other areas maintained by LMAs, approximately 15 acres of initial priority species occurs, which are also made up exclusively of Himalayan blackberry.

Occurrences of Himalayan blackberry in channel maintenance areas are concentrated in the north; those in levee maintenance areas are spread throughout this reach.

5.1.4 Delta Cross Channel to Deep Water Ship Channel

This floodplain consists of Delta islands bordered by sloughs that have been leveed and drained and are in agricultural use. Consequently, the organic soils of these islands have been oxidizing and the land surface subsiding. This Delta reach of the Sacramento River is tidally influenced.

Tributaries to the Sacramento River within this reach consist of Georgiana Slough (at RM 26), Steamboat Slough (at RM 14), and Cache Slough (at RM 14).

Within this reach of the Sacramento River, the 2-mile-wide floodway corridor covers approximately 16,000 acres; very little (less than 2 percent) of the corridor along this reach of the Sacramento River has been conserved (Figure F2-1 of Attachment F2). Conserved land along this reach is limited to a very small portion of the McCormack-Williamson Tract, which is managed by The Nature Conservancy.

Ecosystem Processes

Floodplain Inundation. From the Delta Cross Channel to the Deep Water Ship Channel, most of the corridor along the river has a Below Baseflow FIP and is disconnected from the river (Table 5-1and Figure F2-2 of Attachment F2). Only a few hundred acres along this reach have either a 67-percent-chance Sustained Spring FIP or a 50-percent-chance FIP, most of which is connected to the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 464 feet, ranging between 277 feet and 810 feet. The meander corridor is an estimated 3,617 feet wide (Table 5-2), and the meander amplitude is 2,317 feet. Of the total meander zone within this reach (5,705 acres), the majority (93 percent) is constrained by revetment, levees, or other infrastructure. No natural geology constraints occur along this reach. The remaining meander zone potential (403 acres or 7 percent) is unconstrained.

Habitats

Land cover along this reach of the Sacramento River is predominantly agriculture, with more open water present than natural vegetation (Table 5-3 and Figure F2-3 of Attachment F2). Agriculture represents two-thirds of the corridor's land cover. Natural vegetation, primarily riparian, accounts for less than one-tenth of the land cover. Riparian vegetation is present mostly in narrow corridors adjacent to the river and other stream features within the reach, and almost entirely on the east side of the river.

Shaded Riverine Aquatic Cover. The percentage of banks with potential SRA habitat is low along this reach of the Sacramento River compared to other major river reaches. Of the 48 miles of river bank, 20 miles have natural bank conditions (Table 5-4). Riparian vegetation lines 14 miles of bank, of which 8 miles have natural bank conditions, representing 17 percent of the banks along this reach.

Riparian Habitat. Along this reach, just less than 396 acres of riparian vegetation are located within 1 mile of the Sacramento River, which is approximately 2 percent of the corridor land area (Table 5-3). Most of this habitat is very close to the river: Riparian vegetation occupies 14 percent of the 330-foot-wide corridors along the river banks (Table 5-5) and less than 1 percent of the 10-year floodplain that is connected to the river. Levee VMZs are less than 330 feet from the river banks in this reach.

The connectivity of riparian habitats along this reach is generally poor. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of a patch of riparian vegetation, which is 1.3 acre along this reach (Table 5-5). This habitat is found in extremely narrow patches along the river's edge, primarily on the east side. The habitat is most continuous between RM 16 and RM 19, and most fragmented and narrow between RM 19 and RM 24.

Riparian vegetation consists primarily of forest, which accounts for 66 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. This reach has comparatively few wetlands. There are 38 acres of marsh (13 miles of tidal and 25 miles of nontidal) present along this reach (Table 5-3), less than 0.5 percent of the land area. Only 13 acres of seasonal wetland are present along this reach. Of the 51 acres of wetland, approximately 3 acres (6 percent) are protected as State or private conservancy lands. The marshes range in size from less than 1 acre to 11 acres, and the seasonal wetlands range from less than 1 acre to 5 acres. Most of these features appear to be associated with the river or sloughs in the reach.

A small portion of these features (25 percent of marsh and none of the seasonal wetland) is connected to the river system within the potential meander zone (Table 5-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 80 percent (12,890 acres) of the reach corridor (Table 5-3). All of this agricultural land is situated above the 10-year flood level or protected by levees. Only 11 acres, less than 1 percent of the total agricultural land, is conserved as State, city, or private conservancy land.

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach consist of several plants characteristic of sloughs and tidal marshes (e.g., delta tule pea, and Mason's lilaeopsis, and Suisun Marsh aster), Sanford's arrowhead, woolly rose-mallow, western pond turtle, and Swainson's hawk. The only population of woolly rose-mallow known in this reach is located at Snodgrass Slough just east of Walnut Grove. The only western pond turtle documented in this reach was observed along Georgiana Slough 1 mile east of Isleton.

This reach also provides habitat for several sensitive fish: delta smelt; foraging adult green sturgeon; longfin smelt; migrating, holding, and rearing steelhead and winter- and fall-/late fall–run Chinook salmon; and migrating and rearing spring-run Chinook salmon. The only delta smelt

detected in this reach were observations at the Spring Kodiak Trawl Survey Station 724. This reach contains critical habitat for delta smelt, green sturgeon, steelhead, and Chinook salmon.

Stressors

Small areas of developed land uses occur at Walnut Grove and Isleton, but developed land use only account for a small percentage of the total land along this reach. SR 160 runs along the river bank, and other major infrastructure consists of an electrical transmission line that crosses the river near RM 17, and natural gas pipelines that cross the river near RMs 15, 20, and 21 (Figure F2-4 of Attachment F2). No canals occur in this reach.

Levees. There are 43.9 miles of SPFC levees and 5.8 miles of non-SPFC levees within this reach. SPFC levees are along both river banks (Table 5-7; Figure F2-4 of Attachment F2). The river is constrained in this reach with levees adjacent to the riverbanks, except near RM 14 where Steamboat Slough, Cache Slough, and the Sacramento River converge. The distance of the levees from the river varies from approximately 200 feet to 1,100 feet in this area. The physical condition of the west levee is of medium concern from the Delta Cross Channel to approximately RM 20, and of higher concern from RM 20 to the junction with the Deep Water Ship Channel.

Revetment. There is 28.2 miles of revetment (armoring 58 percent of bank length) along the Sacramento River in this reach (Table 5-4 and Table 5-7). Revetment is fairly continuous throughout this reach, except for in the southern portion of the reach from RM 14 to 16.

Fish Passage Barriers. No priority fish passage barriers have been documented along this reach (Appendix K). No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 22 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 22 species, six are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 5-8. Within DWR channel and levee maintenance areas along this reach, approximately 5 acres of initial priority species occurs, with 3 acres of giant reed and 2 acres of Himalayan blackberry. Within other areas maintained by LMAs, approximately 7 acres of initial priority species occurs, consisting of 1 acre of giant reed and 6 acres of Himalayan blackberry. Occurrences of Himalayan blackberry are in the lower half of the reach; occurrences of giant reed are concentrated at the southern end.

5.1.5 Deep Water Ship Channel to Collinsville

The Sacramento River in this reach is narrow and uniform near the northern portion of the reach, and the channel is generally restricted from meandering. In the southern portion of this reach, the channel becomes much wider.

This Delta reach of the Sacramento River is strongly tidally influenced. The only tributary to the Sacramento River within this reach is Threemile Slough (at RM 9), which connects the Sacramento River to the San Joaquin River.

Within this reach of the Sacramento River, the 2-mile-wide floodway corridor covers approximately 11,000 acres, and approximately 7 percent of the corridor has been conserved (Figure F2-1 of Attachment F2). Conserved areas along this reach include Brannan Island State Recreation Area, which is managed by State Parks, and Decker Island Wildlife Area and Lower Sherman Island Wildlife Area, which are managed by CDFW.

Ecosystem Processes

Floodplain Inundation. From the Deep Water Ship Channel to Collinsville, the corridor along the river consists of Delta islands with a Below Baseflow FIP but disconnected from the river, and an area of uplands downstream from Rio Vista (Table 5-1 and Figure F2-2 of Attachment F2). Only a few hundred acres along this reach have either a 67-percent-chance Sustained Spring FIP or a 50-percent-chance FIP, most of which is disconnected from the river.

Riverine Geomorphic Processes. Due to the altered state of this reach, meander zone calculations were not completed.

Habitats

Land cover along this reach of the Sacramento River is a mix of agriculture and natural vegetation (Table 5-3 and Figure F2-3 of Attachment F2). Agriculture and natural vegetation each represent approximately one-quarter of the corridor's land cover. The natural vegetation is primarily non-wetland/riparian; wetland/riparian is less than one-tenth of the corridor's land cover. Riparian vegetation is patchy along the river and concentrated in two parks present in this reach.

Shaded Riverine Aquatic Cover. The percentage of banks with potential SRA habitat is very low along this reach of the Sacramento River compared to other major river reaches. Of 25 miles of river bank, approximately 11 miles have natural bank conditions (Table 5-4). Riparian vegetation lines less than 1 mile of bank, all of which have natural bank conditions, representing less than 1 percent of the banks along this reach.

Riparian Habitat. Along this reach, approximately 250 acres of riparian vegetation are located within 1 mile of the Sacramento River, which is approximately 2 percent of the corridor's land area (Table 5-3). Most of this habitat is very close to the river: Riparian vegetation occupies 14 percent of the 330-foot-wide corridor along the river banks (Table 5-5) and less than 1 percent of the 10-year floodplain that is connected to the river. Levee VMZs are generally less than 330 feet from the river bank; SPFC levees are only present on the east bank in this reach.

The connectivity of riparian habitats along this reach is generally poor. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of a patch of riparian vegetation, which is 2.3 acres along this reach (Table 5-5). This habitat is found in extremely narrow patches along the river's edge, primarily on the east side. The habitat is most continuous between RM 6 and RM 10, and nearly absent from RM 4 to RM 6 and RM 12 to RM 14.

Riparian vegetation consists primarily of scrub, which accounts for 66 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Marsh and other wetlands are comparatively extensive in this reach. There are 149 acres of marsh (111 acres tidal, 38 acres nontidal), or approximately 1 percent of the land area, and 65 acres of seasonal wetlands present along this reach (Table 5-3). Of the total 214 acres of wetland, 26 acres, or 12 percent, is protected (as State land). The marshes range in size from less than 1 acre to 21 acres, but most are small. The seasonal wetlands range from less than 1 acre to 59 acres, composed of one 0.5-acre and one 5-acre wetland, and one 59-acre wetland complex. Most of these features are associated with the river's edge, around Decker Island and at Sherman Island County Park.

None of these wetland features is connected to the river system within the potential meander zone (Table 5-6).

Floodplain Agriculture. Agricultural land occupies 28 percent (3,150 acres) of the reach's corridor (Table 5-3). It is distributed on both sides of the river; however, most of the west side is outside of the SPA. Almost all of the agricultural land within the reach's corridor (more than 99 percent or 3,150 acres) is situated above the 10-year flood level or protected by levees. Only 1 acre of orchard and vineyard land is within the 10-year (10-percent-chance) floodplain that is connected to the Sacramento River. Only 2 acres, less than 1 percent, of the total agricultural land is conserved as State land.

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach consist of several plants characteristic of sloughs and tidal marshes (e.g., delta mudwort, delta tule pea, Mason's lilaeopsis, and Suisun Marsh aster), woolly rose-mallow, giant garter snake, bank swallow, and Swainson's hawk. The only bank swallow colonies documented in this reach were observed at Brannan Island Recreational Area, 0.2 mile north on Sevenmile Slough from the confluence with Threemile Slough.

This reach also provides habitat for several sensitive fish, such as delta smelt; foraging adult green sturgeon; longfin smelt; migrating, holding, and rearing steelhead and winter- and fall-/late fall–run Chinook salmon; and migrating and rearing spring-run Chinook salmon. The reach contains critical habitat for delta smelt, green sturgeon, steelhead, and Chinook salmon.

Stressors

A small portion of this reach has developed land uses at Rio Vista. In addition to levees, this reach has a high density of other major infrastructure. At Rio Vista, SR 12 and two natural gas pipelines cross the river. The Rio Vista Municipal Airport is within 1 mile of the river. Also, near the downstream end of this reach, from approximately RMs 4 to 7, nine natural gas pipelines and electrical transmission lines cross the river (Figure F2-4 of Attachment F2). No canals occur in this reach.

Levees. There are 13.6 miles of SPFC levees and 9.0 miles of non-SPFC levees within this reach (Table 5-7; Figure F2-4 of Attachment F2). SPFC levees are on the east river bank for the entire length of the reach, and on the west bank at RMs 13 and 14 (near Rio Vista). The distance of the levees from the river varies in this reach from approximately 0.2 mile to more than 1 mile in the Horseshoe Bend area. Approximately half of these levees have a physical condition that is of higher concern, and half are of medium concern.

Revetment. There are 16.1 miles of revetment along this reach (Table 5-7). Of this revetment, 14.2 miles are located along the Sacramento River armoring 58 percent of bank length (Table 5-4). Revetment is almost continuous along the east bank of the river within this reach, and is concentrated at RM 6, RMs 8 to 9, and RMs 11-14 along the west bank of the river.

Fish Passage Barriers. No priority fish passage barriers have been identified along this reach (Appendix K). Two sand mining operations, Asta Construction Sand Pit and Decker Island Aggregates, are located within this reach (DWR 2012f). However, these operations are located relatively far from the water's edge. Asta Construction Sand Pit is within Rio Vista approximately 0.3 mile from the western edge of the Sacramento River, and Decker Island Aggregates is within 125 feet of the western edge of Decker Island.

Invasive Plants. Within the floodway corridor along this reach, 20 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 20 species, four are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 5-8. Within DWR channel and levee maintenance areas along this reach, approximately 25 acres of initial priority species occurs, with 15 acres of giant reed and 11 acres of Himalayan blackberry. Within other areas maintained by LMAs, roughly 9 acres of initial priority species occurs, consisting of less than 1 acre of giant reed and approximately 9 acres of Himalayan blackberry. Occurrences of giant reed are spread throughout this reach; occurrences of Himalayan blackberry are primarily in the southern portion of the reach.

5.2 Basins/Bypasses

The only bypass within the Lower Sacramento River CPA is Yolo Bypass. The Lower Sacramento River CPA also includes Cache Slough, but a detailed habitat description of this area is not provided.

5.2.1 Yolo Bypass

The Yolo Bypass is bordered to the north and east by the natural levees of the Sacramento River and its distributary channels, on the west by the alluvial fans of Putah Creek and Cache Creek, and to the south by the tidal sloughs and islands of the Delta. During flood flows, water enters the Yolo Bypass from the Sacramento River from the north, and Cache Creek, Putah Creek, and Willow Slough from the west; water drains south to the northern Delta.

A substantial portion of the 67,000 acre Yolo Bypass is included in the Yolo Bypass Wildlife Area, which are conserved areas managed by CDFW (Figure F2-1 of Attachment F2). Other conserved areas in this bypass include Fremont Weir Wildlife Area, which is managed by CDFW, and portions of the North Central Valley Wildlife Management Area, which consists of privately owned land and some USFWS-owned land managed by USFWS. Conserved lands cover approximately 20 percent of the area in the bypass.

Ecosystem Processes

Floodplain Inundation. During approximately 70 percent of years, the bypass is inundated at least once (and sometimes several) times for less than 1 to 135 days from May through November (CDFG 2008).

Habitats

Land cover in the Yolo Bypass consists of a mosaic of agricultural and natural vegetation that includes row crops, seasonal wetlands managed as habitat (primarily for waterfowl), permanent wetlands, and uplands (Figure F2-3 of Attachment F2). Natural vegetation accounts for more than one-third of the land cover within the bypass corridor, and riparian/wetland vegetation accounts for just less than one-quarter of the corridor land area.

Shaded Riverine Aquatic Cover. No SRA cover occurs along the Yolo Bypass. Less than 1 mile of river bank occurs within the Yolo Bypass. This is a revetted bank devoid of riparian vegetation.

Riparian Habitat. Along the bypass corridor, 1,566 acres of riparian vegetation occurs within the bypass levees, comprising approximately 17 percent of the land cover. Most of this habitat is in proximity to the levees and channels within the bypass. The connectivity of riparian habitats in the bypass is relatively low.

Riparian vegetation consists primarily of forest, which accounts for 60 percent of the riparian vegetation in the bypass.

Marsh and Other Wetland Habitat. The bypass corridor contains a much larger acreage of wetlands compared to any of the major river reaches in this CPA. The 8,220 acres of nontidal wetland present is approximately 12 percent of the land cover in the bypass corridor. There are 2,785 acres of seasonal wetland and 1,575 acres of tidal marsh. Wetlands are present both within and outside of the bypass levees. Of the total 12,580 acres of wetland, 5,447 acres are protected as State or federal land. The marshes range in size from 1 acre to 5,835 acres, and most are fairly large. The seasonal wetlands range from 1 acre to 1,946 acres, and most are small.

Floodplain Agriculture. Agricultural land is distributed throughout the bypass and occupies approximately 54 percent (37,540 acres) of the bypass corridor. The majority of this agricultural land, 77 percent, is cropland and pasture, 22 percent is rice, less than 1 percent is orchard and vineyard, and 1 percent is identified as other agricultural land. Approximately 16 percent of agricultural land is conserved as State land.

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are Suisun Marsh aster, giant garter snake, least Bell's vireo, Swainson's hawk, and western yellow-billed cuckoo. Suisun Marsh aster has only been documented in this reach at the southwest end of Greens Lake in the Yolo Wildlife Area, between West Sacramento and Davis. Least Bell's vireo has only been detected along the south fork of Putah Creek and Putah Creek Sinks in the Yolo Bypass Wildlife Area.

As described for Sutter Bypass, the Yolo Bypass provides extremely productive inundated floodplain habitat that benefits downstream ecosystems and provides rearing habitat for steelhead and Chinook salmon. The reach contains critical habitat for delta smelt, green sturgeon, steelhead, and Chinook salmon.

Stressors

There is no developed land in the Yolo Bypass. Infrastructure in and adjacent to the Yolo Bypass consists of levees and several major transportation features. The Sacramento Deep Water Ship Channel is east of the bypass. A variety of small interior levees and berms constructed for local agricultural development prevent the inundation of particular areas from tidal fluctuations and small floods. Causeways and bridge crossings of the bypass include I-80, I-5, portions of the abandoned Sacramento North Railroad, and the Southern Pacific Railroad. The Tule Canal is also within the Yolo Bypass and runs north to south (Figure F2-4 of Attachment F2).

Levees. The Yolo Bypass is surrounded completely on the east and partially on the west by approximately 80 miles of SPFC levees (Figure F2-4 of Attachment F2). Levees are set back more than 1 mile throughout the bypass. The physical condition of these levees is of medium to higher concern.

Revetment. There are 11.2 miles of revetment within the Yolo Bypass. The majority of the revetment is on the west side, where the bypass intersects with Cache Creek, Willow Slough Bypass, and Putah Creek.

Fish Passage Barriers. Four fish passage barriers have been documented along the bypass. Three of these barriers, Fremont Weir, Lisbon Weir, and five agricultural earthen crossings or culverts that cross Tule Canal, have been identified as priority barriers for improving fish passage (Figure F2-5 of Attachment F2). No gravel/aggregate mines are present in the bypass (DWR 2012f).

Invasive Plants. Within the floodway corridor along this bypass, 25 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 25 species, 12 are ranked as being highly abundant in at least one quad within the bypass. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 5-8. Within DWR channel and levee maintenance areas along this bypass, approximately 101 acres of initial priority species occurs; all 101 acres are Himalayan blackberry. No acreages of initial priority species have been recorded in other areas maintained by LMAs. Occurrences of Himalayan blackberry are primarily located along the eastern half of the bypass.

5.3 Major Tributaries

5.3.1 American River

The upper and lower portions of the American River are sinuous, and the channel is braided in several areas. In the upper and lower portions of this reach, levees are set back and the channel is actively meandering. Levees in the mid-section of this reach are closer to the river, and the channel is confined.

Tributaries to the American River in this reach are Chicken Ranch Slough (at RM 5) and Buffalo Creek (at RM 19).

Within this reach of the American River, the 2-mile-wide floodway corridor covers approximately 20,800 acres; more than one-quarter of the corridor has been conserved (Figure F2-1 of Attachment F2). This reach has the largest percentage of conserved area among the reaches of the Sacramento and San Joaquin Rivers. Conserved areas along this reach of the American River include Folsom Lake Recreation Area, which is managed by State Parks; several city parks; and the American River Parkway and associated county parks, which are managed by the American River Parkway Foundation and Sacramento County.

Ecosystem Processes

Floodplain Inundation. Along the lowest reach of the American River, approximately 1 percent of the corridor along the river has 67 percent chance Sustained Spring FIP, and only 14 percent has 50 percent chance FIP (Table 5-1 and Figure F2-2 of Attachment F2). Most of these areas are connected to the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 625 feet, ranging between 297 feet and 2,347 feet. The meander corridor is an estimated 5,405 feet wide (Table 5-2), and the meander amplitude is 3,212 feet. Of the total meander zone within this reach (11,443 acres), approximately 39 percent is unrestricted. Approximately 40 percent (4,595 acres) is constrained by revetment, levees, and other infrastructure. Natural geology limits 18 percent of the meander zone (2,018 acres). The remaining meander zone (3 percent) is constrained by both infrastructure and natural geology.

Habitats

Land cover along this reach of the American River is predominantly developed and has more natural vegetation than agriculture (Table 5-3 and Figure F2-3 of Attachment F2). Development represents almost three-quarters of the corridor's land cover. Natural vegetation accounts for almost one-quarter of the land cover, but wetland/riparian cover is only approximately one-tenth of the land cover. Riparian vegetation is strongly associated with the river.

Shaded Riverine Aquatic Cover. The percentage of banks with potential SRA habitat is moderate along the American River compared to other major river reaches. Of the 25 miles of river bank, approximately 19 miles has natural bank conditions (Table 5-4). Riparian vegetation lines 13 miles of the bank, of which 11 miles has natural bank conditions, representing 45 percent of the bank along this reach.

Riparian Habitat. Along this reach, 1,904 acres of riparian vegetation is located within 1 mile of the Sacramento River, approximately 9 percent of the corridor's land area (Table 5-3). Most of this habitat is close to the river: Riparian vegetation occupies 47 percent of the 330-foot-wide corridors along the river banks (Table 5-5) and 12 percent of the 10-year floodplain that is connected to the river. Levee VMZs are generally more than 330 feet from the river banks in the upper half of this reach and less than 330 feet from the river banks on one side in the lower half, with the exception of a short stretch near RM 8 where the VMZs are less than 330 feet from both banks.

The connectivity of riparian habitats along this reach is very good. This level of connectivity is reflected in the percent of 330-foot-wide corridors occupied by riparian vegetation, but the median size of a patch of riparian vegetation is relatively small, at 2.6 acres, along this reach (Table 5-5). This habitat is generally continuous throughout the reach, and is most widely distributed between RM 13 and RM 20, and most narrow between RM 6 and RM 12.

Riparian vegetation consists primarily of forest, which accounts for 93 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Very few wetlands are present along this reach. There are 27 acres of seasonal wetland, less than 0.5 percent of the land area, and only 12 acres of nontidal marsh present along this reach (Table 5-3). All of the total 39 acres are protected as State or county lands. The marshes range in size from 2 to 4 acres, and the seasonal wetlands range from 1 to 11 acres; most are moderate in size. Most of these features appear to be associated with natural areas at river bends associated with historic meander migration.

A substantial portion of these features (92 percent of marsh and all seasonal wetland) is connected to the river system within the potential meander zone (Table 5-6).

Floodplain Agriculture. Agricultural land is patchily distributed along both sides of the river, and occupies less than 1 percent (40 acres) of the reach corridor (Table 5-3). Of the total area within the 10-year (10-percent-chance) floodplain connected to the Sacramento River (3,990 acres), less than 1 percent is agricultural land (6 acres orchard and vineyard and less than 1 acre other agricultural land). Only 1 acre, or 3 percent, of the total agricultural land is conserved (as county land).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are Sanford's arrowhead, VELB, western pond turtle, bank swallow, and Swainson's hawk. The reach contains critical habitat for VELB. Active bank swallow colonies have been documented throughout the reach in steep eroding sandy bluffs and banks.

This reach also provides habitat for migrating, holding, and rearing steelhead, and migrating, holding, spawning, and rearing fall-run Chinook salmon. The reach contains critical habitat for green sturgeon, steelhead, and Chinook salmon.

Stressors

Because this reach passes through the Sacramento metropolitan area, developed land uses occupy more than three-quarters of the land along this reach. Also, a high density of major infrastructure occurs along the river, particularly from RMs 0 to 9 (Figure F2-4 of Attachment F2). Multiple major roads and railroads, natural gas pipelines, and electrical transmission lines cross the river.

Levees. In this reach, 24.4 miles of SPFC levees and 2.6 miles of non-SPFC levees occur (Table 5-7; Figure F2-4 of Attachment F2). Levees in this reach are setback approximately 250 to 3,200 feet. The physical condition of these levees is primarily of lower concern.

Revetment. In this reach, 5.7 miles of revetment occurs along the American River, armoring 23 percent of bank length (Tables 5-4 and 5-7). Most of the revetment in this reach is located between RMs 1 and 9.

Fish Passage Barriers. No priority fish passage barriers have been identified along this reach (Appendix K). The Urrutia gravel mine is located in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 25 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 25 species, six are ranked as being highly abundant in at least one quad within the tributary. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 5-8. Within DWR channel and levee maintenance areas along this reach, approximately 28 acres of initial priority species occurs; all 28 acres are Himalayan blackberry. Within other areas maintained by LMAs, less than 1 acre of initial priority species occurs, which is made up exclusively of Himalayan blackberry. Occurrences of Himalayan blackberry are spread throughout this reach.

5.4 Other Valley Landscape Units

The Other Valley Landscape Unit within the Lower Sacramento River CPA generally extends from just south of the Natomas Cross Canal to Sherman Lake, and covers approximately 263,490 acres (Figure 5-1). The Yolo Bypass and Sacramento River are the major features within this landscape unit. Agricultural land is the predominant land cover type within this landscape unit, totaling 166,380 acres (Table 5-9; Figure F2-3 of Attachment F2). Agricultural lands are found throughout this unit, except for along the east side near the city of Sacramento. The majority of the agricultural land (approximately 127,810 acres) is cropland and pasture, also located throughout the landscape unit. Rice production is concentrated within the Natomas Basin in the northeast portion of this landscape unit and along the east side of this landscape unit.

Natural land cover represents approximately 13 percent of the Other Valley Landscape Unit. Approximately 30 percent of this area (21,220 acres) is represented by other natural landscape, which is concentrated near the Consumes River Preserve and in the southwest portion of the unit near Rio Vista. Nontidal marsh and riparian scrub are the two land cover types with the least coverage within this landscape unit, covering 1,065 acres and 953 acres, respectively. The

majority of the nontidal marsh is found in the mid-section of this landscape unit near the Yolo Bypass. Other land cover types in this unit are water (6,270 acres), tidal marsh (2,275 acres), seasonal wetland (1,440 acres), and riparian forest (1,177 acres). Riparian forest is concentrated in the Consumes River Preserve and Prospect Island within the Delta.

Target and other sensitive species documented within this landscape unit are several plants characteristic of sloughs and tidal marshes (e.g., delta mudwort, delta tule pea, Mason's lilaeopsis, and Suisun Marsh aster), Sanford's arrowhead, woolly rose-mallow, giant garter snake, western pond turtle, California black rail, Swainson's hawk, and colonies of tricolored blackbirds. California black rail has only been documented in this area on the northwest island within the Sherman Island Wildlife Area.

This landscape unit also provides habitat for several sensitive fish, including delta smelt; green sturgeon; longfin smelt; migrating, holding, and rearing steelhead; and migrating and rearing spring-run Chinook salmon. The area contains critical habitat for delta smelt, green sturgeon, steelhead, and Chinook salmon.

Developed land uses occupy less than one-half of this landscape unit (approximately 20 percent), primarily in the vicinity of the city of Sacramento and Natomas. Major infrastructure crossing through this landscape unit consists of I-80, SR 99, and I-5 (Figure F2-4 of Attachment F2).

There are 172.4 miles of non-SPFC levees along waterways within this landscape unit, and no SPFC levees (Table 5-10). There are 2.3 miles of revetment along waterways within this landscape unit, and the majority of the revetment is located along Georgiana Slough.

No priority fish passage barriers have been identified within this landscape unit (Appendix K).

5.5 Other Facilities and Waterways

From north to south, the other facilities in the Feather River CPA are levees; channel clearing projects; and/or diversions along Natomas East Main Drainage Canal, Willow Slough Bypass, Putah Creek, Haas Slough, Lindsey Slough, Cache Slough, Miner Slough, Sutter Slough, Elk Slough, Steamboat Slough, Georgiana Slough, Threemile Slough, small portions of Colusa Basin Drainage, and Cache Creek.

Approximately 61 percent of the 80,360 acres in the Other Facilities and Waterways portion of the Lower Sacramento River CPA is in agricultural use, and more than 75 percent of this is cropland and pasture (Table 5-9 and Figure F2-3 of Attachment F2). Natural land cover makes up 16 percent (12,730 acres) of the total area, with the majority (approximately 69 percent) being natural upland vegetation (8,730 acres). Seasonal marsh and riparian vegetation cover approximately 10 and 15 percent of the total natural land cover, respectively. Approximately 6 percent of this portion of the CPA is tidal and nontidal perennial marsh.

Target and other sensitive species documented within Other Facilities and Waterways consist of several plants characteristic of sloughs and tidal marshes (e.g., delta mudwort, delta tule pea,

Mason's lilaeopsis, and Suisun Marsh aster), Sanford's arrowhead, woolly rose-mallow, giant garter snake, Swainson's hawk, and tricolored blackbird.

Other Facilities and Waterways also provide habitat for several sensitive fish: green sturgeon; longfin smelt; migrating, holding, and rearing steelhead; and migrating and rearing spring-run Chinook salmon. The area contains critical habitat for delta smelt, green sturgeon, steelhead, and Chinook salmon.

Developed land use makes up 15 percent of the land cover within Other Facilities and Waterways. Developed lands include the portions of city of Sacramento within the Natomas East Main Drainage Canal footprint and the city of Davis within the Putah Creek footprint. Major infrastructure consists of pipelines and transmission lines that pass through most of the facility footprints. I-80 passes through the Natomas East Main Drainage Canal and Putah Creek footprints (Figure F2-4 of Attachment F2).

The facilities described above have a total of 189.2 miles of SPFC levees and 66.8 miles of non-SPFC levees (Table 5-10). Revetment covers 52.8 miles, generally along the levees. Levees along Natomas East Main Drainage Canal; Putah Creek; Haas Slough; Cache Slough; Georgiana Slough; Steamboat Slough; and portions of Willow Slough Bypass, Miner Slough, and Threemile Slough are of higher concern. Elk Slough and portions of Willow Slough Bypass, Sutter Slough, and Steamboat Slough are of medium or lower concern or lack sufficient data to characterize.

Within the Other Facilities and Waterways landscape unit, one fish passage barrier is present, but it has not been identified as a priority barrier for fish passage improvement.

5.6 Foothill Landscape Units

The only reservoir within the Foothill Landscape Unit portion of the Lower Sacramento River CPA is Folsom Lake, located on the American River. Folsom Lake's primary purpose is flood management, but water stored in the reservoir is also allocated to a variety of purposes throughout the year, including water supply, recreation, power generation, and fishery enhancement. Folsom Lake is also operated to help maintain water quality in the Delta; prevent saltwater intrusion; and maintain minimum flows on the American River, Sacramento River, and other rivers through coldwater releases (DWR 2012h).

The only outlying community within the Lower Sacramento River CPA is Upper Lake, which is just north of Clear Lake. The Middle Creek and Tributaries Project reduces flood risk for the town of Upper Lake, adjoining agricultural land, SR 20, and several county roads.

Landcover was not mapped for the CVFPP for the majority, over 99 percent, of lands within the Other Foothill Landscape Unit (Table 5-11 and Figure F2-3 of Attachment F2). Thus, a detailed description of land cover is not provided.

Target and other sensitive species documented within this landscape unit are VELB, western pond turtle, bank swallow, Swainson's hawk, colonies of tricolored blackbird, and western yellow-billed cuckoo. Active bank swallow colonies have only been documented in natural banks and gravel pits along Cache Creek. Swainson's hawk nests have only been documented along Cache Creek, 2.5 miles southwest of Yolo. Western yellow-billed cuckoo was only documented in this area sighted at the southern tip of Clear Lake.

This landscape unit does not provide habitat for sensitive fish.

The Middle Creek and Tributaries Project includes approximately 0.1 mile of levees, diversion structures, and a pumping plant (Table 5-12; Figure F2-4 of Attachment F2). There are no revetted banks within this landscape unit.

There are no priority fish passage barriers identified within this landscape unit.

5.7 Tables of Results

Table 5-1. Acreages of Connected and Disconnected Floodplain Inundation Potential Zones along Major River Reaches of, and Major Tributaries to, the Lower Sacramento River Conservation Planning Area[a]

FIP Zone	Verona to American River	American River to Freeport	Freeport to Delta Cross Channel	Delta Cross Channel to Deep Water Ship Channel	Deep Water Ship Channel to Collinsville	American River	Total Acres
Connected							
Baseflow FIP	1,281	972	1,538	1,286	4,778	977	10,833
67 Percent Sustained Spring FIP	700	117	231	84	34	229	1,394
50 Percent FIP	1,123	204	90	146	379	1,221	3,162
10 Percent FIP	170	72	70	74	154	1,566	2,106
Less than 10 Percent FIP	195	94	110	143	531	178	1,250
Subtotal	*3,470*	*1,459*	*2,039*	*1,733*	*5,876*	*4,171*	*18,746*
Disconnected							
Baseflow FIP	29	2,371	13,668	13,695	3,920	2	33,685
67 Percent Sustained Spring FIP	5,551	4,713	7,399	345	10	85	18,103
50 Percent FIP	15,234	7,142	1,117	99	64	2,404	26,059
10 Percent FIP	150	674	193	69	18	5,940	7,044

Table 5-1. Acreages of Connected and Disconnected Floodplain Inundation Potential Zones along Major River Reaches of, and Major Tributaries to, the Lower Sacramento River Conservation Planning Area[a]

FIP Zone	Verona to American River	American River to Freeport	Freeport to Delta Cross Channel	Delta Cross Channel to Deep Water Ship Channel	Deep Water Ship Channel to Collinsville	American River	Total Acres
Less than 10 Percent FIP	307	613	373	247	1,180	8,201	10,922
Subtotal	*21,270*	*15,513*	*22,750*	*14,455*	*5,193*	*16,631*	*95,813*
Total	**24,740**	**16,972**	**24,789**	**16,188**	**11,069**	**20,802**	**114,560**

Source: DWR 2012b
Key: FIP = floodplain inundation potential
Note:
[a] Values may not sum exactly because of rounding.

Table 5-2. Meander Zone Width, Area, and Constraints along Major River Reaches of, and Major Tributaries to, the Lower Sacramento River Conservation Planning Area[a]

Meander Zone Attribute	Verona to American River	American River to Freeport	Freeport to Delta Cross Channel	Delta Cross Channel to Deep Water Ship Channel	American River	Total
Width (feet)	5,036	6,716	4,741	3,617	5,045	NA
Meander Zone Area (acres)						
Unconstrained	1,447	530	110	403	4,464	6,952
Constrained by Resistant Geology Only	0	0	0	0	2,018	2,018
Constrained by Revetment/Levees Only	10,626	10,089	11,194	5,303	4,595	41,807
Constrained by Both	28	421	23	0	366	839
Total Acres	**12,101**	**11,040**	**11,327**	**5,705**	**11,443**	**51,617**

Sources: AECOM 2013, CGS 2013, DWR 2011a, and DWR 2013a
Note:
[a] Values may not sum exactly because of rounding and because of overlap between geology constraints and levee/revetment constraints.

Table 5-3. Acreage of Land Cover Types the Floodway Corridor along Major River Reaches of, and Major Tributaries to, the Lower Sacramento River Conservation Planning Area[a,b]

Land Cover Type	Verona to American River	American River to Freeport	Freeport to Delta Cross Channel	Delta Cross Channel to Deep Water Ship Channel	Deep Water Ship Channel to Collinsville	American River	Total Acres
Agricultural							
Rice	2,350	0	0	0	0	0	2,350
Cropland and Pasture	10,110	4,160	11,440	10,800	2,930	0	39,440
Orchard – Vineyard	3,160	530	7,200	2,090	220	30	13,230
Other Agricultural	1,230	0	10	0	0	10	1,250
Subtotal	*16,850*	*4,690*	*18,650*	*12,890*	*3,150*	*40*	*56,270*
Natural							
Marsh – Tidal	0	13	91	13	111	0	228
Marsh – Nontidal	68	2	17	25	38	12	162
Riparian – Forest	1,530	316	592	260	85	1,774	4,557
Riparian – Scrub	98	57	180	136	165	130	766
Seasonal Wetland	174	12	13	13	65	27	304
Other Natural	1,010	1,870	2,770	1,020	2,430	2,350	11,450
Subtotal	*2,880*	*2,270*	*3,660*	*1,470*	*2,890*	*4,290*	*17,460*
Other							
Water	1,470	1,160	1,870	1,230	4,700	1,000	11,430
Developed	3,550	8,860	610	590	200	15,390	29,200
Not Mapped	0	0	0	0	140	90	230
Total	**24,750**	**16,980**	**24,790**	**16,180**	**11,080**	**20,810**	**114,590**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

Table 5-4. Miles of the Shaded Riverine Aquatic Habitat Attributes along Major River Reaches of, and Major Tributaries to, the Lower Sacramento River Conservation Planning Area[a]

Bank and Vegetation Type	Verona to American River	American River to Freeport	Freeport to Delta Cross Channel	Delta Cross Channel to Deep Water Ship Channel	Deep Water Ship Channel to Collinsville	American River	Total Miles
Natural Bank (Miles)							
With Riparian Vegetation	20.5	9.0	3.1	8.0	0.2	11.3	52.1
Without Riparian Vegetation	2.0	1.1	.4	12.0	10.4	8	33.9
Subtotal	*22.5*	*10.1*	*3.4*	*20.1*	*10.6*	*19.4*	*86.1*
Revetted Bank (Miles)							
With Riparian Vegetation	17.9	12.3	9.8	5.7	0.0	1.6	47.3
Without Riparian Vegetation	2.7	7.0	32.7	22.5	14.2	4.1	83.2
Subtotal	*20.6*	*19.3*	*42.5*	*28.2*	*14.2*	*5.7*	*130.5*
Total	**43.1**	**29.4**	**45.9**	**48.2**	**24.8**	**25.0**	**216.5**

Sources: DWR 2012c, USACE 2007, and USFWS 1992

Note:

[a] Values may not sum exactly because of rounding.

Table 5-5. Indicators of Riparian Continuity along Major River Reaches of, and Major Tributaries to, the Lower Sacramento River Conservation Planning Area[a]

Attribute	Verona to American River	American River to Freeport	Freeport to Delta Cross Channel	Delta Cross Channel to Deep Water Ship Channel	Deep Water Ship Channel to Collinsville	American River	Total
Area of 100- to 330-Foot-Wide Corridor (acres)	1,750	1,218	2,226	1,468	1,042	2,013	9,716
Percent of 100- to 330-Foot-Wide Corridor in Riparian Vegetation	44	19	13	14	14	47	27
Median Patch Size (acres)	4.7	2.4	3.0	1.3	2.3	2.6	2.8

Source: DWR 2011b

Note:

[a] Values may not sum exactly because of rounding.

Table 5-6. Acreage of Land Cover Types of Floodplain in Potential Meander Zone along Major River Reaches of, and Major Tributaries to, the Lower Sacramento River Conservation Planning Area[a,b]

Land Cover Type	Verona to American River	American River to Freeport	Freeport to Delta Cross Channel	Delta Cross Channel to Deep Water Ship Channel	Deep Water Ship Channel to Collinsville	American River	Total Acres
Agricultural							
Rice	0	0	0	0	n/a	0	0
Cropland and Pasture	0	0	0	0	n/a	0	0
Orchard – Vineyard	10	0	0	0	n/a	10	20
Other Agricultural	40	0	0	0	n/a	0	40
Subtotal	*50*	*0*	*0*	*0*	*n/a*	*10*	*60*
Natural							
Marsh – Tidal	0	0	3	9	n/a	0	12
Marsh – Nontidal	0	0	0	0	n/a	11	11
Riparian – Forest	773	205	71	86	n/a	1,346	2,481
Riparian – Scrub	24	13	32	42	n/a	122	233
Seasonal Wetland	1	0	0	0	n/a	27	28
Other Natural	210	140	180	220	n/a	1,320	2,070
Subtotal	*1,010*	*360*	*290*	*350*	*n/a*	*2,820*	*4,840*
Other							
Water	1,260	990	1,210	810	n/a	990	5,260
Developed	190	90	0	10	n/a	290	590
Not Mapped	0	0	0	0	n/a	0	0
Total	**2,510**	**1,440**	**1,500**	**1,180**	**n/a**	**4,110**	**10,740**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

Table 5-7. Levee and Revetment Length (Miles) along Major River Reaches of, and Major Tributaries to, the Lower Sacramento River Conservation Planning Area[a]

Facility Type	Verona to American River	American River to Freeport	Freeport to Delta Cross Channel	Delta Cross Channel to Deep Water Ship Channel	Deep Water Ship Channel to Collinsville	American River	Total Miles
Levees							
SPFC	48.3	29.8	53.8	43.9	13.6	24.4	213.8
Non-SPFC	9.6	7.8	18.1	5.8	9.0	2.6	52.8
Total	**57.9**	**37.6**	**72.0**	**49.6**	**22.5**	**27.0**	**266.6**
Revetment							
Revetment	23.3	19.3	42.5	28.2	16.1	5.7	135.1

Sources: DWR 2012c, DWR 2012e, and USACE 2007
Key:
SPFC = State Plan of Flood Control
Note:
[a] Values may not sum exactly because of rounding.

