CVFPP Conservation Strategy
Draft Appendices A to E

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Appendix A
Target Species List Review and Update

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APPENDIX A

Target Species List Review and Update

Acronym	Definition
2022 Update	2022 Update of Central Valley Flood Protection Plan Conservation Strategy
CESA	California Endangered Species Act
Conservation Strategy (or Strategy)	2016 Central Valley Flood Protection Plan Conservation Strategy
CSC	California Species of Special Concern
CVFPP	Central Valley Flood Protection Plan
Delta	Sacramento–San Joaquin Delta
ESA	Endangered Species Act
SB	State Bill
SPFC	State Plan of Flood Control
State	State of California
Strategy (or Conservation Strategy)	2016 Central Valley Flood Protection Plan Conservation Strategy
USFWS	U.S. Fish and Wildlife Service

Introduction

The preparation of the 2016 Central Valley Flood Protection Plan (CVFPP) Conservation Strategy (Conservation Strategy or Strategy) entailed a comprehensive review of available information and data. The purpose of that review was to identify target species and develop focused conservation plans, which are presented in Appendix G of the 2016 Conservation Strategy. This review has taken place again for the 2022 Update of the Conservation Strategy (2022 Update) to ensure the list of target species includes those that could benefit most from the implementation of the CVFPP and its Conservation Strategy through focused conservation planning.

This appendix provides the rationale for updating the list of target species, discusses the selection processes for target species and focused conservation plans, and presents three additions to the target species list for the 2022 Update. Attachment A.1 provides an update to the references listed in the 2016 Conservation Strategy for the identified target species.

Rationale for Updating the Target Species List

The list of target species has been updated for the following reasons:

- To incorporate new information and data that have become available since the 2016 Strategy.
- To include changes to species' regulatory statuses.
- To reflect changes in the conservation needs of native species that support the species' inclusion on the target species list.

Focused conservation plans have also been developed for the species added to the list of target species.

Selection of Target Species and Focused Conservation Plans

The target species identified in the 2016 Conservation Strategy were selected based on their ability to meet all three of the following criteria:

1. **Sensitive or special-status.** The species is identified as sensitive or special-status in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife, National Marine Fisheries Service, or U.S. Fish and Wildlife Service (USFWS). Sensitive or special-status species include those listed as threatened or endangered under the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA); species identified as candidates for listing; species identified as fully protected under the California Fish and Game Code or as California Species of Special Concern (CSC); and species with California Rare Plant Rank 1A, 1B, or 2.
2. **Associated with target habitats.** The species requires riverine aquatic (including shaded riverine aquatic cover), riparian, marsh, or periodically inundated floodplain or associated habitats as the primary habitat for one or more life stages or ecological needs (e.g., reproduction or foraging).
3. **Potential CVFPP effect.** Implementing the CVFPP, including flood projects and operations and maintenance, could affect the species' populations in California either temporarily or permanently, based on the species' distribution, habitat associations, and ecology (effects may be adverse or beneficial).

Additional target species identified during the 2022 Update meet these criteria based on current information and data. These species will benefit the most from the implementation of the CVFPP and its Conservation Strategy through the restoration of ecosystem processes and habitats and the reduction of flood system stressors.

Appendix G of the 2016 Conservation Strategy presented focused conservation plans prepared for target species that meet three additional criteria:

1. **Existing or potential status as threatened or endangered.** The species is State-of-California (State)-listed or federally listed as threatened or endangered, or has high potential to be listed during the next five to 10 years (e.g., plant species with a California Rare Plant Rank of 1B.1, Rare or Endangered in California and elsewhere, Seriously Endangered in California).

2. **Specialized or localized conservation requirements.** The species has conservation needs that are unlikely to be met without focused measures because of the species' restricted range, specialized habitat requirements, or landscape-level habitat requirements (e.g., proximity of nesting and breeding habitat, connectivity of multiple habitats). Among the species subject to these respective restrictions and requirements are riparian brush rabbit (*Sylvilagus bachmani ripariu*), bank swallow (*Riparia riparia*), Swainson's hawk (*Buteo swainsoni*), and giant gartersnake (*Thamnophis gigas*).

3. **Need for additional conservation planning to support the Conservation Strategy.** Other conservation plans (such as species recovery plans) do not address the relationship between the species' conservation needs and flood management activities in sufficient detail to support the implementation of the CVFPP and its Conservation Strategy.

Focused conservation plans have also been developed for new target species identified by this re-evaluation, and are provided in Appendix B.

Additions to the Target Species List

The 2016 Conservation Strategy provides for amendments to the list of target species during the five-year update process to reflect changing conservation needs and habitats. The target species list in the 2016 Conservation Strategy was thoroughly reviewed and updated during development of the 2022 Update. Adopted conservation plans, status reviews and critical habitat designations, regional conservation planning references, and scientific literature were evaluated.

The three proposed additions to the target species list for the 2022 Update consist of a fish and two birds. This appendix provides rationales for their inclusion. The master list of potentially suitable animal species (Table 2.1 in Appendix G of the 2016 Conservation Strategy) that were considered for the target species list was also revised to include new species, as shown in Table A-1 (at the end of this appendix). No changes were made to the master plant table (Table 2.2 in Appendix G of the 2016 Conservation Strategy). No changes were made to the master plant table (Table G-2 in Appendix G of the 2016 Conservation Strategy).

Delta Smelt

The delta smelt (*Hypomesus transpacificus*) was screened as a potential target species for the 2016 Conservation Strategy. At that time, the species was listed as endangered under CESA and threatened under ESA; however, it was not included as a target species in Appendix G of the 2016 Strategy. In the period between the completion of the 2016 Conservation Strategy and this five-year update, the delta smelt was petitioned for uplisting from threatened to endangered under ESA. USFWS issued a "warranted-but-precluded" determination for uplisting the delta smelt in 2016 (U.S. Fish and Wildlife Service 2017). The delta smelt was one of the species specifically mentioned in the 2016 Conservation Strategy for potential future inclusion as a target species.

Introduction to the Species

Delta smelt are endemic to the San Francisco Bay-Delta estuary. The Bay-Delta consists of San Francisco Bay and the Sacramento–San Joaquin Delta (Delta), defined as the legal delta encompassing all waters east of Chipps Island. The range of the delta smelt extends from Berkeley in San Francisco Bay to the City of Napa on the Napa River, throughout Suisun Bay and the Delta, in the Sacramento River to Knights Landing, and in the San Joaquin River to the City of Lathrop (U.S. Fish and Wildlife Service 2017).

Historically, delta smelt were widely distributed throughout the Delta, Suisun Bay, Suisun Marsh, and western San Pablo Bay (Moyle et al. 2016). The abundance of delta smelt has declined dramatically, particularly since the pelagic organism decline in the early 2000s. In 2010, population estimates for delta smelt dropped to a low of 13,000 individuals (Moyle et al. 2016; U.S. Fish and Wildlife Service 2017).

With the decline in delta smelt abundance, along with changes in habitat conditions (e.g., drought, climate change, hydrology, turbidity, harmful algal blooms), the species' distribution became more restricted. Most delta smelt were confined to an arc of tidal habitat connected by Sacramento River flows from the Cache and Lindsay Slough Complex in the North Delta to Montezuma Slough in Suisun Marsh (Moyle et al. 2016).

Rationale

The following rationale addresses each target species criterion to further consider the delta smelt as a target species.

1. **Sensitive or special-status.** USFWS considered uplisting the delta smelt from threatened to endangered status under ESA (U.S. Fish and Wildlife Service 2017). USFWS determined the uplisting of delta smelt to endangered was warranted and assigned a listing priority number of 2 based on the high magnitude and immediacy of threats, but other higher-priority actions precluded the species' reclassification (U.S. Fish and Wildlife Service 2017). Because this species was considered warranted for federal uplisting to endangered between the 2016 Conservation Strategy and this five-year update, its re-examination as a target species is merited.

2. **Associated with target habitats.** Recent findings have indicated delta smelt may be food-limited, particularly in the spring and summer (Hamilton and Murphy 2018). Smelt collected in areas of greater tidal wetland influence have much greater stomach fullness than those collected in areas of little or no tidal wetland influence, suggesting food resources for delta smelt are more available when near tidal wetlands (Hammock et al. 2019). During the drought from 2012 through 2016, delta smelt were more abundant in the Yolo Bypass than in the previous 14 years, but were present in record low numbers in locations of the estuary where delta smelt were historically found. Delta smelt collected in the Yolo Bypass during the drought were compared to smelt captured elsewhere in the estuary; the findings indicated that smelt in the Yolo Bypass spawned earlier and offspring experienced both higher quality feeding conditions and faster growth rates (Mahardja et al. 2019). The aforementioned studies suggest delta smelt require a mosaic of habitat types that include inundated floodplains and wetlands, particularly because the species is experiencing serious decline. Thus, recent findings indicate a clear connection between the delta smelt and riverine aquatic habitats.

3. **Potential CVFPP effect.** The ecosystem processes targeted by the Conservation Strategy are riverine geomorphic processes and floodplain inundation, which are the natural, dynamic hydrologic and geomorphic processes that sustain target habitats and species. Based on the indications that the delta smelt evolved under these natural riverine processes in the Central Valley, this threatened species appears to be a suitable candidate for inclusion as a target species that would substantially benefit from the implementation of the CVFPP and its Conservation Strategy.

Summary

The rationale for including delta smelt as a target species is based on the following conditions:

- The recent precipitous decline of this species endemic to the San Francisco Bay-Delta estuary, which led to the "warranted-but-precluded" uplisting of the species from threatened to endangered under ESA after the completion of the 2016 Conservation Strategy.

- The demonstrated dependence of delta smelt on habitats with Central Valley riverine and bypass systems.

- The dependence of this species' recovery on existing and additional habitat in the State Plan of Flood Control's (SPFC's) river corridors, sloughs, and the Yolo Bypass.

Tricolored Blackbird

The tricolored blackbird (*Agelaius tricolor*) was screened as a potential target species for the 2016 Conservation Strategy. At that time, the species was a CSC, and it was not included as a target species in Appendix G of the 2016 Strategy. However, between the completion of the 2016 Conservation Strategy and this five-year update, the species was elevated from a CSC to being listed as threatened under CESA. The species was petitioned for listing as endangered

under ESA in 2006 and again in 2015. The federal finding on the petition was published in 2019, and found that listing was not warranted, partly due to the listing under CESA, which is reducing the severity of some existing threats (50 Code of Federal Regulations Part 17). The tricolored blackbird was one of the species specifically mentioned in the 2016 Conservation Strategy for potential future inclusion as a target species.

Introduction to the Species

Except for small nesting colonies found locally in Oregon, Washington, Nevada, and coastal Baja California, the tricolored blackbird occurs primarily in California, with more than 90 percent of the species' population present in California's Central Valley in most years (Hamilton 2000). Historically, populations of this colonial blackbird were present along the California coast and inland in Central and Southern California; however, the agricultural and urban development of these areas has eliminated all but a few of these populations.

Historically, breeding tricolored blackbirds inhabited primarily freshwater tule (*Schoenoplectus acutus*) and cattail (*Typha* spp.) marshes, with small numbers of breeding colonies occurring in willows (*Salix* spp.), California blackberries (*Rubus ursinus*), and other dense forbs (Neff 1937). In the first half of the 20th century, much of this freshwater marsh habitat was drained and converted to urban and agricultural land uses.

Vast flocks of these birds were once present in California; however, habitat loss, poisonings and shootings of blackbirds to protect crops, pesticide use, and large, persistent, and ongoing annual losses of nests and nesting habitat through agricultural practices have contributed to rapid declines of the species in California (Center for Biological Diversity 2015). In 2014, the tricolored blackbird population was the smallest ever recorded, consisting of only 145,000 birds. By comparison, in 1934, Neff (1937) observed as many as 736,500 tricolored blackbirds from just eight Central Valley counties, and 19th century accounts described flocks of thousands "numbering so many thousands as to darken the sky for some distance by their masses" (Heermann [1859], as conveyed by Beedy 2008).