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Table 5-8. Abundance[a] of Targeted Weed Species[b] within Major River Reaches, Tributaries, and Bypasses along the Lower Sacramento Conservation Planning Area

Reach		Verona to American River					American River to Freeport				Freeport to Delta Cross Channel						Delta Cross Channel to Deep Water Ship Channel				Deep Water Ship Channel to Collinsville			Yolo Bypass								American River					
USGS Quad Name		Grays Bend	Sacramento East	Sacramento West	Taylor Monument	Verona	Clarksburg	Florin	Sacramento East	Sacramento West	Bruceville	Clarksburg	Courtland	Florin	Isleton	Thornton	Courtland	Isleton	Rio Vista	Thornton	Antioch North	Jersey Island	Rio Vista	Clarksburg	Davis	Grays Bend	Knights Landing	Liberty Island	Rio Vista	Sacramento West	Saxon	Taylor Monument	Buffalo Creek	Carmichael	Citrus Heights	Folsom	Sacramento East	Sacramento West
Percentage of Reach[c]		12	1	23	50	15	31	4	9	57	1	32	59	8	1	1	3	79	18	1	28	37	35	12	6	13	<1	20	1	18	30	<1	2	36	13	9	40	<1
Species																																						
Common Name	Scientific Name																																					
Barbed goat grass	*Aegilops triuncialis*							L			L			L											M						M		L		L	M		
Tree of heaven	*Ailanthus altissima*	L	L	H	L	H	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	L	H	L	L	L	L	L	L	L	H
Alligator weed	*Alternanthera philoxeroides*														L			L	L		L	L	L						L									
Giant reed[d]	*Arundo donax*	L	L	H	L	L	H	L	L	H	L	H	L	L	L	L	L	L	L	L	L	L	L	H	H	L	H	H	L	H	L	L	L	L	L	L	L	H
Yellow star-thistle	*Centaurea solstitialis*	H	H	L	L	L	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	M	H	H	L	H	M	H	H	H	H	H	L
Pampas grass	*Cortaderia selloana*	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L		L	L	L		L	L	L	L	L		L	L	L		L	L	L	L	L
Scotch broom	*Cytisus scoparius*																																			L		
Stinkwort	*Dittrichia graveolens*	L	M	M	M	M	M	M	M	M	M	M	L	M		M	L			M				M	M	L	L	L		M	L	M	L	M	M	M	M	M
Brazilian waterweed	*Egeria densa*		L	H	H	H	H	L	L	H	L	H	L	L	L		L	L	L		L	L	L	H			H	H	L	H		H		L	L	L	L	H
Medusa head	*Elymus caput-medusae*							M			M		H	M	H		H	H	H		H		H		H			H	H		H		M		H	M		
Blue gum	*Eucalyptus globulus*																								L									L				
Edible fig	*Ficus carica*	H	L	H	H	L	H	L	L	H	L	H	H	L	L	L	H	L	L	L	L	L	L	H	L	H	H	H	L		H	H	L	L	L	L	L	H
Fennel	*Foeniculum vulgare*	L	L	L	L	L	L	L	L	L	L	L	L	L	L		L	L			M	M		L	L	L	L	L		L	L	L		L	L	L	L	L
French broom	*Genista monspessulana*		L						L						L	L		L		L														L	L	L	L	
Shortpod mustard	*Hirschfeldia incana*	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H		H		H	H	H	L	H	H	H	H	H	H	H
Hydrilla	*Hydrilla verticillata*																																					
Perennial pepperweed	*Lepidium latifolium*	M		M	M	M	M	M		M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	H	M	M	H	M	M	H	M			L	L		M
American frogbit	*Limnobium spongia*																																					
Water primrose	*Ludwigia* sp.	M	M	M	M		M	M	M	M	M	M	L, M	M	M	M	L, M	M	M	M	M	M	M	M	L	M		H	M	M		M	M	L, M	M	M	M	M
Purple loosestrife	*Lythrum salicaria*	L		L		L	L			L		L	L		L		L	L	L		L	L	L	L		L			L	L							L

Table 5-8. Abundance[a] of Targeted Weed Species[b] within Major River Reaches, Tributaries, and Bypasses along the Lower Sacramento Conservation Planning Area

Reach		Verona to American River					American River to Freeport				Freeport to Delta Cross Channel						Delta Cross Channel to Deep Water Ship Channel				Deep Water Ship Channel to Collinsville			Yolo Bypass									American River					
USGS Quad Name		Grays Bend	Sacramento East	Sacramento West	Taylor Monument	Verona	Clarksburg	Florin	Sacramento East	Sacramento West	Bruceville	Clarksburg	Courtland	Florin	Isleton	Thornton	Courtland	Isleton	Rio Vista	Thornton	Antioch North	Jersey Island	Rio Vista	Clarksburg	Davis	Grays Bend	Knights Landing	Liberty Island	Rio Vista	Sacramento West	Saxon	Taylor Monument	Buffalo Creek	Carmichael	Citrus Heights	Folsom	Sacramento East	Sacramento West
Percentage of Reach[c]		12	1	23	50	15	31	4	9	57	1	32	59	8	1	1	3	79	18	1	28	37	35	12	6	13	<1	20	1	18	30	<1	2	36	13	9	40	<1
Species																																						
Common Name	Scientific Name																																					
Parrot's feather	*Myriophyllum aquaticum*	L			L	L							H		H	L	H	H	H	L	M	M	H			L	L	H	H			L						
Tree tobacco	*Nicotiana glauca*	L	L	L	L		L		L	L		L	L		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L		L		L		L	L	L
Scotch thistle	*Onopordum acanthium* ssp. *acanthium*										L																											
Crisp-leaved pondweed	*Potamogeton crispus*			M			M			M		M	M				M				L	L		M				M		M								M
Himalayan blackberry[d]	*Rubus armeniacus*	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	H	H	L	L	H	L	L	L	L	L	L	L
Ravenna grass	*Saccharum ravennae*			L						L																				L								L
Russian thistle	*Salsola tragus*	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	H		L	L	L		L	H	L	L	L		L	L	L					L	L
Red sesbania[d]	*Sesbania punicea*[1]		L	L		L	L	L	L	L		L	M	L	M		M	M	M		L	L	M	L	L		L	M	M	L				L	M	L	L	L
Milk thistle	*Silybum marianum*																																					
Saltcedar[d]	*Tamarix* sp.	L	L	L	L	L	L	L	L	L	L		L	L			L		L			L	L	L	L	L	L	L	L	L	L		L	L	L	L	L
Chinese tallowtree	*Triadica sebifera*		L	L	L			L	L	L		L	L											L						L		L		L	L	L	L	L

Source: Cal-IPC 2013

Key:

USGS = United States Geological Survey

Notes:

[a] Abundance rated by Cal-IPC as either H = High; M = Medium; L = Low; blank cells show no occurrences.

[b] Of the 31 target weed species, no data are available for American frogbit or milk thistle.

[c] Values may not sum to 100 because of rounding.

[d] Indicates initial priority species.

Table 5-9. Acreage of Land Cover Types of Valley Landscape Units in the Lower Sacramento River Conservation Planning Area[a,b]

Land Cover	Landscape Unit Type				Total Acres
	Major River Reach	Basin-Bypass[c]	Other Facility – Waterway	Other Valley SPA	
Agricultural					
Rice	2,350	9,470	2,980	21,360	36,160
Cropland and Pasture	39,440	43,690	37,400	127,810	248,340
Orchard – Vineyard	13,230	460	5,560	9,060	28,300
Other Agricultural	1,250	790	3,050	8,150	13,240
Subtotal	*56,270*	*54,410*	*48,990*	*166,380*	*312,790*
Natural					
Marsh – Tidal	227	1,743	361	2,275	4,606
Marsh – Nontidal	161	8,299	372	1,065	9,897
Riparian – Forest	4,557	1,209	1,371	1,177	8,313
Riparian – Scrub	767	758	589	953	3,067
Seasonal Wetland	304	3,149	1,306	1,440	6,198
Other Natural	11,450	12,350	8,730	21,220	53,750
Subtotal	*17,470*	*27,510*	*12,730*	*28,130*	*85,840*
Other					
Water	11,410	9,640	2,830	6,270	30,150
Developed	29,200	1,160	12,310	53,740	96,400
Not Mapped	230	0	3,500	8,980	12,710
Total	**114,560**	**92,720**	**80,360**	**263,500**	**551,130**

Source: DWR 2011b

Key:

SPA = Systemwide Planning Area

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

[c] Basin-Bypass acreages include the Yolo Bypass and a 1-mile corridor on either side of the bypass, and Cache Slough.

Table 5-10. Levee and Revetment Length (Miles) in Valley Landscape Units of the Lower Sacramento River Conservation Planning Area[a]

Facility Type	Landscape Unit Type				Total Miles
	Major River Reach	Basin-Bypass	Other Facility – Waterway	Other Valley SPA	
Levees					
SPFC	213.8	79.9	189.2	0.0	482.9
Non-SPFC	52.8	98.3	66.8	172.4	390.3
Total	**266.6**	**178.2**	**256.0**	**172.4**	**873.2**
Revetment					
Revetment	135.1	15.3	52.8	2.3	205.5

Sources: DWR 2012c, DWR 2012e, and USACE 2007
Key:
SPA = Systemwide Planning Area
SPFC = State Plan of Flood Control Project
Note:
[a] Values may not sum exactly because of rounding.

Table 5-11. Acreage of Land Cover Types of Foothill Landscape Units in the Lower Sacramento River Conservation Planning Area[a,b]

Land Cover	Landscape Unit Type			Total Acres
	Foothill Tributaries	Lake-Reservoir	Outlying Community	
Agricultural				
Rice	0	0	0	0
Cropland and Pasture	0	0	0	0
Orchard – Vineyard	0	0	0	0
Other Agricultural	0	0	0	0
Subtotal	*0*	*0*	*0*	*0*
Natural				
Marsh – Tidal	0	0	0	0
Marsh – Nontidal	0	0	0	0
Riparian – Forest	14	0	0	14
Riparian – Scrub	5	0	0	5
Seasonal Wetland	0	0	0	0
Other Natural	150	0	0	150
Subtotal	*170*	*0*	*0*	*170*
Other				
Water	110	0	0	110
Developed	0	0	0	0
Not Mapped	790	55,060	650	56,500
Total	**1,070**	**55,020**	**650**	**56,780**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

Table 5-12. Levee and Revetment Length in Foothill Landscape Units of the Lower Sacramento River Conservation Planning Area[a]

Facility Type	Landscape Unit Type			Total Miles
	Foothill Tributaries	Lake/Reservoir	Outlying Community	
Levees				
Project	0	0	0	0
Non-Project	0.1	0	0	0.1
Total	0.1	0	0	0.1
Revetment				
Revetment	0	0	0	0

Sources: DWR 2012c, DWR 2012e, and USACE 2007
Note:
[a] Values may not sum exactly because of rounding.

6.0 Summary of Existing Conditions for the Upper San Joaquin River Conservation Planning Area

The Upper San Joaquin River CPA includes the San Joaquin River from Friant Dam to the confluence with the Merced River, and the connected tributaries and bypasses (Figure 6-1). Downstream from Friant Dam, the San Joaquin River is inset between terraces as it descends with a low sinuosity into the San Joaquin Valley and down to Gravelly Ford. At Gravelly Ford, the alluvial fan of the San Joaquin River meets the valley floor. The valley slope increases here, causing an increase in the river's sinuosity until the river nears the city of Mendota. Near Mendota, the river reaches its confluence with Fresno Slough, which drained the former Tule Lake. At this confluence, the San Joaquin River moves north with reduced sinuosity because of the decreased valley slope. Downstream 20 to 25 miles, this single-channel reach enters a basin where the river historically branched into multiple interconnected channels that extended to the confluence with the Merced River.

Important SPFC facilities in this CPA include a bypass system that diverts floodwaters at the Chowchilla Bifurcation Structure and at the Sand Slough Control Structure, and returns flow to the San Joaquin River via the Mariposa and Eastside bypasses. SPFC levees are present along the bypass system and the lower reaches of streams that it intercepts, including the Fresno River, Berenda Slough, and Bear Creek. There are also project levees along the San Joaquin River, primarily from Gravelly Ford to the Chowchilla Bifurcation Structure and downstream of the confluence of the river with the Mariposa Bypass. Revetment associated with these facilities accounts for only a small percentage of banks along the San Joaquin River.

Riverine and floodplain ecosystems in the Upper San Joaquin River CPA have been substantially altered by flow diversion, gravel mining, levee construction, conversion to agricultural land use, and incursions of invasive plants. Approximately three-quarters of this land is hydraulically disconnected from the river.

The extent of riparian and marsh habitats on floodplains has been reduced in the Upper San Joaquin River CPA. Historically, the amount of riparian vegetation differed among reaches of the San Joaquin River, but was extensive along most of the river (The Bay Institute 1998). Riparian vegetation now accounts for only 8 percent of floodplain connected to the Upper San Joaquin River. However, riparian-vegetation lines 65 percent of the river's banks and almost all are in natural condition.

Historically, marshes and other wetlands were extensive downstream from the junction with Fresno Slough, particularly downstream from RM 190 where it was the predominant floodplain vegetation, and in places extended 1 to 3 miles from the river (The Bay Institute 1998). Most of this marsh has been drained and converted to other land cover, primarily for agricultural use.

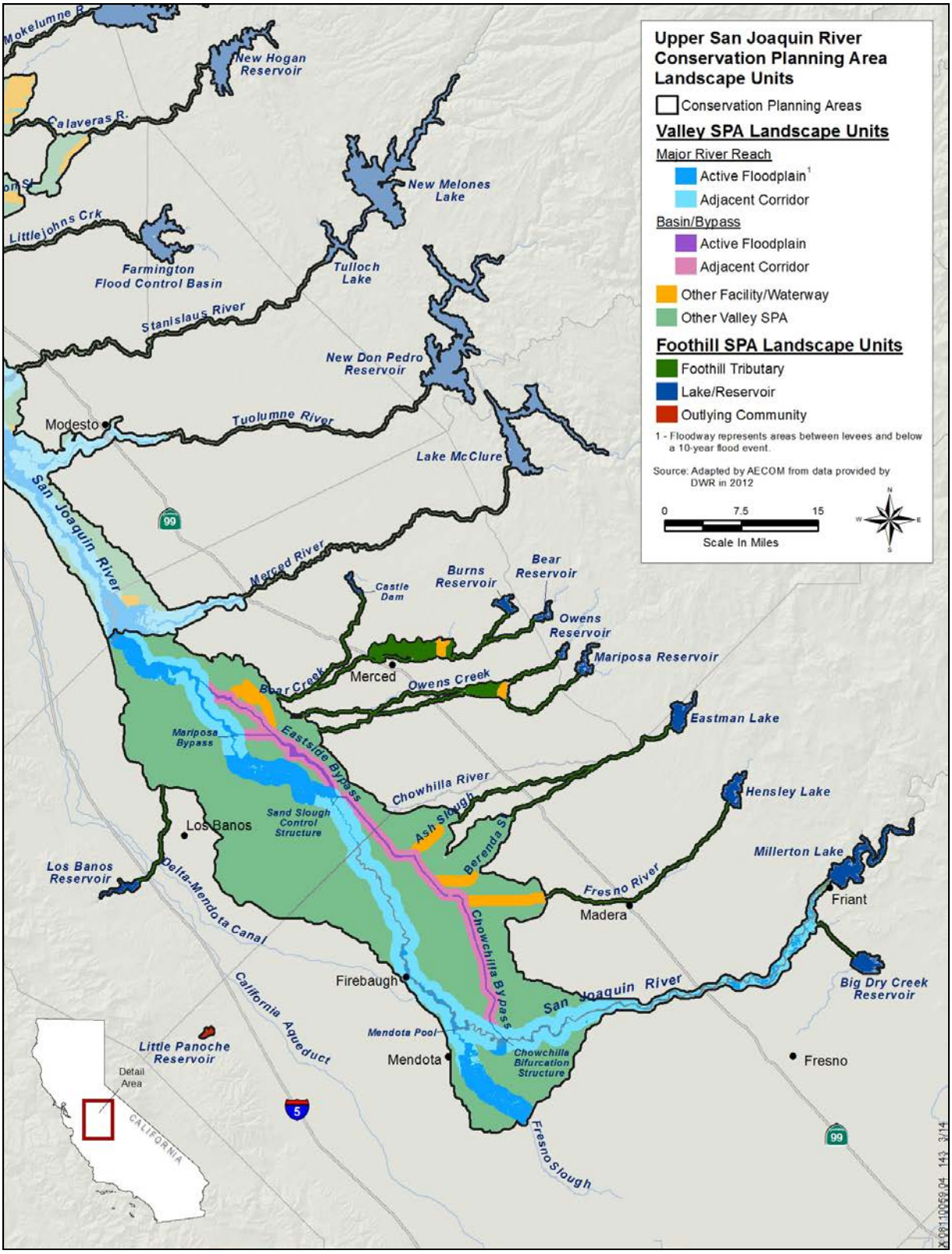

Figure 6-1. Upper San Joaquin River Conservation Planning Area

Marshes and seasonal wetlands now account for only about 18 percent of active floodplain and 9 percent of land in the bypass system.

These alterations of ecosystem processes and habitats have contributed to the extirpation of Chinook salmon and population declines of other sensitive species, including five species that are targets of the Conservation Strategy (not including those known only from historical records or whose distribution in this CPA is poorly documented) (CDFG 2005 and DWR 2011c):

- Delta button-celery
- Valley elderberry longhorn beetle
- Giant garter snake
- Swainson's hawk
- Greater sandhill crane

The primary conservation plan for the San Joaquin River is the San Joaquin River Restoration Program (SJRRP), of which DWR is an implementing agency. The SJRRP is removing flow impediments and initiating flows that are more representative of the river's natural hydrograph, and reintroducing spring and fall-/late fall–run Chinook salmon. In addition, the SJRRP is considering setting back levees (that are not part of the SPFC) to accommodate the planned restoration flows, constructing a bypass around the Mendota Pool, improving fish passage, and filling or isolating gravel pits (SJRRP 2011a, 2011b, 2012). The SJRRP also may implement various other restoration actions, which could include modifying floodplain and side-channel habitat and restoring riparian vegetation. Restoration of river flows is anticipated to substantially increase the extent of riparian vegetation along the San Joaquin River in this CPA, particularly along channel banks, unless vegetation is removed to maintain the capacity of the floodway to convey flood flows (SJRRP 2011c).

Systemwide flood risks and restoration actions by the SJRRP are interrelated throughout this CPA. Thus, DWR is working closely with SJRRP to foster compatibility between SJRRP and the SSIA, including this Conservation Strategy. The State's involvement in the SJRRP has been funded primarily through Proposition 84, the Safe Drinking Water, Water Quality and Supply, Flood Control, River, and Coastal Protection Bond Act of 2006.

Substantial SPFC-related constraints complicate attainment of the objectives of the SJRRP. Among these constraints is the presence of 224 miles of SPFC levees (and 304 miles of non-SPFC levees). Also, at least 50 miles of revetment associated with SPFC levees occurs along waterways in the Upper San Joaquin River CPA.

Furthermore, several SPFC and non-SPFC structures have been impeding fish passage. In addition to dams at multipurpose reservoirs, these impeding structures are as follows:

- San Joaquin River Control Structure on the San Joaquin River

- Chowchilla Bypass Control Structure at the junction of the San Joaquin River and Chowchilla Bypass
- Mendota Dam on the San Joaquin River
- Sack Dam on the San Joaquin River
- Mariposa Bypass Drop Structure at the confluence of the San Joaquin River and Mariposa Bypass
- San Joaquin River Headgates at the confluence of the San Joaquin River and Sand Slough Connector Farm Road Crossings (3) on the San Joaquin River
- Lost Lake Rock Weir #1 (lower) on the San Joaquin River
- Merced Refuge Weir #1 (lower) in the Eastside Bypass
- Merced Refuge Weir #2 (upper) in the Eastside Bypass
- Donny Bridge at the San Joaquin River
- Beaver Dam on the San Joaquin River
- Mariposa Bypass Control Structure in the Mariposa Bypass
- Mariposa Bypass Drop Structure at the confluence of the Mariposa Bypass and the San Joaquin River
- Eastside Bypass Control Structure in the Eastside Bypass
- Avenue 21 County Bridge in the Eastside Bypass
- Eastside Bypass Drop 2 (upper) in the Eastside Bypass
- Dan McNamara Road Crossing in the Eastside Bypass
- Pipeline Crossing in the Eastside Bypass
- Avenue 18½ County Bridge in the Eastside Bypass
- Eastside Bypass Drop 1 (lower) in the Eastside Bypass
- Eastside Bypass Rock Weir in the Eastside Bypass

These structures have not been prioritized for remediation because of uncertainty associated with implementation of the settlement agreement under the SJRRP (see Appendix K).

6.1 Major River Reaches

Detailed descriptions by river reach (Figure 6-2) for the Upper San Joaquin River CPA are provided below.

6.1.1 Friant Dam to SR 99

The San Joaquin River in this reach is confined by bluffs. Within the bottomland between the bluffs, the river is bounded by low terraces.

The only tributary to the San Joaquin River within this reach is Little Dry Creek (at RM 257).

Within this reach of the San Joaquin River, the 2-mile-wide floodway corridor covers approximately 8,700 acres; approximately 37 percent of that corridor is conserved (Figure F3-1 of Attachment F3). Conserved areas along this reach include the San Joaquin River Ecological Reserve, which is managed by CDFW; Camp Pashayan Ecological Preserve, which is managed by the San Joaquin River Conservancy; and multiple parks and lands managed by the San Joaquin River Parkway and Conservation Trust. In addition, there are several city and county parks.

Ecosystem Processes

Floodplain Inundation. The corridor along the river predominantly has greater than 10-percent-chance FIP (Table 6-1 and Figure F3-2 of Attachment F3).

Riverine Geomorphic Processes. In this reach, the average channel width is 204 feet, ranging between 62 feet and 554 feet. The meander corridor is an estimated 1,440 feet wide (Table 6-2) and the meander amplitude is 938 feet. Of the total meander zone (3,411 acres), the majority (86 percent) is unrestricted. Approximately 14 percent of the meander zone is constrained by natural geology. No human-built constraints are present on this reach.

Habitats

Land cover along this reach of the San Joaquin River is predominantly natural vegetation (Table 6-3 and Figure F3-3 of Attachment F3). Natural vegetation represents more than one-third of the corridor's land cover. Riparian and wetland vegetation accounts for just less than one-fifth of the land cover, with riparian vegetation accounting for the majority of that land cover. Riparian vegetation is present throughout, but more prevalent in the northwestern one-third of the corridor.

Shaded Riverine Aquatic Cover. Along this reach of the San Joaquin River, the percentage of river bank with potential SRA habitat is the highest within this CPA (85 percent). All 62 miles of bank have natural bank conditions (Table 6-4). Riparian vegetation lines 52 miles of bank, all of which have natural bank conditions.

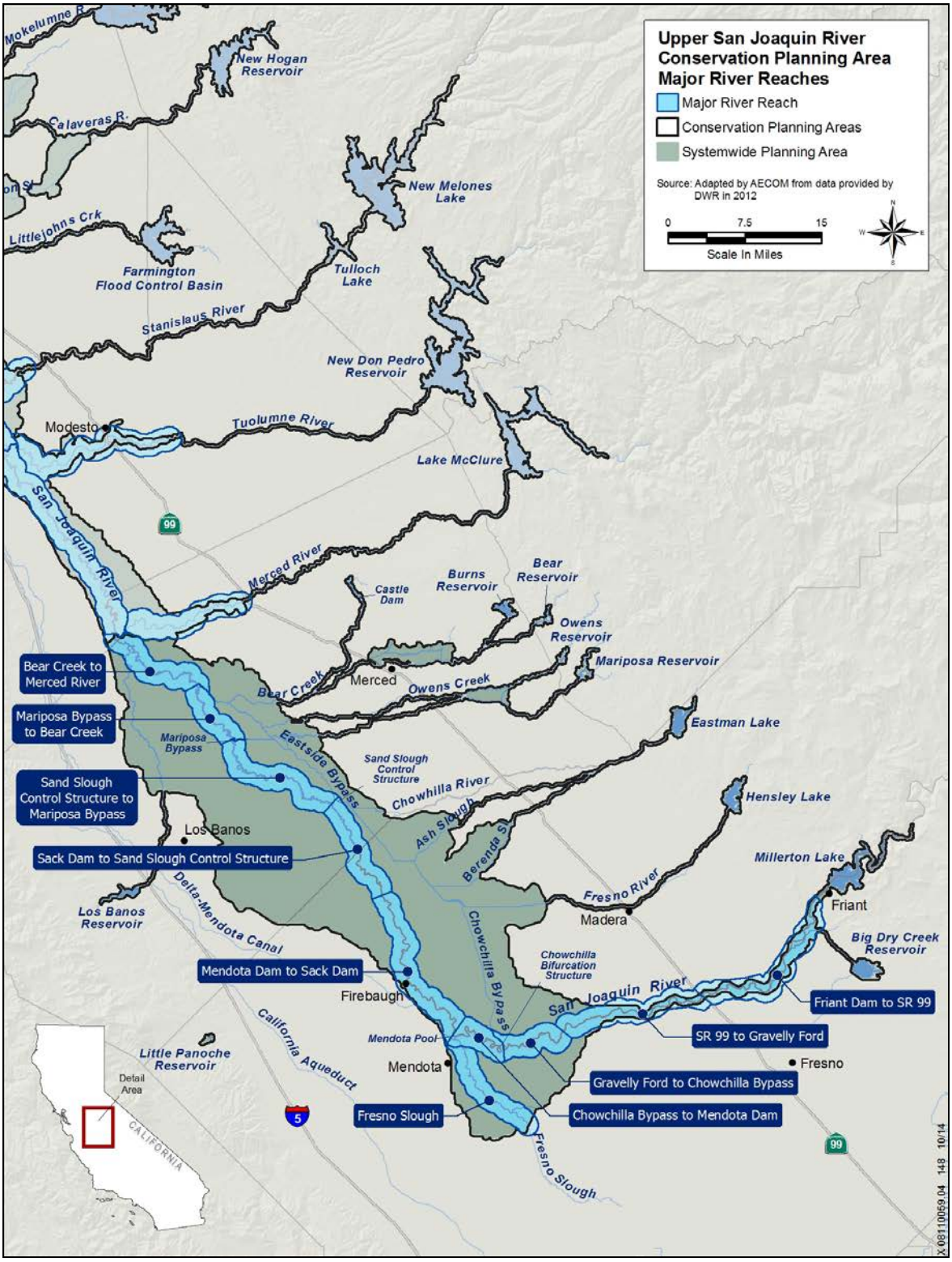

Figure 6-2. River Reach Extent for the Upper San Joaquin River Conservation Planning Area

Riparian Habitat. Along this reach, just less than 1,300 acres of riparian vegetation is located within 1 mile of the San Joaquin River, approximately 15 percent of the corridor land area (Table 6-3). Most of this habitat is close to the river: Riparian vegetation occupies 39 percent of the 330-foot-wide corridors along the river banks (Table 6-5) and 27 percent of the 10-year floodplain that is connected to the river. No SPFC levees are present in this reach of the CPA.

The connectivity of riparian habitats along this reach is extensive compared to other major river reaches in this CPA. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of a patch of riparian vegetation (Table 6-5), which is 3.4 acres along this reach. This habitat is most continuous between RM 253 and RM 262. It is most fragmented between RM 249 and RM 252.

Riparian vegetation consists primarily of forest, which accounts for 76 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Comparatively few acres of marsh or other wetland are present along this reach. Thirty four acres of nontidal marsh, less than 1 percent of the land area, and only 137 acres of seasonal wetland are present along this reach (Table 6-3). Of the total 171 acres of wetland, 58 percent is protected as State, regional, county, or local land. The marshes range in size from less than 1 acre to 13 acres, but most are small, and the seasonal wetlands range from less than 1 acre to 12 acres. Most of these features are associated with oxbow lakes or other floodplain features associated with historical meander migration.

Approximately one-third of these features (34 percent of marsh and 28 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 6-6).

Floodplain Agriculture. No agricultural land is mapped within this reach of the CPA.

Targeted and Other Sensitive Species

The only target and other sensitive species documented along this reach is VELB.

This reach does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

Developed land uses occupy nearly 30 percent of the corridor along this reach, and are most extensive south of the river. Because of its proximity to Fresno, this reach has major infrastructure throughout, particularly near SR 99, where natural gas pipelines, electrical transmission lines, and a railroad cross the river (Figure F3-4 of Attachment F3). Electrical transmission lines also cross the river near RMs 250 and 254, and SR 41 crosses the river near RM 252. Also, Sierra Sky Park Airport is within 1 mile of the river. Canals located in this reach are the Forkner Alluvial Canal and Bullard Canal.

Levees. No SPFC levees or non-SPFC levees are present within this reach. The river in this reach is confined by bluffs and low terraces.

Revetment. No revetment is present in this reach.

Fish Passage Barriers. No fish passage barriers have been documented along this reach. However, a number of historical and several active gravel mines are present along this reach: Bruckner Gravel Pit (near RM 253), Calmat/Fresno (near RM 255), and Rockfield Roullard (near RM 261) (DWR 2012f). Along the river are the pits of active and abandoned aggregate mines. A number of these pits have been captured by the river (i.e., become connected to the river). These captured pits are of conservation concern because of the potential for fish stranding and predation by warm-water fish.

Invasive Plants. Within the floodway corridor along this reach, 14 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 14 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 6-8. No acreages of initial priority species have been recorded within DWR channel and levee maintenance areas along this reach. No acreages of initial priority species have been recorded in other areas maintained by LMAs.

6.1.2 SR 99 to Gravelly Ford

From SR 99 to Gravelly Ford, the San Joaquin River is confined between bluffs. At the downstream end of this reach, the bluffs diminish in height and gradually merge with floodplain surfaces.

No tributaries to the San Joaquin River are present in this reach.

Within this reach of the San Joaquin River, the 2-mile-wide floodway corridor covers approximately 10,100 acres, and only a small amount (less than 1 percent) of the corridor along this reach has been conserved (Figure F3-1 of Attachment F3). A county park (Skaggs Bridge Park) is the only conserved area along this reach of the San Joaquin River.

Ecosystem Processes

Floodplain Inundation. Along this reach of river, the evaluated corridor primarily has a greater than 10-percent-chance FIP (Table 6-1 and Figure F3-2 of Attachment F3).

Riverine Geomorphic Processes. In this reach, the average channel width is 326 feet, ranging between 56 feet and 1,445 feet. The meander corridor is an estimated 2,433 feet wide (Table 6-2) and the meander amplitude is 1,569 feet. Of the total meander zone within this reach (4,539 acres), almost all (97 percent) is unrestricted. Approximately 3 percent is constrained by revetment, levees, and other infrastructure. No geologic constraints are present in this reach.

Habitats

Land cover along this reach of the San Joaquin River is predominantly agriculture (Table 6-3 and Figure F3-3 of Attachment F3). Agricultural land represents just more than three-quarters of the corridor's land cover. Natural vegetation represents a little more than one-eighth of the corridor's land cover. Riparian/wetland vegetation accounts for less than one-tenth of the land cover, with riparian vegetation accounting for the majority of that land cover. Riparian vegetation is distributed close to the river throughout the corridor.

Shaded Riverine Aquatic Cover. Along this reach of the San Joaquin River, the percentage of river bank with potential SRA habitat is one of the highest within this CPA (83 percent). Of the 43 miles of bank, almost all has natural bank conditions (Table 6-4). Riparian vegetation lines 36 miles of bank, all of which has natural bank conditions.

Riparian Habitat. Along this reach, 653 acres of riparian vegetation is within 1 mile of the San Joaquin River, approximately 6 percent of the corridor's land area (Table 6-3). Most of this habitat is close to the river: Riparian vegetation occupies 35 percent of the 330-foot-wide corridors along the river banks (Table 6-5) and 38 percent of the 10-year floodplain that is connected to the river. SPFC levees start near RM 224 at the downstream end of this reach. The levee VMZs are generally more than 330 feet from the river bank on the south side, but less than 330 feet on the north side.

The connectivity of riparian habitats along this reach is extensive compared to other major river reaches. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 3.0 acres along this reach (Table 6-5). This habitat is most continuous between RM 232 and RM 236. It is most fragmented between RM 223 and RM 226.

Riparian vegetation consists primarily of forest, which accounts for 66 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Very few acres of marsh or other wetland are present along this reach. Three acres of nontidal marsh and 23 acres of seasonal wetland, less than 1 percent of the land area, are present along this reach (Table 6-3). Of the total 26 acres of wetland, none are protected. The two marshes present measure 1 acre and 2 acres, and the seasonal wetlands range from less than 1 acre to 5 acres. Most of these features are associated with floodplain features related to historical meander migration.

A substantial portion of these features (92 percent of the marsh and 86 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 6-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and it occupies 73 percent (7,410 acres) of the reach corridor (Table 6-3). Almost all of the agricultural lands within the reach corridor (99 percent, 7,300 acres) are situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (1,450 acres), approximately 8 percent (110 acres) is agricultural land. Of this floodplain agricultural land, 68 percent is orchard and vineyard, less than 1 percent is cropland and pasture, and 32 percent is identified as other agricultural land. Less than 1 percent (10 acres) of the total agricultural land is conserved (as county land).

Targeted and Other Sensitive Species

The only target or other sensitive species documented along this reach is Swainson's hawk. Swainson's hawk has only been observed here along the San Joaquin River, 0.5 mile south of the abandoned Gravelly Ford Canal, north of Jameson.

This reach does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

Developed land uses occupy less than 1 percent of the corridor along this reach. Except for a natural gas pipeline that is along the length of this reach and crosses the river twice between RMs 238 and 240 (Figure F3-4 of Attachment F3), no major infrastructure occurs along this reach of the San Joaquin River. The two canals in this reach, Herndon Canal and Epstein Canal, run parallel to the river.

Levees. There are 2.4 miles of SPFC levees and no non-SPFC levees within this reach (Table 6-7; Figure F3-4 of Attachment F3). The SPFC levees are located near the northwest border of the reach. The physical condition of these levees is primarily of higher concern.

Revetment. There is 0.3 mile of revetment in this reach (Table 6-7). Of this revetment, 0.2 mile is located along the San Joaquin River armoring less than 1 percent of the bank length (Table 6-4). All revetment in this reach is located near RM 224.

Fish Passage Barriers. One fish passage barrier, Donny Bridge, has been documented along this reach (Figure F3-5 of Attachment F3). No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 11 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 11 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 6-8. Within DWR channel and levee maintenance areas along this reach, approximately 6 acres of initial priority species occurs, made up exclusively of red sesbania. Within other areas maintained by LMAs, no acreages of initial priority species are recorded. Red sesbania occurs along the northwestern end of this reach.

6.1.3 Gravelly Ford to Chowchilla Bypass

From Gravelly Ford to Chowchilla Bypass, the San Joaquin River is sand bedded and meandering. Through lateral migration and avulsion, the channel actively moves within the levees.

No tributaries to the San Joaquin River are present in this reach.

Within this reach of the San Joaquin River, the 2-mile-wide floodway corridor covers approximately 10,500 acres. No conserved areas are present along this reach of the San Joaquin River.

Ecosystem Processes

Floodplain Inundation. The FIP of the corridor along this reach varies considerably, with approximately 42 percent of the reach having a 67-percent-chance Sustained Spring or a 50-percent-chance FIP (Table 6-1 and Figure F3-2 of Attachment F3). Most of these areas are disconnected from the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 491 feet, ranging between 91 feet and 1,129 feet. The meander corridor is an estimated 3,847 feet wide (Table 6-2), and the meander amplitude is 2,461 feet. Of the total meander zone within this reach (4,141 acres), the majority (72 percent) is constrained by revetment, levees, and other infrastructure. The remaining 28 percent is unrestricted. No geologic constraints occur in this reach.

Habitats

Agricultural land represents well over three-quarters of the corridor land cover, with little to no development within the corridor (Table 6-3 and Figure F3-3 of Attachment F3). Natural vegetation represents a little over one-eighth of the corridor's land cover. Riparian/wetland vegetation is nearly absent and represents less than 0.5 percent of the land cover. Riparian vegetation is scattered and mostly present in the eastern half of the corridor.

Shaded Riverine Aquatic Cover. Along this reach of the San Joaquin River, the percentage of river bank with potential SRA habitat is the lowest within this CPA (4 percent). Of the 34 miles of bank, 32 miles have natural bank conditions (Table 6-4), yet riparian vegetation lines only 1 mile of bank which has natural bank conditions.

Riparian Habitat. Along this reach, only 16 acres of riparian vegetation is within 1 mile of the San Joaquin River, less than 0.5 percent of the corridor's land area (Table 6-3). Most of this habitat is scattered throughout the floodplain: Riparian vegetation occupies only 1 percent of the 330-foot-wide corridor along the river banks (Table 6-5) and less than 1 percent of the 10-year floodplain that is connected to the river. Levee VMZs are generally less than 330 feet from the river banks.

The connectivity of riparian habitats along this reach is very low compared to other major river reaches. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 1.6 acres along this reach (Table 6-5). This habitat is present but fragmented between RM 219 and RM 223; it is absent between RM 214 and RM 219.

Riparian vegetation consists only of forest; no riparian scrub occurs along this reach.

Marsh and Other Wetland Habitat. No marsh and very little other wetland is present along this reach. There are 11 acres of seasonal wetland, which is less than 1 percent of the land area present along this reach (Table 6-3). None of the wetlands are protected. The seasonal wetlands range in size from 2 to 4 acres. Most of these features are associated with tributaries.

A small portion of these features (36 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 6-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 86 percent (9,050 acres) of the reach corridor (Table 6-3). Almost all of the agricultural land within the reach corridor (99 percent) is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (1,110 acres), a very small amount (2 percent or 20 acres) is agricultural land. All of this floodplain agricultural land is identified as other agricultural land. None of the agricultural land in this reach is conserved.

Targeted and Other Sensitive Species

The only target or other sensitive documented along this reach is Swainson's hawk. This species has only been observed approximately 5 miles east-northeast of Mendota Airport in Firebaugh.

This reach does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

Developed land uses occupy less than 1 percent of the corridor along this reach. Major infrastructure is limited along this reach of the San Joaquin River. A natural gas pipeline is within 1,000 feet of the river from RMs 219 to 220 (Figure F3-4 of Attachment F3). Canals in this reach are Enterprise Canal and Sandridge Canal.

Levees. There are 19.0 miles of SPFC levees and no non-SPFC levees within this reach (Table 6-7; Figure F3-4 of Attachment F3). SPFC levees are along both river banks, and the distance of the levees from the river vary from approximately 100 feet to 1,600 feet. The physical condition of these levees is primarily of higher concern.

Revetment. There is 6.5 miles of revetment along this reach (Table 6-7). Of this revetment, 1.7 miles are located along the San Joaquin River armoring 5 percent of the bank length) in this reach (Table 6-4). Revetment in located throughout this reach, and is concentrated between RMs 214-217 and around RM 221.

Fish Passage Barriers. One fish passage barrier, the Chowchilla Bypass Control Structure, has been documented along this reach (Figure F3-5 of Attachment F3). No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 12 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these12 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 6-8. Within DWR channel and levee maintenance areas along this reach, approximately 13 acres of initial priority species occurs, with 9 acres of red sesbania and 4 acres of Himalayan blackberry. Within other areas maintained by LMAs, approximately 1 acre of initial priority species occurs, made up exclusively of Himalayan blackberry. Occurrences of Himalayan blackberry and red sesbania are primarily in the southeastern half of the reach.

6.1.4 Chowchilla Bypass to Mendota Dam

The backwater of Mendota Pool occupies the lower few miles of this reach. This backwater is an extensive area of open water bordered by riparian and emergent wetland vegetation. The Mendota Pool is formed by Mendota Dam at the confluence of the San Joaquin River and Fresno Slough. The primary source of water to the Mendota Pool is conveyed from the Delta through the Delta-Mendota Canal. The Mendota Pool averages 400 feet wide, and most of it is less than 10 feet deep, with the deepest areas no more than 20 feet deep. Inflows to and outflows from the pool are balanced so that the pool remains at a relatively constant depth. The pool must remain above 14.5 feet at the Mendota Dam gage for users at the southern end of the pool to be able to draw water.