Rationale

The following rationale addresses each target species criterion to further consider the tricolored blackbird as a target species.

1. **Sensitive or special-status.** The tricolored blackbird species was assigned a temporary (six -month) emergency endangered status under CESA in December 2015. The species was identified as a CSC in Appendix G of the 2016 Conservation Strategy, and it was listed as threatened under CESA on March 18, 2019. Therefore, the tricolored blackbird qualifies as a defined special-status species for a target species. Because this species was elevated from a CSC to being State-listed as threatened between the 2016 Conservation Strategy and this five-year update, the re-examination of its status as a target species is warranted.

2. **Associated with target habitats.** The species' basic breeding habitat requirements are access to water and suitable nesting substrate (e.g., marsh vegetation or thornyvegetation) with access to sufficient foraging habitat within a few kilometers of the colony (Beedy and Hamilton 1999). The tricolored blackbird forms the largest breeding colonies of any North American landbird, and in the Central Valley, as many as 20,000 to 30,000 nests have been recorded in cattail marshes of four hectares or less (Beedy 2008). The species also breeds in scrubby riparian and willow riparian habitats, as well as some upland habitats. Regarding ecological dependency on riparian habitat, Beedy (2008) notes:

   "The colonial breeding system of the tricolored blackbird probably evolved in the Central Valley, where the locations of surface waters and rich sources of insect food were ephemeral and varied annually (Orians 1961). Before its rivers were dammed and channelized, the Central Valley flooded in many years, forming a vast mosaic of seasonal wetlands, freshwater marshes, alkali flats, native grasslands, riparian forests, and oak savannas. Virtually all of these habitats once supported nesting or foraging tricolored blackbirds.

   Thus, the ecological dependence of this species is probably based in its geographic isolation and evolutionary adaptation to Central Valley riverine systems in their natural state. The Central Valley supports all of the state's largest colonies (greater than 20,000 individuals) except the Toledo Pits in Riverside County (Beedy 2008). Thus, there is a clear connection between this species and dependence on the riverine-associated habitats listed in the above criterion."

3. **Potential CVFPP effect.** The floodplain inundation and marsh habitats targeted by the Conservation Strategy represent the natural hydrologic process and vegetation that provide habitat for tricolored blackbirds. The restoration of, and increase in, nesting and foraging habitats for tricolored blackbirds (including marsh), as well as increased successional and scrub riparian vegetation in the flood system, would contribute to the recovery of the tricolored blackbird population. The primary conservation priorities for this species are to maintain and enhance existing habitat and to create and restore additional breeding habitats to support nesting and foraging (Tricolored Blackbird Working Group 2007).

Summary

The rationale for including the tricolored blackbird as a target species is based on the following conditions:

- The recent precipitous decline of this near-California-endemic species—of which the Central Valley holds the vast majority of the largest colonies—that led the species' status to be elevated from CSC to listed as threatened under CESA after the completion of the 2016 Conservation Strategy.
- The demonstrated dependence of the tricolored blackbird on habitats associated with Central Valley riverine systems.
- The importance to this species' recovery of existing and additional nesting habitat in the river corridors and bypasses of the SPFC.

Yellow-breasted Chat

The yellow-breasted chat (*Icteria virens*) was screened as a potential target species for the 2016 Conservation Strategy. The species was, and remains, a CSC, but it was not included as a target species in Appendix G of the 2016 Strategy.

Introduction to the Species

The yellow-breasted chat, a CSC, breeds in dense, shrubby, and some open habitats in North America, although the western population breeds primarily in riparian woodlands. The yellow-breasted chat winters from northern Mexico to Central America (Billerman 2020). In California, where this species occurs as a migrant and summer resident, it breeds primarily in early successional riparian habitats with a well-developed shrub layer and open canopy along the narrow borders of streams, creeks, sloughs, and rivers (Comrack 2008). This species skulks in dense vegetation and is often detected by its distinctive vocalizations.

The yellow-breasted chat has an interesting taxonomic history. The species was long considered an aberrant member of the New World warbler family, the Parulidae; however, the yellow-breasted chat has recently been recognized as a quite distinct taxon and placed in a monotypic family, *Icteriidae* (Billerman 2020).

Although still widely distributed in California, the yellow-breasted chat is now rare or absent from much of the Central Valley, as its breeding range has been reduced by approximately 35 percent (Comrack 2008). The destruction of riparian habitat has been implicated in the early decline of this species in the state (Remsen 1978).

Most yellow-breasted chat individuals in the Central Valley currently breed in the northern Sacramento Valley. The species is still considered as breeding in a few locations in the San Joaquin Valley (Comrack 2008; Dybala et al. 2017). Dybala et al. (2017) identified the population in the Sacramento Valley as small (fewer than 10,000 individuals), and the population in the Yolo-Delta region and the San Joaquin Valley as very small (fewer than 1,000 individuals). Small populations may be below a minimum viable population level and vulnerable to extirpation, and very small populations are expected to be well-below a minimum viable population level (Dybala et al. 2017). These population levels indicate likely extirpation in the Yolo-Delta and San Joaquin Valley regions, and possible extirpation in the Sacramento Valley, in the absence of additional riparian habitat.

Dybala et al. (2017) selected the yellow-breasted chat as one of seven focal species for population and habitat objectives for avian conservation in the Central Valley. This selection was based on the following species characteristics:

- The species' use of riparian vegetation as principal breeding habitat.
- Species status, as it warrants special management status or has experienced population declines or reductions in its breeding range in the Central Valley.
- The usefulness of the species for monitoring the effects of management actions in Central Valley riparian ecosystems.

Dybala et al. (2017) demonstrated the importance of increasing riparian habitat in the Central Valley to maintain a viable population of chats in the valley. The inclusion of the yellow-breasted chat as a target species in the 2022 Conservation Strategy aligns the Strategy's goals and objectives with those of the Central Valley Joint Venture regarding the conservation of riparian habitat for avian species.

Rationale

The following rationale addresses each target species criterion to further consider the yellow-breasted chat as a target species.

1. **Sensitive or special-status.** As a CSC, the yellow-breasted chat meets this criterion.
2. **Associated with target habitats.** The yellow-breasted chat is essentially an obligate riparian species in California. Because this species breeds primarily in early successional riparian habitats, it depends on events that lead to riparian succession, such as periodic flooding that leads to the regeneration of riparian vegetation, a goal of the Conservation Strategy.
3. **Potential CVFPP effect.** Loss of riparian habitat (caused by factors such as flood control infrastructure and management) has significantly reduced the yellow-breasted chat population in California, and particularly in the Central Valley. The dependence of the yellow-breasted chat on understory and shrubby riparian vegetation for nesting makes it vulnerable to habitat loss from vegetation removal along river channels during flood control maintenance. This species could benefit substantially from the implementation of the CVFPP and its Conservation Strategy, because it is very closely associated with riverine riparian habitat of the Sacramento and San Joaquin valleys and would benefit substantially from the addition of riparian habitat to the system (as modeled by Dybala et al. 2017). In particular, the species could benefit from the increase in successional riparian habitat associated with natural riverine processes that would be restored to the flood system.

Summary

The rationale for including the yellow-breasted chat as a target species is based on the following conditions:

- The species' status as a CSC.
- The status of the yellow-breasted chat as essentially a riparian-obligate species associated with early successional riparian habitat, which makes it a prime target species that would benefit from the implementation of the CVFPP and its Conservation Strategy. In addition, this species would be an appropriate indicator that the restoration of more natural, dynamic riverine systems has been implemented successfully, a goal of the Strategy.
- The occurrence and continuation of flood management activities that result in substantial adverse effects on this species. However, the Central Valley's yellow-breasted chat population would benefit from the implementation of the CVFPP and its Conservation Strategy, which is anticipated to result in a significant net positive outcome for the species and contribute to the recovery of this population.

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Table A-1. Screening of Animal Species Potentially Affected by the CVFPP (including the Conservation Strategy) for Target Species and Focused Conservation Planning

Species	Common Name and Scientific Name	Regional Distribution in SPA [a]	Habitats	Status FED/CA [b]	Associated with Target Habitat [c]	Major Potential CVFPP Effect [d]	Potential Target Species [e]	T/E Listed or Potential for T/E Listing [f]	Focused Conservation Needs [g]	Target Species Chosen for Focused Conservation Planning [h]
Invertebrates	Conservancy fairy shrimp *Branchinecta conservatio*	USR, LSR, LSJR, USJR	Vernal pools, swales, and other ephemeral wetlands	E/None	No	No	No	Yes	Yes	No
	Lange's metalmark butterfly *Apodemia mormo langei*	LSR	Sand dunes	E/None	No	No	No	Yes	Yes	No
	Longhorn fairy shrimp *Branchinecta longiantenna*	USJR	Vernal pools, swales, and other ephemeral wetlands	E/None	No	No	No	Yes	No	No
	Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	USR, LSR, FR, LSJR, USJR	Elderberries in riparian woodlands or savannas	T/None	Yes	Yes	Yes	Yes	Yes	Yes
	Vernal pool fairy shrimp *Branchinecta lynchi*	USR, LSR, FR, LSJR, USJR	Vernal pools, swales, and other ephemeral wetlands	T/None	No	No	No	Yes	No	No
	Vernal pool tadpole shrimp *Lepidurus packardi*	USR, LSR, LSJR, USJR	Vernal pools, swales, and other ephemeral wetlands	E/None	No	No	No	Yes	No	No
	Crotch's bumblebee *Bombus crotchii*	USR, LSR, FR, LSJR, USJR	Grasslands and open oak woodlands; may occasionally forage in riparian areas with floral resources, but because species is ground-nesting, typically would nest outside flood zones; foraging habitat best characterized by upland grasslands in untilled areas with diverse or abundant floral resources	None/C	No	No	No	Yes	No	No
	Monarch butterfly *Danaus plexippus*	USR, LSR, FR, LSJR, USJR	Nearly any habitat with nectar flowers, milkweed plants, roosting sites, and access to water; riparian habitat with grassland openings is especially important in the Central Valley	C/None	Yes	Yes	Yes	Yes	Yes	No
Fish	California Central Valley steelhead DPS *Oncorhynchus mykiss*	USR, FR, LSJR, LSJR, USJR	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally in inundated floodplains, rivers, tributaries, and the Delta	T/None	Yes	Yes	Yes	Yes	Yes	Yes
	Central California coast steelhead DPS *Oncorhynchus mykiss*	LSR	Spawns in freshwater streams; adults live and forage in oceanic waters	T/T	Yes	No	No	Yes	Yes	No
	Chinook salmon—Central Valley fall-/late fall-run ESU *Oncorhynchus tshawytscha*	USR, LSR, FR, LSJR, USJR	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally in inundated floodplains, rivers, tributaries, and the Delta	None/CSC	Yes	Yes	Yes	Yes	Yes	Yes

Species	Common Name and Scientific Name	Regional Distribution in SPA [a]	Habitats	Status FED/CA [b]	Associated with Target Habitat [c]	Major Potential CVFPP Effect [d]	Potential Target Species [e]	T/E Listed or Potential for T/E Listing [f]	Focused Conservation Needs [g]	Target Species Chosen for Focused Conservation Planning [h]
Fish	Chinook salmon—Central Valley spring-run ESU *Oncorhynchus tshawytscha*	USR, LSR, FR, LSJR	Spawns in freshwater streams and rivers; smolts mature in freshwater streams and later estuarine areas; adults live and forage in oceanic waters and hold in cool, freshwater streams and rivers before spawning	T/T	Yes	Yes	Yes	Yes	Yes	Yes
	Chinook salmon—Sacramento River winter-run ESU *Oncorhynchus tshawytscha*	LSR, USR	Spawns in freshwater streams and rivers; smolts mature in freshwater streams and later estuarine areas; adults live and forage in oceanic waters and hold in cool, freshwater streams and rivers before spawning	E/E	Yes	Yes	Yes	Yes	Yes	Yes
	Delta smelt *Hypomesus transpacificus*	LSR, LSJR	Spawns in shallow, fresh, or slightly brackish water upstream of the mixing zone (saltwater-freshwater interface); adults live along the freshwater edge of the mixing zone when not spawning; before spawning, adults disperse widely into river channels and tidally influenced backwater sloughs	T/E	Yes	Yes	Yes	Yes	Yes	Yes
	North American green sturgeon—Southern DPS *Acipenser medirostris*	USR, FR, LSR, LSJR	Spawns in deep pools in large, turbulent, freshwater mainstem rivers; adults live and forage in oceanic waters, bays, and estuaries when not spawning	T/CSC	Yes	Yes	Yes	Yes	Yes	Yes
	White Sturgeon *Acipenser transmontanus*	USR, LSR, FR, LSJR, USJR	Spawns on deep gravel or rock substrate in moderate to fast currents in mainstem rivers; adults and subadults most abundant in brackish portions of the San Francisco Bay-Delta; adult long-distance marine migrations into estuary and river habitats in WA, OR, and northern CA sometimes occurs.	None/CSC	Yes	Yes	Yes	No	Yes	No
	Hardhead *Mylopharodon conocephalus*	USR, LSR FR, LSJR, USJR	Spawns in pools and side pools of rivers and creeks; juveniles rear in pools of rivers and creeks, and shallow to deeper water of lakes and reservoirs	None/CSC	Yes	No	No	Yes	No	No
	Longfin smelt *Spirinchus thaleichthys*	LSR, LSJR	Typically spawns in freshwater and moves downstream to brackish water to rear, but tolerant of highly saline water and known to spawn in the southern San Francisco Bay	None/T	Yes	No	Yes	Yes	No	No
	Sacramento splittail *Pogonichthys macrolepidotus*	FR, USR, LSR, LSJR	Generally lives in areas of low to moderate current; uses floodplain habitat for feeding and spawning	None/ None	Yes	Yes	Yes	No	No	No
	Central California roach *Lavinia symmetricus*	USR, LSR, FR, LSJR, USJR	Spawns in pools and side pools of small rivers and creeks; juveniles rear in pools of small rivers and creeks	None/CSC	Yes	No	No	Yes	No	No
Amphibians	California red-legged frog *Rana draytonii*	LSJR	Permanent or ephemeral water sources, including lakes, ponds, reservoirs, slow streams, marshes, bogs, and swamps from sea level to 5,000 feet in woodlands, grasslands, and riparian areas	T/CSC	Yes	No	No	Yes	No	No

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Amphibians	California tiger salamander *Ambystoma californiense*	LSR, FR, LSJR, USJR	Restricted to vernal pools and seasonal ponds, including many constructed stock ponds, in grassland and oak savanna plant communities, predominantly from sea level to 2,000 feet in elevation	T/T	No	No	No	Yes	Yes	No
	Foothill yellow-legged frog *Rana boylii*	USR	Streams and rivers with rocky substrate and open, sunny banks, in forests, chaparral, and woodlands from sea level to 6,700 feet; sometimes found in isolated pools, vegetated backwaters, and deep, shaded, spring-fed pools	None/T	Yes	No	No	Yes	No	No
	Northern leopard frog *Lithobates pipiens*	USJR	Grasslands, wet meadows, potholes, forests, woodland, brushlands, springs, canals, bogs, marshes, and reservoirs from sea level to 11,000 feet; generally prefers permanent water with abundant aquatic vegetation	None/CSC	Yes	No	No	Yes	No	No
	Shasta salamander *Hydromantes shastae*	USR	Mixed conifer, woodland, and chaparral habitats, especially near limestone	None/T	No	No	No	Yes	No	No
	Western spadefoot *Spea hammondii*	USR, LSR, FR, LSJR, USJR	Grasslands, scrub, chaparral, and occasionally oak woodlands near aquatic habitat such as vernal pools, wetlands, and low-gradient streams	None/CSC	No	No	No	Yes	No	No
Reptiles	Alameda whipsnake *Masticophis lateralis euryxanthus*	LSJR	Chaparral (northern coastal sage scrub and coastal sage), up to 500 feet into adjacent habitats, including grassland, oak savanna, and occasionally oak-bay woodland	T/T	No	No	No	Yes	No	No
	Blunt-nosed leopard lizard *Gambelia sila*	USJR	Semi-arid grasslands, alkali flats, and washes of the San Joaquin Valley and foothills	E/E, FP	No	No	No	Yes	No	No
	Coast horned lizard *Phrynosoma blainvillii*	LSR, FR, LSJR, USJR	Grasslands, brushlands, woodlands, and open coniferous forests	None/CSC	No	No	No	Yes	No	No
	Giant gartersnake *Thamnophis gigas*	USR, LSR, FR, LSJR, USJR	Marshes, sloughs, drainage canals, and irrigation ditches, especially around rice fields, and occasionally in slow-moving creeks from sea level to 400 feet; prefers locations with vegetation close to the water for basking	T/T	Yes	Yes	Yes	Yes	Yes	Yes
	San Joaquin coachwhip *Masticophis flagellum ruddocki*	USR, LSR, LSJR, USJR	Open, dry vegetation in valley grasslands and saltbush scrub	None/CSC	No	No	No	Yes	No	No
	Silvery legless lizard *Anniella pulchra*	LSJR, USJR	Moist, warm, loose soil with plant cover in sparsely vegetated areas of beach dunes, chaparral, woodlands, desert scrub, sandy washes, and stream terraces	None/CSC	Yes	No	No	Yes	No	No

Species	Common Name and Scientific Name	Regional Distribution in SPA [a]	Habitats	Status FED/CA [b]	Associated with Target Habitat [c]	Major Potential CVFPP Effect [d]	Potential Target Species [e]	T/E Listed or Potential for T/E Listing [f]	Focused Conservation Needs [g]	Target Species Chosen for Focused Conservation Planning [h]
Reptiles	Western pond turtle *Actinemys marmorata*	USR, LSR, FR, LSJR, USJR	Ponds, lakes, rivers, streams, creeks, marshes, and irrigation ditches with abundant vegetation and either rocky or muddy bottoms, in woodland, forest, and grassland	None/CSC	Yes	Yes	Yes	Yes	No	No
Birds	American peregrine falcon *Falco peregrinus anatum*	USR, LSR, FR, LSJR, USJR	*Foraging:* A variety of open habitats, particularly marshes and other wetlands *Nesting:* High rocky cliffs or other high structures	D/D, FP	Yes	No	No	No	No	No
	Bald eagle *Haliaeetus leucocephalus*	FR	*Foraging:* Large bodies of water or free-flowing rivers with abundant fish and adjacent snags or other perches *Nesting:* Large, old-growth trees or snags in remote, mixed stands near water	D/E, FP, EPA	Yes	No	No	Yes	No	No
	Bank swallow *Riparia*	USR, LSR, FR	*Foraging:* Open riparian areas, grassland, wetlands, water, and cropland *Nesting:* Vertical banks and cliffs with fine-textured or sandy friable soils near streams, rivers, ponds, and lakes	None/T	Yes	Yes	Yes	Yes	Yes	Yes
	Black swift *Cypseloides niger*	FR, LSR, LSJR	*Foraging*: Over a wide variety of habitats, sometimes far from nests *Nesting:* Canyon walls near water and sheltered by overhanging rock or moss, preferably near waterfalls	None/ CSC	Yes	No	No	Yes	No	No
	Black tern *Chlidonias niger*	LSR, LSJR, USJR	*Foraging and nesting:* Freshwater emergent wetlands, marshes, lakes, ponds, moist grasslands, and agricultural fields	None/ CSC	Yes	No	No	Yes	No	No
	California black rail *Laterallus jamaicensis coturniculus*	LSR, LSJR	*Foraging and nesting:* Tidal emergent wetlands dominated by pickleweed, in the high wetland zones near the upper limit of tidal flooding, or in brackish marshes supporting bulrushes and pickleweed; in freshwater, usually found in bulrushes, cattails, and saltgrass adjacent to tidal sloughs	None/T, FP	Yes	Yes	Yes	Yes	Yes	Yes
	Ferruginous hawk (wintering) *Buteo regalis*	USR, LSR, FR, LSJR, USJR	*Foraging:* Open grasslands and agricultural fields *Nesting:* Does not breed in the SPA	None/ CSC	No	No	No	Yes	No	No
	Golden eagle *Aquila chrysaetos*	USR, LSR, FR, LSJR, USJR	*Foraging*: open shrublands, grasslands, and oak woodlands *Nesting*: forests, open valleys, oak savannah with large trees, cliffs	None/FP	No	No	No	No	No	No
	Grasshopper sparrow *Ammodramus savannarum*	USR, LSR, FR, LSJR, USJR	*Foraging and nesting:* Short to middle-height, moderately open grasslands with scattered shrubs	None/ CSC	No	No	No	Yes	No	No

Species	Common Name and Scientific Name	Regional Distribution in SPA [a]	Habitats	Status FED/CA [b]	Associated with Target Habitat [c]	Major Potential CVFPP Effect [d]	Potential Target Species [e]	T/E Listed or Potential for T/E Listing [f]	Focused Conservation Needs [g]	Target Species Chosen for Focused Conservation Planning [h]
Birds	Greater sandhill crane *Grus canadensis tabida*	USR, LSR, FR, LSJR, USJR	*Foraging:* Open grasslands, grain fields, and open wetlands for roosting *Roosting:* In flocks standing in moist fields or in shallow water *Nesting:* Does not breed in the SPA	None/T, FP, EPA	Yes	Yes	No	Yes	Yes	Yes
	Least Bell's vireo *Vireo bellii pusillus*	USR, LSR, FR, LSJR, USJR	*Foraging and nesting:* Low, dense riparian growth along water or along dry parts of intermittent streams	E/E	Yes	No	Yes	Yes	Yes	Yes
	Least bittern *Ixobrychus exilis*	LSJR, LSR, USJR, USR	*Foraging and nesting:* Freshwater and brackish marshes with tall, dense emergent vegetation and clumps of woody plants over deep water	None/ CSC	Yes	Yes	Yes	Yes	No	No
	Lesser sandhill crane *Grus canadensis*	LSJR, LSR, FR, USJR, USR	*Foraging:* Pastures, moist grasslands, alfalfa and grain fields, and shallow wetlands for roosting *Nesting:* Does not breed in California	None/ CSC	Yes	Yes	Yes	Yes	Yes	No
	Little willow flycatcher *Empidonax traillii brewsteri*	FR, USR	*Foraging:* Willow thickets and adjacent meadows *Nesting:* Extensive thickets of low, dense willows at edge of wet meadows, ponds, or backwaters	None/E	Yes	Yes	Yes	Yes	No	No
	Loggerhead shrike *Lanius ludovidianus*	USR, LSR, FR, LSJR, USJR	*Foraging:* Grasslands and agricultural fields *Nesting:* Scattered shrubs and trees	None/ CSC	No	No	No	Yes	No	No
	Mountain plover *Charadrius montanus*	USR, LSR, USJR	*Foraging*: Fallow, grazed, or burned fields with short and sparse vegetation cover *Nesting:* Does not breed in California	None/ CSC	No	No	No	Yes	No	No
	Northern harrier *Circus cyaneus*	USR, LSR, FR, LSJR, USJR	*Foraging and nesting:* Tall grasses and forbs in emergent wetland, along rivers or lakes, grasslands, grain fields, or on sagebrush flats several miles from water	None/ CSC	Yes	No	No	Yes	No	No
	Purple martin *Progne subis*	LSJR, LSR	*Foraging:* Conifer, woodland, and riparian habitats *Nesting:* Snags in old-growth, multilayered, open forests and woodlands	None/ CSC	Yes	No	No	Yes	No	No
	Redhead *Aythya americana*	LSR, LSJR, USJR	*Nesting:* Freshwater emergent wetlands where dense stands of cattails and tules are interspersed with areas of deep, open water *Foraging:* Large, deep bodies of water	None/ CSC	Yes	Yes	Yes	Yes	No	No
	Short-eared owl *Asio flammeus*	USR, LSR, FR, LSJR, USJR	*Foraging and nesting:* Open prairies, coastal grasslands, marshes, bogs, savanna, and dunes	None/ CSC	Yes	No	No	Yes	No	No