Tributaries to the San Joaquin River within this reach are Eastside Bypass (at RM 214) and Fresno Slough (at RM 203).

Within this reach of the San Joaquin River, the 2-mile-wide floodway corridor covers approximately 8,300 acres, with almost no conserved lands (Figure F3-1 of Attachment F3). Conserved areas along this reach of the San Joaquin River are limited to a county park (Mendota Pool Park). In addition, the Mendota Wildlife Area, which is managed by CDFW, is along the James Bypass, at the southern end of Mendota Pool.

Ecosystem Processes

Floodplain Inundation. From Chowchilla Bypass to Mendota Dam, FIP varies considerably (Table 6-1 and Figure F3-2 of Attachment F3). However, nearly half of the corridor has a 67-percent-chance Sustained Spring or a 50-percent-chance FIP. Most of these areas are disconnected from the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 380 feet, ranging between 258 feet and 765 feet. The meander corridor is an estimated 2,894 feet wide (Table 6-2), and the meander amplitude is 1,861 feet. Of the total meander zone within this reach (3,384 acres), the majority (67 percent) is constrained by revetment, levees, or other infrastructure. The remaining 33 percent is unrestricted. No geologic constraints occur in this reach.

Habitats

Land cover along this reach of the San Joaquin River is predominantly agriculture (Table 6-3 and Figure F3-3 of Attachment F3). Agricultural land represents three-quarters of the corridor's land cover. Natural vegetation represents one-fifth of the corridor's land cover, and riparian/wetland vegetation represents less than one-tenth of the land cover. Riparian vegetation is distributed along the corridor close to the river.

Shaded Riverine Aquatic Cover. Along this reach of the San Joaquin River, the percentage of river bank with potential SRA habitat is moderate (54 percent) as compared to other major river reaches within this CPA. Of the 28 miles of bank, almost all miles have natural bank conditions (Table 6-4). Riparian vegetation lines 15 miles of bank, of which all have natural bank conditions.

Riparian Habitat. Along this reach, only 211 acres of riparian vegetation is located within 1 mile of the San Joaquin River, which is less than 0.5 percent of the corridor's land area (Table 6-3). Most of this habitat is scattered throughout the floodplain: Riparian vegetation occupies only 15 percent of the 330-foot-wide corridor along the river banks (Table 6-5) and 8 percent of the 10-year floodplain that is connected to the river. No SPFC levees are present in this reach.

The connectivity of riparian habitat along this reach is moderate compared to other major river reaches. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of the patches of riparian vegetation, which is 2.8 acres along this reach (Table 6-5). This habitat is most continuous between RM 205 and RM 209. It is most fragmented between RM 209 and RM 214.

Riparian vegetation consists primarily of forest, which accounts for 61 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Comparatively few acres of marsh or other wetland is present along this reach. Forty three acres of nontidal marsh, or less than 1 percent of the land area, and 68 acres of seasonal wetland are present along this reach (Table 6-3). Of the total 111 acres of wetland, approximately 10 percent is protected (as county lands). The marshes range in size from less than 1 acre to 10 acres, but most are small; seasonal wetlands range from less than 1 acre to 30 acres. Most of these features are associated with oxbow lakes or other floodplain features related to historical meander migration.

A substantial portion of these features (77 percent of the marsh and 92 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 6-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 75 percent (6,240 acres) of the reach corridor (Table 6-3). Almost all of the agricultural lands within the reach corridor (97 percent) are situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (1,770 acres), approximately 10 percent (170 acres) is agricultural land. Of this floodplain agricultural land, 90 percent is cropland and pasture, less than 1 percent is orchard and vineyard, and 9 percent is identified as other agricultural land. Less than 1 percent (just over 6 acres) of the total agricultural land is conserved (as county lands).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are Sanford's arrowhead, giant garter snake, western pond turtle, colonies of bank swallows, Swainson's hawk. Western yellow-billed cuckoo here are possibly extirpated.

This reach does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

Developed land uses occupy approximately 1 percent of the corridor along this reach. Although San Mateo Road crosses the river in this reach and a natural gas pipeline repeatedly crosses the river between RMs 203 and 208, Mendota Dam and the diversions associated with Mendota

Dam account for most major infrastructure along this reach (Figure F3-4 of Attachment F3). Also, a community airport at Mendota is within 2 miles of the river. Mowry Canal is within this reach and runs parallel to the river.

Levees. There are 2.2 miles of SPFC levees and 27.4 miles of non-SPFC levees within this reach (Table 6-7; Figure F3-4 of Attachment F3). Non-SPFC levees are present on both banks of this reach. The physical condition of these levees is of higher concern.

Revetment. There are 7.0 miles of revetment along this reach. Of this revetment, 0.2 mile is located along the San Joaquin River armoring less than 1 percent of the bank length in this reach. Revetment is located throughout the reach, but concentrated between RMs 0 and 1 and between RMs 206 and 209 (Table 6-7).

Fish Passage Barriers. Two fish passage barriers, Mendota Dam and the San Joaquin River Control Structure, have been documented along this reach (Figure F3-5 of Attachment F3). No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 12 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 12 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 6-8. Within DWR channel and levee maintenance areas along this reach, approximately 2 acres of initial priority species occurs, made up exclusively of Himalayan blackberry. No acreages of initial priority species have been recorded in other areas maintained by LMAs. Occurrences of Himalayan blackberry are isolated along this reach.

6.1.5 Mendota Dam to Sack Dam

Along this reach, regulated flows for water deliveries from the Delta-Mendota Canal are conveyed through the San Joaquin River channel to Sack Dam for diversion to Arroyo Canal.

The only tributary to the San Joaquin River within this reach is Firebaugh Wasteway (at RM 195).

Within this reach of the San Joaquin River, the 2-mile-wide floodway corridor covers approximately 23,000 acres. There is almost no conserved area along this reach of the San Joaquin River, with the exception of a few city parks (Figure F3-1 of Attachment F3).

Ecosystem Processes

Floodplain Inundation. From Mendota Dam to Sack Dam, approximately two-thirds of the corridor along the river has a 50-percent-chance FIP, and most of the remainder (mostly located near Firebaugh) has a greater than 10-percent-chance FIP (Table 6-1 and Figure F3-2 of Attachment F3). Along this reach, nearly 90 percent of areas with a 50-percent-chance FIP are disconnected from the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 366 feet, ranging between 73 feet and 1,024 feet. The meander corridor is an estimated 2,772 feet wide (Table 6-2), and the meander amplitude is 1,784 feet. Of the total meander zone within this reach (7,177 acres), the majority (62 percent) is constrained by revetment, levees, and other infrastructure. An additional 2 percent (152 acres) is constrained by both natural geology and infrastructure. The remaining area within the meander zone, 2,584 acres (36 percent of the reach), is unrestricted.

Habitats

Land cover along this reach of the San Joaquin River is predominantly agriculture (Table 6-3 and Figure F3-3 of Attachment F3). Agricultural land represents well over three-quarters of the corridor's land cover. Natural vegetation represents one-tenth of the corridor's land cover, and riparian/wetland vegetation represents less than 5 percent of the land cover. Riparian vegetation is distributed along the corridor, primarily close to the river.

Shaded Riverine Aquatic Cover. Along this reach of the San Joaquin River, the percentage of river bank with potential SRA habitat is one of the highest (82 percent) within this CPA. Of the 47 miles of bank, almost all is in natural condition, with less than 1 mile of revetted bank (Table 6-4). Riparian vegetation lines 38 miles of bank, of which nearly all has natural bank conditions.

Riparian Habitat. Along this reach, 738 acres of riparian vegetation is located within 1 mile of the San Joaquin River, representing 3 percent of the corridor's land area (Table 6-3). Much of this habitat is close to the river: Riparian vegetation occupies 30 percent of the 330-foot-wide corridor along the river banks (Table 6-5), and percent of the 10-year floodplain that is connected to the river. No SPFC levees are present in this reach.

The connectivity of riparian habitats along this reach is high compared to other major river reaches in this CPA. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 3.5 acres along this reach (Table 6-5). This habitat is most continuous between RM 180 and RM 191; it is most fragmented between RM 194 and RM 201.

Riparian vegetation consists primarily of forest, which accounts for 79 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Relatively few marshes and seasonal wetlands are present in this reach. Fifty acres of nontidal marsh, or less than 1 percent of the land area, and 136 acres of seasonal wetland are present along this reach (Table 6-3). Of the total 186 acres of wetland, none are protected. The marshes range in size from less than 1 acre to 50 acres, but most are small; seasonal wetlands range from less than 1 acre to 10 acres. Most of these features are associated with oxbow lakes or other floodplain features related to historical meander migration.

A substantial portion of these features (none of the marsh but 56 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 6-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 85 percent (19,480 acres) of the reach corridor (Table 6-3). Almost all of

the agricultural lands within the reach corridor (94 percent) are situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (2,450 acres), almost half (48 percent or 1,170 acres) is agricultural land. Of this floodplain agricultural land, 93 percent is cropland and pasture, and 7 percent is other agricultural land. None of the agricultural land is conserved.

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are Sanford's arrowhead, giant garter snake, western pond turtle, Swainson's hawk, and western yellow-billed cuckoo. Sanford's arrowhead has only been documented in Mendota Pool at the entrance of Firebaugh Canal. Giant garter snake documentations in this reach are limited to the Mendota Pool area 1.5 miles north of Mendota. Western pond turtles have only been observed in this reach along the San Joaquin River approximately 1.5 miles north of Mendota. Western yellow-billed cuckoo in this reach were found at Mendota Pool on the San Joaquin River but are possibly extirpated.

This reach does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

Developed land uses occupy approximately 5 percent of the corridor along this reach, and are extensive in the vicinity of Firebaugh on the west bank. Major infrastructure along this reach is a crossing by Avenue 7½; electrical transmission line crossings near RMs 184, 185, and 195; and a natural gas pipeline crossing near RM 192 (Figure F3-4 of Attachment F3). There is also a community airport at Firebaugh within 1 mile of the river. For most of its length, this reach is bounded on both sides by human-made structures, including irrigation canals and non-SPFC levees. Canals located in this reach are Columbia Canal, River Branch Columbia Canal, and Poso Canal, which all run parallel to the river.

Levees. There are 70.1 miles of non-SPFC levees and no SPFC levees within this reach (Table 6-7. At some locations, land within the floodway is actively used for agricultural production and is protected by local or interior levees. During the 2006 flood, a number of these parcels were inundated.

Revetment. There is 1.4 miles of revetment along this reach (Table 6-7). Of this revetment, 0.2 mile is located along the San Joaquin River armoring less than 1 percent of bank length in this reach (Table 6-4). This revetment is located in the southeast portion of the reach, near RMs 195 to 196 and RMs 200 to 202.

Fish Passage Barriers. No fish passage barriers have been documented along this reach (Figure F3-5 of Attachment F3). Two gravel mines, Maiorino Farms (near RM 188) and Bass Avenue Material Site (near RM 202), are located in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 14 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 14 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 6-8. Within

DWR channel and levee maintenance areas along this reach, approximately 21 acres of initial priority species occurs, made up exclusively of Himalayan blackberry. Within other areas maintained by LMAs, approximately 7 acres of initial priority species occurs, also made up exclusively of Himalayan blackberry. Occurrences of Himalayan blackberry are primarily within the southern portion of this reach with a few isolated occurrences in the northern portion.

6.1.6 Sack Dam to Sand Slough Control Structure

From Sack Dam to the Sand Slough Control Structure, the geomorphology of the San Joaquin River is transitional from the meandering river channel and associated floodplain of upstream reaches to the numerous sloughs and extensive flood basins downstream. Many sloughs originate in this reach and the reach immediately downstream of the San Joaquin River.

This reach typically carries only seepage water from Sack Dam and from adjacent agricultural areas. At its downstream end, any water in the channel flows through Sand Slough and into the Eastside Bypass.

Within this reach of the San Joaquin River, the 2-mile-wide floodway corridor covers approximately 14,880 acres. No conserved lands are present along this reach of the San Joaquin River.

Ecosystem Processes

Floodplain Inundation. Along this reach, the floodway is only approximately 300 feet wide. Outside of this floodway, the corridor along the river consists predominantly of areas with a 50-percent-chance FIP; these areas are disconnected from the river (Table 6-1 and Figure F3-2 of Attachment F3).

Riverine Geomorphic Processes. In this reach, the average channel width is 331 feet, ranging between 89 and 860 feet. The meander corridor is an estimated 2,278 feet wide (Table 6-2), and the meander amplitude is 1,596 feet. Of the total meander zone within this reach (3,886 acres), the majority (78 percent) is constrained by revetment, levees, and other infrastructure. Less than 1 percent of the area is constrained by natural geology. Approximately 5 percent (212 acres) is constrained by both natural geology and infrastructure. The remaining area within the meander zone, 622 acres (16 percent of the reach), is unrestricted.

Habitats

Land cover along this reach of the San Joaquin River is predominantly agriculture (Table 6-3 and Figure F3-3 of Attachment F3). Agricultural land represents nine-tenths of the corridor's land cover, and natural vegetation represents one-tenth, with little to no development within the corridor. Riparian/wetland vegetation accounts for less than 5 percent of the land cover. Riparian vegetation is distributed along the corridor, primarily close to the river.

Shaded Riverine Aquatic Cover. Along this reach of the San Joaquin River, approximately one-half (50 percent) of the river banks along this reach are potential SRA habitat, a moderate amount compared to other major river reaches in this CPA. Of the 36 miles of bank, all have

natural bank conditions (Table 6-4). Riparian vegetation lines 18 miles of bank, all of which have natural bank conditions.

Riparian Habitat. Along this reach, 257 acres of riparian vegetation is located within 1 mile of the San Joaquin River, representing 2 percent of the corridor's land area (Table 6-3). Some of this habitat is associated with agricultural drainages, but some of the habitat is close to the river. Riparian vegetation occupies 14 percent of the 330-foot-wide corridors along the river banks (Table 6-5) and 24 percent of the 10-year floodplain that is connected to the river. SPFC levees are present at the downstream end of the reach beginning at RM 168. The levee VMZs are less than 330 feet from the river banks where the levees are present.

The connectivity of riparian habitats along this reach is moderate compared to other major river reaches in this CPA. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of a patch of riparian vegetation, which is 2.0 acres along this reach (Table 6-5). This habitat is most continuous between RM 166 and RM 170. It is most fragmented between RM 174 and RM 178.

Riparian vegetation consists primarily of forest, which accounts for 65 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Relatively few marshes or seasonal wetlands are present in this reach. Seven acres of nontidal marsh, or less than 0.5 percent of the land area, and 117 acres of seasonal wetland are present along this reach (Table 6-3). Of the total 117 acres of wetland, none are protected. There are two marshes present, 2 acres and 4 acres, and the seasonal wetlands range from less than 1 acre to 40 acres. The majority of these features are associated with floodplain features, but many are associated with agricultural drainages.

A substantial portion of these features (none of the marsh but 67 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 6-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach and occupies 90 percent (13,370 acres) of the reach corridor (Table 6-3). Almost all of the agricultural land within the reach corridor (99 percent) is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (650 acres), very little (4 percent or 30 acres) is agricultural land. Of this floodplain agricultural land, 91 percent is cropland and pasture and 9 percent is other agricultural land. None of the agricultural land in this reach is conserved.

Targeted and Other Sensitive Species

The only target or other sensitive species documented along this reach is Swainson's hawk.

This reach does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

The floodplain of this reach is almost entirely in agricultural use. It is primarily undeveloped and major infrastructure is limited: SR 152 and an electrical transmission line cross the river at RM

173, and a natural gas pipeline crosses the river near Sack Dam (Figure F3-4 of Attachment F3). Canals and drainage infrastructure in this reach are Wood Slough Drain, San Juan Drain #4, and Riverside Canal, which all generally run parallel to the river.

Levees. There are 5.0 miles of SPFC levees and 44.9 miles of non-SPFC levees within this reach (Table 6-7 and Figure F3-4 of Attachment F3). Non-SPFC levees are close to the river along all of this reach except at the northern end, where there are SPFC levees. The distance of the levees from the river varies from approximately 100 feet to 2,600 feet. The physical condition of the SPFC levees is primarily of higher concern.

Revetment. There is 2.1 miles of revetment present within this reach (Table 6-7), however none is located along the San Joaquin River.

Fish Passage Barriers. No fish passage barriers have been documented along this reach, and five unscreened diversions are located in this reach. No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 14 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 14 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 6-8. Within DWR channel and levee maintenance areas along this reach, approximately 2 acres of initial priority species occurs, made up exclusively of Himalayan blackberry. No acreages of initial priority species have been recorded in other areas maintained by LMAs. Himalayan blackberry occurs in isolated locations along this reach.

6.1.7 Sand Slough Control Structure to Mariposa Bypass

In this reach, the channel of the San Joaquin River historically was connected to sloughs and flood basins.

The only tributary to the San Joaquin River in this reach is the Eastside Bypass (at RM 166).

Within this reach of the San Joaquin River, the 2-mile-wide floodway corridor covers approximately 19,000 acres, and approximately 6 percent of the corridor along this reach has been conserved (Figure F3-1 of Attachment F3). Conserved areas along this reach include a portion of the San Luis National Wildlife Refuge, which is managed by USFWS.

Ecosystem Processes

Floodplain Inundation. More than two-thirds of the corridor along the river has a 67-percent-chance FIP, and most of the remainder has Below Baseflow FIP (Table 6-1 and Figure F3-2 of Attachment F3). This reach has the largest percentage of a 67-percent-chance FIP among reaches of the San Joaquin and Sacramento River systems. Approximately 60 percent of these areas is disconnected from the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 307 feet, ranging between 153 feet and 466 feet. The meander corridor is an estimated 2,159 feet wide (Table 6-2), and the meander amplitude is 1,395 feet. Of the total meander zone within this reach (4,787 acres), the majority (79 percent) is unrestricted. Approximately 10 percent of the reach is constrained by revetment, levees, and other infrastructure. An additional 6 percent is constrained by natural geology, and the remaining meander zone (227 acres or 5 percent) is constrained by both natural geology and infrastructure.

Habitats

Land cover along this reach of the San Joaquin River is predominantly agriculture (Table 6-3 and Figure F3-3 of Attachment F3). Agricultural land represents well over three-quarters of the corridor's land cover. Natural vegetation represents one-eighth and riparian/wetland vegetation accounts for one-tenth of the land cover. Riparian vegetation is distributed throughout the corridor, primarily close to the river.

Shaded Riverine Aquatic Cover. Along this reach of the San Joaquin River, the percentage of river bank with potential SRA habitat is moderately high (73 percent) compared to other major river reaches within this CPA. Nearly all of the 53 miles of bank have natural bank conditions (Table 6-4). Riparian vegetation lines approximately 38 miles of bank, all of which has natural bank conditions.

Riparian Habitat. Along this reach, just less than 479 acres of riparian vegetation is located within 1 mile of the San Joaquin River, representing a little more than 2 percent of the corridor's land area (Table 6-3). Some of this habitat is associated with sloughs, but some of the habitat is close to the river: Riparian vegetation occupies 14 percent of the 330-foot-wide corridors along the river banks (Table 6-5) and 3 percent of the 10-year floodplain that is connected to the river. SPFC levees are present only at the downstream end of the reach, beginning near RM 148 on the west side and RM 146 on the east side. Levee VMZs are generally less than 330 feet from the river banks where levees are present.

The connectivity of riparian habitats along this reach is moderate compared to other major river reaches in this CPA. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 1.9 acres along this reach (Table 6-5). This habitat is most continuous between RM 145 and RM 153. It is most fragmented between RM 153 and RM 157.

Riparian vegetation consists primarily of forest, which accounts for 76 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Relatively few wetlands and marshes are present in this reach, and the majority is found in the lower part of the reach (northern end). There are 346 acres of nontidal marsh, or 2 percent of the land area, and 665 acres of seasonal wetland along this reach (Table 6-3). Of the total 1,011 acres of wetland, approximately 72 percent is protected (as federal land). The marshes range in size from less than 1 acre to 40 acres, but most are small, and

the seasonal wetlands range from less than 1 acre to 260 acres. Most of these features are associated with oxbow lakes or other floodplain features related to historical meander migration.

A small portion of these features (27 percent of marsh and 9 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 6-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 85 percent (16,330 acres) of the reach corridor (Table 6-3). Very little agricultural land within the reach corridor (14 percent) is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (15,430 acres), almost all (91 percent or 13,990 acres) is agricultural land. Of this floodplain agricultural land, 99 percent is cropland and pasture, and less than 1 percent is other agricultural land. Less than 1 percent (less than 1 acre) of the total agricultural land is conserved (as federal land).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are delta button-celery, giant garter snake, and Swainson's hawk. Giant garter snake in this reach has only been documented within the San Luis National Wildlife Refuge, 10 miles north-northeast of Los Banos. Populations of delta button-celery have only been documented in the San Joaquin River floodplain, along Turner Island just south of Mariposa Slough.

This reach does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

Developed land uses in this reach are limited. Other than the Sand Slough Control Structure and the Mariposa Bypass at the ends of this reach and several levees, this reach has almost no major infrastructure. Canals and drainage infrastructure in this reach are Island Canals C and D, Loop Ditch #1 and #2, Pick Anderson Drain, East Side Canal, Dairy Field Ditch, Dairy Field Ditch #2, and Orchard Ditch (Figure F3-4 of Attachment F3).

Levees. There are 8.2 miles of SPFC levees and 4.9 miles of non-SPFC levees within this reach (Table 6-7. SPFC levees are along both banks at the northern end of this reach, and non-SPFC levees are at two locations upstream. The physical condition of the SPFC levees is of higher concern.

Revetment. There is 0.1 mile of revetment present within this reach near the bypass.

Fish Passage Barriers. One fish passage barrier, San Joaquin River Headgates, has been documented along this reach (Figure F3-5 of Attachment F3). No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 15 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 15 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 6-8. No

acreages of initial priority species have been recorded within DWR channel and levee maintenance areas along this reach. No acreages of initial priority species have been recorded in other areas maintained by LMAs.

6.1.8 Mariposa Bypass to Bear Creek

From the Mariposa Bypass to Bear Creek, the San Joaquin River was historically connected to sloughs and flood basins.

No tributaries to the San Joaquin River occur in this reach; however, the Mariposa Bypass is located along the southern border of this reach near RM 145.

Within this reach of the San Joaquin River, the 2-mile-wide floodway corridor covers approximately 9,700 acres, and more than 70 percent of the corridor along this reach has been conserved (Figure F3-1 of Attachment F3). Unlike most reaches, most of this conserved land is disconnected from the river. Conserved areas along this reach include a portion of the San Luis National Wildlife Refuge, which is managed by USFWS.

Ecosystem Processes

Floodplain Inundation. Approximately 90 percent of the corridor along this reach has a 50-percent-chance FIP (Table 6-1 and Figure F3-2 of Attachment F3). Most of this area is disconnected from the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 331 feet, ranging between 164 feet and 511 feet. The meander corridor is an estimated 2,475 feet wide (Table 6-2) and the meander amplitude is 1,596 feet. Of the total meander zone within this reach (2,824 acres), the majority is constrained. Approximately 21 percent is constrained by natural geology; 12 percent is constrained by revetment, levees, and other infrastructure; and an additional 38 percent is constrained by both. The remaining meander zone is unrestricted (828 acres, 29 percent of the meander zone).

Habitats

Land cover along this reach of the San Joaquin River is predominantly natural vegetation (Table 6-3 and Figure F3-3 of Attachment F3). Natural vegetation represents almost nine-tenths of the corridor's land cover. Riparian/wetland vegetation accounts for well over one-third of the land cover. Riparian vegetation is well distributed throughout the corridor, primarily close to the river, with a large area of riparian forest present at the north end of the corridor within the San Luis National Wildlife Refuge.

Shaded Riverine Aquatic Cover. Along this reach of the San Joaquin River, with potential SRA habitat is moderately high (80 percent) compared to other major river reaches within this CPA. Of the 24 miles of bank, nearly all have natural bank conditions (Table 6-4). Riparian vegetation lines 20 miles of bank, of which almost all has natural bank conditions.

Riparian Habitat. Along this reach, 445 acres of riparian vegetation is located within 1 mile of the San Joaquin River, representing approximately 5 percent of the corridor's land area (Table 6-

3). Most of this habitat is close to the river: Riparian vegetation occupies 28 percent of the 330-foot-wide corridors along the river banks (Table 6-5) and 5 percent of the 10-year floodplain that is connected to the river. Levee VMZs are generally more than 330 feet from the river banks, although many short stretches occur through the reach where the VMZs are less than 330 from the banks.

The connectivity of riparian habitat along this reach is moderately high compared to other major river reaches in this CPA. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 2.4 acres along this reach (Table 6-5). This habitat is most continuous between RM 137 and RM 142. It is most fragmented between RM 133 and RM 137.

Riparian vegetation consists primarily of forest, which accounts for 94 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Numerous seasonal wetlands and marshes are present in this reach. There are 1,775 acres of nontidal marsh, or 18 percent of the land area, and 1,532 acres of seasonal wetland along this reach (Table 6-3). Of the total 3,307 acres of wetland, approximately 88 percent is protected (as federal land). The marshes range in size from less than 1 acre to a complex of more than 910 acres; most are moderate in size, and the seasonal wetlands range from less than 1 acre to more than 240 acres. Most of these features are associated with oxbow lakes or other floodplain features related to historical meander migration.

Only a small portion of these features (3 percent of marsh and 7 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 6-6).

Floodplain Agriculture. In this reach, agricultural land is found primarily in the middle of the reach on the northeast side of the river. Agricultural land occupies 9 percent (900 acres) of the reach corridor (Table 6-3), and all of it is situated above the 10-year flood level or protected by levees. Eighty-four percent of the total agricultural land is conserved (as federal land).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are delta button-celery, giant garter snake, western pond turtle, and Swainson's hawk. Giant garter snake, western pond turtle, and Swainson's hawk have only been documented at the southern end of the reach, in or near the San Luis National Wildlife Refuge. Giant garter snake habitat here is in the San Luis National Wildlife Refuge, 10 miles north-northeast of Los Banos.

This reach does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

Most of this reach is undeveloped. Major infrastructure is limited along this reach and consists of one electrical transmission line that crosses the river at RM 142 (Figure F3-4 of Attachment F3). No canals are located in this reach.

Levees. There are 17.6 miles of SPFC levees and 1.3 miles of non-SPFC levees within this reach (Table 6-7). SPFC levees are on both banks along this reach. The distance of the levees from the river varies from approximately 200 feet to 1,600 feet. The physical condition of these levees is of higher concern.

Revetment. There is 0.3 mile of revetment present within this reach (Table 6-7). Of this revetment, 0.1 mile is located along the San Joaquin River at the north boundary along Bear Creek and between RMs 144 and 145 armoring less than 1 percent of the bank (Table 6-4).

Fish Passage Barriers. Four fish passage barriers, Eastside Bypass Rock Weir, Beaver Dam, San Luis Refuge Low Flow Crossing, and Mariposa Bypass Drop Structure, have been documented along this reach (Figure F3-5 of Attachment F3). Eastside Bypass Rock Weir is on the boundary of this reach and the Bear Creek to Mercer River reach. No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 11 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 11 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 6-8. No acreages of initial priority species have been recorded within DWR channel and levee maintenance areas along this reach. No acreages of initial priority species have been recorded in other areas maintained by LMAs.

6.1.9 Bear Creek to Merced River

From Bear Creek to the Merced River, the San Joaquin River has more sinuosity than in upstream reaches, and oxbow, side channel, and remnant channel landforms are present.

The primary tributary to the San Joaquin River within this reach is Bear Creek (at RM 133).

Within this reach of the San Joaquin River, the 2-mile-wide floodway corridor covers approximately 16,000 acres; more than 50 percent of this reach of the San Joaquin River is preserved (Figure F3-1 of Attachment F3). Conserved areas along this reach include the North Grasslands Wildlife Area, which is managed by CDFW; Great Valley Grasslands State Park, which is managed by State Parks; and San Luis National Wildlife Refuge, which is managed by USFWS.

Ecosystem Processes

Floodplain Inundation. Approximately one-half of the corridor along the river has a 50-percent-chance FIP, and most of these areas are connected to the river (Table 6-1 and Figure F3-2 of Attachment F3).

Riverine Geomorphic Processes. In this reach, the average channel width is 351 feet, ranging between 153 feet and 743 feet. The meander corridor is an estimated 2,641 feet wide (Table 6-2), and the meander amplitude is 1,701 feet. Of the total meander zone within this reach (4,978 acres), a little more than one-half is restricted. Approximately 34 percent is constrained by

natural geology; 2 percent is constrained by revetment, levees, and other infrastructure; and an additional 16 percent is constrained by both. The remaining meander zone (48 percent or 2,400 acres) is unrestricted.

Habitats

Land cover along this reach of the San Joaquin River is predominantly natural vegetation (Table 6-3 Figure F3-3 of Attachment F3). Natural vegetation represents more than one-half of the corridor's land cover. Riparian/wetland vegetation accounts for one-fifth of the land cover. Riparian vegetation is widespread throughout the corridor in the river floodplain.

Shaded Riverine Aquatic Cover. Along this reach of the San Joaquin River, the percentage of river bank with potential SRA habitat is moderately low (50 percent) compared to other major river reaches within this CPA. Of the 43 miles of bank, 42 miles have natural bank conditions (Table 6-4). Riparian vegetation lines 21 miles of bank, of which almost all has natural bank conditions.

Riparian Habitat. Along this reach, 1,000 acres of riparian vegetation is located within 1 mile of the San Joaquin River, representing approximately 5 percent of the corridor's land area (Table 6-3). Most of this habitat is close to the river: Riparian vegetation occupies 21 percent of the 330-foot-wide corridors along the river banks (Table 6-5) and 11 percent of the 10-year floodplain that is connected to the river. SPFC levees are present only on the northeast side of the river for most of this reach. On the southwest side, the SPFC levee is present on the upstream end from RM 128 to RM 133. Levee VMZs are generally more than 330 feet from the river bank on the east side. On the west side, the levee VMZs are generally less than 330 feet from the river bank from RM 128 to RM 130.

The connectivity of riparian habitats along this reach is moderate compared to other major river reaches in this CPA. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of the patches of riparian vegetation, which is 2.3 acres along this reach (Table 6-5). This habitat is most continuous between RM 124 and RM 127. It is most fragmented between RM 120 and RM 123.

Riparian vegetation consists primarily of forest, which accounts for 88 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Numerous seasonal wetlands and marshes are present in this reach. There are 1,520 acres of seasonal wetland, or 9 percent of the land area, and 610 acres of nontidal marsh present along this reach (Table 6-3). Of the total 2,130 acres of wetland, approximately 86 percent are protected (as federal or State land). The seasonal wetlands range in size from less than 1 acre to complexes more than 500 acres, but most moderate in size; the marshes range from less than 1 acre to 180 acres. Most of these features are associated with oxbow lakes or other floodplain features related to historical meander migration.

Only a small portion of these features (14 percent of marsh and 21 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 6-6).

Floodplain Agriculture. In this reach, agricultural land is distributed almost entirely on the northeast side of the river. Agriculture occupies 31 percent (4,990 acres) of the reach corridor (Table 6-3). Almost all of the agricultural land within the reach corridor (95 percent) is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (8,960 acres), very little (6 percent or 550 acres) is agricultural land. Of this floodplain agricultural land, 59 percent is cropland and pasture and 41 percent is other agricultural land. Less than 1 percent (20 acres) of the total agricultural land is conserved (as federal or State land).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are delta button-celery, western pond turtle, Swainson's hawk, and colonies of tricolored blackbirds. Colonies of tricolored blackbirds have only been observed 2.6 miles northeast of Newman, along Hills Ferry Road.

This reach does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

Developed land uses occupy approximately 2 percent of the corridor along this reach. Major infrastructure along this reach is limited; an electrical transmission line is located near the river at RM 116, SR 140 crosses the river near RM 123, and Lander Avenue crosses the river near RM 130 (Figure F3-4 of Attachment F3). No canals are present in this reach.

Levees. There are 19.1 miles of SPFC levees and no non-SPFC levees within this reach (Table 6-7 and Figure F3-4 of Attachment F3). An SPFC levee is located along the river's east side and extends for several miles along the west side. The physical condition of the east levee is of medium concern; the physical condition of the west levee is of higher concern.

Revetment. There is less than 0.1 mile of revetment present within this reach, located at the south boundary along Bear Creek and between RMs 127 and 128.

Fish Passage Barriers. Eastside Bypass Rock Weir is partway in this reach and partway in the Mariposa Bypass to Bear Creek reach (Figure F3-5 of Attachment F3). No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 12 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 12 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 6-8. Within DWR channel and levee maintenance areas along this reach, approximately 1 acre of initial priority species occurs, made up exclusively of Himalayan blackberry. Within other areas maintained by LMAs, no acreages are recorded of initial priority species. Occurrences Himalayan blackberry are located at the northern end of this reach.

6.2 Basins/Bypasses

The San Joaquin River bypass system was generally constructed to convey flood flows from the San Joaquin River at the Chowchilla Bifurcation Structure, as well as intersect tributary inflow, and carry it to the San Joaquin River upstream of the Merced River Confluence. There are three bypasses that are part of this system within the Upper San Joaquin CPA: the Chowchilla Bypass Canal, Eastside Bypass, and Mariposa Bypass. Detailed habitat descriptions have been included for these three bypasses.

6.2.1 Chowchilla Bypass Canal

The Chowchilla Bypass Canal begins approximately 5 miles east of the town of Mendota on the San Joaquin River and conveys floodwater north from the Chowchilla Bypass Bifurcation Structure. The approximately 1,000 foot-wide bypass continues to the confluence with the Fresno River where it becomes the Eastside Bypass.

There are no conserved areas within the Chowchilla Bypass Canal (Figure F3-1 of Attachment F3).

Ecosystem Processes

Floodplain Inundation. The entire bypass has the potential to serve as floodplain.

Habitats

Upland natural vegetation accounts for more approximately 99 percent of the Chowchilla Bypass Canal. The remaining 1 percent is in agriculture with orchards and vineyards and other agricultural lands (Figure F3-3 of Attachment F3).

Shaded Riverine Aquatic Cover. There is no shaded riverine aquatic habitat within the bypass corridor.

Riparian Habitat. There is no riparian vegetation within the Chowchilla Bypass Canal.

Marsh and Other Wetland Habitat. There are no wetlands within the Chowchilla Bypass Canal.

Floodplain Agriculture. Agriculture is very limited within the Chowchilla Bypass Canal (less than 1 percent of the land cover) and is in isolated locations.

Targeted and Other Sensitive Species

The only target and other sensitive species documented along this bypass canal is Swainson's hawk. The Chowchilla Bypass Canal does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

No developed land is located in the Chowchilla Bypass Canal corridor. Major infrastructure is limited to several road crossings and interconnected electrical transmission lines (Figure F3-4 of Attachment F3).

Levees. The approximately 28.1 miles of levees along the Chowchilla Bypass Canal are SPFC levees (Figure F3-4 of Attachment F3); they extend the entire length of both sides of the bypass. The physical condition of these levees is generally of higher concern.

Revetment. There is 2.3 miles of revetment along the bypass canal (Table 6-10). Revetment is located throughout the Chowchilla Bypass Canal in small, localized points where transmission lines and roads cross the bypass canal. Revetment is concentrated where the bypass canal intersects with the Chowchilla Bypass – Mendota Dam reach, extending north for approximately 2.2 miles.

Fish Passage Barriers. There are three fish passage barriers in the Chowchilla Bypass Canal: bridges at Avenue 14, Firebaugh Road, and Avenue 7 (see Appendix K).

Invasive Plants. Within the bypass corridor, eight of the 31 target invasive plants are known to occur, based on information provided by Cal-IPC (2013). Of the eight species, one is ranked as being highly abundant in at least one quadrangle within the bypass. No acreages of initial priority species have been recorded within DWR channel and levee maintenance areas along this reach. No acreages of initial priority species have been recorded in other areas maintained by LMAs.

6.2.2 Eastside Bypass

The Eastside Bypass, approximately 4,000 feet wide, begins at the confluence of the Chowchilla Canal Bypass and Fresno River. The Eastside Bypass extends north for approximately 25 miles where it intersects the Mariposa Bypass, then continues north to a point approximately 1.7 miles north of Bear Creek.

The tributaries that join the Eastside Bypass above the Mariposa Bypass are: Berenda Slough, Ash Slough, Sand Slough, and the Chowchilla River. Below the Mariposa Bypass, Duck Slough, Owens Creek, and Bear Creek intersect the Eastside Bypass.

Approximately 41 percent of the 4,060-acre Eastside Bypass has been conserved (Figure F3-1 of Attachment F3). Conserved areas in the Eastside Bypass include the San Luis and Merced National Wildlife Refuges, both of which are managed by USFWS.

Ecosystem Processes

Floodplain Inundation. The entire bypass has the potential to serve as floodplain.

Habitats

Natural vegetation and open water account for more than 99 percent of the Eastside Bypass. The remaining area (less than 1 percent) is in agriculture (Figure F3-3 of Attachment F3).

Shaded Riverine Aquatic Cover. There is no shaded riverine aquatic habitat within the bypass corridor.

Riparian Habitat. Along the Eastside Bypass, approximately 2 percent of the land cover (60 acres) is riparian vegetation, and the entire area is riparian forest. Most of the riparian habitat is near the channels in the bypass. The other concentration of riparian forest habitat is located approximately 1.4 miles southeast of the intersection of Sandy Mush Road and Nickel Road. Riparian habitat in the bypass is patchy and the connectivity is relatively low.

Marsh and Other Wetland Habitat. There are 466 acres of wetlands within the Eastside Bypass, representing approximately 11 percent of the land cover. Almost all of this area (415 acres) is seasonal wetlands. Approximately 85 percent of these wetlands are protected as State or federal lands. The marshes range in size from less than 1 acre to slightly more than 17 acres, but most are small. The seasonal wetlands range from less than 1 acre to 87 acres and most are small**.**

Floodplain Agriculture. Agriculture represents less than 1 percent of the area's land cover (24 acres), in isolated locations. One-third of this agricultural land is in cropland and pasture; the remaining two-thirds is identified as other agricultural land. One-third (approximately 6 acres) of these lands are conserved as State or federal lands.

Targeted and Other Sensitive Species

Target and other sensitive species documented along this bypass are Delta button celery, Sanford's arrowhead, and Swainson's hawk.

This bypass does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

No developed land is located in the Eastside Bypass corridor. Major infrastructure is limited to several road crossings (most notably SR 152), several interconnected electrical transmission lines, and interconnected gas pipelines (Figure F3-4 of Attachment F3).

Levees. All the levees in the Eastside Bypass are SPFC levees (Figure F3-4 of Attachment F3). The 63.0 miles of levees extend the entire length of both sides of the bypass. The physical condition of these levees is generally of higher concern with the exception of the right bank levees between the Fresno River and Ash Slough that are of medium concern.

Revetment. There is 18 miles of revetment (armoring along 30 percent of bank length) within the Eastside Bypass (Table 6-10). Short lengths (less than 0.2 mile) of revetment are scattered along the entire length of the bypass. Revetment is typically located where transmission lines and roads cross the bypass. Revetment is concentrated along the portion of the bypass running parallel to the Sand Slough Control Structure – Mariposa Bypass Reach.

Fish Passage Barriers. A total of 21 fish passage barriers are scattered throughout the Eastside Bypass, including two drop structures (Eastside Bypass Drop Structure 1 and 2), two weirs (Merced Refuge Weir 1 and 2), 13 bridges, four crossings, and the Eastside Bypass Control Structure (see Appendix K).

Invasive Plants. Within the bypass corridor, 15 of the 31 target invasive plants are known to occur, based on information provided by Cal-IPC (2013). Of the 15 species, two are ranked as being highly abundant in at least one quadrangle within the bypass. No acreages of initial priority species have been recorded within DWR channel and levee maintenance areas along this reach. No acreages of initial priority species have been recorded in other areas maintained by LMAs.

6.2.3 Mariposa Bypass

The Mariposa Bypass is a narrow flood channel, approximately 660 feet wide, that delivers flow from the Eastside Bypass, approximately 3.5 miles, back to the San Joaquin River. The Mariposa Bypass meets the San Joaquin River near RM 148, east of the San Luis National Wildlife Refuge.

There are no conserved areas within the Mariposa Bypass (Figure F3-1 of Attachment F3).

Ecosystem Processes

Floodplain Inundation. The entire bypass has the potential to serve as floodplain.

Habitats

Natural vegetation accounts for 99 percent of the Mariposa Bypass. Most (77 percent) is upland vegetation, with approximately 20 percent of the land cover in seasonal wetlands. Less than 1 percent is in agriculture (Figure F3-3 of Attachment F3).

Shaded Riverine Aquatic Cover. There is no shaded riverine aquatic habitat within the bypass corridor.

Riparian Habitat. Along the Mariposa Bypass, less than 1 percent of the land cover (1 acre) is riparian forest. All riparian vegetation is located within the bypass levees, and is represented by a single patch of vegetation adjacent to open water.