Species	Common Name and Scientific Name	Regional Distribution in SPA [a]	Habitats	Status FED/CA [b]	Associated with Target Habitat [c]	Major Potential CVFPP Effect [d]	Potential Target Species [e]	T/E Listed or Potential for T/E Listing [f]	Focused Conservation Needs [g]	Target Species Chosen for Focused Conservation Planning [h]
Birds	Suisun song sparrow *Melospiza melodia maxillaries*	LSJR, LSR	*Foraging:* Bare surface of tidally exposed mud among tules and along slough margins in brackish marshes *Nesting:* Along edges of tidal sloughs and bays supporting mixed stands of bulrush, cattail, and other emergent vegetation	None/ CSC	Yes	No	No	Yes	Yes	No
	Swainson's hawk *Buteo swainsoni*	USR, LSR, FR, LSJR, USJR	*Foraging:* Open desert, grassland, or cropland containing scattered large trees or small groves *Nesting:* Open riparian habitat, in scattered trees or small groves in sparsely vegetated flatlands and agricultural areas; often found near water in the Central Valley	None/T	Yes	Yes	Yes	Yes	Yes	Yes
	Tricolored blackbird *Agelaius tricolor*	USR, LSR, FR, LSJR, USJR	*Foraging:* On ground in croplands, grassy fields, flooded land, and along edges of ponds *Nesting:* Dense	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Western burrowing owl *Athene cunicularia hypugaea*	USR, LSR, LSJR, USJR	*Foraging and nesting*: Grasslands and agricultural fields	None/ CSC	No	No	No	Yes	No	No
	Western snowy plover *Charadrius alexandrinus nivosus*	LSR, USJR	*Foraging and nesting:* Above high-tide line on coastal beaches, sand spits, dune-backed beaches, sparsely vegetated dunes, beaches at creek and river mouths, and salt pans at lagoons and estuaries	T/CSC	Yes	No	No	Yes	No	No
	Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	USR, LSR, FR, LSJR, USJR	*Foraging and nesting:* Extensive deciduous riparian thickets or forests with dense, low-level, or understory foliage adjacent to slow-moving watercourses, backwaters, or seeps; willow is almost always a dominant component of the vegetation. In the Sacramento Valley, also rarely uses adjacent walnut orchards; prefers sites with a dominant cottonwood overstory for foraging. Occurs primarily in riparian habitat in migration in California, although can occur in a wider variety of habitats (e.g., gallery and secondary forests) in migration and winter in the neotropics	T/E	Yes	Yes	Yes	Yes	Yes	Yes
	White-tailed kite *Elanus leucurus*	USR	*Foraging:* Undisturbed, open grasslands, meadows, farmlands, and emergent wetlands *Nesting:* Large groves of dense, broad-leafed deciduous trees close to foraging areas	None/FP	Yes	No	No	No	No	No
	Yellow-breasted chat *Icteria virens*	USR, LSR, FR, LSJR, USJR	*Foraging and nesting:* Early successional thickets of willow and other brushy habitat near rivers, streams, or other watercourses	None/ CSC	Yes	Yes	Yes	Yes	Yes	Yes

Species	Common Name and Scientific Name	Regional Distribution in SPA [a]	Habitats	Status FED/CA [b]	Associated with Target Habitat [c]	Major Potential CVFPP Effect [d]	Potential Target Species [e]	T/E Listed or Potential for T/E Listing [f]	Focused Conservation Needs [g]	Target Species Chosen for Focused Conservation Planning [h]
Birds	Yellow-headed blackbird *Xanthocephalus*	LSR, LSJR, USJR	*Foraging:* Freshwater emergent wetland and sometimes along shorelines and in nearby open fields, preferably on moist ground *Nesting:* Dense emergent wetland of cattails and tules, often along borders of lakes or ponds	None/ CSC	Yes	Yes	Yes	Yes	No	No
	Yellow warbler *Dendroica petechia*	USJR, USR, LSR,[i] FR, LSJR, USJR[i]	*Foraging and nesting*: Low- to mid-story, open-canopy riparian deciduous woodlands with a heavy brush understory; sometimes in montane shrubbery in open conifer forests	None/ CSC	Yes	Yes	Yes	Yes	No	No
Mammals	American badger *Taxidea taxus*	USR, LSR, FR, LSJR, USJR	Drier open states of most scrub, forest, and herbaceous habitats with friable soils	None/ CSC	No	No	No	Yes	No	No
	Fresno kangaroo rat *Dipodomys nitratoides exilis*	USJR	Alkali desert scrub habitats between 200 and 300 feet elevation	E/E	No	No	No	Yes	No	No
	Giant kangaroo rat *Dipodomys ingens*	USJR	Annual grasslands and shrub habitats with sparse vegetative cover	E/E	No	No	No	Yes	No	No
	Hoary bat *Lasiurus cinereus*	USR, LSR, FR, LSJR, USJR	*Foraging:* Over open forested and riparian areas *Roosting:* In the foliage of trees, prefers woodlands and coniferous forests; noncolonial	None/ None	Yes	No	No	No	No	No
	Nelson's antelope squirrel *Ammospermophilus nelsoni*	USR	Arid grasslands with loamy soils and moderate shrub cover	None/T	No	No	No	Yes	No	No
	Pallid bat *Antrozous pallidus*	USR, LSR	*Foraging:* On bare ground and in short grasses in a variety of habitats including chaparral, oak woodland, grassland, ruderal, and agricultural habitats *Roosting:* In crevices of rocky outcrops, hollow trees, cliffs, bridges, barns, and other anthropogenic structures	None/ None	Yes	No	No	No	No	No
	Ringtail *Bassariscus astutus*	FR, USR, LSR	Prefers riparian habitats in many situations, rocky talus slopes, and brushy habitats in most forests	None/FP	Yes	No	No	No	No	No
	Riparian brush rabbit *Sylvilagus bachmani riparius*	LSJR	Riparian woodlands dominated by oaks with a dense understory of wild roses, grapes, and blackberries	E/E	Yes	Yes	Yes	Yes	Yes	Yes
	Riparian (= San Joaquin Valley) woodrat *Neotoma fuscipes riparia*	LSJR	Riparian habitats with associated evergreen and deciduous oak with dense understories; willow thickets	E/CSC	Yes	Yes	Yes	Yes	Yes	Yes
	Sacramento Valley red fox *Vulpes patwin*	FR, USR	Grasslands	None/ None	No	No	No	No	No	No

Species	Common Name and Scientific Name	Regional Distribution in SPA [a]	Habitats	Status FED/CA [b]	Associated with Target Habitat [c]	Major Potential CVFPP Effect [d]	Potential Target Species [e]	T/E Listed or Potential for T/E Listing [f]	Focused Conservation Needs [g]	Target Species Chosen for Focused Conservation Planning [h]
Mammals	San Joaquin kit fox *Vulpes macrotis mutica*	USJR, LSJR	Saltbush scrub, grasslands, oak savannas, and freshwater scrub	E/T	No	No	No	Yes	No	No
	Salt-marsh harvest mouse *Reithrodontomys raviventris*	LSR, LSJR	Salt marsh dominated by pickleweed and saltgrass; requires non-submerged, salt-tolerant vegetation for escape during high tides	E/E, FP	Yes	No	No	Yes	No	No
	Spotted bat *Euderma maculatum*	USR, USJR	*Foraging:* Over water and along washes in deserts, grasslands, and mixed conifer forests from below sea level to above 10,000 feet *Roosting:* In rock crevices in cliffs	None/CSC	Yes	No	No	Yes	No	No
	Townsend's big-eared bat *Plecotus townsendii*	USR, LSR, FR, LSJR, USJR	*Foraging:* Along edges of a variety of habitats *Roosting:* In caves, tunnels, mines, cavernous trees, and buildings	None/C	Yes	No	No	Yes	No	No
	Western mastiff bat *Eumops perotis californicus*	USR, USJR	*Foraging:* Open aerial forager over many habitats and landscapes *Roosting:* In crevices of exposed vertical cliffs of any rock type, and rarely in bridges or tall buildings	None/CSC	Yes	No	No	Yes	No	No
	Yuma myotis *Myotis yumanensis oxalis*	LSR, LSJR	*Foraging:* On flat fresh and brackish waters, mostly in open areas *Roosting:* In tree cavities and in bridges, barns, and other anthropogenic structures	None/ Under State review	Yes	Yes	No	Yes	No	No
	Western red bat *Lasiurus blossevillii*	USR, LSR, FR, LSJR, USJR	*Foraging:* Includes oak woodlands, coniferous forest (at low elevations), along riparian corridors, among non-native trees in urban and rural residential areas, and within mature orchards *Roosting:* Maternity roosts in foliage of mostly old-growth riparian trees; distribution limited mostly to the edges of the mainstems of river systems and Delta waterways; winter roosts are often under leaf litter	None/ CSC	Yes	Yes	Yes	Yes	No	No

Sources: California Interagency Wildlife Task Group 2008; Shuford and Gardali 2008; California Department of Fish and Wildlife 2019.

[a] Regional Distribution in SPA:

FR = CVFPP Feather River Implementation Region
LSJR = Mid–San Joaquin River, Lower San Joaquin River, and Delta South CVFPP Implementation Regions
LSR = Lower Sacramento River and Delta-North CVFPP Implementation Regions
USJR = Upper San Joaquin River CVFPP Implementation Region
USR = Upper Sacramento River and Mid-Sacramento River CVFPP Implementation Regions
Distribution in upstream SPA aquatic and floodplain habitats is included in immediately downstream CVFPP Implementation Region.

[b] Status FED/CA:

Federal:
None = No listing
C = Candidate for listing under the federal ESA
E = listed as endangered under ESA
T = Listed as threatened under ESA
D = Delisted under ESA
California:
None = No listing
C = Candidate for listing under the CESA
E = Listed as endangered under CESA
T = Listed as threatened under CESA
FP = Fully protected under the California Fish and Game Code
CSC = California Species of Special Concern
D = Delisted under CESA

[c] Associated with Target Habitat:

Yes = Species is associated with riverine aquatic (including shaded riverine aquatic), riparian, perennial wetland, or periodically inundated floodplain habitats.
No = Species is not associated with any of these target habitats.

[d] Major Potential CVFPP Effect:

Yes = Implementation of the CVFPP (flood management and conservation actions) could substantially affect California populations of this species, based on distribution, habitat associations, and ecology of species. Effects may be adverse or beneficial.
No = Implementation of the CVFPP would not substantially affect California populations of this species.

[e] Target Species:

Yes = Species both associated with a target habitat and could be substantially affected by CVFPP implementation.
No = Species either not associated with a target habitat or not substantially affected by CVFPP implementation. Target species are species with greatest potential to benefit from or be adversely affected by CVFPP implementation.

[f] **Potential for T/E Listing:**

Yes = Species is currently State- or federally listed as threatened or endangered, or has high potential of being listed during the next five to 10 years.
No = Species is not State- or federally listed.

[g] **Focused Conservation Needs:**

Yes = Species has restricted distribution in SPA, requires habitat elements with restricted distribution (e.g., cut banks), or requires large-scale connectivity of habitat features for completion of life cycle.
No = Species does not have focused conservation needs.

[h] **Focused Conservation Planning:**

Yes = Species is a target species with listing potential and focused conservation needs.
No = Species is not a target species, or does not have listing potential or focused conservation needs. Focused conservation planning addresses specific conservation needs that otherwise may not be met by restoration of ecological processes and habitats within each region.

[i] Potential distribution is based on historic records or poorly known.