Marsh and Other Wetland Habitat. There are 47 acres of seasonal wetlands within the Mariposa Bypass, representing approximately 20 percent of the land cover. None of these wetlands are protected as State or federal lands. This is a single seasonal wetland within the bypass levees.

Floodplain Agriculture. Agriculture represents less than 1 percent of the land cover (1 acre) of the area. All of this land is considered other agricultural land. This area is not conserved as State or federal lands.

Targeted and Other Sensitive Species

The only target and other sensitive species documented along this bypass are Delta button celery and Swainson’s hawk.

This bypass does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

No developed land is located in the Mariposa Bypass corridor, nor is major infrastructure present.

Levees. All levees in the Mariposa Bypass are SPFC levees (Figure F3-4 of Attachment F3). The 5.6 miles of levees extend the entire length of both sides of the bypass. The physical condition of these levees is generally of higher concern.

Revetment. There is very little (less than 0.1 mile) revetment in the Mariposa Bypass (Table 6-10). Revetment is located at confluence of the Eastside Bypass.

Fish Passage Barriers. There is one fish passage barrier in the Mariposa Bypass, the Mariposa Control (see Appendix K).

Invasive Plants. Within the bypass corridor, six of the 31 target invasive plants are known to occur, based on information provided by Cal-IPC (2013). Of the six species, none are ranked as being highly abundant in at least one quad within the bypass. No acreages of initial priority species have been recorded within DWR channel and levee maintenance areas along this reach. No acreages of initial priority species have been recorded in other areas maintained by LMAs.

6.3 Major Tributaries

6.3.1 Fresno Slough

Fresno Slough actively meanders along the entire reach. The banks along this slough are natural (i.e., without revetment), and the active channel is fairly wide in some areas. The slough splits into multiple forks near Mendota, and then reforms into a single channel before joining the San Joaquin River.

The only tributary to the Fresno Slough is Fish Slough (at RM 12).

Within this reach of the Fresno Slough, the 2-mile-wide floodway corridor covers approximately 14,400 acres, and approximately 43 percent of the corridor has been conserved (Figure F3-1 of Attachment F3). All of this conserved acreage falls within the Mendota Wildlife Area managed by CDFW.

Ecosystem Processes

Floodplain Inundation. The majority of the corridor along Fresno Slough has greater than 10 percent chance FIP, and most of this area (approximately 85 percent) is connected to the slough (Table 6-1 and Figure F3-2 of Attachment F3).

Riverine Geomorphic Processes. In this reach, the average channel width is 351 feet, ranging between 153 feet and 743 feet. The meander corridor is an estimated 2,641 feet wide (Table 6-2),

and the meander amplitude is 1,701 feet. Of the total meander zone potential within this reach (4,978 acres), a little more than one-half is restricted. Approximately 34 percent is constrained by natural geology; 2 percent is constrained by revetment, levees, and other infrastructure; and an additional 16 percent is constrained by both. The remaining meander zone potential (48 percent or 2,400 acres) is unrestricted.

Habitats

Land cover along this reach of the Fresno Slough is predominantly natural vegetation. Natural vegetation represents one-half of the corridor's land cover (Table 6-3 and Figure F3-3 of Attachment F3). Riparian/wetland vegetation accounts for just less than one-half of the land cover. Riparian vegetation is found predominantly in the upper (southern) portion of this reach.

Shaded Riverine Aquatic Cover. There is no shaded riverine aquatic habitat within the bypass corridor.

Riparian Habitat. Along this reach, 210 acres of riparian vegetation is located within 1 mile of the Fresno Slough, representing approximately 1 percent of the corridor's land area (Table 6-3). Some of this habitat is close to the slough, but most is associated with adjacent marsh and wetland: Riparian vegetation occupies 8 percent of the 330-foot-wide corridor along the river banks (Table 6-5) and 2 percent of the 10-year floodplain that is connected to the river. No SPFC levees are present in this reach.

The connectivity of riparian habitats along this reach is low compared to other major river reaches in this CPA. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 2.2 acres along this reach (Table 6-5). This habitat is mostly continuous, but patchy between RM 10 and RM 12. It is nearly absent between RM 1 and RM 7.

Riparian vegetation consists primarily of forest, which accounts for 69 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. The Fresno Slough reach contains a larger acreage of wetlands than any of the river reaches in this CPA. There are 3,950 acres of seasonal wetland, or 27 percent of the land cover, and 2,340 acres of nontidal marsh, or 16 percent of the land cover, present along this reach (Table 6-3). Of the total 6,290 acres of wetland, 5,440 acres (87 percent) is protected (as State land). The seasonal wetlands range in size from 10 acres to a wetland complex that is more than 1,830 acres; most are relatively large. The marshes range from 2 acres to 290 acres. Most of these features are associated with the slough and are part of the Mendota Wildlife Area.

Floodplain Agriculture. In this reach, agricultural land is distributed on both sides of the river, primarily in the upper portion of the reach. Agricultural land occupies 38 percent (5,500 acres) of the reach corridor (Table 6-3). Approximately one-third of the agriculture in this reach (31 percent) is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (12,150 acres),

approximately one-third (31 percent or 3,780 acres) is agricultural land. Of this floodplain agricultural land, 84 percent is cropland and pasture and 16 percent is other agricultural land. Only 30 acres (less than 1 percent) is protected (as State land).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are giant garter snake, western pond turtle, and Swainson's hawk.

This reach does not provide habitat or critical habitat for target or other sensitive fish species.

Stressors

Developed land uses occupy less than 2 percent of the corridor along this reach, and are concentrated near Mendota. Major infrastructure is SR 180, electrical transmission lines, and natural gas pipelines (Figure F3-4 of Attachment F3).

Levees. There are 27.4 miles of non-SPFC levees within this reach (Table 6-7 and Figure F3-4 of Attachment F3). No SPFC levees are present. Levees along Fresno Slough are set back between approximately 500 feet and 2,640 feet.

Revetment. No revetment is present along Fresno Slough.

Fish Passage Barriers. No fish passage barriers have been documented along this reach. No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 12 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 12 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 6-8. No acreages of initial priority species have been recorded within DWR channel and levee maintenance areas along this reach. No acreages of initial priority species have been recorded in other areas maintained by LMAs.

6.4 Other Valley Landscape Units

The Other Valley Landscape Unit within the Upper San Joaquin River CPA generally extends from Friant Dam to just north of Modesto, and covers approximately 345,820 acres (Figure 6-1). This landscape unit includes the land that surrounds the San Joaquin River. Agricultural land is the predominant land cover type within this landscape unit, totaling 202,010 acres (Table 6-9; Figure F3-3 of Attachment F3). Agricultural lands are found throughout this unit, the majority of which (approximately 151,460 acres) is cropland and pasture.

Natural lands cover approximately 32 percent of the Other Valley Landscape Unit. Approximately 40 percent of this area (43,920 acres) is represented by other natural land cover, which is concentrated in the northwest portion of the landscape unit within the Delta. Riparian scrub is the land cover type with the least coverage within this landscape unit, covering 220

acres. Other land cover types in this unit are nontidal marsh (33,900 acres), seasonal wetland (31,910 acres), and riparian forest (650 acres). Very little riparian forest and riparian scrub occur within this landscape unit; these land cover types are concentrated along tributaries to the San Joaquin River.

Target and other sensitive species documented in this landscape unit are delta button-celery, Sanford's arrowhead, giant garter snake, western pond turtle, Swainson's hawk, colonies of tricolored blackbirds, and yellow-headed blackbird. Yellow-headed blackbirds in this landscape unit have only been sighted in Dos Palos and south of Dos Palos.

This landscape unit does not provide habitat or critical habitat for target or other sensitive fish species. Developed land uses occupy less than 1 percent of this landscape unit, primarily in the vicinity of Merced and Firebaugh. Major infrastructure crossing through this landscape unit is natural gas pipelines and PG&E transmission lines. SRs 33, 59, 140, 152, and 180, and a small portion of SR 99 also cross through this landscape unit.

There are 67.4 miles of non-SPFC levees along waterways within this landscape unit and no SPFC levees (Table 6-10). In addition, no revetment is present along the waterways within this landscape unit.

One fish passage barrier, Lost Lake Rock Weir #1, has been documented within this landscape unit (Figure F3-5 of Attachment F3).

6.5 Other Facilities and Waterways

From north to south, the other facilities in the Upper San Joaquin River CPA are levees; channel-clearing projects; and/or diversions from Black Rascal Creek to Bear Creek, from Owens Creek to Mariposa Creek, and along Ash Slough, Berenda Slough, and the Fresno River.

Approximately 36 percent of the 16,600 acres in the Other Facilities and Waterways portion of the Upper San Joaquin River CPA is in agricultural use, and more than half of this amount is cropland and pasture (Table 6-9; Figure F3-3 of Attachment F3). Natural land cover makes up 21 percent of the total area (3,520 acres), with the majority (approximately 79 percent) being natural upland vegetation (2,770 acres). Nontidal marsh and seasonal wetland cover approximately 9 and 10 percent of the Other Facilities and Waterways, respectively. Riparian vegetation only covers approximately 2 percent of the total land cover within this unit.

Target and other sensitive species documented within Other Facilities and Waterways are Sanford's arrowhead and Swainson's hawk. Sanford's arrowhead has only been documented at Crane Ranch, northwest of the Merced National Wildlife Refuge, and Swainson's hawk has only been documented along Berenda Slough northeast of Fig Road and Avenue 17, approximately 2.5 miles southwest of Dairyland.

This area does not provide habitat or critical habitat for target or other sensitive fish species.

No developed land uses occur within the Other Facilities and Waterways landscape unit.

The facilities described above have a total of 44.1 miles of SPFC levees and 16.7 miles of non-SPFC levees (Table 6-10). Revetment covers 4.3 miles, generally along the levees. Levees along the Fresno River are of higher concern, and portions of Bear Creek and Brenda Slough are of medium concern. Levees along Ash Slough are of lower concern.

No fish passage barriers are present along waterways within this landscape unit (Figure F3-5 of Attachment F3).

6.6 Foothill Landscape Units

The reservoirs in the Foothill Landscape Unit portion of the Upper San Joaquin River CPA are Los Banos Creek Reservoir on Los Banos Creek, Lake McClure on the Merced River, Castle Dam on Canal Creek, Bear Reservoir on Bear Creek, Burns Reservoir on Burns Creek, Owens Reservoir on Owens Creek, Mariposa Reservoir on Mariposa Creek, Eastman Lake on Ash Slough and Brenda Slough, and Hensely Lake on the Fresno River.

Los Banos Creek Reservoir is located on Los Banos Creek, which is a westside tributary to the San Joaquin River. Los Banos Creek Reservoir is operated to provide flood protection to the San Luis and Delta-Mendota Canals, the community of Los Banos, and agricultural lands downstream.

Lake McClure regulates releases to the lower Merced River. Lake McClure is operated for flood management, power production, irrigation, recreation, and downstream fishery and wildlife purposes.

The Merced County Stream Group Project consists of five dry dams (Castle, Burns, Bear, Owens, and Mariposa) and two diversion structures. A dry dam allows the channel to flow freely during normal conditions without impoundment, but temporarily stores flood waters, releasing the flows downstream at a controlled rate. All of the dams are in the foothills east of the city of Merced on tributaries to the San Joaquin River, and provide flood protection to Merced. The objective of the Merced County Stream Group Project is to restrict the flood flows of several streams in the Merced County Stream Group (Bear, Burns, Owens, and Mariposa Creeks) to the nondamaging capacity of the valley floor channels from the foothill line to the city of Merced (DWR 2012h).

The outlying community of Little Panoche Reservoir is also within the Foothill Landscape Unit of the Upper San Joaquin River CPA. Little Panoche Dam is a feature of the Central Valley Project and serves as a detention dam on Little Panoche Creek. Little Panoche Creek flows east-northeast through Little Panoche Reservoir, which flows into the California Aqueduct.

Landcover was not mapped for the CVFPP for the majority, over 99 percent, of lands within the Other Foothill Landscape Unit (Table 6-11 and Figure F3-3 of Attachment F3). Thus, a detailed description of land cover is not provided.

The target and other sensitive species documented in the Foothill Landscape Units are Sanford's arrowhead, western pond turtle, giant garter snake, Swainson's hawk, and colonies of tricolored blackbirds. Giant garter snake habitat in the area is possibly extirpated. Sanford's arrowhead plants have only been documented in the lowermost pond within the Bear Creek Dam Reservoir.

This Landscape Unit does not provide habitat or critical habitat for target or other sensitive fish species.

The facilities described above have a total of 39.8 miles of associated non-SPFC levees and no SPFC levees. There is no revetment along the levees within the Foothill Landscape Unit (Table 6-12).

6.7 Tables of Results

Table 6-1. Acreages of Connected and Disconnected Floodplain Inundation Potential Zones along Major River Reaches of, and Major Tributaries to, the Upper San Joaquin River Conservation Planning Area[a]

FIP Zone	Friant Dam to SR 99	SR 99 to Gravelly Ford	Gravelly Ford to Chowchilla Bypass	Chowchilla Bypass to Mendota Dam	Mendota Dam to Sack Dam	Sack Dam to Sand Slough Control Structure	Sand Slough Control Structure to Mariposa Bypass	Mariposa Bypass to Bear Creek	Bear Creek to Merced River	Fresno Slough	Total Acres
Connected											
Baseflow FIP	1,814	400	286	806	498	205	3,635	217	665	7,644	16,170
67 Percent Sustained Spring FIP	210	268	267	580	418	231	11,533	263	704	2,333	16,807
50 Percent FIP	270	409	374	218	1,512	204	212	1,033	6,762	375	11,369
10 Percent FIP	774	375	183	168	21	6	51	20	832	1,798	4,229
Less than 10 Percent FIP	0	14	183	101	414	159	20	29	62	1	982
Subtotal	*3,068*	*1,466*	*1,294*	*1,872*	*2,862*	*806*	*15,452*	*1,562*	*9,026*	*12,150*	*49,557*
Disconnected											
Baseflow FIP	14	3	293	1,821	467	24	107	17	1	819	3,567
67 Percent Sustained Spring FIP	0	0	1,091	1,607	232	1,219	1,750	324	7	0	6,230
50 Percent FIP	0	<1	2,678	1,634	14,129	12,127	1,581	7,672	1,774	0	41,595
10 Percent FIP	0	21	1,738	1,002	183	73	24	67	2,399	226	5,734
Less than 10 Percent FIP	5,610	8,626	3,416	404	4,967	647	262	47	2,930	1,223	28,133
Subtotal	*5,624*	*8,651*	*9,216*	*6,469*	*19,978*	*14,089*	*3,725*	*8,127*	*7,113*	*2,268*	*85,258*
Total	**8,692**	**10,117**	**10,510**	**8,340**	**22,840**	**14,894**	**19,177**	**9,689**	**16,138**	**14,418**	**134,815**

Source: DWR 2012b

Key:

FIP = floodplain inundation potential

Note:

[a] Values may not sum exactly because of rounding.

Table 6-2. Meander Zone Width, Area, and Constraints along Major River Reaches of, and Major Tributaries to, the Upper San Joaquin River Conservation Planning Area[a]

Meander Zone Attribute	Friant Dam to SR 99	SR 99 to Gravelly Ford	Gravelly Ford to Chowchilla Bypass	Chowchilla Bypass to Mendota Dam	Mendota Dam to Sack Dam	Sack Dam to Sand Slough Control Structure	Sand Slough Control Structure to Mariposa Bypass	Mariposa Bypass to Bear Creek	Bear Creek to Merced River	Total
Width (feet)	1,440	2,433	3,847	2,894	2,772	2,478	2,159	2,475	2,641	NA
Meander Zone Area (acres)										
Unconstrained	2,943	4,388	1,155	1,131	2,584	622	3,803	828	2,400	19,854
Constrained by Resistant Geology Only	468	<1	0	0	0	2	275	585	1,691	3,021
Constrained by Revetment/Levees Only	0	150	2,986	2,253	4,441	3,049	482	329	93	13,783
Constrained by Both	0	0	0	0	152	212	227	1081	793	2,465
Total	**3,411**	**4,539**	**4,141**	**3,384**	**7,177**	**3,886**	**4,787**	**2,824**	**4,978**	**39,125**

Sources: AECOM 2013, CGS 2013, DWR 2011a, and DWR 2013a

Note:

[a] Values may not sum exactly because of rounding and because of overlap between geology constraints and levee/revetment constraints.

Table 6-3. Acreage of Land Cover Types in the Floodway Corridor along Major River Reaches of, and Major Tributaries to, the Upper San Joaquin River Conservation Planning Area[a,b]

Land Cover Type	Friant Dam to SR99	SR99 to Gravelly Ford	Gravelly Ford to Chowchilla Bypass	Chowchilla Bypass to Mendota Dam	Mendota Dam to Sack Dam	Sack Dam to Sand Slough Control Structure	Sand Slough Control Structure to Mariposa Bypass	Mariposa Bypass to Bear Creek	Bear Creek to Merced River	Fresno Slough	Total Acres
Agricultural											
Rice	0	0	0	0	70	0	0	0	0	0	70
Cropland and Pasture	0	650	3,010	4,830	17,170	12,450	16,010	750	3,280	3,900	62,060
Orchard and Vineyard	0	6,470	5,740	1,050	970	10	0	0	20	0	14,270
Other Agricultural	0	290	300	360	1,270	910	320	150	1,690	1,590	6,860
Subtotal	*0*	*7,410*	*9,050*	*6,240*	*19,480*	*13,370*	*16,330*	*900*	*4,990*	*5,490*	*83,260*
Natural											
Marsh – Tidal	0	0	0	0	0	0	0	0	0	0	0
Marsh – Nontidal	34	3	0	43	50	7	346	1,775	610	2,339	5,202
Riparian – Forest	991	434	16	130	585	168	362	419	920	145	4,171
Riparian – Scrub	309	219	0	81	153	89	117	26	80	64	1,139
Seasonal Wetland	137	23	11	68	136	117	665	1,532	1,520	3,950	8,171
Other Natural	1,800	790	1,410	1,320	930	990	1,090	4,820	7,350	830	21,320
Subtotal	*3,270*	*1,460*	*1,430*	*1,640*	*1,850*	*1,380*	*2,580*	*8,580*	*10,480*	*7,330*	*40,000*
Other											
Water	1,060	220	20	310	590	120	250	210	490	1,220	4,490
Developed	0	30	0	150	880	0	0	0	180	260	1,500
Not Mapped	4,350	980	0	0	0	0	0	0	0	90	5,420
Total Acres	**8,680**	**10,110**	**10,510**	**8,340**	**22,800**	**14,860**	**19,160**	**9,680**	**16,140**	**14,390**	**134,660**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

Table 6-4. Miles of the Shaded Riverine Aquatic Habitat Attributes along Major River Reaches of, and Major Tributaries to, the Upper San Joaquin River Conservation Planning Area[a,b,c]

Bank and Vegetation Type	Friant Dam to SR 99	SR 99 to Gravelly Ford	Gravelly Ford to Chowchilla Bypass	Chowchilla Bypass to Mendota Dam	Mendota Dam to Sack Dam	Sack Dam to Sand Slough Control Structure	Sand Slough Control Structure to Mariposa Bypass	Mariposa Bypass to Bear Creek	Bear Creek to Merced River	Fresno Slough	Total Miles
Natural Bank (Miles)											
With Riparian Vegetation	52.3	35.5	1.4	15.0	38.4	18.0	38.4	19.6	21.1	0.0	239.8
Without Riparian Vegetation	9.4	7.2	31.0	12.7	8.3	17.7	14	4.8	21.2	0.0	126.3
Subtotal	*61.7*	*42.7*	*32.4*	*27.7*	*46.7*	*35.7*	*52.5*	*24.4*	*42.3*	*0.0*	*366.0*
Revetted Bank (Miles)											
With Riparian Vegetation	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.2	0.0	0.4
Without Riparian Vegetation	0.0	0.2	1.7	0.2	0.1	0.0	0.1	0.0	0.0	0.0	2.3
Subtotal	*0.0*	*.2*	*1.7*	*0.2*	*0.2*	*0.0*	*0.1*	*0.1*	*0.2*	*0.0*	*2.7*
Total	**61.7**	**42.9**	**34.1**	**27.9**	**46.9**	**35.7**	**52.6**	**24.6**	**42.5**	**0.0**	**368.8**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Acreages of shaded riverine aquatic (SRA) cover with all three habitat components (natural banks, eroding substrates, and riparian vegetation) are not represented as the data are unavailable for the San Joaquin.

[c] Data derived from locations of riparian vegetation along the river bank and distribution of revetment.

Table 6-5. Indicators of Riparian Continuity along Major River Reaches of, and Major Tributaries to, the Upper San Joaquin River Conservation Planning Area[a]

Attribute	Friant Dam to SR 99	SR 99 to Gravelly Ford	Gravelly Ford to Chowchilla Bypass	Chowchilla Bypass to Mendota Dam	Mendota Dam to Sack Dam	Sack Dam to Sand Slough Control Structure	Sand Slough Control Structure to Mariposa Bypass	Mariposa Bypass to Bear Creek	Bear Creek to Merced River	Fresno Slough	Total
Area of 100- to 330-Foot-Wide Corridor (acres)	2,080	1,480	950	1,180	1,830	1,120	1,720	1,010	2,150	1,620	15,210
Percent of 100- to 330-Foot-Wide Corridor in Riparian Vegetation	39	35	1	15	30	14	14	28	21	8	22
Median Patch Size (Acres)	3.4	3.0	1.6	2.8	3.5	2.0	1.9	2.4	2.4	2.2	2.6

Source: DWR 2011b

Note:

[a] Values may not sum exactly because of rounding.

Table 6-6. Acreage of Land Cover Types of Floodplain in Potential Meander Zone along Major River Reaches of the Upper San Joaquin River Conservation Planning Area[a, b]

Land Cover Type	Friant Dam to SR 99	SR 99 to Gravelly Ford	Gravelly Ford to Chowchilla Bypass	Chowchilla Bypass to Mendota Dam	Mendota Dam to Sack Dam	Sack Dam to Sand Slough Control Structure	Sand Slough Control Structure to Mariposa Bypass	Mariposa Bypass to Bear Creek	Bear Creek to Merced River	Total Acres
Agricultural										
Rice	0	0	0	0	0	0	0	0	0	0
Cropland and Pasture	0	0	0	140	1,130	30	2,930	0	120	4,350
Orchard and Vineyard	0	60	0	0	0	0	0	0	0	60
Other Agricultural	0	30	30	10	100	10	130	0	40	350
Subtotal	0	90	30	150	1,230	40	3,060	0	160	4,760
Natural										
Marsh – Tidal	0	0	0	0	0	0	0	0	0	0
Marsh – Nontidal	11	3	0	33	0	0	95	54	85	281
Riparian – Forest	396	360	14	110	444	95	216	324	647	2,606
Riparian – Scrub	204	183	0	59	142	78	106	26	72	870
Seasonal Wetland	39	20	4	63	76	85	57	112	322	778
Other Natural	230	500	1,080	544	500	347	320	810	2,510	6,840
Subtotal	*880*	*1,070*	*1,100*	*810*	*1,160*	*610*	*790*	*1,330*	*3,640*	*11,380*
Other										
Water	570	220	0	200	310	40	110	120	280	1,850
Developed	0	0	0	0	20	0	0	0	20	40
Not Mapped	80	50	0	0	0	0	0	0	0	130
Total Acres	**1,530**	**1,430**	**1,130**	**1,160**	**2,720**	**690**	**3,960**	**1,450**	**4,090**	**18,160**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

Table 6-7. Levee and Revetment Length (Miles) along Major River Reaches of, and Major Tributaries to, the Upper San Joaquin River Conservation Planning Area[a]

Facility Type	Friant Dam to SR 99	SR99 to Gravelly Ford	Gravelly Ford to Chowchilla Bypass	Chowchilla Bypass to Mendota Dam	Mendota Dam to Sack Dam	Sack Dam to Sand Slough Control Structure	Sand Slough Control Structure to Mariposa Bypass	Mariposa Bypass to Bear Creek	Bear Creek to Merced River	Fresno Slough	Total Miles
Levees											
SPFC	0.0	2.4	19.0	2.2	0.0	5.0	8.2	17.6	19.1	0.0	73.6
Non-SPFC	0.0	0.0	0.0	27.4	70.1	44.9	4.9	1.3	0.0	27.4	176.1
Total	**0.0**	**2.4**	**19.0**	**29.6**	**70.1**	**49.9**	**13.1**	**18.9**	**19.1**	**27.4**	**249.6**
Revetment											
Revetment	0.0	0.3	6.5	7.0	1.4	2.1	0.1	0.3	0.0	0.0	17.8

Sources: DWR 2012c, DWR 2012e, and USACE 2007

Key:

SPFC = State Plan of Flood Control

Note:

[a] Values may not sum exactly because of rounding.

Table 6-8. Abundance[a] of Targeted Invasive Plant Species[b] within Major River Reaches, Tributaries, and Bypasses along the Upper San Joaquin River Conservation Planning Area

Reach		Friant Dam to SR 99				SR 99 to Gravelly Ford			Gravelly Ford to Chowchilla Bypass		Chowchilla Bypass to Mendota Dam			Mendota Dam to Sack Dam				Sack Dam to Sand Slough Control Structure				Sand Slough Control Structure to Mariposa Bypass					Mariposa Bypass to Bear Creek			Bear Creek to Merced River		Fresno Slough			
USGS Quad Name		Fresno North	Friant	Herndon	Lanes Bridge	Biola	Gravelly Ford	Herndon	Gravelly Ford	Mendota Dam	Firebaugh	Mendota Dam	Tranquility	Firebaugh	Mendota Dam	Oxalis	Poso Farm	Bliss Ranch	Oxalis	Poso Farm	Santa Rita Bridge	Delta Ranch	San Luis Ranch	Sandy Mush	Santa Rita Bridge	Turner Ranch	San Luis Ranch	Stevinson	Turner Ranch	Gustine	Stevinson	Firebaugh	Jamesan	Mendota Dam	Tranquility
Percentage of Reach[c]		34	20	20	26	51	24	25	71	29	2	98	1	42	7	3	49	4	7	4	85	8	20	4	11	57	71	28	2	69	32	1	14	13	72
Species																																			
Common Name	Scientific Name																																		
Barbed goat grass	*Aegilops triuncialis*																																		
Tree of heaven	*Ailanthus altissima*	L	L	L	L	L		L								L		L	L		L	L	L	L	L	L	L	L	L	L	L				
Alligator weed	*Alternanthera philoxeroides*																																		
Giant reed[d]	*Arundo donax*	L	M	L	L	L	L	L	L	L	L	L	M	L	L	L	L		L	L			L	L		L	L	L	L	L	L	L	L		M
Yellow star-thistle	*Centaurea solstitialis*	M	M	M	M	M	M	M	M	M	M	M	L	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	L	M	L
Pampas grass	*Cortaderia selloana*															L		L	L		L	L	L	L	L	L	L	L	L	L	L				
Scotch broom	*Cytisus scoparius*																																		
Stinkwort	*Dittrichia graveolens*																						L				L								
Brazilian waterweed	*Egeria densa*																																		
Medusa head	*Elymus caput-medusae*		M																																
Blue gum	*Eucalyptus globulus*																																		
Edible fig	*Ficus carica*		L																								L			L				
Fennel	*Foeniculum vulgare*																																		
French broom	*Genista monspessulana*															L		L	L		L				L										
Shortpod mustard	*Hirschfeldia incana*	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H				H						H	H	H	H
Hydrilla	*Hydrilla verticillata*																																		
Perennial pepperweed	*Lepidium latifolium*[1]												L								M	M	M	M	M	M	M	M	M	M				L
American frogbit	*Limnobium spongia*																																		
Water primrose	*Ludwigia* sp.	M	M	M	M	M	M	M	M	M	M	M		M	M	M	M	M	M	M	M				M					L		M		M	
Purple loosestrife	*Lythrum salicaria*																																		
Parrot's feather	*Myriophyllum aquaticum*	M	M	M	M	M	M	M	M	M	M	M		M	M	M	M	M	M	M	M				M					L		M		M	

Table 6-8. Abundance[a] of Targeted Invasive Plant Species[b] within Major River Reaches, Tributaries, and Bypasses along the Upper San Joaquin River Conservation Planning Area

Reach		Friant Dam to SR 99				SR 99 to Gravelly Ford			Gravelly Ford to Chowchilla Bypass		Chowchilla Bypass to Mendota Dam			Mendota Dam to Sack Dam				Sack Dam to Sand Slough Control Structure				Sand Slough Control Structure to Mariposa Bypass					Mariposa Bypass to Bear Creek			Bear Creek to Merced River		Fresno Slough			
USGS Quad Name		Fresno North	Friant	Herndon	Lanes Bridge	Biola	Gravelly Ford	Herndon	Gravelly Ford	Mendota Dam	Firebaugh	Mendota Dam	Tranquility	Firebaugh	Mendota Dam	Oxalis	Poso Farm	Bliss Ranch	Oxalis	Poso Farm	Santa Rita Bridge	Delta Ranch	San Luis Ranch	Sandy Mush	Santa Rita Bridge	Turner Ranch	San Luis Ranch	Stevinson	Turner Ranch	Gustine	Stevinson	Firebaugh	Jamesan	Mendota Dam	Tranquility
Percentage of Reach[c]		34	20	20	26	51	24	25	71	29	2	98	1	42	7	3	49	4	7	4	85	8	20	4	11	57	71	28	2	69	32	1	14	13	72
Species																																				
Common Name	Scientific Name																																			
Tree tobacco	*Nicotiana glauca*	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Scotch thistle	*Onopordum acanthium* ssp. *acanthium*																																			
Crisp-leaved pondweed	*Potamogeton crispus*									L	L	L		L	L	L	L	L	L	L	L				L							L		L	
Himalayan blackberry[d]	*Rubus armeniacus*	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M		H		M		H	H			H	M	M	M	M
Ravenna grass	*Saccharum ravennae*																																			
Russian thistle	*Salsola tragus*	H		H		H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
Red sesbania[d]	*Sesbania punicea*	M	M	M	L	M	M	M	M	M		M			M																				M	
Milk thistle	*Silybum marianum*																																			
Saltcedar[d]	*Tamarix* sp.		L		L					L	L	L	L	L	L	L	L		L	L			L				L	L		L	L	L		L	L
Chinese tallowtree	*Triadica sebifera*	L		L		L	L	L	L																											

Source: Cal-IPC 2013

Key:

USGS = United States Geological Survey

Notes:

[a] Abundance rated by Cal-IPC as either H = High; M = Medium; L = Low; blank cells show no occurrences.

[b] Of the 31 target weed species, no data are available for American frogbit or milk thistle.

[c] Values may not sum to 100 because of rounding.

[d] Indicates initial priority species.

Table 6-9. Acreage of Land Cover Types of Valley Landscape Units in the Upper San Joaquin River Conservation Planning Area[a,b]

Land Cover	Landscape Unit Type				Total Acres
	Major River Reach	Basin-Bypass[c]	Other Facility-Waterway	Other Valley SPA	
Agricultural					
Rice	70	0	0	1,630	1,700
Cropland and Pasture	62,060	14,020	3,680	151,460	231,110
Orchard and Vineyard	14,260	3,830	2,030	30,260	50,380
Other Agricultural	6,870	1,850	280	18,670	27,400
Subtotal	*83,260*	*19,700*	*5,990*	*202,020*	*310,580*
Natural					
Marsh – Tidal	0	0	0	0	0
Marsh – Nontidal	5,202	1,440	315	33,900	40,857
Riparian – Forest	4,171	92	44	651	4,918
Riparian – Scrub	1,139	0	18	216	1,368
Seasonal Wetland	8,171	1,656	366	31,909	42,098
Other Natural	21,320	10,750	2,770	43,920	78,690
Subtotal	*39,890*	*13,940*	*3,520*	*110,590*	*167,940*
Other					
Water	4,490	370	100	3,000	7,940
Developed	1,500	0	0	2,590	4,070
Not Mapped	5,420	1,910	7,000	27,630	41,970
Total Acres	**134,660**	**35,920**	**16,600**	**345,840**	**532,490**

Source: DWR 2011b

Key:

SPA = Systemwide Planning Area

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

[c] Basin-Bypass acreages include the Chowchilla Canal Bypass, Eastside Bypass, and Mariposa Bypass and a 1-mile corridor along each side of each bypass.

Table 6-10. Levee and Revetment Length (Miles) in Valley Landscape Units of the Upper San Joaquin River Conservation Planning Area[a]

Facility Type	Landscape Unit Type				Total Miles
	Major River Reach	Basin-Bypass	Other Facility-Waterway	Other Valley SPA	
Levees					
SPFC	73.6	106.1	44.1	0.0	223.7
Non-SPFC	176.1	3.8	16.7	67.4	264.0
Total	**249.6**	**109.9**	**60.8**	**67.4**	**487.8**
Revetment					
Revetment	17.8	28.3	4.3	0.0	50.3

Sources: DWR 2012c, DWR 2012e, and USACE 2007
Key:
SPA = Systemwide Planning Area
SPFC = State Plan of Flood Control
Note:
[a] Values may not sum exactly because of rounding.

Table 6-11. Acreage of Land Cover Types of Foothill Landscape Units in the Upper San Joaquin River Conservation Planning Area[a,b]

Land Cover	Landscape Unit Type			Total Acres
	Foothill Tributaries	Lake-Reservoir	Outlying Community	
Agricultural				
Rice	90	0	0	90
Cropland and Pasture	2,320	0	0	2,320
Orchard and Vineyard	1,220	0	0	1,220
Other Agricultural	490	0	0	490
Subtotal	4,110	0	0	4,110
Natural				
Marsh – Tidal	0	0	0	0
Marsh – Nontidal	12	0	0	12
Riparian – Forest	369	0	0	369
Riparian – Scrub	143	0	0	143
Seasonal Wetland	219	0	0	219
Other Natural	338	0	0	338
Subtotal	*1,080*	*0*	*0*	*1,080*
Other				
Water	210	0	0	210
Developed	3,490	0	0	3,490
Not Mapped	1,200	12,630	210	14,050
Total	**10,090**	**12,630**	**210**	**22,940**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

Table 6-12. Levee and Revetment Length (Miles) in Foothill Landscape Units of the Upper San Joaquin River Conservation Planning Area[a]

Facility Type	Landscape Unit Type			Total Miles
	Foothill Tributaries	Lake-Reservoir	Outlying Community	
Levees				
SPFC	0.0	0.0	0.0	0.0
Non-SPFC	39.8	0.0	0.0	39.8
Total	**39.8**	**0.0**	**0.0**	**39.8**
Revetment				
Revetment	0.0	0.0	0.0	0.00

Sources: DWR 2012c, DWR 2012e, and USACE 2007
Key:
SPFC = State Plan of Flood Control
Note:
[a] Values may not sum exactly because of rounding.

7.0 Summary of Existing Conditions for the Lower San Joaquin River Conservation Planning Area

The Lower San Joaquin River CPA encompasses the San Joaquin River from its confluence with the Merced River into the Delta (Figure 7-1). It also includes major tributaries that are of significance for both flood management and conservation: the Merced, Stanislaus, and Tuolumne Rivers. The San Joaquin River is actively meandering in portions of the reach from its confluence with the Merced River to its confluence with the Stanislaus River. The river corridor includes a floodplain with complex topography such as oxbows, swales, and other products of channel migration. In their lower reaches, the Merced, Tuolumne, and Stanislaus Rivers also have sinuous channels within alluvial floodplains. Downstream from its confluence with the Stanislaus River, the San Joaquin River flows into a network of channels that spread into the Delta.

Along the San Joaquin River from its confluence with the Merced River to its confluence with the Stanislaus River, SPFC and non-SPFC levees are discontinuous. In this CPA, Paradise Cut carries flood waters directly to Old River and Delta channels. From Mossdale in the Stockton area into the Delta, levees are frequently close to channels. SPFC and non-SPFC levees are also discontinuous along the lower reaches of the Merced, Tuolumne, and Stanislaus Rivers, except for the lowermost 10 miles of the Stanislaus River, where SPFC levees are nearly continuous.

Along the lower San Joaquin River and lower reaches of the Merced, Tuolumne, and Stanislaus Rivers, revetment associated with SPFC facilities accounts for about 19 percent of bank length, but private revetment may be extensive and has not been inventoried.

Riverine and floodplain ecosystems have been substantially degraded in the Lower San Joaquin River CPA. The extent of inundated floodplain in this CPA has been substantially reduced by dams, diversions, and the flood control system, significantly reducing the ecological function. Within 1 mile of the major rivers, only about one-third of land with a FIP of 50 percent or more is hydraulically connected to the river system. Consequently, rearing habitat for salmonids provided by inundated floodplains has been reduced by more than 98 percent (see Appendix H). Channel migration has also been reduced in the Lower San Joaquin River CPA, particularly along the San Joaquin River, because river flows that erode banks and the length of natural bank have been reduced, and levees isolate much of the meander zone from the river channel. Approximately 40 percent of the meander zone is isolated from major rivers by levees or revetment.

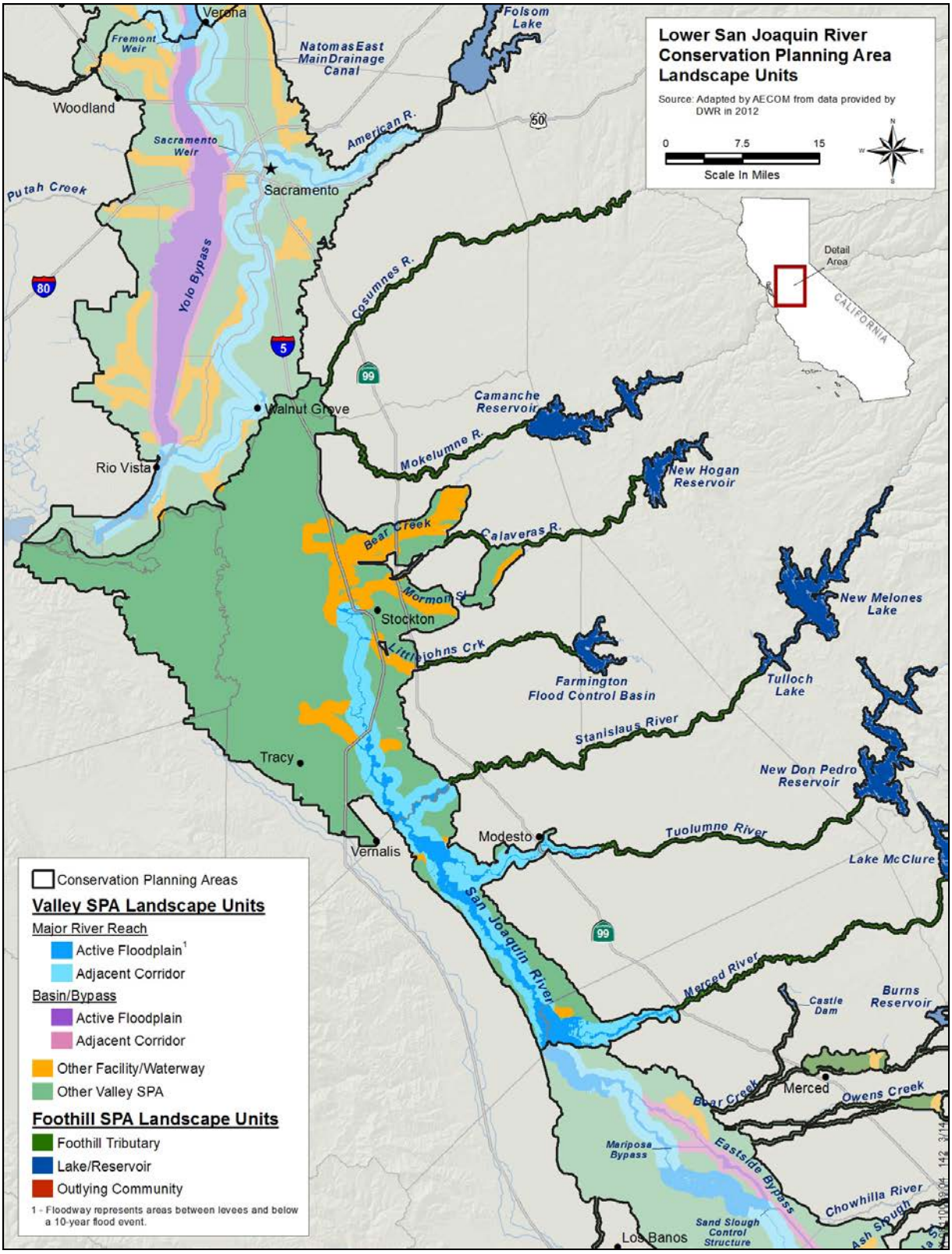

Figure 7-1. Lower San Joaquin River Conservation Planning Area

The extent of riparian and marsh vegetation has also been reduced substantially. Historically, riparian vegetation formed a corridor that was 0.5 mile to 2 miles wide along the San Joaquin River from its junction with the Merced River to its junction with the Stanislaus River, along the lower reaches of these tributaries, and in a narrower corridor along the lower Tuolumne River (The Bay Institute 1998). Riparian vegetation now accounts for about one-quarter of active floodplains, and about one-half of river banks are lined with riparian vegetation. Historically, marsh was also a major component of floodplain vegetation along the lower San Joaquin River. Downstream of its confluence with the Stanislaus River, the San Joaquin River flowed through a marsh-dominated landscape as it entered the Delta (The Bay Institute 1998). Almost all of this marsh has been drained and converted to other land cover, for primarily agricultural use and urban development. Marshes and other wetlands now account for about 3 percent of the floodplain connected to the lower San Joaquin River and the Merced, Tuolumne, and Stanislaus Rivers.