Notes:
CA = California
DPS = Distinct Population Segment
EPA = Bald and Golden Eagle Protection Act
ESU = Evolutionarily Significant Unit
FED = federal
SPA = Systemwide Planning Area

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Attachment A.1
Reference Update for the 2016 Conservation Strategy's Target Species

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ATTACHMENT A.1

Reference Update for the 2016 Conservation Strategy's Target Species

Acronym	Definition
CCV	California Central Valley
Conservation Strategy (or Strategy)	Conservation Strategy (or Strategy)
Delta	Sacramento–San Joaquin Delta
DPS	Distinct Population Segment
ESU	Evolutionarily Significant Unit
Strategy (or Conservation Strategy)	2016 Central Valley Flood Protection Plan Conservation Strategy

Introduction

The development of the 2016 Central Valley Flood Protection Plan (CVFPP) Conservation Strategy (Conservation Strategy or Strategy) entailed a comprehensive review and the synthesis of key reference materials used to inform its Appendix G, "Identification of Target Species and Focused Conservation Plans," and Appendix L, "Measurable Objectives Development: Summary of Conservation Needs and Scale of Restoration Opportunities." This attachment summarizes the relevant reference materials that have become available for the target species listed in the 2016 Strategy since its publication (the updated reference materials).

This information can help determine whether the 2016 Conservation Strategy's measurable objectives need to be updated, and whether the existing measures for multi-benefit projects to restore or enhance habitat for target species should be modified. Appendix G of the 2016 Strategy lists potentially suitable species that were considered for inclusion in the Strategy, and describes the evaluation process and criteria for selecting target species. The 2016 Strategy includes provisions for amending the list of target species as part of the five-year update process, to reflect changing conservation needs and habitats. Therefore, this update to the reference material also considered the potentially suitable species that were not selected as

target species in the 2016 Strategy (i.e., non-target species) but were considered for inclusion in the five-year update.

As part of the Conservation Strategy 2022 Update, three additional species are being added to the list of 17 target species:

1. Delta smelt (*Hypomesus transpacificus*).
2. Tricolored blackbird (*Agelaius tricolor*).
3. Yellow-breasted chat (*Icteria virens*).

Reference materials are included for these species in addition to references cited in the individual conservation plans (Appendix B). This attachment also lists updated reference materials for selected non-target species associated with target habitats.

Target Species References

The updated reference materials for target species are summarized as follows and organized into four categories:

1. **Adopted Conservation Plans.** Conservation plans adopted by government agencies may focus on one or more of the following areas: recovering species, managing land, or supporting an incidental take authorizations or permits.[1] Plans adopted since 2016 have been grouped into three categories: recovery plans, habitat conservation plans and natural community conservation plans, and regional conservation investment strategies. No other types of conservation plans applicable to the Conservation Strategy have been updated since 2016.

2. **Status Reviews and Critical Habitat Designations.** Agency reviews of the status of listed species frequently update the recommended actions or other content of recovery plans, and critical habitat designations add to federal agencies' recovery planning efforts. These references are grouped by target species.

3. **Regional Conservation Planning References.** Publications regarding conservation of species groups in the Sacramento and San Joaquin valleys and the Sacramento–San Joaquin Delta (Delta) address multiple target species and recommend actions based on recent science.

4. **Other Target Species References.** These references consist of scientific literature relevant to the conservation of target species and not included in one of the preceding categories. These references are grouped by target species.

[1] The 2016 Strategy defines "conservation" as the maintenance, enhancement, and restoration of populations, communities, and ecosystem functions to sustain the services, benefits, and values of public trust resources.

Adopted Conservation Plans

The following conservation plans have been developed for target species since the release of the 2016 Strategy.

Recovery Plans

National Marine Fisheries Service. 2018. *Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon (Acipenser medirostris).* Sacramento (CA): National Oceanic and Atmospheric Administration. August 8, 2018.

- Lists criteria for demographic and threat-based recovery.
- Presents 20 recovery actions aiming to restore passage and habitat; reduce mortality from fisheries, entrainment, and poaching; and address threats resulting from contaminants, climate change, predation, sediment loading, and oil and chemical spills.
- Contains 17 priority recovery actions and three secondary priority actions.
- Identifies 16 research priorities.
- Proposes monitoring and education and outreach programs.

U.S. Fish and Wildlife Service. 2017. *Recovery Plan for the Giant Gartersnake (Thamnophis gigas).* Sacramento (CA). September. 28, 2017.

- Focuses on identifying and protecting areas for habitat restoration, enhancement, or creation, including connectivity between populations.
- Defines nine recovery units corresponding with geographically and genetically distinct populations: the Butte Basin, Colusa Basin, Sutter Basin, American Basin, Yolo Basin, Delta Basin, Cosumnes-Mokelumne Basin, San Joaquin Basin, and Tulare Basin.
- Defines three objectives and criteria for achieving objectives:

    1. Establish and protect self-sustaining populations.
    2. Restore and conserve healthy Central Valley wetland ecosystems.
    3. Ameliorate or eliminate current and future threats.

- Proposes 10 recovery actions.

U.S. Fish and Wildlife Service. 2019. *Revised Recovery Plan for Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus).* Sacramento (CA). October 4, 2019.

- Focuses on loss and degradation of habitat.
- Defines three management units: Sacramento River, San Joaquin River, and Putah Creek.
- Describes two recovery objectives: preserve resilient populations across the historical range by maintaining occupancy in at least 80 percent of major river system subbasins; and protect and manage a system of connected habitat patches along each river or major drainage within subbasins.
- Presents five recovery criteria.
- Identifies two priority recovery actions, one secondary priority recovery action, and two tertiary priority recovery actions.

Habitat Conservation Plans and Natural Community Conservation Plans

U.S. Fish and Wildlife Service. 2018. Biological and Conference Opinion, Issuance of a Section 10(a)(1)(B) Permit for the Yolo County Habitat Conservation Plan and Natural Community Conservation Plan. File Number 08ESMF00-2017-F-3219-1. Sacramento (CA). August 2, 2018.

ICF International. 2018. Yolo Habitat Conservation Plan and Natural Community Conservation Plan.

Volume I and Volume II. Prepared for Yolo Habitat Conservancy. Sacramento (CA). April 2018.

- This document and the U.S. Fish and Wildlife Service (2018) document address six of the Conservation Strategy's target species: valley elderberry longhorn beetle, giant gartersnake, bank swallow (*Riparia riparia*), Least Bell's vireo (*Vireo bellii pusillus*), Swainson's hawk (*Buteo swainsoni*), and western yellow-billed cuckoo (*Coccyzus americanus*).

County of Sacramento, City of Rancho Cordova, City of Galt, Sacramento County Water Agency, Sacramento Regional County Sanitation District, and the Southeast Connector Joint Powers Authority. 2018. *Final South Sacramento Habitat Conservation Plan.* Volumes I and II. Sacramento (CA). January 2018.

- This document addresses five of the Conservation Strategy's target species—giant gartersnake, Swainson's hawk, valley elderberry longhorn beetle, greater sandhill crane, and tricolored blackbird—and several potential suitable non-target species.

Status Reviews and Critical Habitat Designations

The following status review reports and critical habitat designations have been developed for target species since the release of the 2016 Strategy.

California Central Valley Steelhead–Distinct Population Segment

National Marine Fisheries Service. 2016. *5-Year Review: Summary and Evaluation California Central Valley Steelhead Distinct Population Segment.* Sacramento (CA): National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

- Recommends that California Central Valley (CCV) steelhead (*Oncorhynchus mykiss*) Distinct Population Segment (DPS) remain listed as threatened.
- Gives an overview of listing history and determinations.
- Increases the recovery priority number from 7 to 5 because of an increase in recovery potential.
- Recommends adding the Mokelumne River Hatchery to the CCV steelhead DPS because of the near-identical genetic relationship with Feather River Hatchery fish, which are considered native and part of the DPS.
- Outlines the recovery plan, including success criteria, and discusses progress toward achievement.
- Summarizes relevant new information and presents new data on population trends and abundance.
- Reports an increase in hatchery returns from wild fish salvage; however, all concerns from the previous status review remain.
- Discusses genetic structure and population dynamics (including hatchery data), but with a caveat that there is a general lack of data on the status of wild populations.
- Conducts a five-factor analysis, including threats, conservation measures, and regulatory mechanisms. One major factor contributing to the species' threatened status remains a reduction in habitat quality or quantity caused by anthropogenic changes to the river systems.
- Describes restoration projects that have benefited and are expected to benefit habitat in the future.
- Discusses direct human impacts (e.g., commercial, recreational, scientific, or educational), disease and predation impacts, and the inadequacies of existing regulatory mechanisms.

- Details hatchery and harvest effects on the species' continued survival.
- Includes an extensive discussion of climate change, precipitation and drought, and oceanic conditions.
- Summarizes how each ESA listing factor has changed since the 2011 status review and lists eight recommendations for future actions.

Chinook Salmon–Central Valley Spring-run Evolutionarily Significant Unit

National Marine Fisheries Service. 2016. *5-Year Review: Summary and Evaluation of Central Valley Spring-run Chinook Salmon Evolutionarily Significant Unit.* April. Sacramento (CA): National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

- Recommends that Central Valley spring-run Chinook salmon (*O. tshawytscha*) Evolutionarily Significant Unit (ESU) remain listed as a threatened species; however, the review suggests that its status has improved as a result of extensive restoration projects.
- Explains that drought conditions raise the level of concern for the species.
- Gives an overview of listing history and determinations.
- Describes critical habitats for the species, and outlines the recovery plan and criteria.
- Summarizes relevant new information regarding the ESU delineation, and presents new data on population trends and abundance.
- Conducts a five-factor analysis including threats, conservation measures, and regulatory mechanisms. Examines the effects of traditional habitat loss and remaining habitat degradation, particularly associated with dams and water projects.
- Summarizes several restoration and monitoring projects and touches upon flood management and the effects of "self-mitigating" levee maintenance.
- Discusses direct human impacts (e.g., commercial, recreational, scientific, or educational).
- Includes an extensive discussion on climate change, precipitation and drought, and oceanic conditions.
- Summarizes changes to ESA listing factors since the last review.
- Presents four priority near-term drought actions.
- Presents 11 priority actions for the recovery of Central Valley spring-run Chinook salmon.

Chinook Salmon–Sacramento River Winter-run Evolutionarily Significant Unit

National Marine Fisheries Service. 2016. *5-Year Status Review: Summary and Evaluation of Sacramento River Winter-Run Chinook Salmon ESU.* Sacramento (CA): National Oceanic and Atmospheric Administration, U.S. Department of Commerce. December 2016.

- Recommends that Sacramento River winter-run Chinook salmon ESU remain listed as an endangered species.
- Gives an overview of listing history and determinations.
- Describes critical habitats for the species, and outlines the recovery plan and criteria.
- Summarizes relevant new information regarding the ESU delineation, and presents new data on population trends and abundance.
- Discusses current threats to habitat and range, including the effects of flood management, Central Valley restoration project efforts, and climate change.
- Discusses seven recommendations for future actions.

Green Sturgeon

National Marine Fisheries Service. 2021. *Southern Distinct Population Segment of North American Green Sturgeon (Acipenser medirostris) 5-Year Review: Summary and Evaluation.* Sacramento (CA): National Oceanic and Atmospheric Administration, U.S. Department of Commerce. November 2021.

- Gives an overview of listing, rulemaking, and review history.
- Summarizes new information for the species including confirmed spawning in the Feather and Yuba rivers, and confirmed detection in the Stanislaus River and San Joaquin River at the mouth of the Merced River.
- Lists recovery criteria and discusses how each have or have not been met.
- Describes species ecology and status including new information since 2015 review.
- Presents five-factor analysis of threats, conservation measures and regulatory mechanisms including a discussion of the effects of barriers and flow in the Sacramento River system, levee projects, diversions, and climate change.
- Recommends no change to species status and lays out five recommendations to assist in improving the status of and available information about the species.

U.S. Fish and Wildlife Service. 2020. "Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews for Eulachon, Yelloweye Rockfish, Bocaccio, and Green Sturgeon." Federal Register Volume 85: Pages 12,905 to 12,906.