These alterations of ecosystem processes and habitats have contributed to the population declines of sensitive species, including 14 species that are targets of the Conservation Strategy (not including those known only from historical records or whose distribution in this CPA is poorly documented) (CDFG 2005 and DWR 2011c):

- Delta button-celery
- Slough thistle
- Valley elderberry longhorn beetle
- Steelhead, California Central Valley DPS
- Chinook salmon, Central Valley fall-/late fall-run ESU
- Chinook salmon, Central Valley spring-run ESU
- Green sturgeon, Southern DPS
- Giant garter snake
- California black rail
- Swainson’s hawk
- Least Bell’s vireo
- Greater sandhill crane
- Riparian brush rabbit
- Riparian woodrat

To recover these and other native species, multiple conservation plans include objectives and actions that call for floodplain reconnection and functional riparian corridors along the lower San Joaquin River or for riparian and marsh habitats in general (CVJV 2006; USFWS 1998, 1999, 2001). Restoring these processes and habitats would support recovery of multiple aquatic and terrestrial species. For example, to support the AFRP "doubling goal" for Chinook salmon, from 4,000 to 5,000 acres of additional rearing habitat on inundated floodplains would be needed (see Appendix H).

Substantial SPFC-related constraints complicate attainment of these objectives. Among these constraints is the presence of 235 miles of SPFC levees (and 840 miles of non-SPFC levees). Also, at least 103 miles of revetment associated with SPFC levees occurs along waterways in the Lower San Joaquin River CPA. The establishment of continuous corridors of riparian vegetation and SRA cover along the Lower San Joaquin River is also constrained by the flow capacity of the SPFC and its limited ability to accommodate additional roughness without causing considerable increases in flood stage elevations, or altering flows in a way that would substantially and adversely affect the opposite bank.

7.1 Major River Reaches

Detailed descriptions by river reach (Figure 7-2) for the Lower San Joaquin River CPA are provided below.

7.1.1 Merced River to Tuolumne River

Between the Merced and Tuolumne Rivers, the San Joaquin River is sinuous and, in some areas, actively meandering. The corridor along this reach of the San Joaquin River includes abandoned sloughs, channel portions, and oxbow cutoffs.

Tributaries to the San Joaquin River within this reach are the Merced River (at RM 116), which is the southern border of this reach, Dry Creek (at RM 111), and Hinds Lateral (at RM 92).

Within this reach of the San Joaquin River, the 2-mile-wide floodway corridor covers approximately 32,800 acres, and only a small portion (approximately 5 percent) of that corridor has been conserved (Figure F4-1 of Attachment F4). However, several conserved areas are along this reach, such as the West Hilmar Wildlife Area, which is managed by CDFW; a portion of the San Joaquin National Wildlife Refuge, which is managed by USFWS; a portion of the George J. Hatfield State Recreation Area, which is managed by State Parks; and several county and regional parks and open space areas, including Gomes Lake, which is managed by Turlock Irrigation District.

Ecosystem Processes

Floodplain Inundation. In this reach, more than one-half of the corridor along the San Joaquin River has a 10-percent-chance or greater than a 10-percent-chance FIP (Table 7-1 and Figure F4-2 of Attachment F4). A 50-percent-chance FIP accounts for almost 40 percent of the corridor, and approximately one-half of these areas are disconnected from the river.

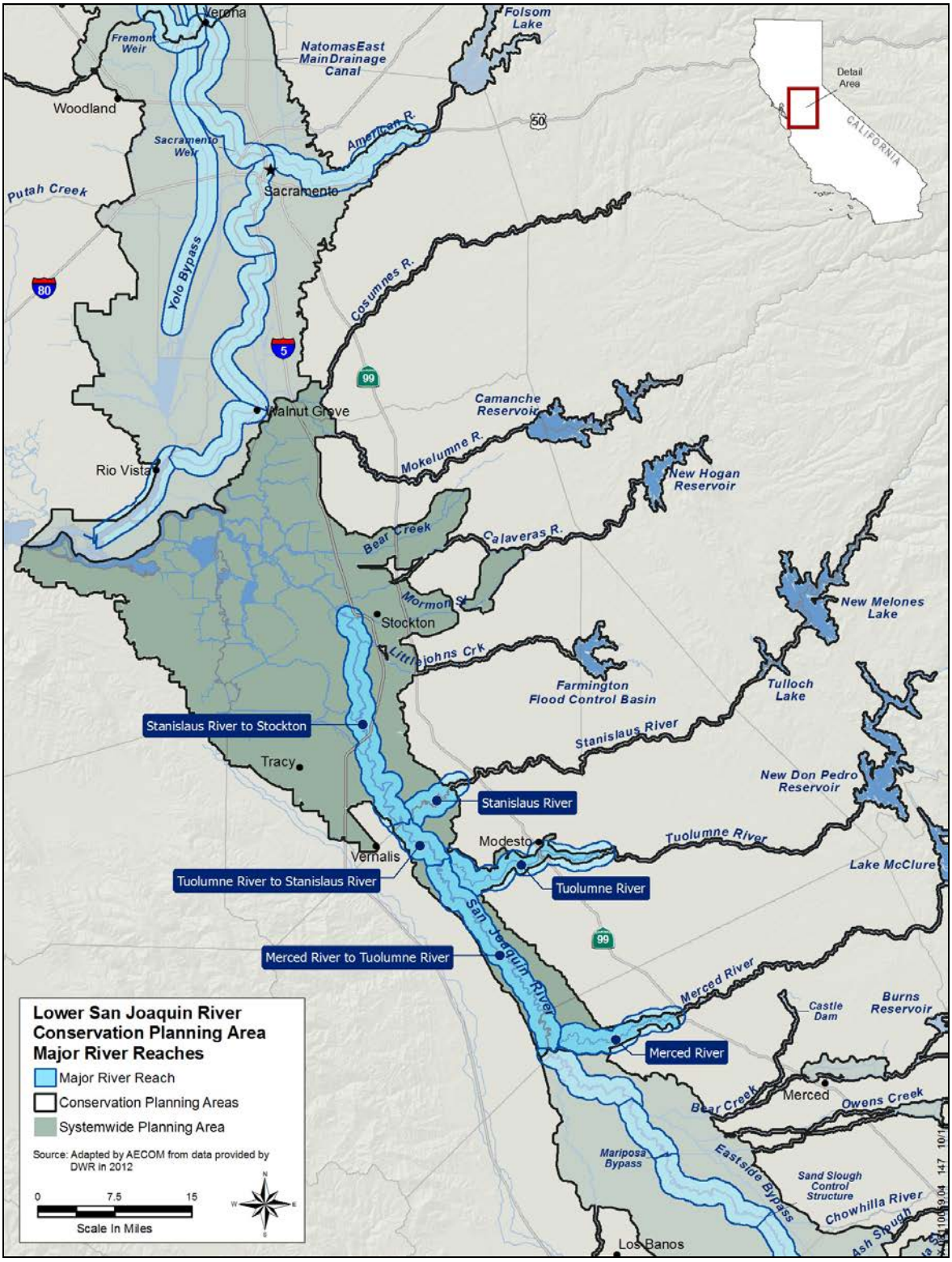

Figure 7-2. River Reach Extent for the Lower San Joaquin River Conservation Planning Area

Riverine Geomorphic Processes. In this reach, the average channel width is 509 feet, ranging between 159 feet and 2,353 feet. The meander corridor is an estimated 4,006 feet wide (Table 7-2), and the meander amplitude is 2,561 feet. Of the total meander zone (14,456 acres), the majority (51 percent) is unrestricted. Approximately 39 percent is constrained by revetment, levees, and other infrastructure; 3 percent is restricted by natural geology; and 7 percent is constrained by both infrastructure and geology.

Habitats

Land cover along this reach of the San Joaquin River is predominantly agriculture and natural vegetation, with little development (Table 7-3 and Figure F4-3 of Attachment F4). Agriculture represents just more than two-thirds of the corridor's land cover. Natural vegetation, primarily riparian and non-wetland vegetation, accounts for one-quarter of the land cover. Riparian/wetland vegetation accounts for just less than one-eighth of the land cover. Riparian vegetation is widespread, particularly close to the river.

Shaded Riverine Aquatic Cover. Along this reach of the San Joaquin River, the percentage of river bank with potential SRA habitat is moderate compared to other major river reaches in this CPA. Of the 77 miles of bank, 64 miles have natural bank conditions (Table 7-4). Riparian vegetation lines 32 miles of bank, of which 26 miles have natural bank conditions, representing 33 percent of the total bank along this reach.

Riparian Habitat. Along this reach, 3,405 acres of riparian vegetation is located within 1 mile of the San Joaquin River, approximately 10 percent of the corridor's land area (Table 7-3). Most of this habitat is close to the river: Riparian vegetation occupies 36 percent of the 330-foot-wide corridors along the river banks and 23 percent of the 10-year floodplain that is connected to the river (Table 7-5). SPFC levees are present on the east side from RM 84 to RM 86 and from RM 92 to RM 109. On the west side, SPFC levees are present from RM 82 to RM 84 and from RM 97 to RM 104. Levee VMZs are generally more than 330 feet from the eastern river banks, except from RM 103 to RM 109 on the east side and RM 82 to RM 84 on the west side. There are no stretches where the levee VMZ is less than 330 feet from the banks on both sides.

The connectivity of riparian habitats along this reach is moderate compared to other major river reaches in this CPA. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 3.5 acres along this reach (Table 7-5). This habitat is widest and most continuous between RM 89 and RM 96. It is most fragmented between RM 85 and RM 88.

Riparian vegetation consists primarily of forest, which accounts for 89 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. This reach has the highest acreage of marsh or other wetland present in this CPA. The 248 acres of nontidal marsh covers less than 1 percent of the land area; also, 561 acres of seasonal wetland is present along this reach (Table 7-3). Of the total 809 acres of wetland, just less than 70 acres is protected as federal, State, regional, or county lands. The marshes range in size from less than 1 acre to 20 acres, but most are small, and the

seasonal wetlands range from less than 1 acre to approximately 80 acres. Most of these features are associated with oxbow lakes or other floodplain features related to historical meander migration.

A substantial portion of these features (28 percent of marsh and 51 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 7-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 70 percent (22,840 acres) of the reach corridor (Table 7-3). The majority of the agricultural lands within the reach corridor (17,730 acres or 78 percent) is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (12,120 acres), almost one-half (5,120 acres or 42 percent) is agricultural land. Of this floodplain agricultural land, 80 percent is cropland and pasture, 1 percent is orchard and vineyard, and 19 percent is other agricultural land. Only 93 acres (less than 1 percent) of the total agricultural land is conserved as federal, State, regional, or county land.

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are least Bell's vireo, Swainson's hawk, and colonies of tricolored blackbirds. Least Bell's vireo nests were only documented approximately 2.5 miles east of Oaklea Road at South River Road, approximately 3 miles north of Grayson.

This reach also provides habitat for Sacramento splittail, and migrating, holding, and rearing steelhead and fall-run Chinook salmon. Sacramento splittail has only been found in the San Joaquin River 0.25 mile up and downstream of Crows Landing Bridge, 4 miles northeast of Crows Landing. The reach contains critical habitat for steelhead.

Stressors

Developed land uses occupy approximately 5 percent of the corridor along this reach. However, major infrastructure is widely dispersed along this reach. Electrical transmission lines cross the river near RMs 85, 87, and 101, and pipelines cross the river near RMs 101 and 107 (Figure F4-4 of Attachment F4). In addition to these crossings, a wastewater treatment facility is on the east bank at RMs 93 and 94, and an aggregate mine is near RM 107. The only canal within this reach is the Hinds Lateral.

Levees. There are 29.0 miles of SPFC levees and 17.1 miles of non-SPFC levees within this reach (Table 7-7 and Figure F4-4 of Attachment F4). SPFC levees are along most of the east bank and portions of the west bank, but neither connects to other SPFC levees upstream or downstream from this reach. The physical condition of these levees is of higher concern, except for a west levee at the junction with Tuolumne River, which has a physical condition of medium concern.

Revetment. There are 17.7 miles of revetment along this reach (Table 7-7). Of this revetment, 13.3 miles are along the San Joaquin River armoring 17 percent of the bank length in this reach (Table 7-4). Revetment is located throughout this reach, with a lesser extent observed at RM 99 and between RMs 110 and 112.

Fish Passage Barriers. No fish passage barriers have been documented along this reach (Figure F4-5 of Attachment F4). One aggregate mine, Green Pit, is present in this reach near RM 107 (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 16 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 16 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 7-8. Within DWR channel and levee maintenance areas along this reach, approximately 5 acres of initial priority species occurs, with less than 1 acre of giant reed and 4 acres of Himalayan blackberry. No initial priority species occur within other areas maintained by LMAs. Occurrences of Himalayan blackberry are isolated in the southern portion of this reach; occurrences of giant reed are primarily in the northern portion of this reach close to the confluence with the Tuolumne River.

7.1.2 Tuolumne River to Stanislaus River

The San Joaquin River is actively meandering in portions of this reach, and the river corridor features a floodplain with complex topography, including oxbows, swales, and other products of channel migration.

The only tributary to the San Joaquin River within this reach is the Tuolumne River (at RM 82), which is also the southern border of this reach.

Within this reach of the San Joaquin River, the 2-mile-wide floodway corridor covers approximately 8,100 acres, and more than one-third of that corridor is conserved (Figure F4-1 of Attachment F4). This conserved land is part of the San Joaquin National Wildlife Refuge, which is managed by USFWS.

Ecosystem Processes

Floodplain Inundation. Between the Tuolumne and Stanislaus Rivers, nearly one-half of the corridor along the San Joaquin River has a 50-percent-chance FIP, and most of the remainder has either a 10-percent-chance or greater than a 10-percent-chance FIP (Table 7-1 and Figure F4-2 of Attachment F4). Approximately 60 percent of areas with a 50-percent-chance FIP are disconnected from the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 430 feet, ranging between 210 feet and 930 feet. The meander corridor is an estimated 3,317 feet wide (Table 6-2), and the meander amplitude is 2,127 feet. Of the total meander zone within this reach (3,616 acres), the majority (65 percent) is unrestricted. Approximately 24 percent is constrained by revetment, levees, or other infrastructure; 1 percent is restricted by natural geology; and another 9 percent is constrained by both infrastructure and geology.

Habitats

Land cover along this reach of the San Joaquin River is predominantly agriculture and natural vegetation, with little development (Table 7-3 and Figure F4-3 of Attachment F4). Agriculture represents just less than one-half of the corridor's land cover. Natural vegetation, primarily

riparian and non-wetland vegetation, also accounts for just less than one-half of the land cover. Riparian/wetland vegetation accounts for just more than one-quarter of the land cover. Riparian vegetation is widespread throughout this reach corridor.

Shaded Riverine Aquatic Cover. Along this reach of the San Joaquin River, the percentage of river bank with potential SRA habitat is moderate compared to other major river reaches in this CPA. Of the 25 miles of bank, 23 miles have natural bank conditions (Table 7-4). Riparian vegetation lines 7 miles of bank, of which 6 miles have natural bank conditions, representing 26 percent of the total bank along this reach.

Riparian Habitat. Along this reach, just more than 1,716 acres of riparian vegetation is located within 1 mile of the San Joaquin River, approximately 21 percent of the corridor's land area (Table 7-3). Most of this habitat is close to the river: Riparian vegetation occupies 41 percent of the 330-foot-wide corridor along the river banks and 37 percent of the 10-year floodplain that is connected to the river (Table 7-5). SPFC levees are generally present on both sides of the river in this reach from RM 73 to RM 79. Levee VMZs are generally more than 330 feet from the river banks on both sides, except on the west side from RM 73 to RM 75. One very short length is present where the VMZs are less than 330 feet on both sides of the river.

The connectivity of riparian habitats along this reach is moderate compared to other major river reaches in this CPA. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 3.7 acres along this reach (Table 7-5). This habitat is found in a broad area of the corridor on the southwest side in the upper portion of the reach. The habitat is most continuous between RM 76 and RM 78. It is most fragmented between RM 79 and RM 80.

Riparian vegetation consists primarily of forest, which accounts for 80 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. This reach has a relatively high acreage of marsh or other wetland present compared to other major river reaches in this CPA. The 302 acres of nontidal marsh is 4 percent of the land area; also, 323 acres of seasonal wetland is present along this reach (Table 7-3). Of the total 625 acres of wetland, 340 acres is protected (as federal land). The marshes range in size from less than 1 acre to 30 acres, but most are small, and the seasonal wetlands range from less than 1 acre to approximately 70 acres. Most of these features are associated with oxbow lakes or other floodplain features related to historical meander migration.

A substantial portion of these features (32 percent of marsh and 22 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 7-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 48 percent (3,870 acres) of the reach corridor (Table 7-3). The majority of agricultural lands within the reach corridor (87 percent, 3,370 acres) is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (3,620 acres), 14 percent (1,460 acres) is

agricultural land. Of this floodplain agricultural land, 95 percent is cropland and pasture and 5 percent is other agricultural land. Fifteen percent (580 acres) of the total agricultural land is conserved (as federal land).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are VELB, least Bell's vireo, Swainson's hawk, colonies of tricolored blackbirds, and riparian woodrat. VELB was only documented along the San Joaquin River approximately 8 miles west of Modesto. Least Bell's vireo nests in this reach were only documented approximately 3 miles north of Grayson. The one tricolored blackbird colony documented in this reach was observed at the intersection of Maze Road and River Road, approximately 9 miles southwest of Ripon.

This reach also provides habitat for migrating, holding, and rearing, steelhead and fall-run Chinook salmon. The reach contains critical habitat for delta smelt and steelhead.

Stressors

This reach is primarily undeveloped. Major infrastructure is limited to levees between RM 75 and RM 78; Maze Boulevard and an electrical transmission line cross the river (Figure F4-4 of Attachment F4). No canals are present in this reach.

Levees. There are 14.0 miles of SPFC levees and 11.0 miles of non-SPFC levees within this reach (Table 7-7). SPFC levees are present on portions of both banks and non-SPFC levees connect to and/or are inside of the SPFC levees. The distance of levees from the river varies from approximately 300 feet to almost 1 mile. The physical condition of these levees is primarily of higher concern.

Revetment. There is 3.9 miles of revetment in this reach (Table 7-7). Of this revetment, 2.1 miles is located along the San Joaquin River armoring 9 percent of bank length) in this reach (Table 7-4). Revetment is located throughout this reach, with the greatest concentration between RMs 75 and 78.

Fish Passage Barriers. No fish passage barriers have been documented along this reach (Figure F4-5 of Attachment F4). No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 17 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 17 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 7-8. No acreages of initial priority species have been recorded within DWR channel and levee maintenance areas along this reach. No acreages of initial priority species have been recorded in other areas maintained by LMAs.

7.1.3 Stanislaus River to Stockton

The San Joaquin River is actively migrating in portions of this reach, and the corridor along the river includes floodplains with complex topography and oxbow lakes.

In this tidally influenced reach, the San Joaquin River enters the legal Delta. Tributaries to the San Joaquin River within this reach are Stanislaus River (at RM 73), which is the southern border of this reach; Walthall Slough (at RM 58); Paradise Cut (at RM 59); Old River (at RM 54); French Camp Slough (at RM 44); and Burns Cutoff (at RM 41).

Within this reach of the San Joaquin River, the 2-mile-wide floodway corridor covers approximately 34,300 acres, and a small portion (approximately 1 percent) of that corridor is conserved (Figure F4-1 of Attachment F4). Conserved areas along this reach include the Vernalis Riparian Habitat, which is a preserve near Vernalis, managed by CDFW; and several city and county parks.

Ecosystem Processes

Floodplain Inundation. From the Stanislaus River to Stockton, approximately 40 percent of the corridor along the San Joaquin River has a 50-percent-chance FIP, and most of the remainder is distributed relatively evenly between areas with Below Baseflow, a 67-percent-chance Sustained Spring, and a 10-percent-chance FIP (Table 7-1 and Figure F4-2 of Attachment F4). Approximately 90 percent of areas with a 67-percent-chance Sustained Spring or a 50-percent-chance FIP is disconnected from the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 455 feet, ranging between 217 feet and 2,433 feet. The meander corridor is an estimated 3,536 feet wide (Table 7-2), and the meander amplitude is 2,266 feet. Of the total meander zone within this reach (13,439 acres), the majority (76 percent) is constrained by revetment, levees, and other infrastructure. Approximately 2 percent is constrained by natural resistant geology, and another 4 percent is restricted by both infrastructure and natural geology. The remaining area within the meander zone, 2,366 acres (18 percent), is unrestricted.

Habitats

Land cover along this reach of the San Joaquin River is predominantly agriculture (Table 7-3 and Figure F4-3 of Attachment F4). Agriculture represents almost two-thirds of the corridor's land cover. Natural vegetation, primarily riparian and nonwetland vegetation, accounts for just less than one-fifth of the land cover. Riparian/wetland vegetation accounts for approximately 5 percent of the land cover. Riparian vegetation is patchily distributed within this reach, and is most prevalent in the upper portion of the reach.

Shaded Riverine Aquatic Cover. Along this reach of the San Joaquin River, the percentage of river bank with potential SRA habitat is relatively low compared to other major river reaches in this CPA. Of the 75 miles of bank, 37 miles have natural bank conditions (Table 7-4). Riparian vegetation lines 27 miles of bank, of which 18 miles have natural bank conditions, representing 25 percent of the total bank along this reach.

Riparian Habitat. Along this reach, 1,522 acres of riparian vegetation is located within 1 mile of the San Joaquin River, approximately 4 percent of the corridor's land area (Table 7-3). Most of this habitat is close to the river: Riparian vegetation occupies 24 percent of the 330-foot-wide corridor along the river banks and 25 percent of the 10-year floodplain that is connected to the

river (Table 7-5). SPFC levees are present on both sides of the river, except at the downstream-most end of the reach from RM 39 to RM 41; SPFC levees are present only on the east side at the upstream end from RM 70 to RM 72. Levee VMZs are generally less than 330 feet from the river banks throughout the majority of this reach, and nearly continuously less than 330 feet from the river banks on both sides from RM 41 to RM 57.

The connectivity of riparian habitat is lowest along this reach of the CPA. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 4.7 acres along this reach (Table 7-5). This habitat is widest and most continuous between RM 67 and RM 72; it is narrowest and most fragmented between RM 39 and RM 43.

Riparian vegetation consists primarily of forest, which accounts for 81 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Very few wetlands are present in this CPA. The 56 acres of marsh (28 acres of tidal marsh and 28 acres of nontidal marsh) is less than 1 percent of the land area; 20 acres of seasonal wetland is also present along this reach (Table 7-3). Of the total 76 acres of wetland, none are protected. The marshes and seasonal wetlands range in size from less than 1 acre to 10 acres. Most of these features are associated with oxbow lakes or other floodplain features related to historical meander migration.

A substantial portion of these features (12 percent of marsh and 40 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 7-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 60 percent (20,590 acres) of the reach corridor (Table 7-3). Almost all of the agricultural lands within the reach corridor (97 percent, 20,060acres) is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (4,420 acres), approximately 12 percent (540 acres) is agricultural land. Of this floodplain agricultural land, more than 99 percent is cropland and pasture and less than 1 percent is other agricultural land. Only 20 acres (less than 1 percent) of the total agricultural land is conserved (as State or county land).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are several plants associated with marshes and sloughs (e.g., slough thistle), Swainson's hawk, colonies of tricolored blackbirds, yellow-headed blackbird, riparian brush rabbit, and riparian woodrat. The only documented occurrence of slough thistle in this reach is located on the San Joaquin River approximately 1 mile north of the San Joaquin River Club. Yellow-headed blackbirds in this reach have only been documented just east of Lathrop. Riparian woodrats have only been documented along the San Joaquin River and at Kincaid's Ranch, 2 to 3 miles northeast of Vernalis.

This reach also provides habitat for several sensitive fish species: longfin smelt; migrating, holding, and rearing steelhead and fall-run Chinook salmon; and foraging adult green sturgeon. The reach contains critical habitat for delta smelt and steelhead.

Stressors

Developed land uses are extensive, occupying more than one-quarter of the corridor along this reach. This reach of the San Joaquin River has a high density of major infrastructure that not only includes major road, railroad, natural gas pipeline, and electrical transmission line crossings, but also aggregate mines and refineries (Figure F4-4 of Attachment F4). However, no major infrastructure is present between RMs 43 and 46, between RMs 61 and 65, or at RMs 47 or 56. No canals are present in this reach.

Levees. There are 69.6 miles of SPFC levees and 26.6 miles of non-SPFC levees within this reach (Table 7-7). Except for an upstream portion of the west bank, SPFC levees are present on both banks along this reach. Levees in the northern portion are close to the river (approximately 100 feet); levees in the southern portion of the reach are set back farther (4,224 feet). The physical condition of these levees is predominantly of higher concern, but there are sections on both banks where physical condition is of medium or lower concern (each totaling approximately 10 miles).

Revetment. There is 54.8 miles of revetment in this reach (Table 7-7). Of this revetment 38.0 miles is located along the San Joaquin River armoring 51 percent of the bank length in this reach (Table 7-4). Revetment is present throughout this reach, with lesser extents observed between RMs 39 and 40 and RMs 64 and 73.

Fish Passage Barriers. No fish passage barriers have been documented in this reach (Figure F4-5 of Attachment F4). Within this reach are three gravel mines: Brown Sand (near RM 57), Mossdale Road Pit (near RM 57), and Kasson Road Pit (near RM 65) (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 19 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 19 species, three are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 7-8. Within DWR channel and levee maintenance areas along this reach, approximately 15 acres of initial priority species occurs; all 15 acres are Himalayan blackberry. Within other areas maintained by LMAs, approximately 4 acres of initial priority species occurs; all 4 acres are Himalayan blackberry. Occurrences of Himalayan blackberry are spread throughout this reach.

7.2 Basins/Bypasses

No bypasses occur within the Lower San Joaquin River CPA.

7.3 Major Tributaries

7.3.1 Merced River

The lowermost reach of the Merced River has a relatively narrow floodplain constrained by uplands of higher elevation.

No tributaries to the Merced River occur in this reach.

Within this reach of the Merced River, the 2-mile-wide floodway corridor covers approximately 12,300 acres, and only a small portion (less than 1 percent) of that corridor is conserved (Figure F4-1 of Attachment F4). Conserved areas along this reach are limited to a portion of the George J. Hatfield State Recreation Area, which is managed by State Parks, and Hagaman County Park.

Ecosystem Processes

Floodplain Inundation. Almost three-quarters of the corridor along this reach has a greater than a 10-percent-chance FIP (Table 7-1 and Figure F4-2 of Attachment F4). Only a small area of floodplain has a 50-percent-chance FIP or a 67-percent-chance Sustained Spring FIP, most of which is connected to the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 183 feet, ranging between 106 feet and 468 feet. The meander corridor is an estimated 1,278 feet wide (Table 7-2), and the meander amplitude is 834 feet. Of the total meander zone within this reach (2,654 acres), the majority (76 percent) is unrestricted. The remaining 24 percent is restricted by natural resistant geology. No infrastructure is present in this reach.

Habitats

Land cover along this reach of the Merced River is predominantly agriculture (Table 7-3 and Figure F4-3 of Attachment F4). Agriculture represents nearly nine-tenths of the corridor's land cover. Natural vegetation, primarily riparian, accounts for less than one-tenth of the land cover. Riparian vegetation is widespread, particularly close to the river.

Shaded Riverine Aquatic Cover. Along this reach of the San Joaquin River, the percentage of river bank with potential SRA habitat is extensive compared to other major river reaches in this CPA. All of the 37 miles of bank have natural bank conditions (Table 7-4). Riparian vegetation lines 32 miles of bank.

Riparian Habitat. Along this reach of the San Joaquin River, just more than 635 acres of riparian vegetation is located within 1 mile of the Merced River, approximately 5 percent of the corridor's land area (Table 7-3). Most of this habitat is close to the river. Riparian vegetation occupies 32 percent of the 330-foot-wide corridor along the river banks and 11 percent of the 10-year floodplain that is connected to the river (Table 7-5). No SPFC levees are present on the Merced River.

The connectivity of riparian habitat is comparatively low along this reach of the CPA. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by

riparian vegetation, but also in the median size of patches of riparian vegetation, which is 2.5 acres along this reach (Table 7-5). This habitat is widest and most continuous between RM 1 and RM 4. It is narrowest and most fragmented between RM 18 and RM 24.

Riparian vegetation consists primarily of forest, which accounts for 96 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. This reach has the least acreage of wetlands present in this CPA. Seven acres of nontidal marsh, less than 1 percent of the land area, and 19 acres of seasonal wetland are present along this reach (Table 7-3). Of the total 26 acres of wetland, less than 1 acre is protected (as State land). The marshes range in size from less than 1 acre to 3 acres, and the seasonal wetlands range from less than 1 acre to approximately 9 acres. Most of these features are associated with oxbow lakes or other floodplain features related to historical meander migration.

A substantial portion of these features (33 percent of marsh and 34 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 7-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 89 percent (10,970 acres) of the reach corridor (Table 7-3). Approximately two-thirds of the agricultural lands within the reach corridor (64 percent, 7,060 acres) is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (4,920 acres), approximately 80 percent (540 acres) is agricultural land. Of this floodplain agricultural land, 76 percent is cropland and pasture, 12 percent is orchard and vineyard, and 12 percent is other agricultural land. Less than 1 acre of the total agricultural land is conserved (as county land).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are VELB and Swainson's hawk. VELB has only been documented only along the Merced River, where SR 99 crosses at Livingston Bridge in the town of Livingston.

This reach also provides habitat for migrating, holding, and rearing steelhead and fall-run Chinook salmon. The reach contains critical habitat for steelhead.

Stressors

Developed land uses occupy approximately 8 percent of the corridor along this reach. Although dispersed throughout the reach, they are more extensive near Livingston at the upstream end of the reach. Major infrastructure along this reach is a gravel mine near RM 17, and road crossings by Landers Avenue at RM 12 and SR 99 near RM 21. Additionally, a natural gas pipeline, an oil pipeline, and an electrical transmission line cross the river within this reach (Figure 4 of Attachment F4). Canal and drainage infrastructure in this reach is Cross Ditch #1 (near RM 7) and Garibaldi Lateral (near RM 17).

Levees. There are 3.8 miles of non-SPFC levees on the south bank of the river at several locations, but no SPFC levees in this reach (Table 7-7 and Figure F4-4 of Attachment F4).

Revetment. No revetment is present within this reach (Table 7-7).

Fish Passage Barriers. No fish passage barriers have been documented along this reach (Figure F4-5 of Attachment F4). One gravel mine, Oak Street Pit, is located in this reach near RM 17 (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 13 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 13 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 7-8. No initial priority species occur within DWR channel and levee maintenance areas along this reach. Within other areas maintained by LMAs, roughly 1 acre of initial priority species occurs, which is all Himalayan blackberry. Occurrences of Himalayan blackberry are located close to the confluence with the San Joaquin River.

7.3.2 Tuolumne River

Similar to the Merced River, the lowermost reach of the Tuolumne River has a relatively narrow floodplain constrained by uplands of higher elevation.

No tributaries to the Tuolumne River occur in this reach.

Within this reach of the Tuolumne River, the 2-mile-wide floodway corridor covers approximately 12,700 acres, and only a small portion (nearly 5 percent) of that corridor is conserved (Figure F4-1 of Attachment F4). Conserved areas along this reach are limited to city and county parks, including the Tuolumne River Regional Park and Ceres River Bluff Regional Park.

Ecosystem Processes

Floodplain Inundation. Nearly 90 percent of the corridor along this reach has a greater than 10-percent-chance FIP (Table 7-1 and Figure F4-2 of Attachment F4). Only a small area of floodplain, 24 acres in size, has a 50-percent-chance FIP or a 67-percent-chance Sustained Spring FIP, approximately one-half of which is connected to the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 295 feet, ranging between 132 feet and 680 feet. The meander corridor is an estimated 2,172 feet wide (Table 7-2), and the meander amplitude is 1,404 feet. Of the total meander zone within this reach (5,126 acres), the majority (61 percent) is unrestricted. Approximately 19 percent is constrained by natural geology; 15 percent is constrained by revetment, levees, and other infrastructure; and the remaining 5 percent is constrained by both.

Habitats

Land cover along this reach of the Tuolumne River is predominantly agriculture (Table 7-3 and Figure F4-3 of Attachment F4). Agriculture represents just less than two-thirds of the corridor's land cover. Natural vegetation, primarily riparian, accounts for one-eighth of the land cover. Riparian vegetation is widespread, particularly close to the river.

Shaded Riverine Aquatic Cover. Along this reach of the Tuolumne River, the percentage of river bank with potential SRA habitat is extensive compared to other major river reaches in this CPA. Of the 45 miles of bank, almost all has natural bank conditions (Table 7-4). Riparian vegetation lines 41 miles of bank, nearly all of which has natural bank conditions, representing 90 percent of the total bank along this reach.

Riparian Habitat. Along this reach, 1,079 acres of riparian vegetation is located within 1 mile of the San Joaquin River, approximately 8 percent of the corridor's land area (Table 7-3). Most of this habitat is close to the river. Riparian vegetation occupies 40 percent of the 330-foot-wide corridor along the river banks and 37 percent of the 10-year floodplain that is connected to the river (Table 7-5). No SPFC levees are present on the Tuolumne River.

The connectivity of riparian habitats along this reach is moderate compared to other major river reaches in this CPA. This level of connectivity is reflected not only in the percent of 330-foot-wide corridors occupied by riparian vegetation, but also in the median size of patches of riparian vegetation, which is 2.9 acres along this reach (Table 7-5). This habitat is generally narrow, but is widest and most continuous between RM 2 and RM 7. It is most fragmented between RM 1 and RM 2 and RM 22 and beyond.

Riparian vegetation consists primarily of forest, which accounts for 87 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. This reach has the second lowest acreage of marsh or other wetland present in this CPA. Eleven acres of nontidal marsh, less than 1 percent of the land area, and 18 acres of seasonal wetland are present along this reach (Table 7-3). Of the total 29 acres of wetland, just less than 2 acres is protected (as city land). The marshes range in size from less than 1 acre to 3 acres, and the seasonal wetlands range from less than 1 acre to 2 acres. Most of these features are associated with floodplain features related to historical meander migration.

A substantial portion of these features (7 percent of marsh and 75 percent of seasonal wetland) is connected to the river system within the potential meander zone (Table 7-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 63 percent (8,040 acres) of the reach corridor (Table 7-3). Almost all of the agricultural lands within the reach corridor (94 percent, 7,590 acres) is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (1,720 acres), approximately one-quarter (450acres or 26 percent) is agricultural land. Of this floodplain agricultural land, 56 percent is cropland and pasture, 38 percent is orchard and vineyard, and 6 percent is other agricultural land. Less than 1 percent (110 acres) of the total agricultural land is conserved (as city land).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are VELB, Swainson's hawk, and colonies of tricolored blackbirds. Nesting Swainson's hawk pairs in this reach have only been observed southeast of the Modesto City/County Airport approximately 2 miles northeast of Ceres.

This reach also provides habitat for migrating, holding, and rearing steelhead and fall-run Chinook salmon. The reach contains critical habitat for steelhead.

Stressors

Developed land uses occupy more than one-third of the corridor along this reach. Although located throughout the reach, developed land uses and major infrastructure are most extensive at Modesto (from RMs 10 to 22). Major infrastructure is concentrated between approximately RM 13 and RM 22, where major road, railroad, electrical transmission line, and natural gas pipeline crossings occur (Figure F4-4 of Attachment F4). The Modesto City/County Airport is also located within 1 mile of the river in this area. Canals in this reach are Collins Lateral and Ceres Main Canal.

Levees. There are 10.9 miles of non-SPFC levees on portions of each bank along this reach, but no SPFC levees (Table 7-7 and Figure F4-4 of Attachment F4).

Revetment. There are 1.2 miles of revetment in this reach. Of this revetment, 0.3 mile is located along the Tuolumne River armoring less than 1 percent of the bank length in this reach (Table 7-4). All revetment is concentrated in the west portion of this reach.

Fish Passage Barriers. No fish passage barriers have been documented along this reach (Figure F4-5 of Attachment F4). No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 17 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 17 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 7-8. No acreages of initial priority species have been recorded within DWR channel and levee maintenance areas along this reach. No acreages of initial priority species have been recorded in other areas maintained by LMAs.

7.3.3 Stanislaus River

Similar to the Merced and Tuolumne Rivers, the lowermost reach of the Stanislaus River has a relatively narrow floodplain constrained by uplands of higher elevation.

No tributaries to the Stanislaus River occur in this reach.

Within this reach of the Stanislaus River, the 2-mile-wide floodway corridor covers approximately 7,800 acres, and nearly 15 percent of that corridor is conserved (Figure F4-1 of Attachment F4). Conserved areas along this reach of the Stanislaus River include Caswell Memorial State Park, which is managed by State Parks; the San Joaquin National Wildlife Refuge, which is managed by USFWS; and Dos Rios and Hidden Valley Ranch, which are managed by River Partners.

Ecosystem Processes

Floodplain Inundation. More than one-half of the corridor along this reach has a greater than 10-percent-chance FIP, and most of the remainder has a 10-percent-chance FIP (Table 7-1 and Figure F4-2 of Attachment F4). Only a small area of floodplain has a 50-percent-chance FIP or a

67-percent-chance Sustained Spring FIP, more than two-thirds of which is disconnected from the river.

Riverine Geomorphic Processes. In this reach, the average channel width is 170 feet, ranging between 82 feet and 383 feet. The meander corridor is an estimated 1,171 feet wide (Table 7-2), and the meander amplitude is 765 feet. Of the total meander zone within this reach (1,416 acres), the majority (73 percent) is unrestricted. Approximately 12 percent is constrained by revetment, levees, and other infrastructure; 1 percent of the area is constrained by natural geology; and approximately 14 percent (195 acres) is constrained by both natural geology and infrastructure.

Habitats

Land cover along this reach of the Stanislaus River is predominantly agriculture (Table 7-3 and Figure F4-3 of Attachment F4). Agriculture represents nearly three-quarters of the corridor's land cover. Natural vegetation, primarily riparian, accounts for one-fifth of the land cover. Riparian/wetland vegetation accounts for just more than one-eighth of the land cover. Riparian vegetation is more widespread in the lower portions of the reach.

Shaded Riverine Aquatic Cover. Along this reach of the Stanislaus River, the percentage of river bank with potential SRA habitat is the most extensive of the major river reaches in this CPA. Of the 25 miles of bank, 24 miles has natural bank conditions (Table 7-4). Riparian vegetation lines 24 miles of bank, of which 23 miles has natural bank conditions, representing 95 percent of the total bank along this reach.

Riparian Habitat. Along this reach, 953 acres of riparian vegetation is located within 1 mile of the Stanislaus River, approximately 12 percent of the corridor's land area (Table 7-3). Most of this habitat is close to the river: Riparian vegetation occupies 69 percent of the 330-foot-wide corridors along the river banks and 51 percent of the 10-year floodplain that is connected to the river (Table 7-5). SPFC levees are present on both sides of the Stanislaus River up to RM 9 and on the south side up to RM 11. Levee VMZs are generally less than 330 feet from the river banks on at least one side of the river, and are only less than 330 feet in a few short sections.

The connectivity of riparian habitat along this reach is the highest of the major river reaches in this CPA. This level of connectivity is reflected in the percent of 330-foot-wide corridors occupied by riparian vegetation, which is 69 percent (Table 7-5). This habitat is found in large, broad swaths in the lower half of the reach, and is most continuous between RM 0 and RM 10. It is narrow and most fragmented between RM 12 and RM 15.

Riparian vegetation consists primarily of forest, which accounts for 94 percent of the riparian vegetation along this reach.

Marsh and Other Wetland Habitat. Very few marsh or other wetlands are present in this reach of the Stanislaus River. Approximately 99 acres of nontidal marsh, less than 2 percent of the land area, and 39 acres of seasonal wetland are present along this reach (Table 7-3). Of the total 138 acres of wetland, just more than 100 acres is protected (as federal land). Three large marshes are present in the southwest portion of the reach and are approximately 10 acres, 50 acres, and 130 acres. Seasonal wetlands are found in the same area and range from more than 1 acre to 10 acres.

Most of these features are not near the active channel but are associated with historic oxbow lakes or other floodplain features related to historical meander migration; most of these features are located within the San Joaquin River National Wildlife Refuge.

None of these features are connected to the river system within the potential meander zone (Table 7-6).

Floodplain Agriculture. Agricultural land is distributed on both sides of the river throughout this reach, and occupies 71 percent (5,570 acres) of the reach corridor (Table 7-3). Almost all of the agricultural lands within the reach corridor (94 percent, 5,250) is situated above the 10-year flood level or protected by levees. Of the total area within the 10-year (10-percent-chance) floodplain connected to the San Joaquin River (1,060 acres), approximately one-third (320 acres or 30 percent) is agricultural land. Of this floodplain agricultural land, 62 percent is cropland and pasture, 34 percent is orchard and vineyard, and 4 percent is other agricultural land. Only 20 acres (less than 1 percent) of the total agricultural land is conserved (as State or county land).

Targeted and Other Sensitive Species

Target and other sensitive species documented along this reach are VELB, Swainson's hawk, riparian brush rabbit, and riparian woodrat.

This reach also provides habitat for migrating, holding, and rearing steelhead and fall-run Chinook salmon. The reach contains critical habitat for delta smelt and steelhead.

Stressors

Developed land uses occupy approximately 9 percent of the corridor along this reach. Although some developed land uses are located throughout the reach, they are extensive at Ripon (RMs 12 to 14). Along this reach, major infrastructure is limited to SPFC and non-SPFC levees, and natural gas pipelines that cross the river near RM 4 and RM 15 (Figure F4-4 of Attachment F4). No canals are present in this reach.

Levees. There are 10.7 miles of SPFC levees and 7.1 miles of non-SPFC levees within this reach (Table 7-7). SPFC levees are on both banks for approximately the first 10 river miles. This reach of river is actively meandering, and the distance of the levees from the river varies from approximately 100 feet to 3,700 feet. The physical condition of these SPFC levees is of higher concern. Non-SPFC levees extend upstream discontinuously along both sides of the river.

Revetment. There are 1.8 miles of revetment along this reach. Of this revetment, 0.8 mile is located along the Stanislaus River armoring 4 percent of the bank length) in this reach (Table 7-4). Revetment is located between RMs 2 and 8.

Fish Passage Barriers. No fish passage barriers have been documented along this reach (Figure F4-5 of Attachment F4). No gravel/aggregate mines are present in this reach (DWR 2012f).

Invasive Plants. Within the floodway corridor along this reach, 16 of the 31 target invasive plants are known to occur based on information provided by Cal-IPC (Cal-IPC 2013). Of these 16 species, two are ranked as being highly abundant in at least one quad within the reach. Cal-IPC abundance ratings for all species occurring within this reach are shown in Table 7-8. Within

DWR channel and levee maintenance areas along this reach, approximately 4 acres of initial priority species occurs; all 4 acres are Himalayan blackberry. No initial priority species occur within other areas maintained by LMAs. Occurrences of these species are spread throughout this reach.

7.4 Other Valley Landscape Units

The Other Valley Landscape Unit within the Lower San Joaquin River CPA generally extends from Walnut Grove to just north of the Merced River, and covers approximately 457,460 acres (Figure 7-1). This landscape unit includes the land that surrounds the lower San Joaquin River and land to the west, extending to Honker Bay. Agricultural land is the predominant land cover type within this landscape unit, totaling 291,570 acres (Table 7-9 and Figure F4-3 of Attachment F4). Agricultural lands are found throughout this unit, the majority of which (approximately 251,010 acres) is cropland and pasture.

Natural land cover only represents approximately 13 percent of the Other Valley Landscape Unit. Approximately 75 percent of this area (44,270 acres) is represented by other natural land cover, which is concentrated in the northwest portion of the landscape unit within the Delta. Seasonal wetland is the land cover type with the least coverage within this landscape unit, covering 1,921 acres. Other land cover types in this unit are tidal marsh (4,092 acres), riparian scrub (2,869 acres), nontidal marsh (2,861 acres), and riparian forest (2,662 acres). Riparian forest is concentrated along the northern portion of the waterways in the mid-section of the landscape unit within the Delta.

The target and other sensitive species documented in this landscape unit are delta mudwort, several plants characteristic of sloughs and tidal marshes (e.g., delta tule pea, Mason's lilaeopsis, and Suisun Marsh aster), Sanford's arrowhead, woolly rose-mallow, VELB, giant garter snake, western pond turtle, California black rail, Swainson's hawk, colonies of tricolored blackbirds, and yellow-headed blackbird. Yellow-headed blackbirds in this landscape unit have only been sighted just east of Lathrop.

This landscape unit also provides habitat for several sensitive fish: delta smelt; foraging adult green sturgeon; longfin smelt; migrating, holding, and rearing steelhead and winter- and fall-/late fall–run Chinook salmon; and migrating and rearing spring-run Chinook salmon. The area contains critical habitat for delta smelt, green sturgeon, steelhead, and Chinook salmon.

Developed land uses occupy approximately 13 percent of this landscape unit, primarily in the vicinity of Stockton, Tracy, and Modesto. Major infrastructure crossing through this landscape unit consists of SRs 4, 12, 26, 99, and 120, and I-5 and I-205 (Figure F4-4 of Attachment F4).

There are 677.2 miles of non-SPFC levees along waterways within this landscape unit and no SPFC levees (Table 7-10). In addition, 8.2 miles of revetment along the Middle River is present within this landscape unit.

No fish passage barriers have been documented within this landscape unit (Figure F4-5 of Attachment F4).

7.5 Other Facilities and Waterways

From north to south, the other facilities in the Lower San Joaquin River CPA are levees, channel clearing projects, and/or diversions along Bear Creek, a portion of Calaveras River, Mormon Slough, Littlejohns Creek, Old River, and Paradise Cut.

Approximately 54 percent of the 56,620 acres in the Other Facilities and Waterways portion of the Lower San Joaquin River CPA is in agricultural use, and the majority (approximately 70 percent) of this amount is in cropland and pasture (Table 7-9; Figure F4-3 of Attachment F4). Natural land cover makes up 9 percent of the total area (5,270 acres), with the majority (approximately 74 percent) being natural upland vegetation (3,920 acres). Riparian vegetation covers approximately 15 percent, and seasonal wetland covers approximately 8 percent of the total natural land cover. Less than 5 percent of this portion of the CPA is tidal and nontidal marsh.

Target and other sensitive species documented within Other Facilities and Waterways are several plants characteristic of sloughs and tidal marshes (e.g., delta tule pea, Mason's lilaeopsis, and Suisun Marsh aster), Sanford's arrowhead, woolly rose-mallow, VELB, giant garter snake, western pond turtle, California black rail, Swainson's hawk, colonies of tricolored blackbirds, and riparian brush rabbit. California black rail has been documented only in the White Slough Wildlife Area approximately 1.5 miles south-southwest of the intersection of I-5 and SR 12, and riparian brush rabbit has been documented at Paradise Cut approximately 1.5 miles southwest of Mossdale.

This landscape unit also provides habitat for several sensitive fish: delta smelt; foraging adult green sturgeon; longfin smelt; migrating, holding, and rearing steelhead and winter- and fall-/late fall–run Chinook salmon; and migrating and rearing spring-run Chinook salmon. The area contains critical habitat for delta smelt, green sturgeon, and steelhead.

Developed land use makes up approximately 31 percent of the land cover within Other Facilities and Waterways. Developed lands include the city of Stockton within the Bear Creek and Mormon Slough footprints, and the Stockton Metropolitan Airport within the Littlejohns Creek footprint. Major infrastructure includes pipelines and transmission lines that pass through most of the facility footprints. SR 99 passes through the Bear Creek, Mormon Slough, and Littlejohns Creek footprints (Figure F4-4 of Attachment F4).

The facilities described above have a total of 111.3 miles of SPFC levees and 85.3 miles of non-SPFC levees (Table 7-10). Revetment covers 15 miles of these levees. Levees along Old River, Paradise Cut, Crocker Cut, and a small portion of Bear Creek and Littlejohns Creek are of higher concern. A small portion of levees along Mormon Slough are of medium concern, and the

remaining levees within the Other Facilities and Waterways are of lower concern. Revetment covers 15.0 miles, generally along the levees.

No fish passage barriers have been documented within this landscape unit (Figure F4-5 of Attachment F4).

7.6 Foothill Landscape Units

Tributaries and reservoirs within the Foothill Landscape Unit portion of the Lower San Joaquin River CPA are the Cosumnes River, Camanche Reservoir on the Mokelumne River, New Hogan Reservoir on the Calaveras River, Farmington Flood Control Basin on Littlejohns Creek, New Melones Lake and Tulloch Lake on the Stanislaus River, and New Don Pedro Reservoir on the Tuolumne River.

The Cosumnes River is generally considered to be undammed because it has no major hydroelectric dams. However, hydropower diversions are distributed in upstream reaches. For example, there is a small dam on Camp Creek—a tributary of the north fork of the river—that impounds a relatively small percentage of watershed runoff (TNC 2008).

Because of the low elevation of its headwaters, the Cosumnes River receives most of its water from rainfall. Flooding on the Cosumnes River affects the towns of Thornton and Wilton, as well as adjacent agricultural communities (DWR 2012h).

The Camanche Reservoir on the Mokelumne River is operated in conjunction with Pardee Dam and Reservoir (by the East Bay Municipal Utility District), and Salt Springs and Lower Bear Reservoirs (by the Pacific Gas & Electric Company), all located upstream from Camanche Dam. The Camanche Reservoir is operated for flood management, downstream fishery needs, irrigation, hydroelectric power generation, and recreation. It provides flood protection to the lower Mokelumne River basin—Lodi, Woodbridge, Thornton, and 69,000 acres of agricultural land—by reducing river flows to the downstream objective release of 5,000 cubic feet per second (DWR 2012h).

The major water management facilities on the Calaveras River—New Hogan Dam and Reservoir—are operated for flood management and, if possible, for M&I water supply, irrigation, recreation, and power generation purposes. New Hogan Dam and Reservoir are owned and operated by USACE; the reservoir has a total storage capacity of 317.1 thousand acre feet and a flood management reservation of 165 thousand acre feet (DWR 2012h).

Farmington Flood Control Basin is on Littlejohns Creek, and is owned and operated by USACE to restrict downstream flood flows to nondamaging levels throughout the network of channels along the lower reaches of Littlejohns and Rock Creeks (DWR 2012h).

New Melones Dam regulates flow on the Stanislaus River. New Melones Dam and Lake are operated for flood control, water supply, instream water quality, Delta water quality, irrigation, hydropower, fishery enhancement, and recreation. The U.S. Department of the Interior, Bureau

of Reclamation operates New Melones Dam as part of the Central Valley Project. Downstream from New Melones Dam on the mainstem Stanislaus River, flow is reregulated by Tulloch Dam (DWR 2012h). Tulloch Lake is operated for recreation, water supply, and hydropower.

New Don Pedro Dam, owned and operated jointly by Merced and Turlock Irrigation Districts, regulates flow on the lower portion of the Tuolumne River. New Don Pedro Reservoir stores water for flood management, irrigation, hydroelectric generation, fish and wildlife enhancement, and recreation. The City and County of San Francisco, Modesto Irrigation District, and Turlock Irrigation District receive water supply from this reservoir (DWR 2012h).

No outlying communities are present within the Lower San Joaquin River CPA.

Approximately 64 percent of the land cover within the Foothill Landscape Unit of the Lower San Joaquin CPA was not mapped for the CVFPP (Table 7-11). The remaining majority, 34 percent, is mapped as open water. Approximately 2 percent of the area is in natural land cover with half of that (669 acres) in riparian forest. Less than 1 percent of the area is in agricultural land cover.

The target and other sensitive species documented in the Foothill Landscape Units are VELB, western pond turtle, Swainson's hawk, colonies of tricolored blackbirds, and yellow warbler. Yellow warbler has been sighted only along the Mokelumne River approximately 1.5 miles northeast of Lockeford.

This landscape unit also provides habitat for sensitive fish: Sacramento splittail and migrating, holding, and rearing steelhead and winter- and fall-/late fall–run Chinook salmon. The area contains critical habitat for steelhead.

The facilities described above have less than 1 mile of associated non-SPFC levees and no SPFC levees. There is no revetment along the levees within the Foothill Landscape Unit (Table 7-12).

7.7 Tables of Results

Table 7-1. Acreages of Connected and Disconnected Floodplain Inundation Potential Zones along Major River Reaches of, and Major Tributaries to, the Lower San Joaquin River Conservation Planning Area[a]

FIP Zone	Merced River to Tuolumne River	Tuolumne River to Stanislaus River	Stanislaus River to Stockton	Merced River	Tuolumne River	Stanislaus River	Total Acres
Connected							
Baseflow FIP	822	337	1,598	186	321	159	3,423
67 Percent Sustained Spring FIP	934	202	420	113	145	38	1,852
50 Percent FIP	6,898	2,307	1,327	741	674	123	12,070
10 Percent FIP	3,463	775	1,075	3,883	578	741	10,516
Less than 10 Percent FIP	924	456	290	16	64	434	2,184
Subtotal	*13,042*	*4,076*	*4,710*	*4,939*	*1,782*	*1,496*	*30,044*
Disconnected							
Baseflow FIP	<1	3	4,786	0	3	2	4,794
67 Percent Sustained Spring FIP	202	93	4,730	0	24	5	5,054
50 Percent FIP	5,627	1,947	12,754	0	571	248	21,147
10 Percent FIP	3,444	908	5,485	0	568	2,929	13,334
Less than 10 Percent FIP	10,454	1,085	1,864	7,368	9,790	3,107	33,668
Subtotal	*19,728*	*4,035*	*29,620*	*7,368*	*10,956*	*6,291*	*77,997*
Total	**32,770**	**8,111**	**34,330**	**12,307**	**12,738**	**7,787**	**108,042**

Source: DWR 2012b

Key:

FIP = floodplain inundation potential

Note:

[a] Values may not sum exactly because of rounding.

Table 7-2. Meander Zone Width, Area, and Constraints along Major River Reaches of, and Major Tributaries to, the Lower San Joaquin River Conservation Planning Area[a]

Meander Zone Attribute	Merced River to Tuolumne River	Tuolumne River to Stanislaus River	Stanislaus River to Stockton	Merced River	Tuolumne River	Stanislaus River	Total
Width (feet)	4,006	3,317	3,536	1,258	2,172	1,171	NA
Meander Zone Area (acres)							
Unconstrained	7,360	2,365	2,366	2,009	3,121	1,030	18,251
Constrained by Resistant Geology Only	416	53	230	645	990	16	2,351
Constrained by Revetment/Levees Only	5,704	861	10,257	0	765	175	17763
Constrained by Both	976	337	585	0	250	195	2,343
Total	**14,456**	**3,616**	**13,439**	**2,654**	**5,126**	**1,416**	**40,707**

Sources: AECOM 2013, CGS 2013, DWR 2011a, and DWR 2013a

Note:

[a] Values may not sum exactly because of rounding and because of overlap between geology constraints and levee/revetment constraints.

Table 7-3. Acreage of Land Cover Types in the Floodway Corridor along Major River Reaches of, and Major Tributaries to, the Lower San Joaquin River Conservation Planning Area[a,b]

Land Cover Type	Merced River to Tuolumne River	Tuolumne River to Stanislaus River	Stanislaus River to Stockton	Merced River	Tuolumne River	Stanislaus River	Total Acres
Agricultural							
Rice	0	0	0	0	0	0	0
Cropland and Pasture	18,310	3,670	19,690	7,420	3,450	4,030	56,570
Orchard and Vineyard	1,970	20	870	2,430	3,540	1,350	10,170
Other Agricultural	2,560	180	30	1,120	1,050	190	5,130
Subtotal	*22,840*	*3,870*	*20,590*	*10,970*	*8,040*	*5,570*	*71,870*
Natural							
Marsh – Tidal	0	0	28	0	0	0	28
Marsh – Nontidal	248	302	28	7	11	99	695
Riparian – Forest	3,026	1,369	1,229	610	938	897	8,069
Riparian – Scrub	379	347	293	25	141	56	1,240
Seasonal Wetland	561	323	20	19	18	39	978
Other Natural	3,600	1,450	4,480	320	550	460	10,860
Subtotal	*7,810*	*3,790*	*6,080*	*980*	*1,660*	*1,550*	*21,850*
Other							
Water	1,700	410	2,920	170	360	250	5,800
Developed	400	30	4,680	180	2,660	70	8,010
Not Mapped	0	20	60	0	10	350	440
Total	**32,750**	**8,120**	**34,330**	**12,300**	**12,730**	**7,790**	**107,990**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

Table 7-4. Miles of Shaded Riverine Aquatic Attributes along Major River Reaches of and Major Tributaries to, the Lower San Joaquin River Conservation Planning Area[a,b,c]

Bank and Vegetation Type	Merced River to Tuolumne River	Tuolumne River to Stanislaus River	Stanislaus River to Stockton	Merced River	Tuolumne River	Stanislaus River	Total Miles
Natural Bank (Miles)							
With Riparian Vegetation	25.7	6.3	18.3	31.6	40.4	23.3	145.5
Without Riparian Vegetation	38.2	16.2	18.3	5.8	4.2	0.3	83.1
Subtotal	63.9	22.5	36.6	37.4	44.5	23.6	228.6
Revetted Bank (Miles)							
With Riparian Vegetation	5.9	0.9	8.9	0.0	0.2	0.8	16.6
Without Riparian Vegetation	7.4	1.3	29.2	0.0	0.1	0.1	38.0
Subtotal	*13.3*	*2.1*	*38*	*0.0*	*0.3*	*0.8*	*54.6*
Total	**77.2**	**24.6**	**74.6**	**37.4**	**44.8**	**24.5**	**283.2**

Sources: DWR 2012c, USACE 2007, and USFWS 1992

Notes:

[a] Values may not sum exactly because of rounding.

[b] Acreages of shaded riverine aquatic (SRA) cover with all three habitat components (natural banks, eroding substrates, and riparian vegetation) are not represented as the data are unavailable for the San Joaquin.

[c] Data derived from locations of riparian vegetation along the river bank and distribution of revetment.

Table 7-5. Indicators of Riparian Continuity along Major River Reaches of, and Major Tributaries to, the Lower San Joaquin River Conservation Planning Area[a]

Attribute	Merced River to Tuolumne River	Tuolumne River to Stanislaus River	Stanislaus River to Stockton	Merced River	Tuolumne River	Stanislaus River	Total
Area of 100- to 330-Foot-Wide Corridor (acres)	3,110	900	3,920	1,450	1,740	870	11,990
Percent of 100- to 330-Foot-Wide Corridor in Riparian Vegetation	36	41	24	32	40	69	35
Median Patch Size (Acres)	3.5	3.7	4.7	2.5	2.9	0.1	2.9

Source: DWR 2011b

Note:

[a] Values may not sum exactly because of rounding.

Table 7-6. Acreage of Land Cover Types of Floodplain in Potential Meander Zone along Major River Reaches of, and Major Tributaries to, the Lower San Joaquin River Conservation Planning Area[a,b]

Land Cover Type	Merced River to Tuolumne River	Tuolumne River to Stanislaus River	Stanislaus River to Stockton	Merced River	Tuolumne River	Stanislaus River	Total Acres
Agricultural							
Rice	0	0	0	0	0	0	0
Cropland and Pasture	2,950	340	480	440	180	150	4,530
Orchard/Vineyard	20	0	0	320	160	40	540
Other Agricultural	630	30	0	230	40	20	950
Subtotal	*3,600*	*370*	*480*	*990*	*380*	*200*	*6,020*
Natural							
Marsh – Tidal	0	0	4	0	0	0	4
Marsh – Nontidal	68	99	3	3	1	0	174
Riparian – Forest	2,124	781	871	456	457	611	5,300
Riparian – Scrub	339	186	183	24	119	54	905
Seasonal Wetland	286	71	8	6	13	0	384
Other Natural	2,630	830	890	230	160	50	4,790
Subtotal	*5,450*	*1,970*	*1,960*	*720*	*750*	*720*	*11,560*
Other							
Water	780	310	1,600	160	320	150	3,310
Developed	100	0	60	30	90	0	280
Not Mapped	0	0	0	0	0	0	0
Total	**9,930**	**2,640**	**4,100**	**1,900**	**1,540**	**1,070**	**21,170**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

Table 7-7. Levee and Revetment Length (Miles) along Major River Reaches of, and Major Tributaries to, the Lower San Joaquin River Conservation Planning Area[a]

Facility Type	Merced River to Tuolumne River	Tuolumne River to Stanislaus River	Stanislaus River to Stockton	Merced River	Tuolumne River	Stanislaus River	Total Miles
Levees							
SPFC	29.0	14.0	69.6	0.0	0.0	10.7	123.4
Non-SPFC	17.1	11.0	26.6	3.8	10.9	7.1	76.6
Total	**46.2**	**25.1**	**96.2**	**3.8**	**10.9**	**17.9**	**200.0**
Revetment							
Revetment	17.7	3.9	54.8	0.0	1.2	1.8	79.4

Sources: DWR 2012c, DWR 2012e, and USACE 2007

Key:

SPFC = State Plan of Flood Control

Note:

[a] Values may not sum exactly because of rounding.

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Table 7-8. Abundance[a] of Targeted Weed Species[b] within Major River Reaches, Tributaries, and Bypasses along the Lower San Joaquin Conservation Planning Area

Reach		Merced River to Tuolumne River						Tuolumne River to Stanislaus River			Stanislaus River to Stockton				Merced River					Tuolumne River								Stanislaus River	
USGS Quad Name		Brush Lake	Crows Landing	Gustine	Hatch	Newman	Westley	Ripon	Vernalis	Westley	Lathrop	Ripon	Stockton West	Vernalis	Cressey	Gustine	Hatch	Stevinson	Turlock	Brush Lake	Ceres	Denair	Ripon	Riverbank	Salida	Waterford	Westley	Ripon	Salida
Percentage of Reach[c]		19	35	8	15	1	24	67	5	29	39	6	27	29	5	32	6	21	36	44	25	1	1	15	2	2	10	99	1
Species																													
Common Name	Scientific Name																												
Barbed goat grass	*Aegilops triuncialis*																												
Tree of heaven	*Ailanthus altissima*	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Alligator weed	*Alternanthera philoxeroides*																												
Giant reed[d]	*Arundo donax*	L		L			L	L		L	L	L	L		L	L		L	L	L			L	L	L		L	L	L
Yellow star-thistle	*Centaurea solstitialis*	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Pampas grass	*Cortaderia selloana*	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Scotch broom	*Cytisus scoparius*																												
Stinkwort	*Dittrichia graveolens*					L	L	L	L	L		L		L									L				L	L	
Brazilian waterweed	*Egeria densa*												H																
Medusa head	*Elymus caput-medusae*							M				M											M	M	M	M		M	M
Blue gum	*Eucalyptus globulus*																												
Edible fig	*Ficus carica*						L	L		L		L			L			L			L		L	L	L		L	L	L
Fennel	*Foeniculum vulgare*																												
French broom	*Genista monspessulana*																												
Shortpod mustard	*Hirschfeldia incana*					L	L	L		L		L											L				L	L	
Hydrilla	*Hydrilla verticillata*																												
Perennial pepperweed	*Lepidium latifolium*	M	M	M			M	L		M		L	L		M	M		M		M			L		L		M	L	L
American frogbit	*Limnobium spongia*																												

Table 7-8. Abundance[a] of Targeted Weed Species[b] within Major River Reaches, Tributaries, and Bypasses along the Lower San Joaquin Conservation Planning Area

Reach		Merced River to Tuolumne River						Tuolumne River to Stanislaus River			Stanislaus River to Stockton				Merced River					Tuolumne River								Stanislaus River	
USGS Quad Name		Brush Lake	Crows Landing	Gustine	Hatch	Newman	Westley	Ripon	Vernalis	Westley	Lathrop	Ripon	Stockton West	Vernalis	Cressey	Gustine	Hatch	Stevinson	Turlock	Brush Lake	Ceres	Denair	Ripon	Riverbank	Salida	Waterford	Westley	Ripon	Salida
Percentage of Reach[c]		19	35	8	15	1	24	67	5	29	39	6	27	29	5	32	6	21	36	44	25	1	1	15	2	2	10	99	1
Species																													
Common Name	Scientific Name																												
Water primrose	*Ludwigia* sp.			L				L			L	L	L			L							L					L	
Purple loosestrife	*Lythrum salicaria*						L			L			L						L							L	L		
Parrot's feather	*Myriophyllum aquaticum*			L							L		L			L													
Tree tobacco	*Nicotiana glauca*	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Scotch thistle	*Onopordum acanthium* ssp. *acanthium*																												
Crisp-leaved pondweed	*Potamogeton crispus*							L				L											L					L	
Himalayan blackberry[d]	*Rubus armeniacus*						H	H		H		H			H			H					H	H	H	H	H	H	H
Ravenna grass	*Saccharum ravennae*																												
Russian thistle	*Salsola tragus*	H	H	H	H	H	H	H	H		H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H		H	H
Red sesbania[d]	*Sesbania punicea*	L						L				L								L			L					L	
Milk thistle	*Silybum marianum*																												
Saltcedar[d]	*Tamarix* sp.	L		L		L	L	L		L		L			L	L		L		L			L				L	L	
Chinese tallowtree	*Triadica sebifera*																												

Source: Cal-IPC 2013

Key:

USGS = United States Geological Survey

Notes:

[a] Abundance rated by Cal-IPC as either H = High; M = Medium; L = Low; blank cells show no occurrences.

[b] Of the 31 target weed species, no data are available for American frogbit or milk thistle.

[c] Values may not sum to 100 because of rounding.

[d] Indicates initial priority species.

Table 7-9. Acreage of Land Cover Types of Valley Landscape Units in the Lower San Joaquin River Conservation Planning Area[a,b]

Land Cover	Landscape Unit Type				Total Acres
	Major River Reach	Basin-Bypass	Other Facility-Waterway	Other Valley SPA	
Agricultural					
Rice	0	0	210	2,630	2,840
Cropland and Pasture	56,570	0	21,600	251,010	329,170
Orchard and Vineyard	10,170	0	6,760	33,320	50,260
Other Agricultural	5,130	0	1,810	4,610	11,550
Subtotal	*71,870*	*0*	*30,380*	*291,570*	*393,820*
Natural					
Marsh – Tidal	28	0	143	4,092	4,263
Marsh – Nontidal	695	0	30	2,861	3,586
Riparian – Forest	8,069	0	447	2,662	11,177
Riparian – Scrub	1,240	0	321	2,869	4,430
Seasonal Wetland	978	0	412	1,921	3,312
Other Natural	10,860	0	3,920	44,270	59,045
Subtotal	*21,870*	*0*	*5,273*	*58,675*	*85,810*
Other					
Water	5,800	0	2,110	35,470	43,380
Developed	8,010	0	17,600	60,030	85,630
Not Mapped	440	0	1,260	11,720	13,410
Total	**107,990**	**0**	**56,610**	**457,465**	**622,060**

Source: DWR 2011b

Key:

SPA = Systemwide Planning Area

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

Table 7-10. Levee and Revetment Length (Miles) in Valley Landscape Units of the Lower San Joaquin River Conservation Planning Area[a]

Facility Type	Landscape Unit Type				Total Miles
	Major River Reach	Basin-Bypass	Other Facility-Waterway	Other Valley SPA	
Levees					
SPFC	123.4	0.0	111.3	0.0	234.8
Non- SPFC	76.6	0.0	85.3	677.2	839.0
Total	**200.0**	**0.0**	**196.6**	**677.2**	**1,073.7**
Revetment					
Revetment	79.4	0.0	15.0	8.2	102.6

Sources: DWR 2012c, DWR 2012e, and USACE 2007
Key:
SPA = Systemwide Planning Area
SPFC = State Plan of Flood Control
Note:
[a] Values may not sum exactly because of rounding.

Table 7-11. Acreage of Land Cover Types of Foothill Landscape Units in the Lower San Joaquin River Conservation Planning Area[a,b]

Land Cover	Landscape Unit Type			Total Acres
	Foothill Tributaries	Lake-Reservoir	Outlying Community	
Agricultural				
Rice	0	0	0	0
Cropland and Pasture	30	0	0	30
Orchard and Vineyard	10	0	0	10
Other Agricultural	20	0	0	20
Subtotal	*60*	*0*	*0*	*60*
Natural				
Marsh – Tidal	0	0	0	0
Marsh – Nontidal	<1	0	0	<1
Riparian – Forest	669	0	0	669
Riparian – Scrub	106	0	0	106
Seasonal Wetland	72	0	0	72
Other Natural	210	200	0	410
Subtotal	*1,060*	*200*	*0*	*1,250*
Other				
Water	1,470	16,250	0	17,720
Developed	10	0	0	10
Not Mapped	480	33,010	0	33,490
Total	**3,060**	**49,460**	**0**	**52,520**

Source: DWR 2011b

Notes:

[a] Values may not sum exactly because of rounding.

[b] Values are provided based on the Minimum Mapping Unit (MMU) available. MMU for agricultural lands, other natural lands, and other lands = 10 acres, MMU for wetlands and riparian habitats = 1 acre.

Table 7-12. Levee and Revetment Length (Miles) in Foothill Landscape Units of the Lower San Joaquin River Conservation Planning Area[a]

Facility Type	Landscape Unit Type			Total Miles
	Foothill Tributaries	Lake-Reservoir	Outlying Community	
Levees				
SPFC	0.0	0.0	0.0	0.0
Non-SPFC	0.8	0.0	0.0	0.8
Total	**0.8**	**0.0**	**0.0**	**0.8**
Revetment				
Revetment	0.0	0.0	0.0	0.0

Sources: DWR 2012c, DWR 2012e, and USACE 2007
Key:
SPFC = State Plan of Flood Control
Note:
[a] Values may not sum exactly because of rounding.

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9.0 Acronyms and Other Abbreviations

AFRP	Anadromous Fish Restoration Program
Cal-IPC	California Invasive Plant Council
CDFW	California Department of Fish and Wildlife
CNDDB	California Natural Diversity Database
Conservation Strategy	Central Valley Flood Protection Plan Conservation Strategy
CPA	Conservation Planning Area
CVFPP	Central Valley Flood Protection Plan
CVRMP	Central Valley Riparian Mapping Project
Delta	Sacramento–San Joaquin Delta
DPS	distinct population segment
DWR	California Department of Water Resources
ESU	evolutionarily significant unit
FIP	floodplain inundation potential
FROA	Floodplain Restoration Opportunity Analysis
GIS	geographic information systems
I	Interstate
LWM	large woody material
MMU	minimum mapping unit
NAIP	National Agricultural Imagery Program
RFMP	Regional Flood Management Planning
RM	River Mile
SPA	Systemwide Planning Area
SPFC	State Plan of Flood Control
SR	State Route
SRA	shaded riverine aquatic
State Parks	California Department of Parks and Recreation
UP	Union Pacific
USACE	U.S. Army Corps of Engineers

USACE-HEC	U.S. Army Corps of Engineers Hydrologic Engineering Center
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VELB	valley elderberry longhorn beetle
VMZ	vegetation management zone

F1. Maps for the Upper Sacramento and Feather River Conservation Planning Areas

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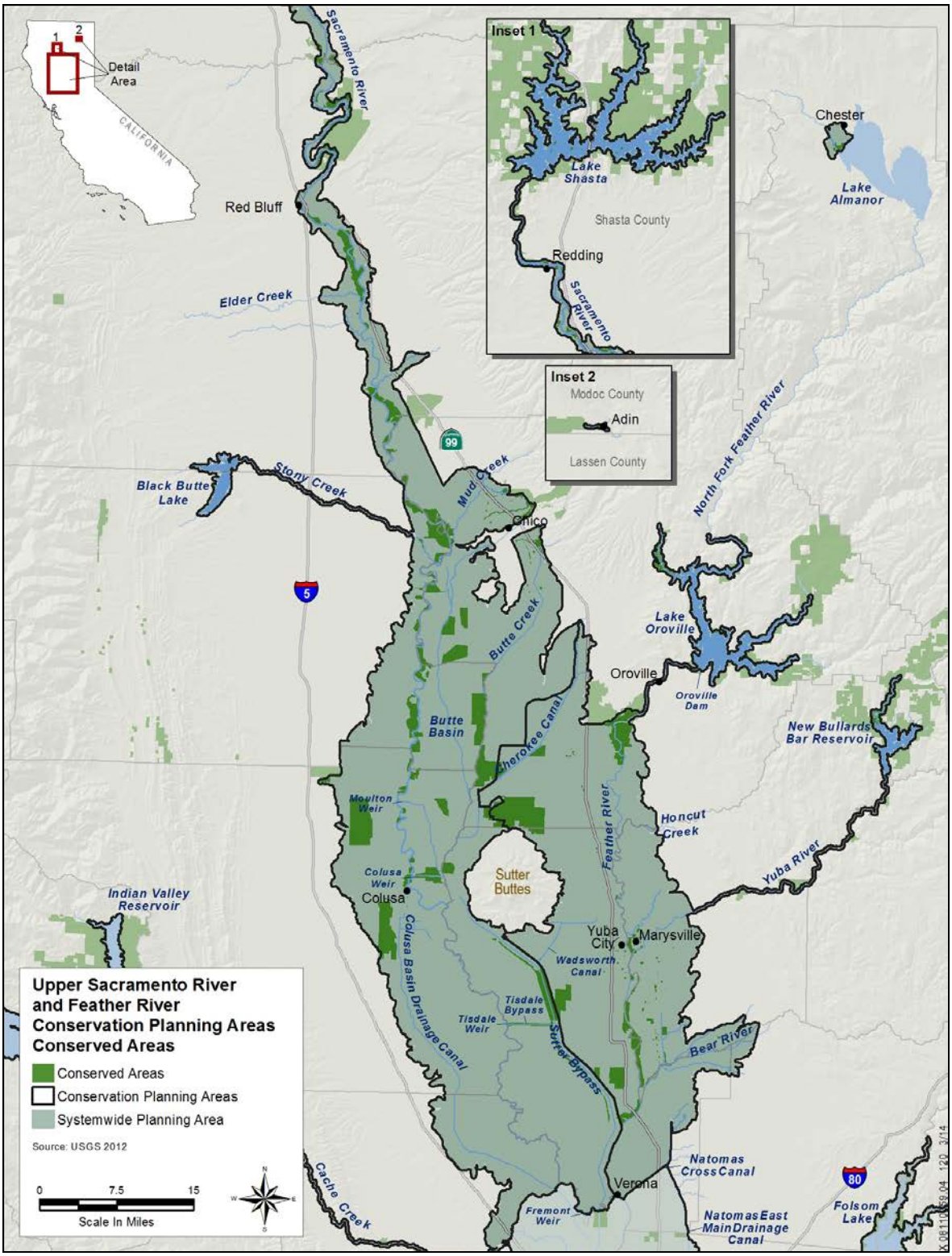

Figure F1-1. Upper Sacramento River and Feather River Conservation Planning Areas Conserved Areas

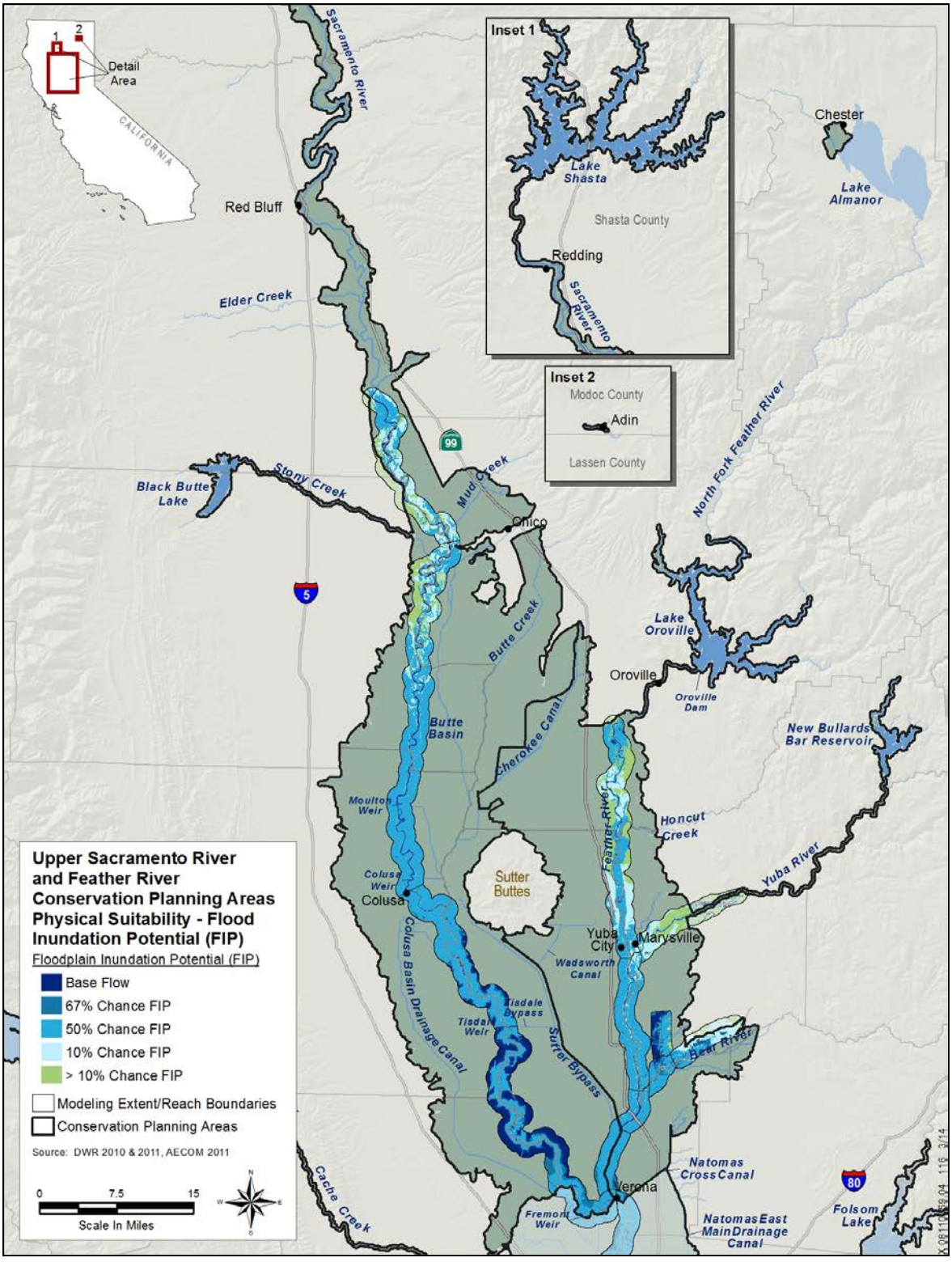

Figure F1-2. Upper Sacramento River and Feather River Conservation Planning Areas Physical Suitability - Floodplain Inundation Potential (FIP)

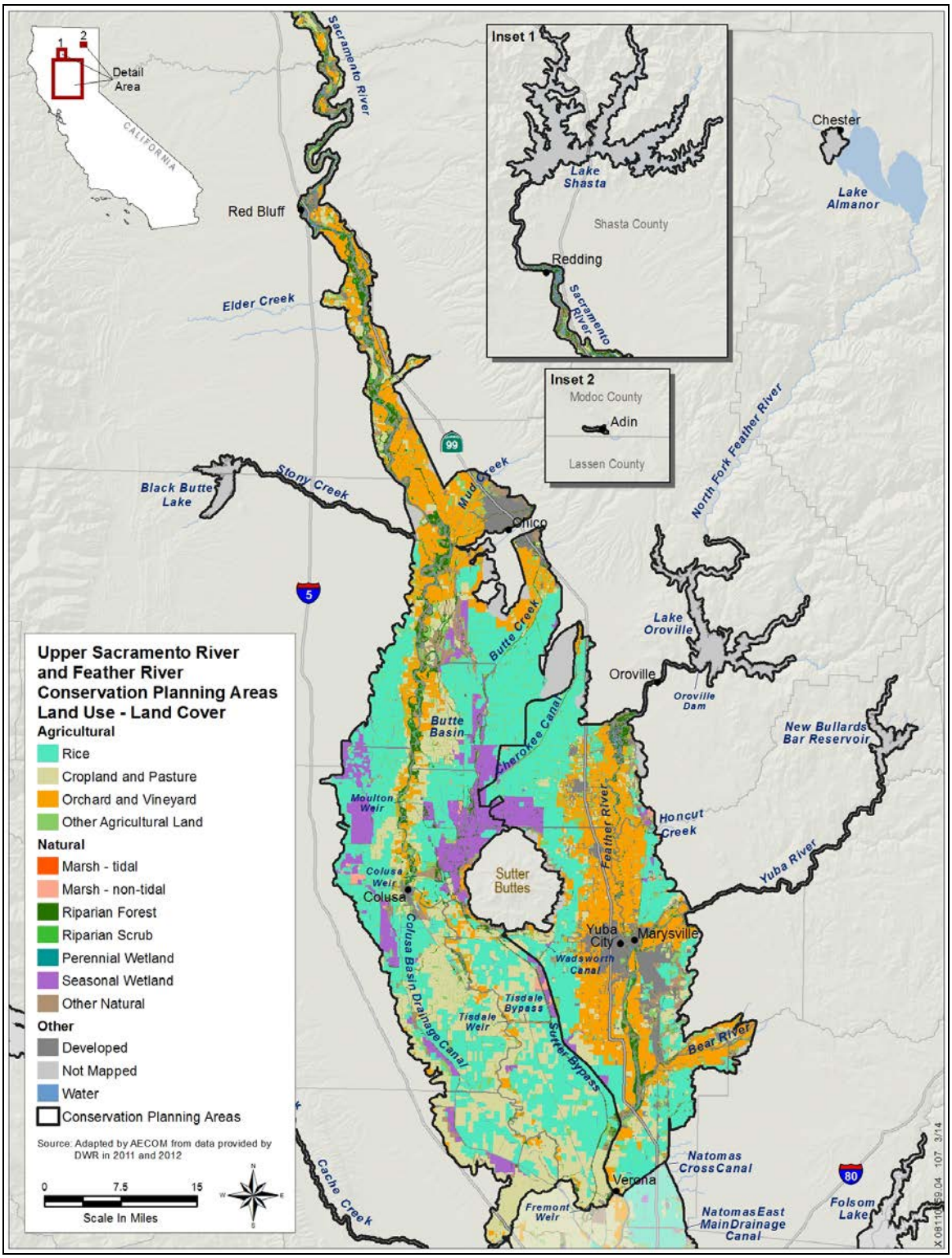

Figure F1-3. Upper Sacramento River and Feather River Conservation Planning Areas Land Use - Land Cover