- Presents a notice of the initiation of reviews and a request for information.

Giant Gartersnake

U.S. Fish and Wildlife Service. 2020. *Giant Gartersnake (Thamnophis gigas) 5-Year Review: Summary and Evaluation*. Sacramento (CA). June 2020.

- Gives an overview of listing history and determinations, and recommends no change to the species' status.
- Describes spatial distribution and abundance, including information for each recovery unit. Includes the notable discovery of giant gartersnakes at Liberty Farms in the Yolo Basin, where the population was previously presumed extirpated.
- Identifies four ongoing giant gartersnake studies being conducted by the U.S. Geological Survey.
- Discusses threats and conservation efforts, including habitat conservation plans.
- Outlines progress toward recovery criteria identified in the species recovery plan.

Riparian Brush Rabbit

California Department of Fish and Wildlife. 2020. *5-Year Status Review of Riparian Brush Rabbit (Sylvilagus bachmani riparius).* Report submitted to the California Fish and Game Commission. Sacramento (CA). February 21, 2020.

- Recommends no change to the species' status.
- Describes the species' life history, trends in abundance, threats and survival factors, distribution (current and historical), and habitat.
- Examines the degree and immediacy of threats.
- Discusses flood control projects (e.g., Paradise Cut) and effects on riparian brush rabbit in Lathrop, California.
- Discusses the effects of flooding on population and includes maps.
- Contains a large section on management activities and species recovery that includes recommendations (e.g., establishment of additional flood-secure populations, and the filling of data gaps).

Riparian Woodrat

U.S. Fish and Wildlife Service. 2020. *5-Year Review Riparian Woodrat (Neotoma fuscipes riparia).* Sacramento (CA). July 8, 2020.

- Retains the species' endangered status.
- Discusses the status, abundance, and taxonomy of two known populations of riparian woodrats.
- Presents current threats to the species.
- Describes current conservation efforts and mechanisms.

Valley Elderberry Longhorn Beetle

U.S. Fish and Wildlife Service. 2020. "Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 66 Species in California and Nevada." Federal Register Volume 85: Pages 4,692 to 4,694.

- Presents a notice of the initiation of reviews and a request for information for 66 species, including valley elderberry longhorn beetle.

Western Yellow-billed Cuckoo

U.S. Fish and Wildlife Service. 2020. "Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Western Distinct Segment of the Yellow-Billed Cuckoo." Federal Register Volume 85: Pages 11,458 to 11,594.

- Documents the current best assessment of the areas that meet the definition of critical habitat for western yellow-billed cuckoo.
- Presents a conservation strategy focused on breeding habitat including areas for nesting, foraging, and dispersal when breeding or food resources may not be optimal.
- Discusses how the determination was focused on areas known to have breeding or suspected breeding habitat.
- Describes the species' life history and habitat associations.
- Discusses climate change and hydrologic processes.
- Reduces the August 15, 2014, area of proposed critical habitat of 546,335 acres in 80 units to 493,665 acres in 72 units.
- Describes Unit 63, CA–1 Sacramento River: Colusa, Glenn, Butte, and Tehama counties.

Regional Conservation Planning References

The following conservation planning references for the Sacramento–San Joaquin Valley and Delta have been published since 2016.[2]

Dayer A, Meyers R. 2016. Central Valley Joint Venture Human Dimensions Chapter Manuscript. December 20, 2016.

- Assesses priority areas for the human dimensions inquiry for the Central Valley Joint Venture.
- Presents a literature review to identify and summarize the human dimensions research relevant to wildlife conservation, with an emphasis on the Central Valley.
- Provides recommendations to inform the revision of the Implementation Plan.
- Provides cross-over content related to flooding or flood control.

Dahm C, Kimmerer W, Korman J, Moyle PB, Ruggerone GT, Simenstad CA. 2019. *Developing Biological Goals for the Bay-Delta Plan: Concepts and Ideas from an Independent Scientific Advisory Panel.* A Final Report to the Delta Science Program. Prepared for Delta Stewardship Council, Delta Science Program. April 2019.

- Provides biological goals for:
  - Ecosystem structure and function.
  - Native fish species.
  - Salmonids.
- Uses a geographic scope that includes the following areas:
  - San Joaquin River and its major tributaries (including the Merced, Tuolumne, and Stanislaus rivers).
  - Sacramento River including Sacramento River tributaries and Delta eastside tributaries (Mokelumne, Cosumnes, and Calaveras rivers).
  - Delta and Suisun Marsh.

Dybala, KE, Clipperton N, Gardali T, Holet GG, Kelsey R, Lorenzato S, Melcer R Jr., Seavy NE, Silveira JG, Yarris GS. 2017. “Population and Habitat Objectives for Avian Conservation in California’s Central Valley Riparian Ecosystems.” San Francisco Estuary & Watershed

[2] Several sections of the Delta Stewardship Council’s 2013 Delta Plan (https://deltacouncil.ca.gov/delta-plan/) have been updated since 2016; however, those sections are not relevant to the Conservation Strategy.

Science Volume 15 (Issue 1): Article 5. Viewed online at: AvianConservation. Accessed: March 25, 2020.

- Defines the long-term conservation goal of establishing riparian ecosystems that provide sufficient habitat to support genetically robust, self-sustaining, and resilient bird populations.
- Selects 12 riparian landbird focal species as ecosystem indicators in four Central Valley Joint Venture planning regions.
  - Focal species include six Appendix G species (including three target species): western yellow-billed cuckoo, bank swallow, least Bell's vireo, yellow-breasted chat, yellow warbler (*Setophaga petechia*), and song sparrow (*Melospiza melodia*).
- Defines long-term (100-year) population objectives.
- Estimates long-term species density and riparian restoration objectives required to achieve long-term population objectives.
- Proposes short-term (10-year) objectives to track progress toward the long-term objectives.

National Marine Fisheries Service. 2019. Endangered Species Act Section 7(a)(2) Biological Opinion, Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response, and Fish and Wildlife Coordination Act Recommendations, Sacramento River Bank Protection Project Post Authorization Change Report. Action Agency, U.S. Army Corps of Engineers. National Marine Fisheries Service Environmental Consultation Organizer Number: WCRO-2019-01893. Sacramento (CA). August 30, 2019.

- Describes proposed levee protection measures and flood risk management improvements under the Sacramento River Bank Protection Project Post Authorization Change Reportthat encompass levees and weirs within the Sacramento River Flood Control Project.
- Covers 20,535 linear feet at 35 identified potential future erosion repair sites within Economically Justified Basins.
- Does not restrict the number of repair sites covered by the biological opinion, but limits linear footage to 30,000 linear feet.
- Identifies a framework for site selection and implementation.
- Describes five bank protection measures and designs:
  1. Setback levees.
  2. Bank fill stone protection with no on-site vegetation.
  3. Adjacent levee.
  4. Riparian benches with revegetation.
  5. Bank fill stone protection with on-site vegetation.

- Presents operations and maintenance measures, a compensation strategy, and conservation measures.
- Defines the biological opinion and incidental take assessment approach and rangewide status of the affected species and their designated critical habitat for:
  - Central Valley spring-run Chinook salmon ESU.
  - CCV steelhead DPS.
  - Southern DPS of North American green sturgeon.
  - Sacramento River winter-run Chinook salmon ESU.
- Establishes an environmental baseline including current land cover types, previous flood management actions, species and critical habitat status within the Action Area, and approved mitigation banks.
- Describes direct and indirect effects of the proposed action on the species and critical habitat, and discusses cumulative effects.
  - Cumulative effects include agricultural practices, aquaculture and fish hatcheries, increased urbanization, nonfederal and illegal rock revetment, and levee repair projects.
- Provides a synthesis of the effects, environmental baseline, cumulative effects, and status of the species and critical habitat.
- Indicates the proposed action is not likely to jeopardize the continued existence of the affected species or destroy or adversely modify its designated critical habitat.
- Provides 15 conservation recommendations.
- Recommends that U.S. Army Corps of Engineers complete a study of potential rock revetment removal sites on the Sacramento River where rock revetment does not serve a flood risk reduction purpose and can be removed to enhance green sturgeon and salmonid shoreline habitat.

National Marine Fisheries Service. 2021. Endangered Species Act Section 7(a)(2) Biological Opinion, Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the American River Watershed Common Features General Reevaluation Report Reiniation 2020. Action Agency, U.S. Army Corps of Engineers. National Marine Fisheries Service Environmental Consultation Organizer Number: WCRO-2020-03082. Sacramento (CA). May 12, 2021.

- Analyzes the effects of the American River Watershed Common Features General Reevaluation Report based on the final biological assessment for the project and the best available science for:
  - Sacramento River winter-run Chinook salmon ESU.
  - Central Valley spring-run Chinook salmon ESU.

  - Southern DPS of North American green sturgeon.
  - California Central Valley steelhead DPS.
  - The designated critical habitats of these species.
  - Essential fish habitat for Pacific Coast salmon.

- Summarizes the background and consultation history, and the proposed federal action to reduce flood risk caused by release of 160,000 cubic feet per second from Folsom Dam to the City of Sacramento, by adding support to the surrounding levees. Includes CVFPB and SAFCA as the project's nonfederal sponsors.

- Discusses designs, processes, and construction methods for American River, Natomas East Main Drain Canal and Arden Creek, Sacramento River, and Sacramento Weir and Fish Passage Facility infrastructure improvements.

  - Includes design, construction methods, and conservation measures for the Arden Pond mitigation site, which is intended to provide compensatory mitigation for impacts to salmonid species resulting from the Proposed Action.

- Requires the development and implementation of the Green Sturgeon Habitat, Mitigation, and Monitoring Plan (HMMP) to minimize adverse effects to green sturgeon habitat.

  - Provides a purpose, framework, and goals by which the Habitat, Mitigation, and Monitoring Plan will be developed.

- Lists 30 general minimization measures to be applied to the entire project, specific species, and/or specific locations within the project area.

- Includes an estimated three- to five-year maintenance schedule for riparian habitat mitigation.

- Requires compensatory mitigation for construction effects on listed species and their critical habitat and discusses on- and off-site compensatory mitigation associated with the Proposed Action.

- Provides Section 7 Biological Opinion.

  - Describes the Section 7 approach.

  - Reviews and analyzes the current status of the listed species and critical habitat; environmental baseline within action area; effects of the Proposed Action; effects of other activities caused by the proposed action; and cumulative effects.

  - Concludes with the biological opinion that the proposed action is not likely to jeopardize the continued existence of Sacramento River winter-run Chinook salmon, Central Valley

spring-run Chinook salmon, DPS North American green sturgeon, and California Central Valley steelhead or destroy or adversely modify their designated critical habitat.

- Provides Incidental Take Statement
  - Defines take, harm, and incidental take and how each will be determined within the Action Area and the thresholds for allowable take.
  - Includes five "Reasonable and prudent measures" that are nondiscretionary and necessary or appropriate to minimize the impact of the amount or extent of incidental take.
  - Recommends eight conservation measures.
- Describes the purpose of consultation under the Magnuson-Stevens Fishery Conservation and Management Act regarding conservation of Essential Fish Habitat.
- Defines Essential Fish Habitat affected by the Project and the aspects of the Proposed Action that are expected to have adverse effects within the Action Area.
- Recommends 13 conservation measures to avoid and minimize adverse effects.

Pandolfino ER, Handel CM. 2018. "Population Trends of Birds Wintering in the Central Valley of California." *In* Shuford WD, Gill RE Jr., Handel CM (eds.), *Trends and Traditions: Avifaunal Change in Western North America*. Studies of Western Birds 3. Camarillo (CA): Western Field Ornithologists.

- Documents the population trends for Central Valley wintering birds through the analysis of Christmas bird counts.

Shuford WD, Dybala KE. 2017. "Conservation Objectives for Wintering and Breeding Waterbirds in California's Central Valley." San Francisco Estuary & Watershed Science Volume 15 (Issue 1): Article 4. Viewed online at: Breeding-Birds. Accessed: March 25, 2020.