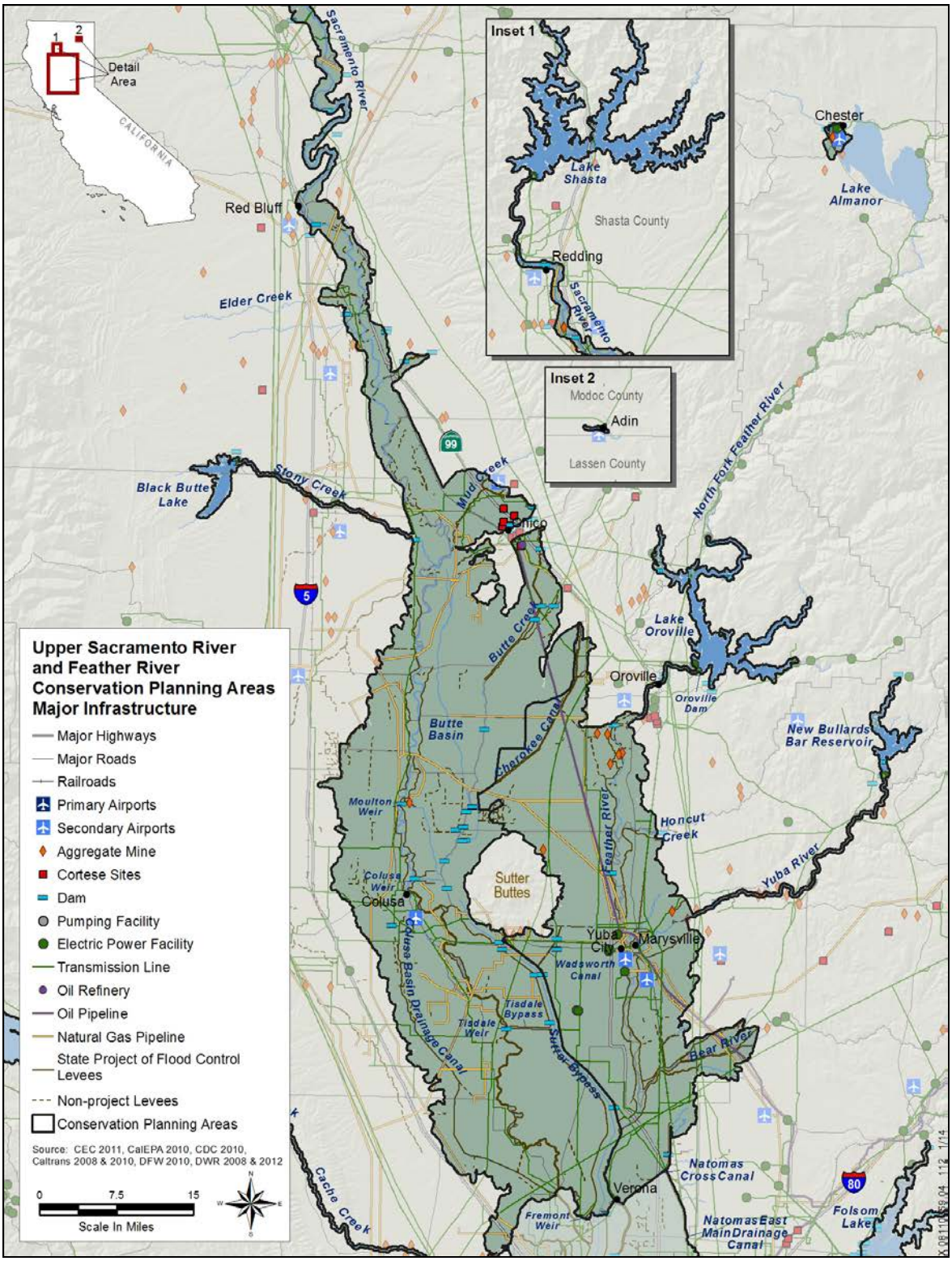

Figure F1-4. Upper Sacramento River and Feather River Conservation Planning Areas Major Infrastructure

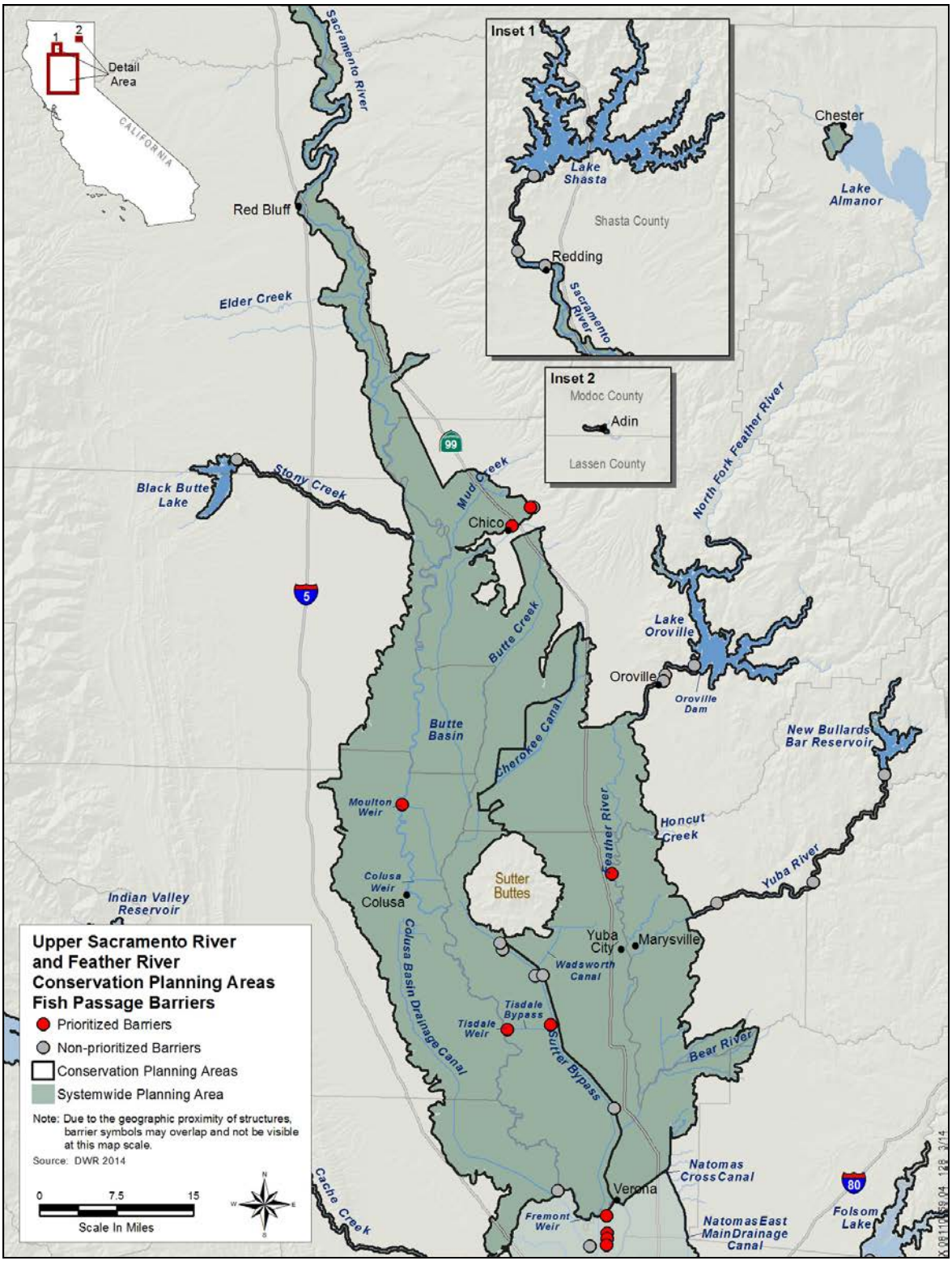

Figure F1-5. Upper Sacramento River and Feather River Conservation Planning Areas Fish Passage Barriers

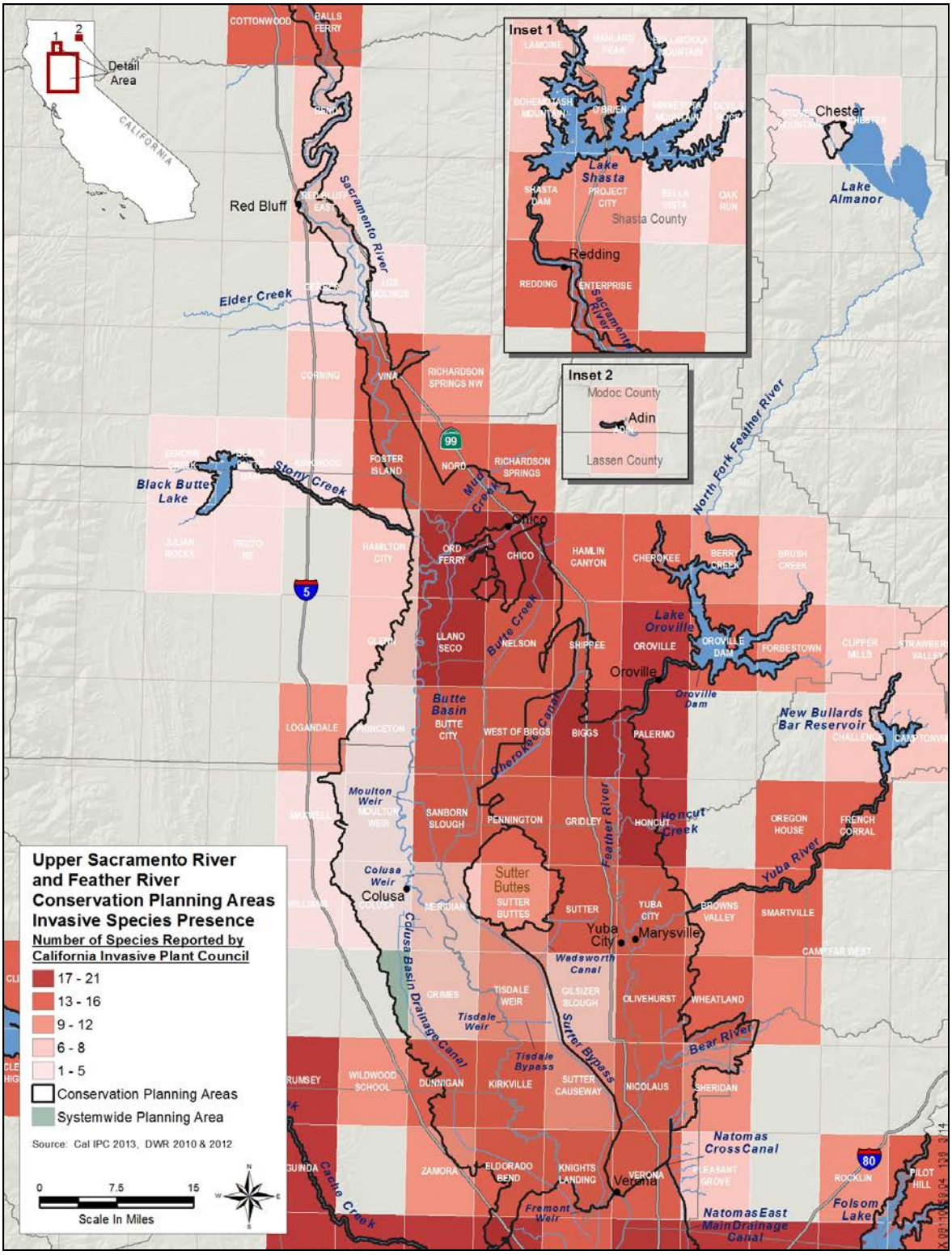

Figure F1-6. Upper Sacramento and Feather River Conservation Planning Areas - Invasive Species Presence

F2. Maps for the Lower Sacramento River Conservation Planning Area

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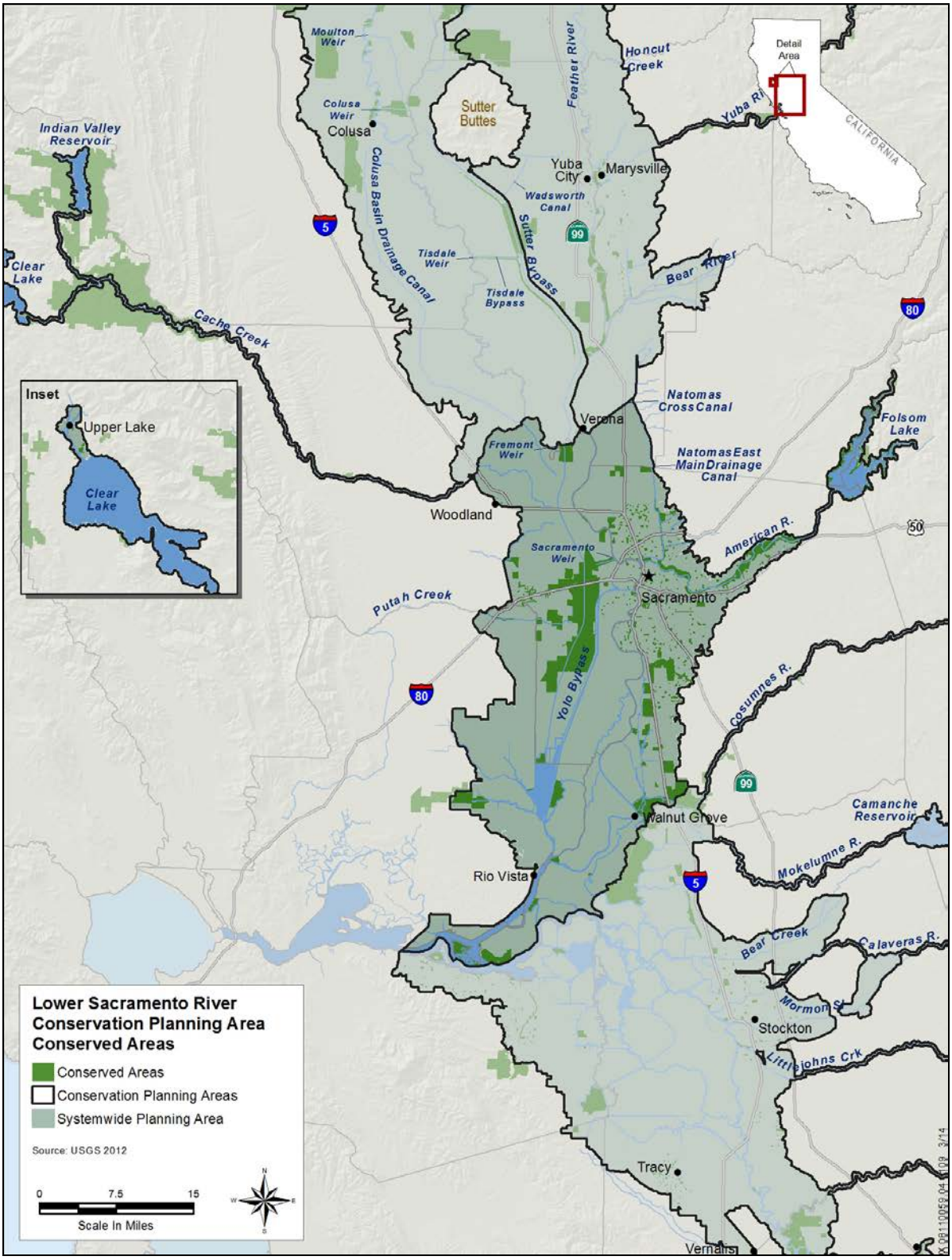

Figure F2-1. Lower Sacramento River Conservation Planning Area – Conserved Areas

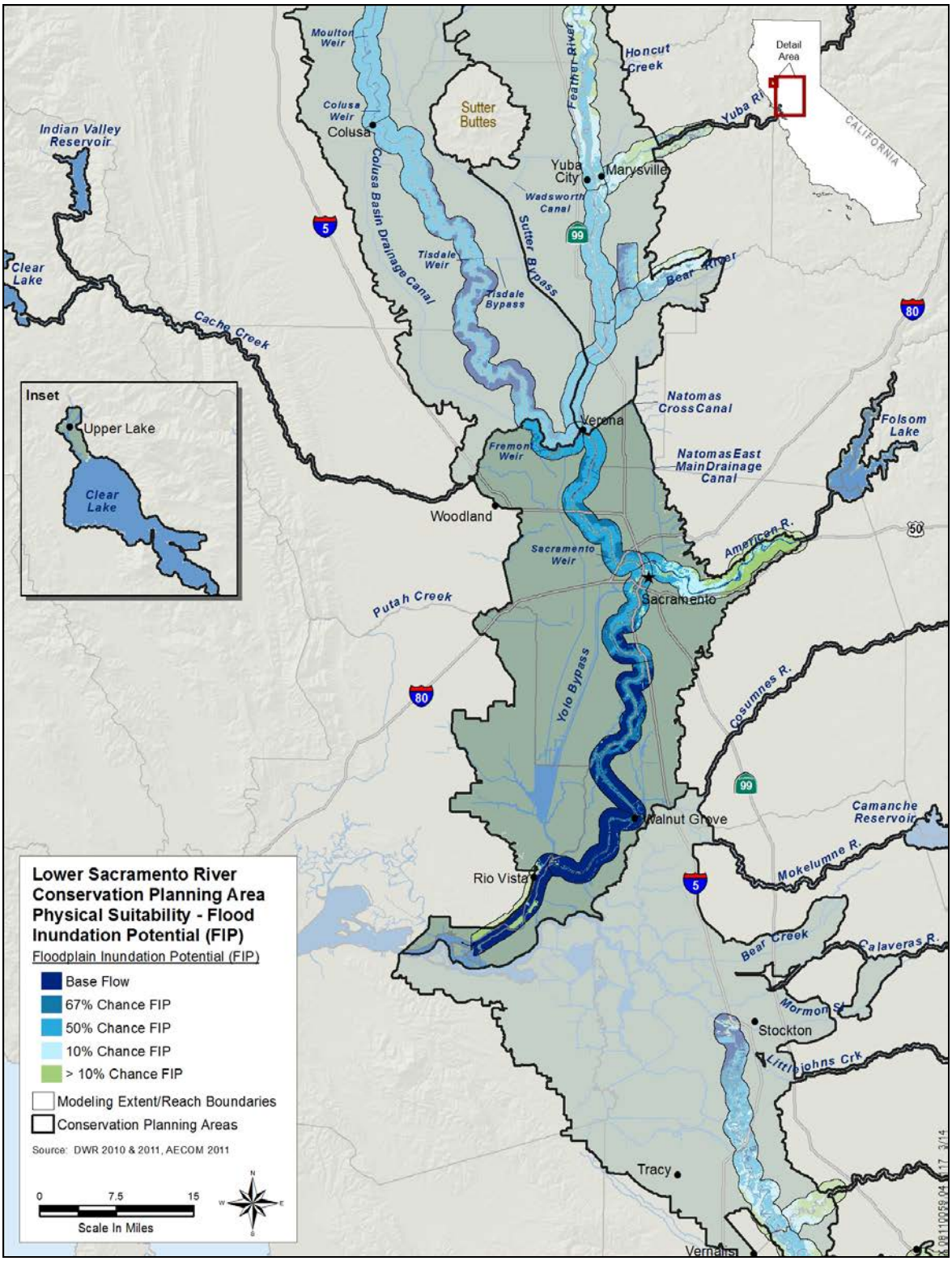

Figure F2-2. Lower Sacramento River Conservation Planning Area Physical Suitability - Floodplain Inundation Potential (FIP)

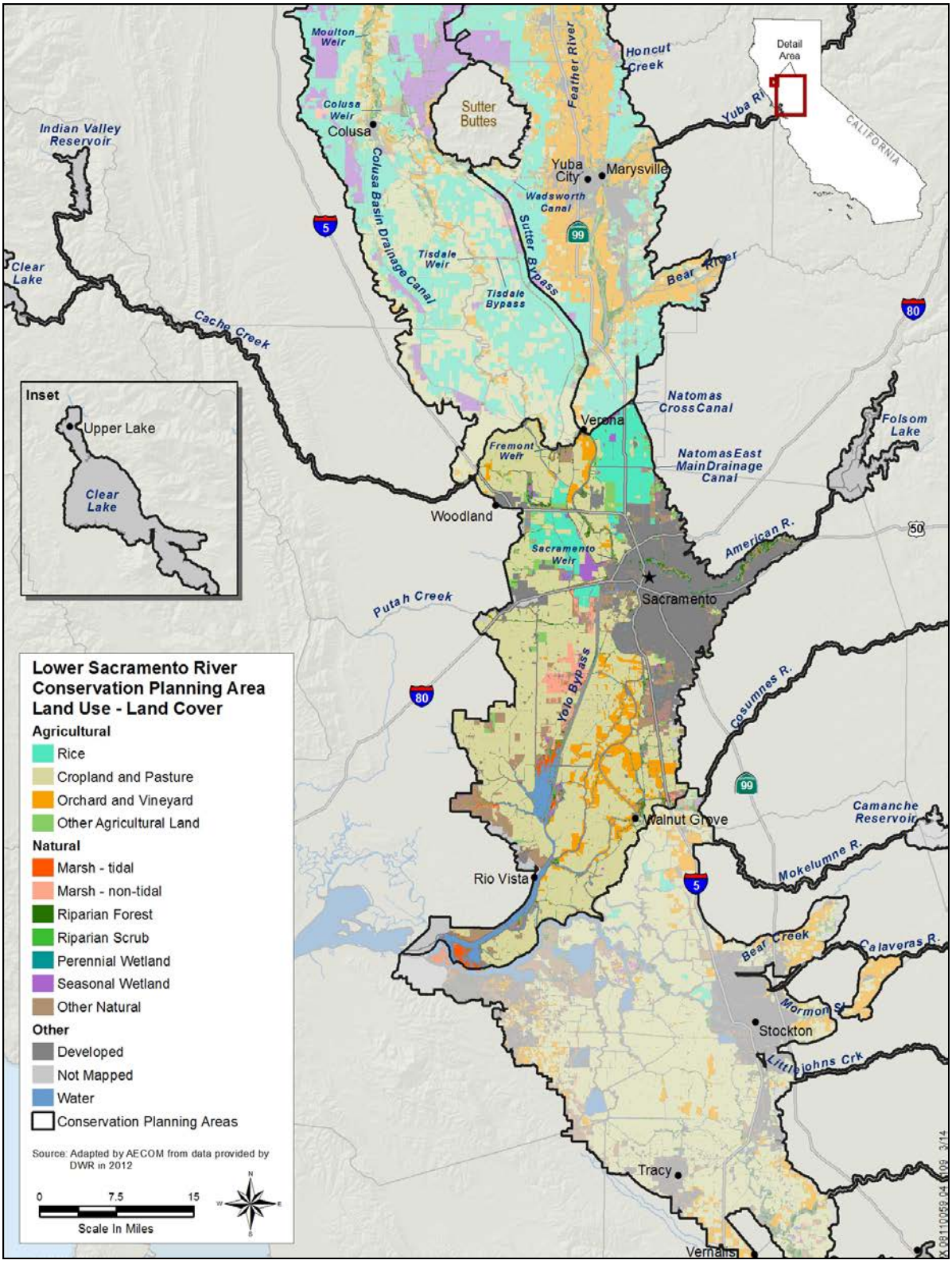

Figure F2-3. Lower Sacramento River Conservation Planning Area Land Use - Land Cover

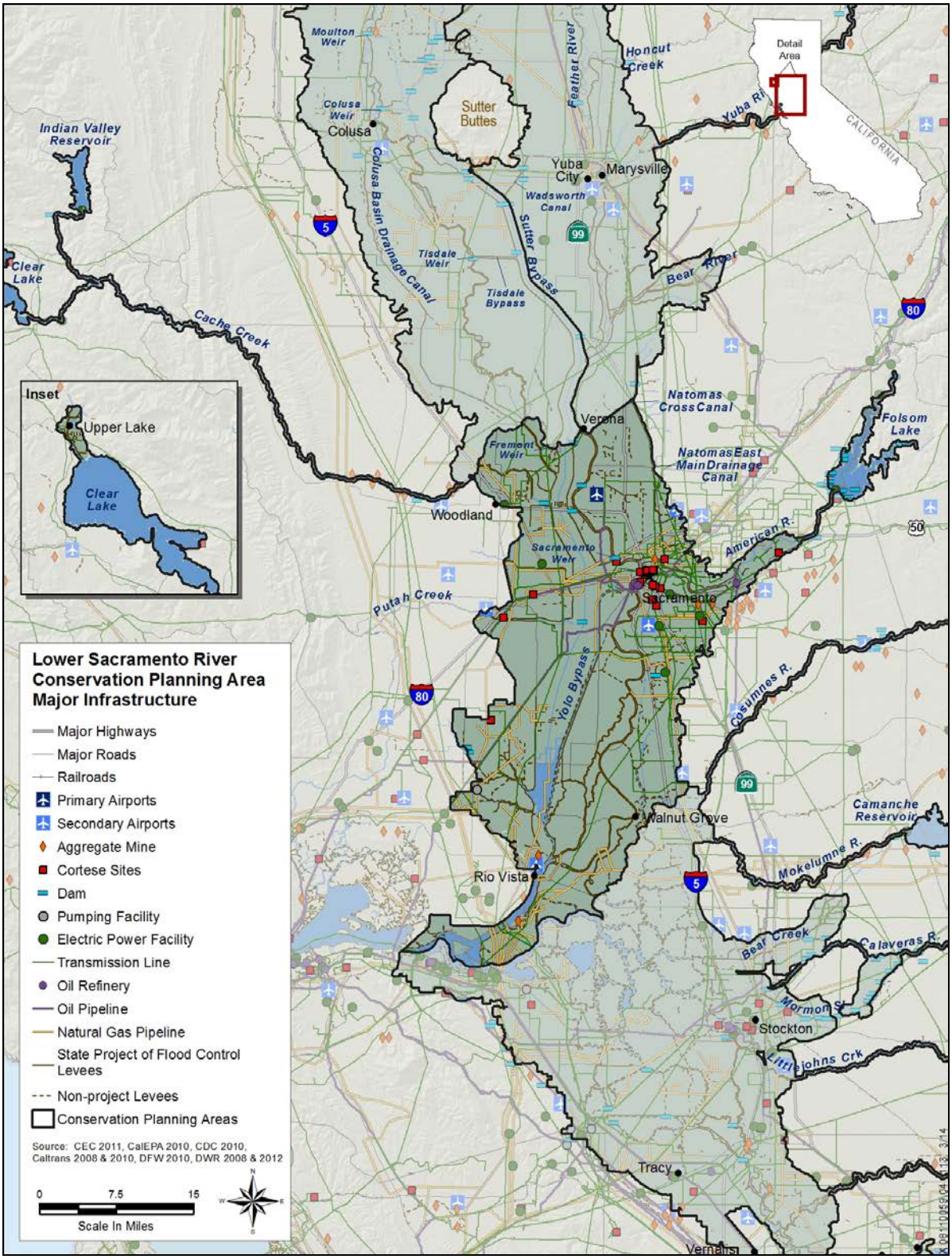

Figure F2-4. Lower Sacramento River Conservation Planning Area Major Infrastructure

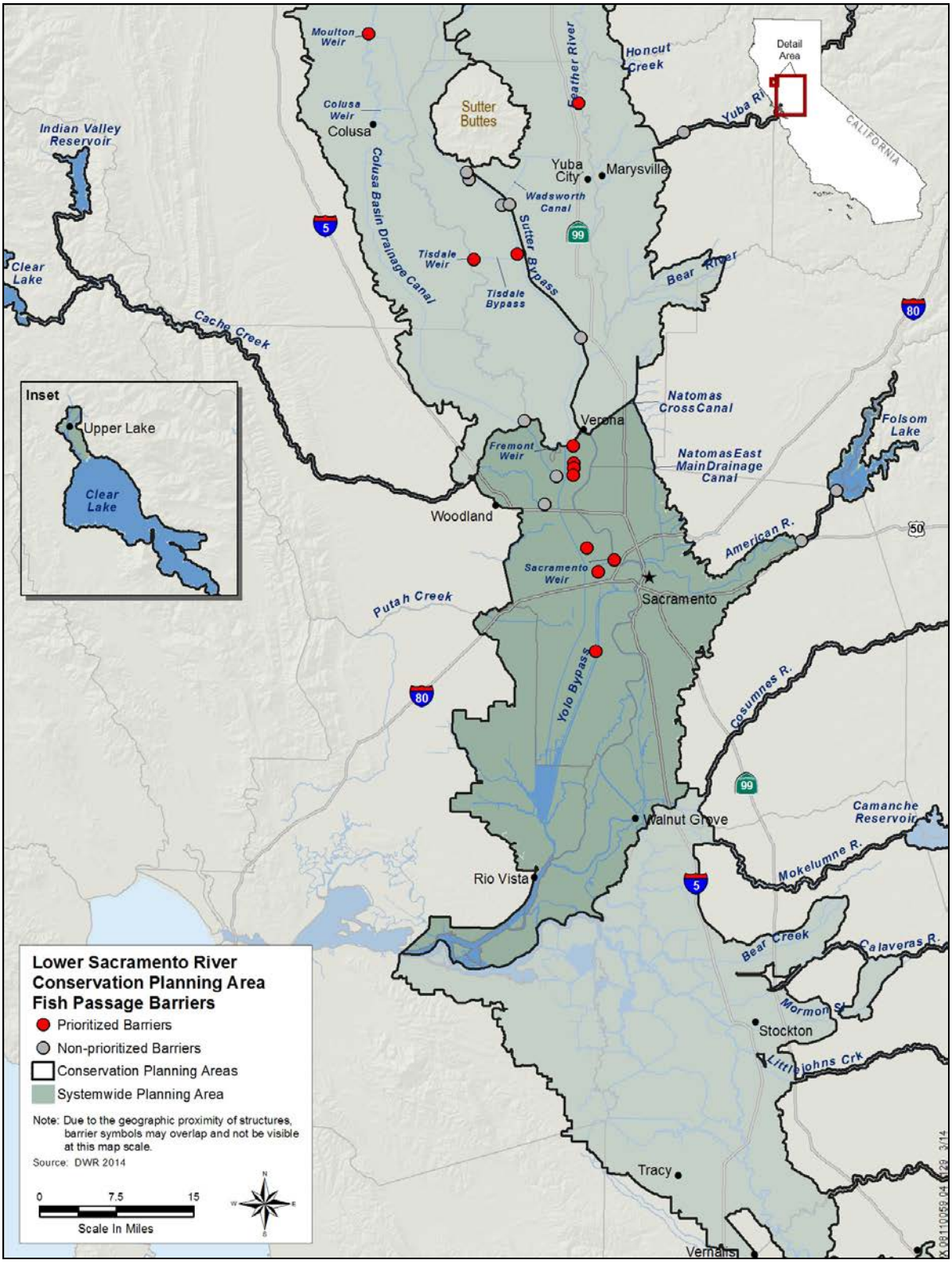

Figure F2-5. Lower Sacramento River Conservation Planning Area Fish Passage Barriers

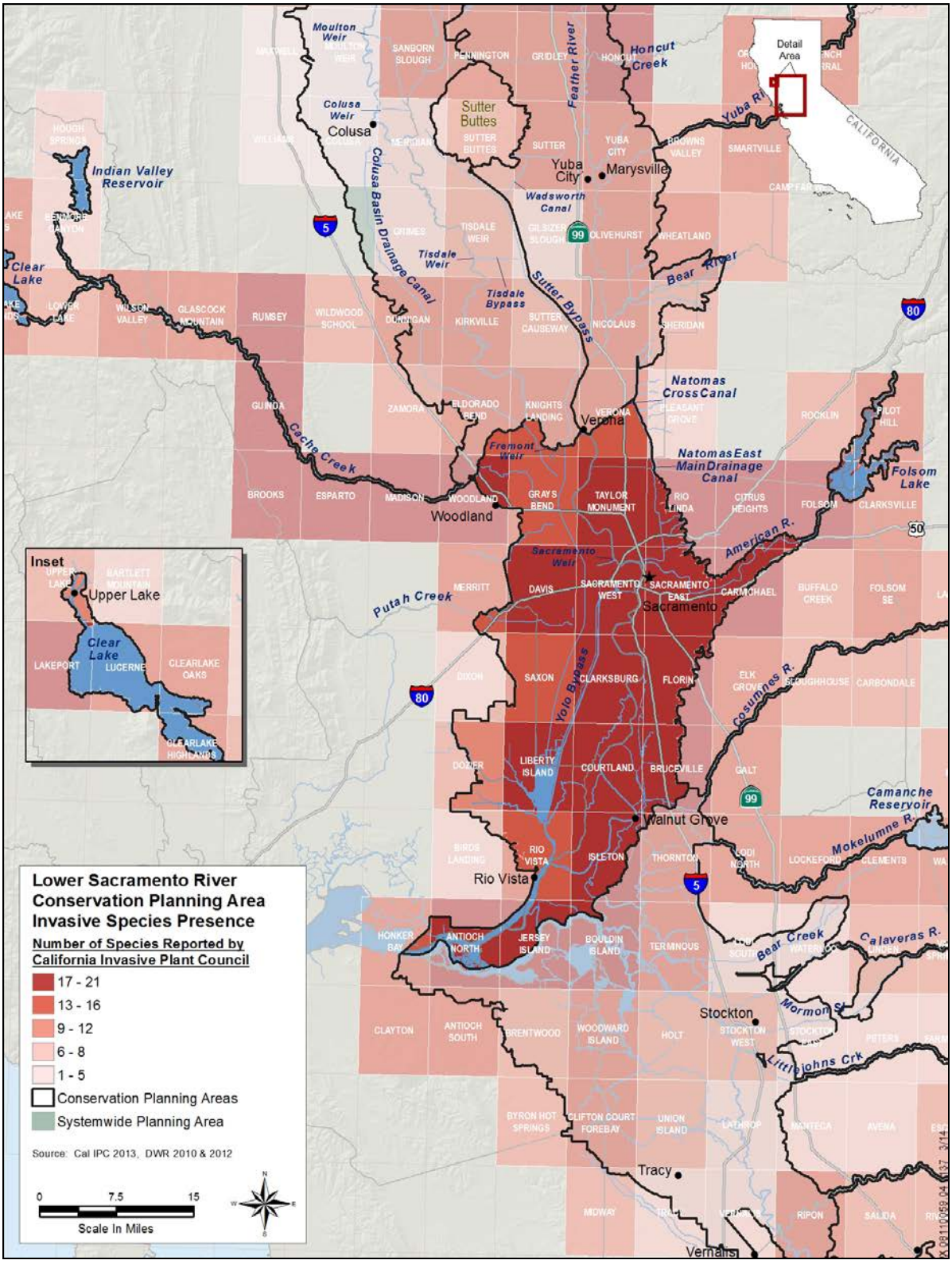

Figure F2-6. Lower Sacramento Conservation Planning Area - Invasive Species Presence

F3. Maps for the Upper San Joaquin River Conservation Planning Area

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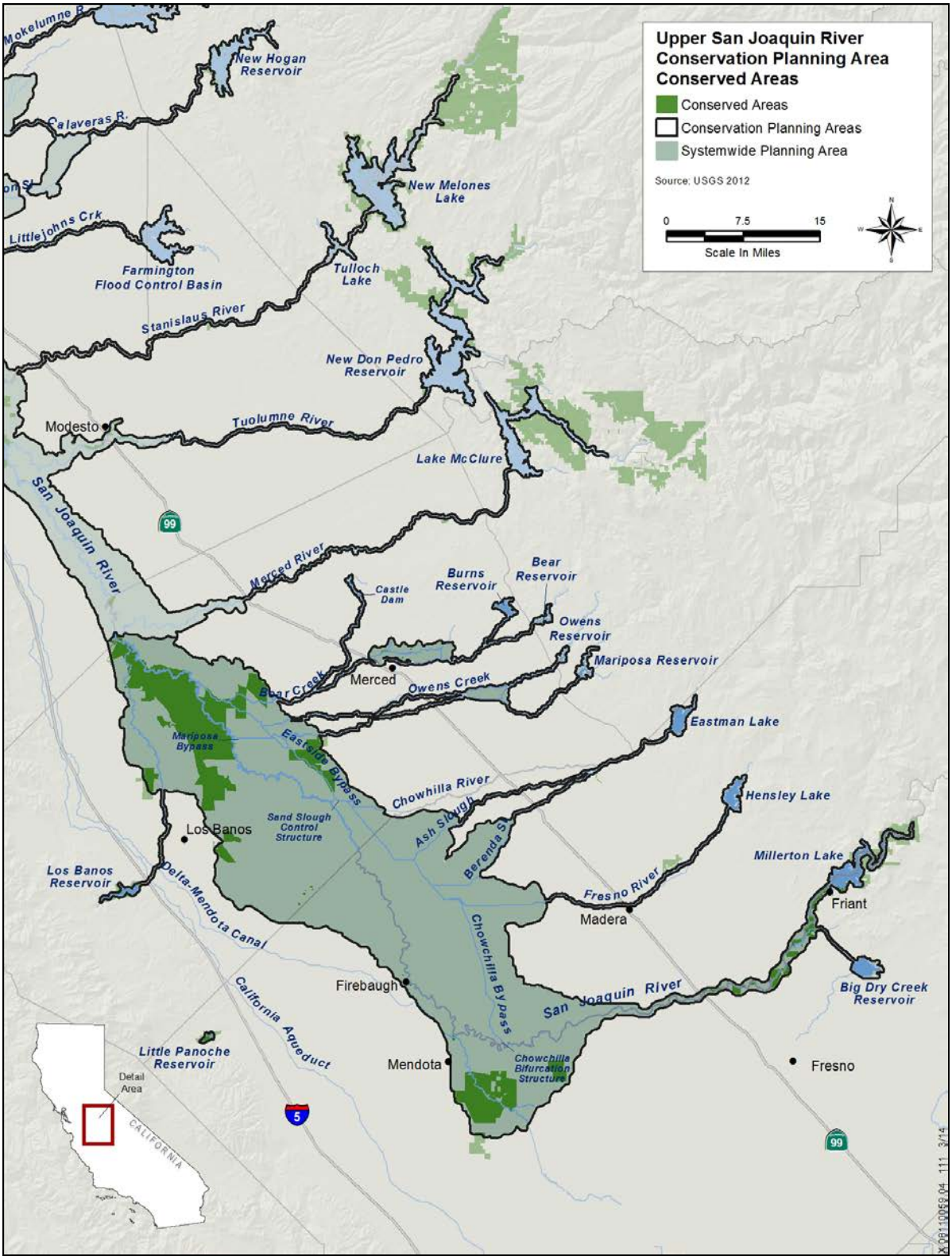

Figure F3-1. Upper San Joaquin River Conservation Planning Area – Conserved Areas

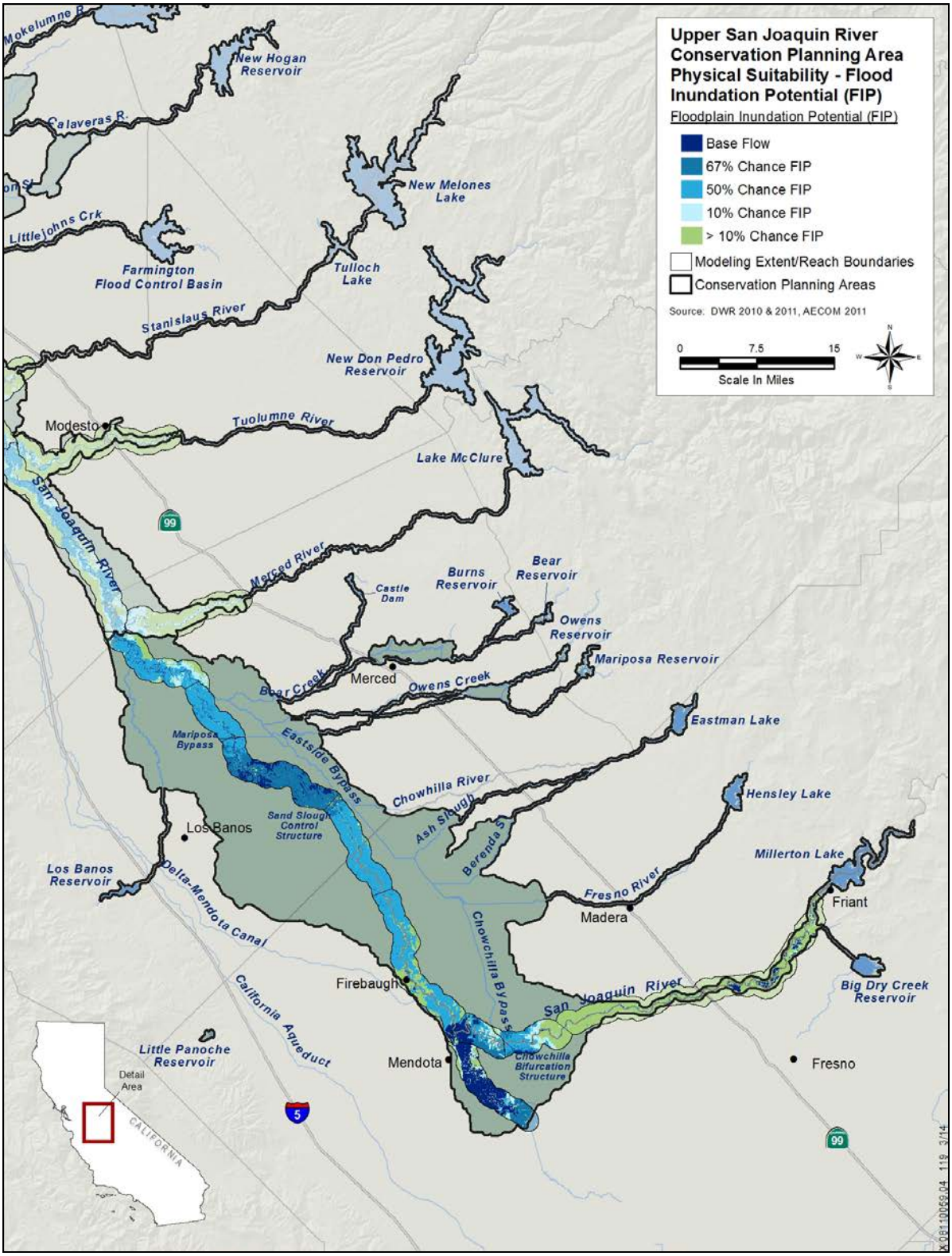

Figure F3-2. Upper San Joaquin River Conservation Planning Area Physical Suitability - Floodplain Inundation Potential (FIP)

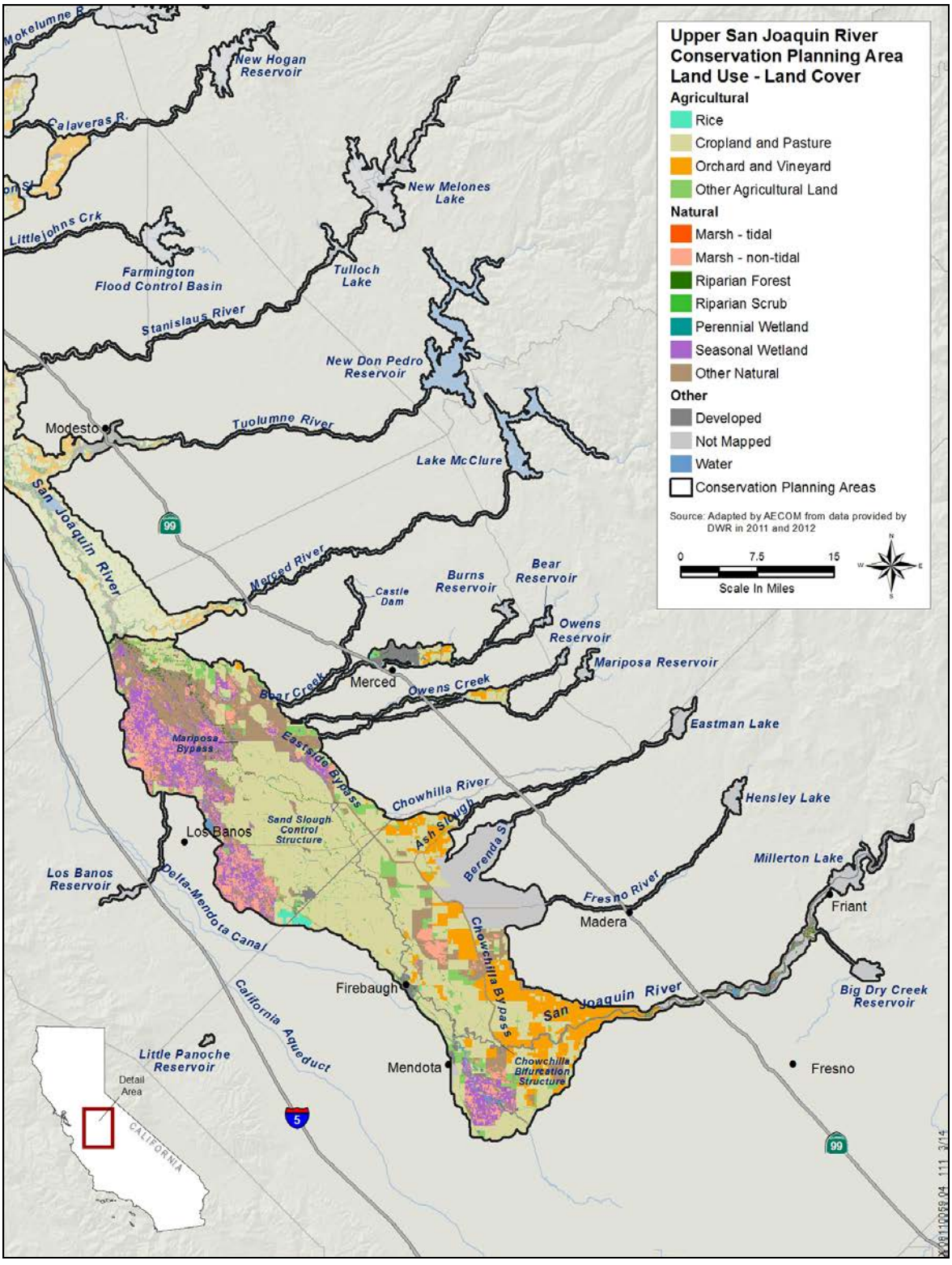

Figure F3-3. Upper San Joaquin River Conservation Planning Area Land Use - Land Cover

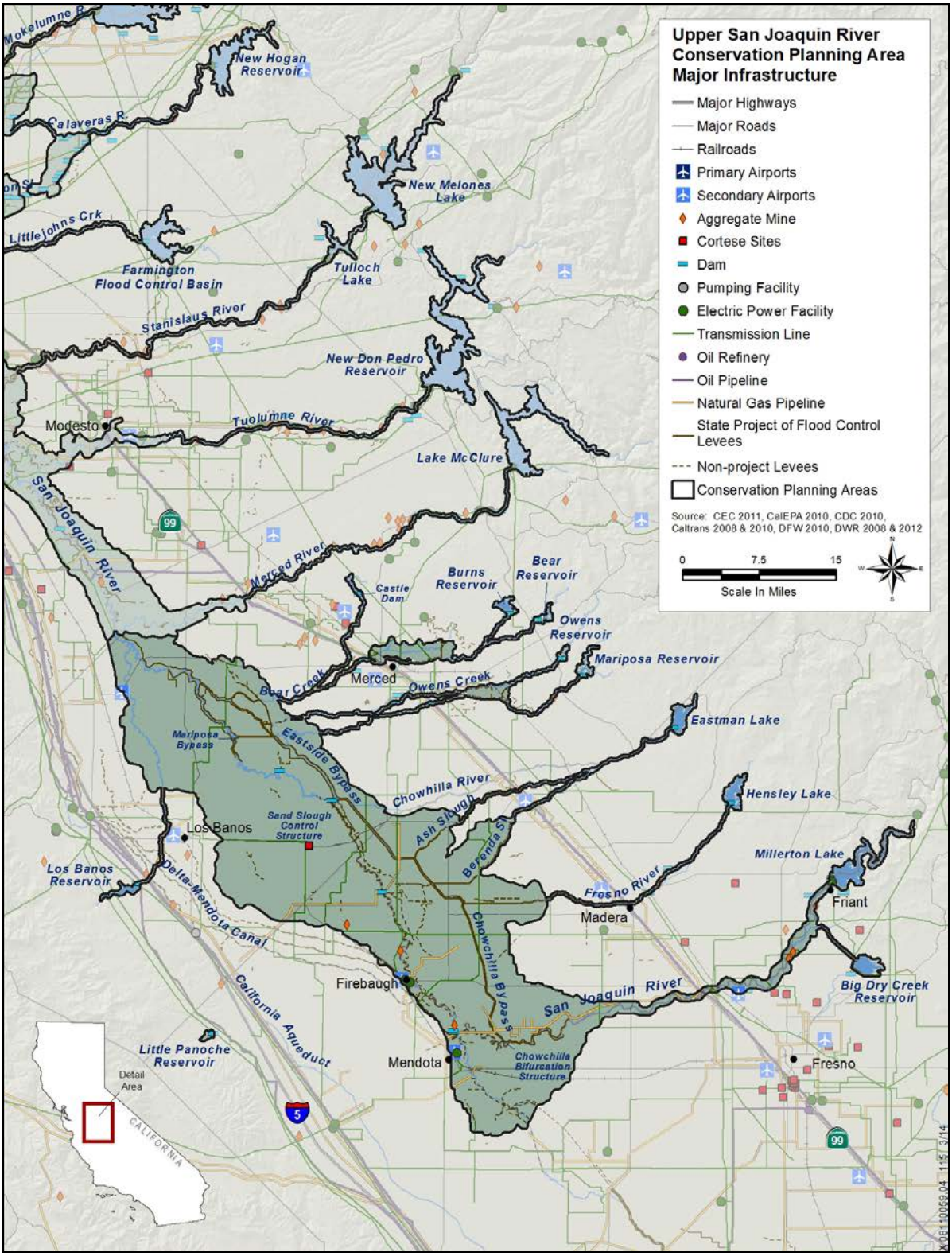

Figure F3-4. Upper San Joaquin River Conservation Planning Area Major Infrastructure

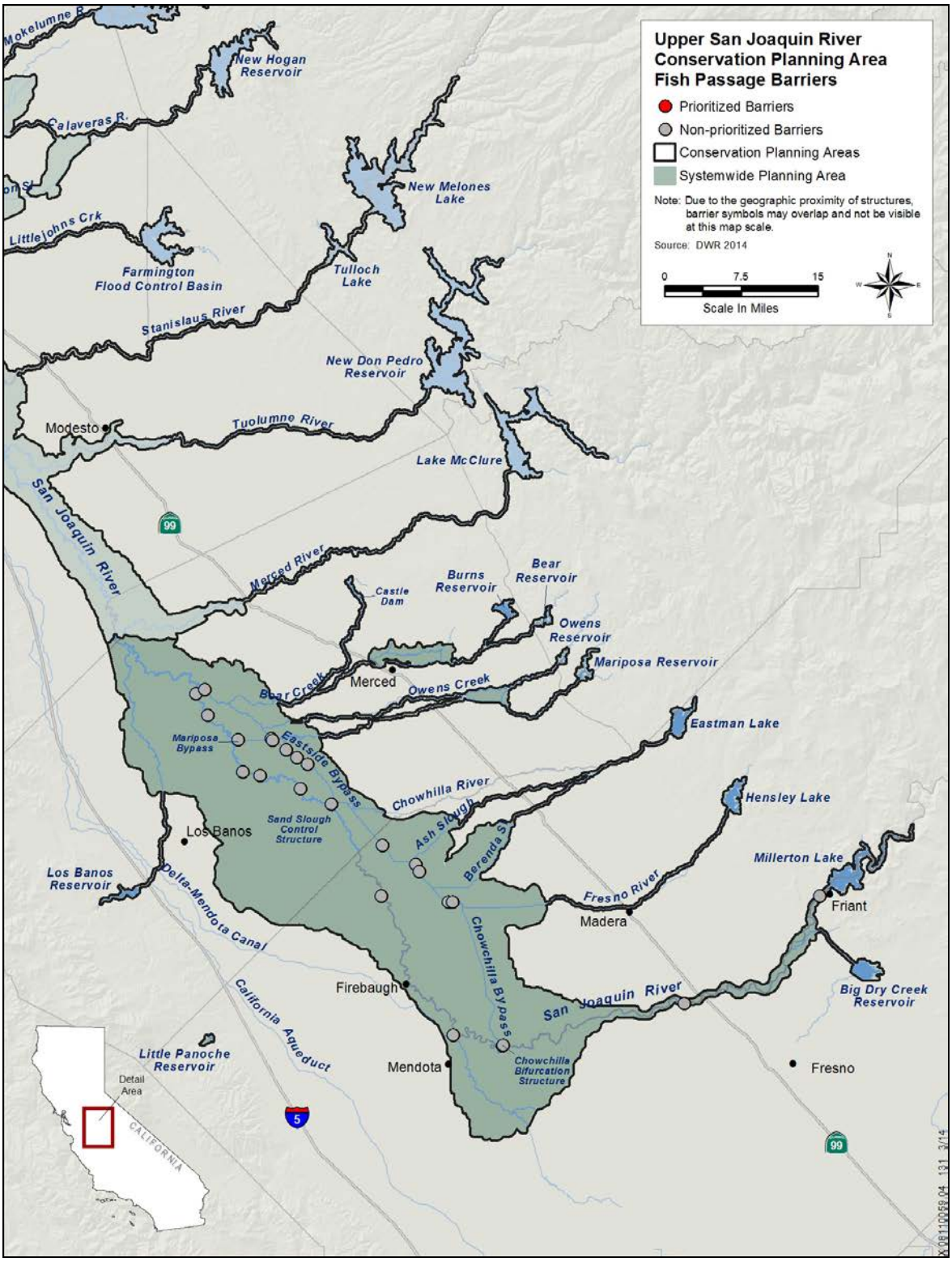

Figure F3-5. Upper San Joaquin River Conservation Planning Area Fish Passage Barriers

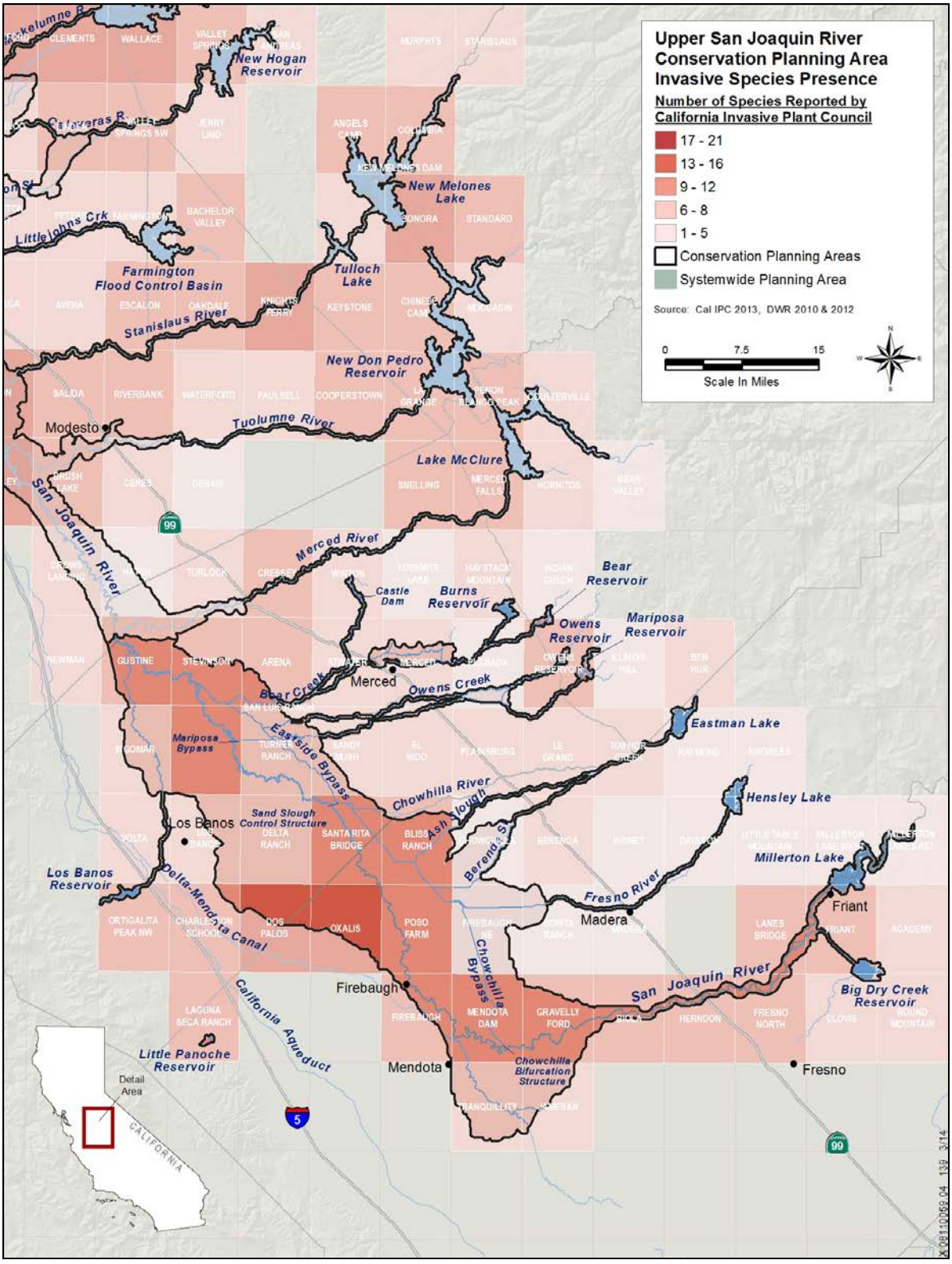

Figure F3-6. Upper San Joaquin Conservation Planning Area - Invasive Species Presence

F4. Maps for the Lower San Joaquin River Conservation Planning Area

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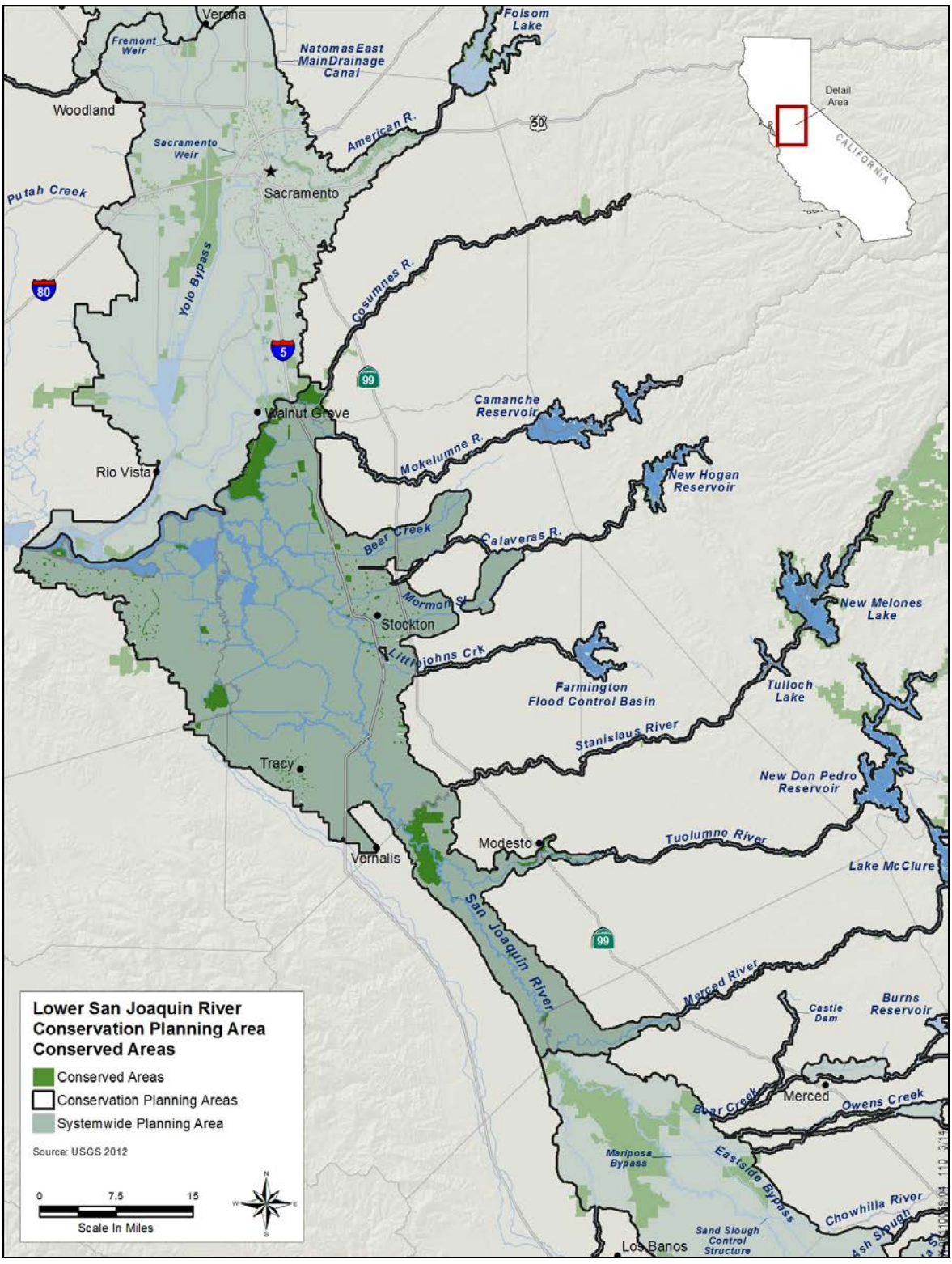

Figure F4-1. Lower San Joaquin River Conservation Planning Area – Conserved Areas

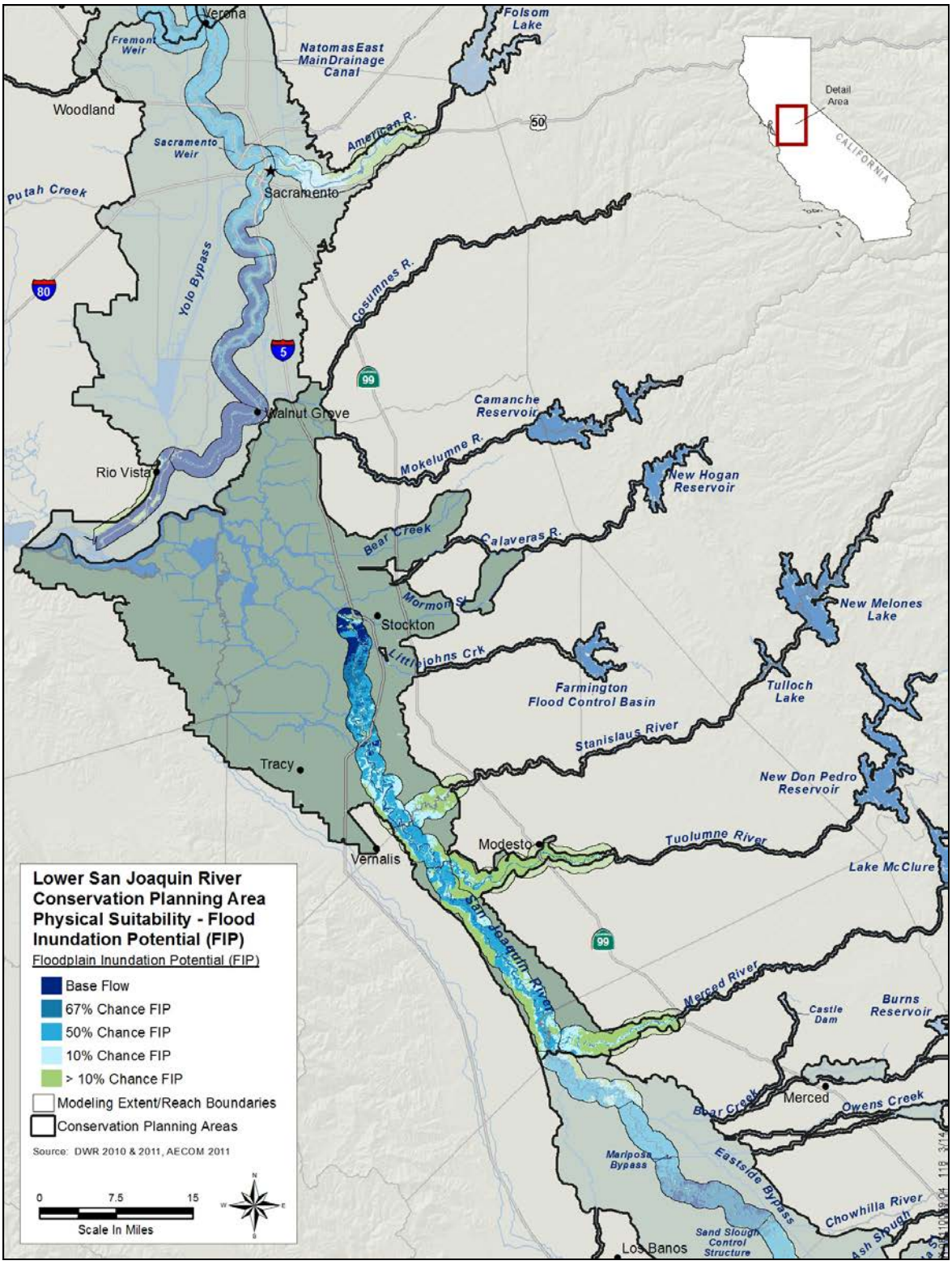

Figure F4-2. Lower San Joaquin River Conservation Planning Area Physical Suitability - Floodplain Inundation Potential (FIP)

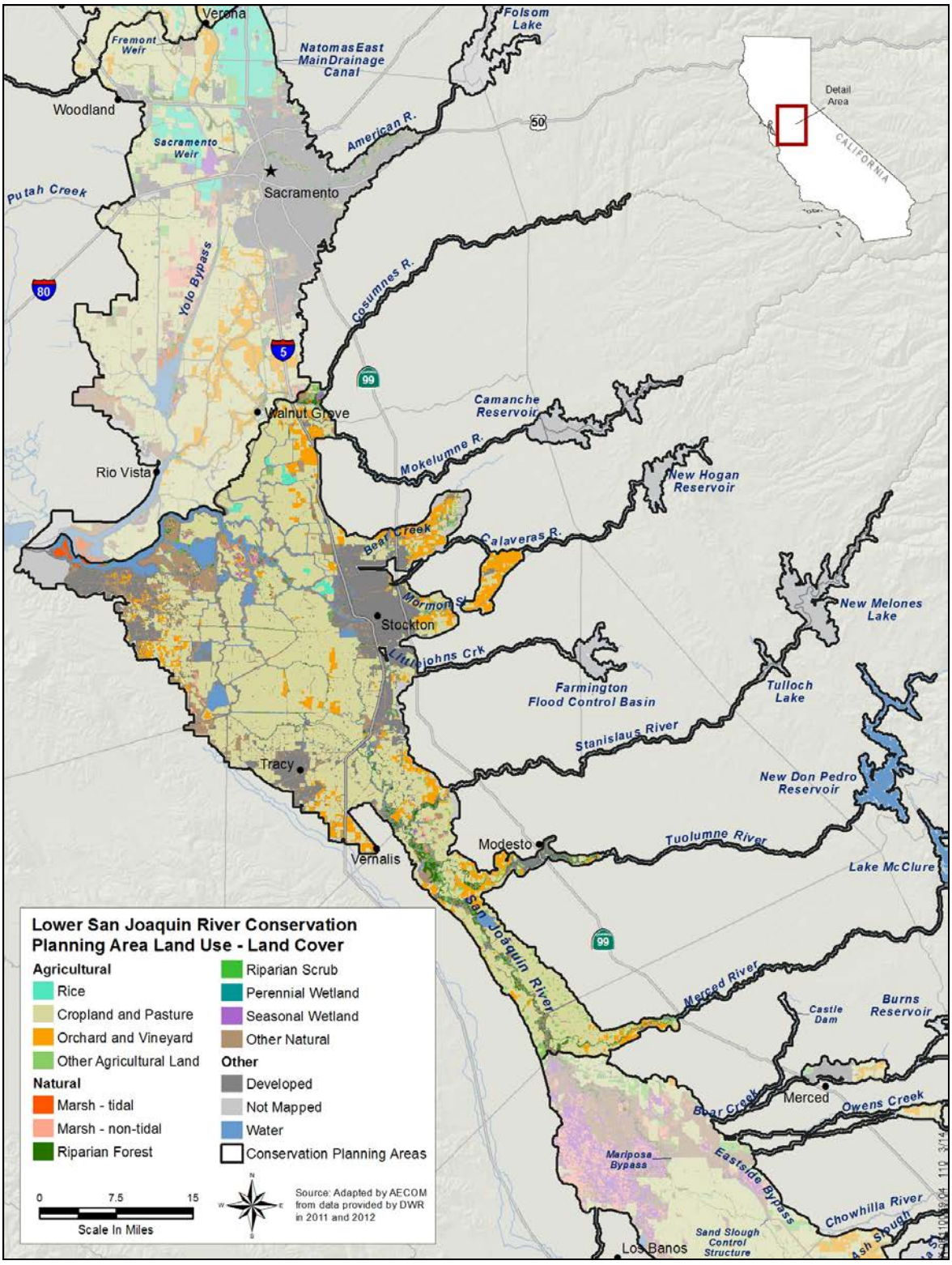

Figure F4-3. Lower San Joaquin River Conservation Planning Area Land Use - Land Cover

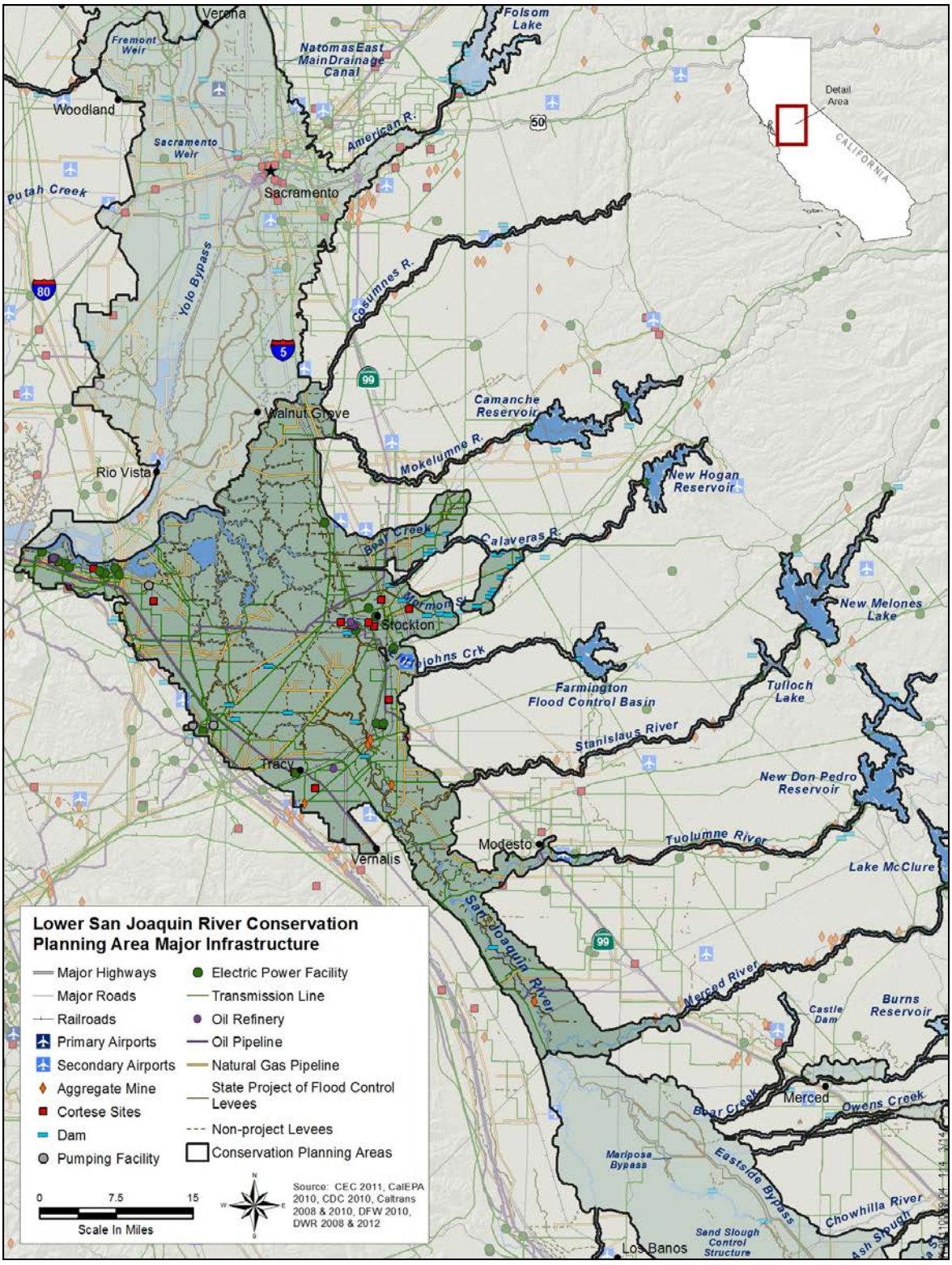

Figure F4-4. Lower San Joaquin River Conservation Planning Area Major Infrastructure

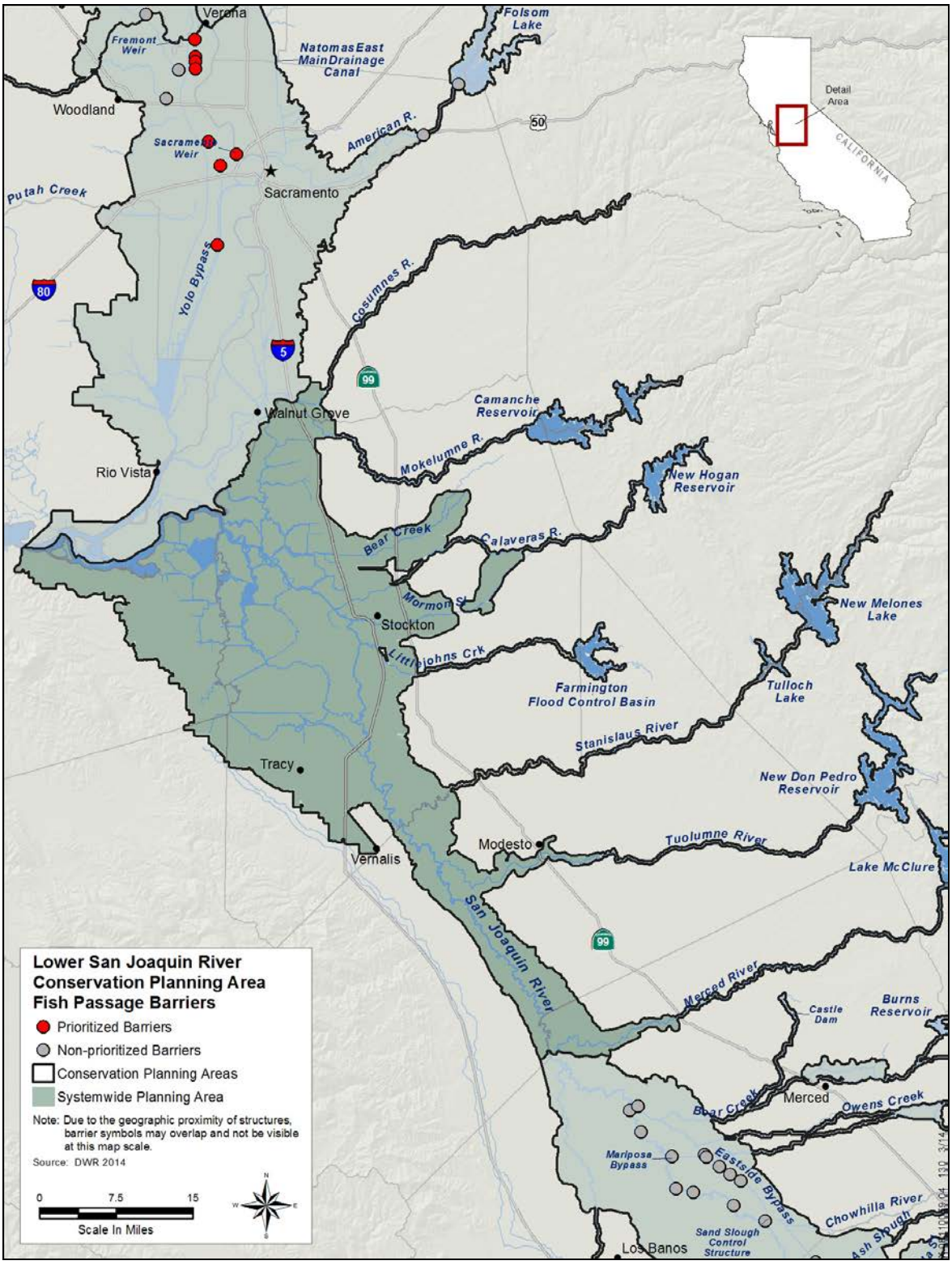

Figure F4-5. Lower San Joaquin River Conservation Planning Area Fish Passage Barriers

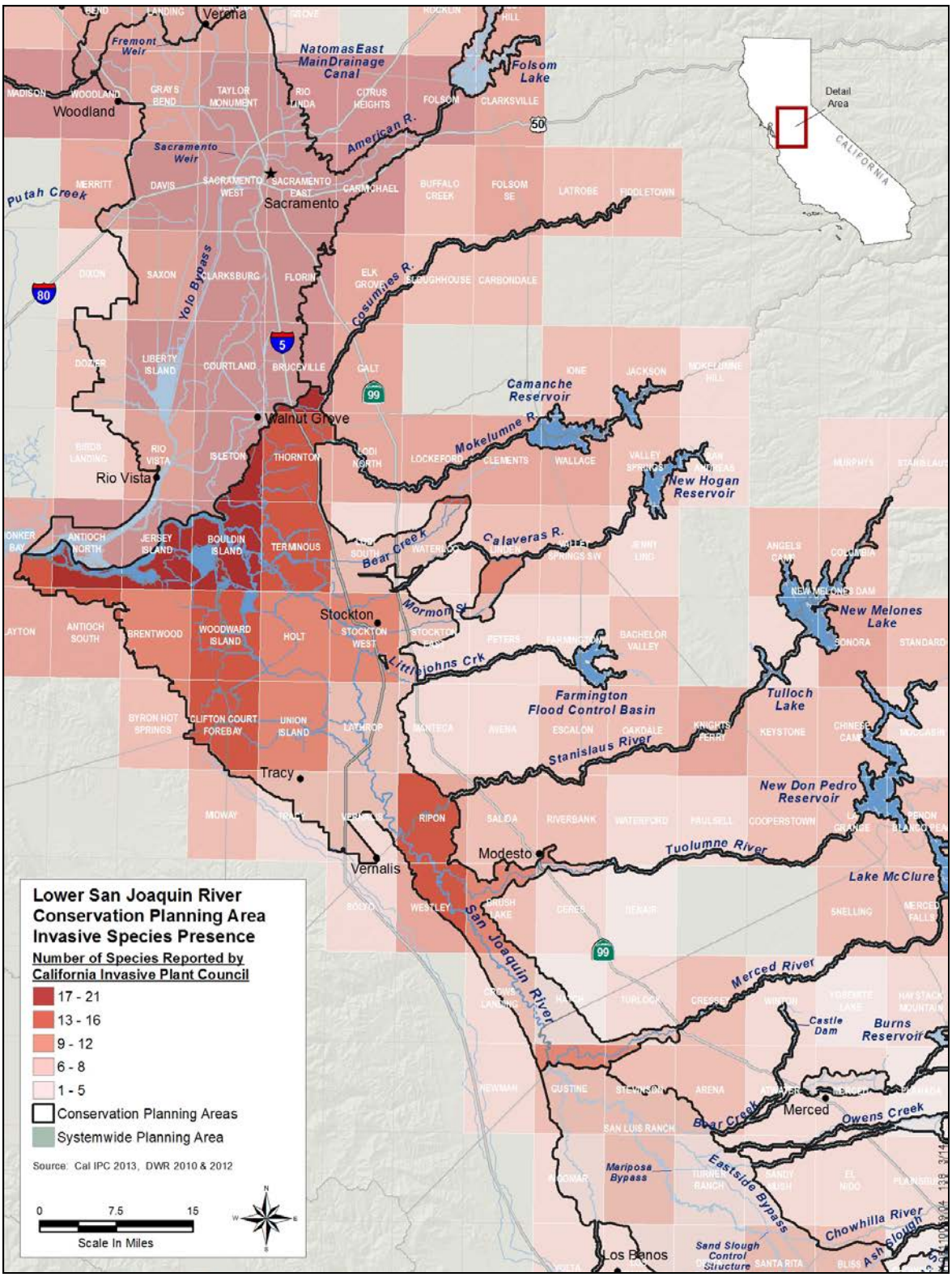

Figure F4-6. Lower San Joaquin Conservation Planning Area - Invasive Species Presence

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