- Builds on previous efforts in the Central Valley Joint Venture to establish specific, quantitative population and habitat objectives for Central Valley waterbirds.
- Estimates the current extent, temporal availability, and distribution of suitable waterbird habitat in the Central Valley; describes the selection of 10 focal species; and summarizes new estimates of current population sizes.
  - Focal species include two Appendix G target species: California black rail (*Laterallus jamaicensis coturniculus*) and greater sandhill crane (*Antigone canadensis*).

- Defines short-term (10-year) and long-term (100-year) population objectives for each species and the corresponding habitat objectives to meet overarching waterbird needs in the Central Valley over these time frames.

- Recognizes fine-scale habitat needs and limiting factors of each focal species.

- Makes specific conservation recommendations to benefit focal species and a wide range of other waterbirds that breed or winter in the Central Valley.

Shuford WD, Hertel M. 2017. "Bird Species at Risk in California's Central Valley: A Framework for Setting Conservation Objectives." San Francisco Estuary & Watershed Science Volume 15 (Issue 1): Article 7. Viewed online at: Article7. Accessed: March 25, 2020.

- Identifies 38 at-risk species, subspecies, or distinct populations of birds that warrant heightened conservation efforts in the Central Valley.

- Contains the following six Appendix G target species: bank swallow, California black rail, greater sandhill crane, least Bell's vireo, Swainson's hawk, and western yellow-billed cuckoo.

- Includes non-target species identified in Appendix G:

  - Tricolored blackbird and yellow-breasted chat (both now included as target species).
  - Burrowing owl, bald eagle (*Haliaeetus leucocephalus*).
  - Black tern (*Chlidonias niger*).
  - Grasshopper sparrow (*Ammodramus savannarum*).
  - Lesser sandhill crane (*Antigone canadensis canadensis*).
  - Redhead (*Aythya americana*).
  - Suisun song sparrow (*Melospiza melodia maxillaris*).
  - Mountain plover (*Charadrius montanus*).
  - Western snowy plover (*Charadrius alexandrinus*).
  - Loggerhead shrike (*Lanius ludovicianus*).
  - Short-eared owl (*Asio flammeus*).
  - Yellow-headed blackbird (*Xanthocephalus xanthocephalus*).
  - Northern harrier (*Circus cyaneus*).
  - Purple martin (*Progne subis*).

- Evaluates subregional distribution, habitat, and threats in the Central Valley.

- Assesses the adequacy of approaches taken to establish conservation objectives.

- Discusses a conceptual framework for determining population or habitat objectives.

U.S. Bureau of Reclamation and U.S. Fish and Wildlife Service. 2020. Near-term Restoration Strategy for the Central Valley Project Improvement Act Fish Resource Area FY2021–FY2025. Prepared for the Bureau of Reclamation and U.S. Fish and Wildlife Service. Sacramento (CA).

- Develops priorities to form a strategy to double anadromous fish populations in the Central Valley through the prioritization of restoration, research, and monitoring efforts that will be implemented during the 2021-2025 fiscal year cycle.
- Outlines focused prioritizations for the investment of restoration funds.
- Intended to facilitate the planning, design, and implementation of large-scale restoration efforts and the documentation of population-level effects on multiple anadromous fish species.
- Describes current efforts and future efforts, including restoration projects, monitoring programs, and targeted research, and provides an organizational framework to record, analyze, and repeat beneficial efforts toward increasing anadromous fish populations in the Central Valley.

U.S. Bureau of Reclamation. 2020. Record of Decision: Reinitiation of Consultation on the Coordinated Long-Term Modified Operations of the Central Valley Project and State Water Project. February. Region 10 – California Great Basin, Sacramento (CA).

- Approves the Bureau of Reclamation's preferred alternative, Alternative 1, to better integrate ESA compliance actions and water supply operations through an operational plan that improves its flexibility in managing the Central Valley Project, and best meets the authorized project purposes.
- Includes a significant commitment to improved coordinated operations with California Department of Water Resources to meet ESA requirements for Delta Smelt, North American green sturgeon, California Central Valley steelhead, Central Valley spring-run Chinook salmon, and Sacramento winter-run Chinook salmon and their habitat.
- Describes the alternatives and the key considerations for the decision to approve Alternative 1, the preferred alternative.

U.S. Bureau of Reclamation. 2021. Public Draft Workplan: Fiscal Year 2021 Obligation Plan for CVPIA Authorities, Central Valley Project, California. February. Region 10 – California Great Basin, Sacramento (CA).

- Describes the Bureau of Reclamation's Fiscal Year 2021 planned obligations using the authorities provided by the Central Valley Improvement Act, the Central Valley Project Restoration Fund, and other Federal appropriations.

U.S. Fish and Wildlife Service. 2017. Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle. Sacramento (CA).

Williams TH, Spence BC, Boughton DA, Johnson RC, Crozier LG, Mantua NJ, O'Farrell MR, Lindley ST. 2016. *Viability Assessment for Pacific Salmon and Steelhead Listed under the Endangered Species Act: Southwest*. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-564.

- Suggests the extinction risk for the CCV steelhead DPS has not changed since 2010, but the extinction risk has increased for Sacramento River winter-run Chinook salmon ESU and Central Valley spring-run Chinook salmon ESU.

- Provides an overview of new information for consideration of boundary delineations for listed California ESUs and DPSs of Chinook salmon, coho salmon (*Oncorhynchus kisutch*), and CCV steelhead DPS.

  - Climate and ocean conditions.
  - Central Valley recovery domain.
  - Sacramento River winter-run Chinook salmon ESU.
  - Central Valley spring-run Chinook salmon ESU.
  - CCV steelhead DPS.

- Provides the following information for each species subsection:

  - DPS and ESU boundary delineation.
  - Summary of previous assessments.
  - Brief review of technical recovery team documents and previous findings.
  - New data and updated analyses; harvest impacts; summary and conclusions.

DiGaudio RT, Dybala KE, Seavy NE, Gardali T. 2017. "Population and Habitat Objectives for Avian Conservation in California's Central Valley Grassland–Oak Savanna Ecosystems." San Francisco Estuary & Watershed Science Volume 15 (Issue 1): Article 6. Viewed online at: Article6. Accessed: March 25, 2020.

- Lists 12 focal species that include four of the non-target species in Appendix G: western burrowing owl, grasshopper sparrow, loggerhead shrike, and northern harrier.

Regional Conservation Investment Strategies

ICF International Inc. 2020. *Yolo Regional Conservation Investment Strategy/Local Conservation Plan*. Final. (ICF 00723.16.) Sacramento, California. Prepared for Yolo Habitat Conservancy, Woodland (CA). October 2020.

- Provides mitigation and stewardship-driven conservation in Yolo County; describes the existing condition for the amount, location, and type of natural communities and focal species habitat in the document's strategy area.
- Recommends conservation actions to address land cover types, and focal species to direct project planning and conservation efforts.
- Includes 40 focal species and 97 conservation species. The focal species list includes 13 of the 2016 Strategy's target species, and the three new target species; multiple non-target species are identified as either focal or conservation species.

ICF International. 2020. Final Draft Mid-Sacramento Valley Regional Conservation Investment Strategy. (ICF 00428.17.) Sacramento (CA). Prepared for Reclamation District 108, Grimes, (CA). December 2020.

- Based primarily on the Mid- and Upper Sacramento Regional Flood Management Plan and the Feather River Regional Flood Management Plan, which provide regional frameworks for integrating conservation into the flood management system and operations.
- Identifies conservation and habitat enhancement actions that can be used to provide compensatory mitigation for flood management and other infrastructure projects in the regions.
- Identifies 12 focal species; of those, 10 overlap with the 2016 Strategy's target species, tricolored blackbird is a new target species, and western pond turtle (*Actinemys marmorata*) is a non-target species.

Other Reference Materials for Target Species

Updated reference materials are available for many of the target species, which are listed in this section.

Delta Button-celery

No updated reference materials have become available for Delta button-celery (*Eryngium racemosum)* since the release of the 2016 Strategy.

Slough Thistle

No updated reference materials have become available for slough thistle (*Cirsium crassicaule*) since the release of the 2016 Strategy.

Valley Elderberry Longhorn Beetle

Within this attachment, "Adopted Conservation Plans," and "Regional Conservation Planning References," provide more details.

Dobbins MT, Holyoak M. 2021. "Population Viability and Management of the Valley Elderberry Longhorn Beetle." Biodiversity and Conservation Volume 30: pages 481 to 496. Viewed online at: Longhorn-Beetle. Accessed: October 2021.

- Investigates the valley elderberry longhorn beetle population's viability and sensitivity to environmental and anthropogenic stochasticity across five major Central Valley Rivers with known populations: American River, Cache Creek, Sacramento River, Cosumnes River, and Putah Creek.
- Assesses the effects of increased habitat loss, more frequent drought and wildfires, and increased juvenile mortality due to invasive predators.
- Finds that across all scenarios, the region-wide metapopulation was more robust to extinction than individual rivers, and that extinction probabilities were lower for larger rivers than smaller ones.
- Finds that modest increases in the annual probability of drought or wildfires and juvenile mortality greatly reduced population persistence at all spatial scales, often leading to rapid within-river extinctions, while increases in habitat loss had moderate impacts.
- Finds that increases in dispersal rates among rivers had negligible effects on improving population viability.
- Highlights the vulnerability of the species to further environmental and anthropogenic disturbance and emphasizes the importance of maintaining a healthy metapopulation structure with large tracts of suitable habitat for long-term valley elderberry longhorn beetle viability.

Rayburn AP, Rogner M, Frank P. 2018. "Abundance and Distribution of Blue Elderberry (*Sambucus nigra* ssp. *caerulea*) on Lower Cache Creek: Implications for Adaptive Floodplain Management." San Francisco Estuary & Watershed Science Volume 16 (Issue 3): Article 7. Davis (CA). Accessed: March 2020.Viewed online at: Blue-Elderberry. Accessed: March 2020.

- Describes a comprehensive field survey to map elderberry shrubs (the valley elderberry longhorn beetle's host plant) across the 904-hectare Cache Creek Resource Management Plan area, and to collect spatially explicit abundance and distribution data.
- Analyzes shrub distribution relative to floodplain inundation zones and associated vegetation, slope, and aspect.

California Central Valley Steelhead–Distinct Population Segment

Within this attachment, "Status Reviews and Critical Habitat Designations," and "Regional Conservation Planning References," provide more details.

Beakes M, Phillis C. 2021. "Monitoring Steelhead Populations in the San Joaquin Basin – Life-History Variation in Oncorhynchus mykiss." ResearchGate. Viewed online: Steelhead-Populations. Accessed: October 2021.

- Describes 14 alternative life-history pathways for Oncorhynchus mykiss and the complex interactions in the genetic makeup and internal conditions of individual fish.
- Discusses knowledge gaps in patterns and process related to Oncorhynchus mykiss life -history variations.
- Identifies the following knowledge gaps:
  - Importance of non-natal habitats in supporting divergent life-history types (e.g., intermittent streams and the Bay-Delta).
  - Genetics as a tool for management and predicting anadromy.
  - The effects of water management, salmon management, and climate change on the environmental and genetic controls of steelhead life-history diversity.

Buchanan RA, Buttermore E, Israel J. 2021. "Outmigration Survival of a Threatened Steelhead Population Through a Tidal Estuary." Canadian Journal of Fisheries and Aquatic Sciences (Author's Accepted Manuscript). Viewed online: Threatened-Steelhead. Accessed October 2021.

- Uses acoustic telemetry with multistate release-recapture models to investigate survival patterns during a key stage of the juvenile emigration of anadromous steelhead through the Delta over multiple years, including three drought years.
- Designed to address uncertainties in San Joaquin River steelhead survival through the Delta and its relationship with the seasonal water management strategies used by federal and state agencies in the Delta.
- Presents six year migration survival results, spatial patterns in survival estimates, survival patterns compared to water management and environmental conditions, and drought effects on survival modeling.
- Finds steelhead survival through the Delta varies considerably both between and within years.
- Suggests combination of habitat loss, reduced river flows, increased resource use, warming temperatures, and non-native aquatic community structure is intensified in the Delta

because of its southern latitude in the steelhead range and because of human development of the region.

- Discusses in detail water management in the San Joaquin River and its tributaries as it enters the Delta, and the way it affects steelhead movement and survival.
- Suggests the results have implications for management designed to support emigrant survival in the Delta, including timing the reservoir releases from the multiple tributaries to coincide with the juvenile migration, manipulating flow regimens, and restoring Delta habitat.
- Identifies the following factors for future investigation:
  - Factors driving route selection at various junctions in the Delta.
  - Juvenile steelhead residence time and the propensity of Delta rearing.
  - Reach-specific flow-survival relationships.
  - Survival differences between hatchery and run-of-river steelhead and between steelhead and Chinook salmon.
  - The role of non-native predators and non-native vegetation on survival patterns in different regions of the Delta.
  - The sensitivity of adult returns to estuarine and early marine survival.
- Identifies the need to estimate steelhead survival further downstream through the bays.

Moniz PJ, Pasternack GB, Massa DA, Stearman LW, Bratovich PM. 2019. "Do Rearing Salmonids Predictably Occupy Physical Microhabitat?" Journal of Ecohydraulics Volume 5 (Issue 2): Pages 132 to 150. Accessed: April 2020.Viewed online: Rearing-Salmonids.

- Further develops and applies a generalized bioverification framework to salmonid microhabitat suitability models.
- Develops water depth and velocity habitat suitability criteria functions for two size classes of rearing *Oncorhynchus tshawytscha* and *O. mykiss* using three years of snorkel survey data from the lower Yuba River.
- Accurately predicts both preferred and avoided habitat, using microhabitat suitability levels.
- Provides a generalized bioverification framework recommended for evaluating and comparing the accuracy and reliability of ecohydraulic models.

Chinook Salmon—Central Valley Fall and Late Fall-run Evolutionarily Significant Unit

Within this attachment, "Regional Conservation Planning References," provides more details.

Iglesias SI, Henderson MJ, Michel CJ, Ammann AJ, Huff DD. 2017. Chinook Salmon Smolt Mortality Zones and Influence of Environmental Factors on Out-Migration Success in the Sacramento River Basin. Prepared for D. Meier, U.S. Fish and Wildlife Service Anadromous Fish Screen Program Agreement Number F15PG00146. Sacramento (CA). April 2017.

- Incorporates a breadth of individual fish attributes, environmental covariates, and reach-specific habitat types into mark-recapture survival models to determine which factors are most influential to outmigration success for hatchery-origin, late fall-run yearling smolts.
- Examines the relationship of smolt survival to environmental factors influenced by broad-scale, basin-wide-level dynamics, as well as smaller-scale, reach-specific habitat features.
- Finds that mortality during outmigration is spatially heterogeneous, with a general trend of increased survival through lower reaches.
- Among the factors evaluated, correlates diversion density (structures for refugia), off-channel habitat availability, and sinuosity with survival; however, increased flow, smolt condition, swim speed, and release strategy exhibited the strongest correlations with outmigration success.
- Discusses limitations to the model and acknowledges that other variables not included in the model, such as turbidity, predation, and availability of large wood debris, could have improved the model fit-to-survival data and better explain the biological mechanisms causing mortality during outmigration.
- Cautions that results should be viewed in the context of a highly altered river system with severe reductions in historical flows and the elimination of vast expanses of rearing habitat, and that the study used hatchery-origin Chinook salmon, which may differ from natural-origin smolts in their behavior and vulnerabilities.

Chinook Salmon—Central Valley Spring-run Evolutionarily Significant Unit

Within this attachment, "Status Reviews and Critical Habitat Designations," and "Regional Conservation Planning References," provide more details.

Notch JJ, McHuron AS, Michel CJ, Cordoleani F, Johnson M, Henderson MJ, Ammann AJ. 2020. "Outmigration Survival of Wild Chinook Salmon Smolts through the Sacramento River during

Historic Drought and High Water Conditions." Environmental Biology of Fishes Volume 103: Pages 561 to 576.

- Describes the decline of wild spring-run Chinook salmon in the Central Valley and risks to outmigrating smolts associated with current conditions.
- Measures the movement and survival rates of acoustic-tagged wild Chinook salmon smolts from Mill Creek at fine spatial scales throughout Mill Creek and the Sacramento River over five consecutive years (2013 to 2017).
- Includes a research period of three consecutive years of drought, followed by an extremely wet year.
- Finds that higher flows resulted in increased survival rates.
- Suggests that supplying enough water instream for smolts during the critical migration window can lead to higher outmigration survival and increased returns of spawning adults.
- Proposes that managers consider tradeoffs between streamflows for agriculture and fisheries needs, with an emphasis on maintaining adequate streamflows during critical stages of the salmon life cycle and synchronizing managed flow increases with natural flow events occurring in natal tributaries.

Chinook Salmon—Sacramento River Winter-run Evolutionarily Significant Unit

Within this attachment, "Status Reviews and Critical Habitat Designations," and "Regional Conservation Planning References," provide more details.

National Marine Fisheries Service. 2016. "Species in the Spotlight: Priority Actions 2016–2020, Sacramento River Winter-Run Chinook Salmon 5-Year Action Plan." January 1, 2016. Chinook-Salmon. Accessed: January 2021.

- Summarizes status of Sacramento River winter-run Chinook salmon and key conservation efforts and challenges.
- Lays out five key actions needed for 2016 to 2020 and describes background, expected benefits, sources defining actions (e.g., recovery plans), and the current status of progress.
- Discusses improvements to Yolo Bypass fish habitat and passage.
- Provides options for the management of winter and early-spring Delta conditions to improve juvenile survival.

National Marine Fisheries Service. 2021. "Species in the Spotlight: Sacramento River Winter-run Chinook Salmon, Priority Actions 2021-2025." Viewed online: Chinook-Salmon. Accessed: October 2021.

- Summarizes the progress made on five major actions identified in the 2016 to 2020 action plan.
- Lays out six key actions needed for 2021 to 2025 and describes background, expected benefits, sources defining actions (e.g., recovery plans), and the current status of progress.

Phillis CC, Sturrock AM, Johnson RC, Webber PK. 2018. "Endangered Winter-Run Chinook Salmon Rely on Diverse Rearing Habitats in a Highly Altered Landscape." Biological Conservation Volume 217: Pages 358 to 362.

- Uses otolith strontium isotope ratios to reconstruct juvenile habitat use by winter-run Chinook that survived to adulthood.
- Finds that 44 to 65 percent of surviving adults reared in non-natal habitats, most of which are not designated as critical habitat.
- States that most non-natal habitats were not previously known to be demographically important.
- Suggests that non-natal habitats likely provide suitable growth and survival benefits and contribute to the adult population in demographically relevant numbers.
- Reports that all winter-run juveniles at the freshwater exit were comparable in size regardless of the type of rearing habitat.
- Concludes that diverse juvenile rearing habitats promote phenotypic diversity, but that the relative importance of non-natal rearing habitats to the population may fluctuate with California's hydraulic extremes.
- Proposes that protecting a diversity of habitat options can buffer against extinction risks and that failure to do so limits recovery opportunities and may increase extinction risk.

Chinook Salmon (General)

Hellmair M, Peterson M, Mulvey B, Young K, Montgomery J, Fuller A. 2018. "Physical Characteristics Influencing Nearshore Habitat Use by Juvenile Chinook Salmon in the Sacramento River, California." North American Journal of Fisheries Management Volume 38 (Issue 4): Pages 959 to 970.

- Analyzes associations between environmental characteristics and habitat occupancy in the lower Sacramento River.

- Evaluates habitat use by emigrating juvenile Chinook salmon relative to three different shoreline types:

    1. Rock revetment, defined as armored with rock and lacking additional features to enhance habitat.

    2. Mitigated, characterized by contoured, gradually sloping banks with a substrate of soil or fine sediment, deliberately planted vegetation, and anchored or embedded large wood debris.

    3. Natural, defined as not engineered, devoid of revetment, and dominated by native, naturally established vegetation.

- Finds that habitat use was significantly higher at natural shorelines and at those with mitigation features than those consisting of rock revetment.

- Explains that inundated terrestrial vegetation was associated with substantial increases in the probability of occupancy, presumably by providing cover and foraging. Shallow seasonally inundated habitat is often associated with high-quality nursery habitat and increased juvenile abundance.

- Discloses that Chinook salmon occupancy was lower in areas with large, rocky substrate and increased depth, and higher for non-native predators.

- Notes that lateral bank slope was also an important predictor of juvenile Chinook salmon presence while steep banks are less likely to be occupied.

- States that although higher mean velocity was associated with a decrease in occupancy, an increasing velocity gradient also increased habitat use, suggesting juvenile Chinook salmon preferentially occupy habitat that provides refuge from fast current, but is in proximity, to enable more efficient feeding.

- Explains that although the habitat value of mitigated shoreline habitats may be lower than that of large, seasonally inundated floodplains, nearshore habitats in the main channel are available to emigrating Chinook salmon year-round, in all years. By contrast, floodplains are only accessible for rearing in some years for relatively short periods of time, and therefore, are accessible to a comparatively small fraction of the overall juvenile salmonid population.

Lehman B, Huff DD, Hayes SA, Lindley ST. 2017. “Relationships between Chinook Salmon Swimming Performance and Water Quality in the San Joaquin River, California.” Transactions of the American Fisheries Society Volume 146 (Issue 2): Pages 349 to 358.

- Quantifies the swimming performance of juvenile hatchery-reared Chinook salmon in relation to water quality variables in controlled laboratory and field environments.

- Explains that trials were conducted during a six-week period that coincided with peak smolt outmigration. Water quality covariates included water temperature, turbidity, dissolved oxygen, and conductivity.

- Notes that the trials found negative relationships between maximum swim speeds and both temperature and turbidity.
- Acknowledges that other environmental factors likely influence the swimming performance of juvenile salmon in the San Joaquin River system that the researchers either did not measure or could not isolate.
- Recognizes that hatchery smolts were released in excellent health condition, but wild fish may travel longer distances with variable health conditions.
- Suggests that Delta water quality cannot be managed for salmon health solely by setting threshold temperatures, but freshwater turnover may be just as important for salmonid health.
- Proposes strategies to manage temperatures and concentrations of suspended sediment, such as coordinating dam and pump operations or restoring habitat structure, thereby improving water quality to optimize smolt swimming capacity.

Sabal M, Hayes S, Merz J, Setka J. 2016. "Habitat Alterations and a Nonnative Predator, the Striped Bass, Increase Native Chinook Salmon Mortality in the Central Valley, California." North American Journal of Fisheries Management Volume 36 (Issue 2): Pages 309 to 320.

- Assesses how striped bass and habitat alterations interact to influence the mortality of native juvenile Chinook salmon during their emigration from the lower Mokelumne River.
- Assesses aggregative responses of striped bass by their relative abundance and diet surveys across natural and human-altered habitats.
- States that per capita consumption of juvenile salmon and behavioral aggregation were elevated at a small diversion dam (Woodbridge Irrigation District Dam).
- Uses experimental striped bass removal, diet energetic analysis, and a before and after impact assessment to estimate the consumption of emigrating juvenile salmon by striped bass.
- Results illustrate how the synergistic relationship between habitat modification and non-native predators can exacerbate juvenile salmon mortality during emigration.
- Highlights the importance of considering interactions among stressors when planning local management strategies and assessing population-level impacts on salmon.

Sturrock AM, Carlson SM, Wikert JD, Heyne T, Nusslé S, Merz J, Sturrock HJW, Johnson R. 2020. "Unnatural Selection of Salmon Life Histories in a Modified Riverscape." Global Change Biology Volume 26: pages 1,235 to 1,247.

- Quantifies the expression and ultimate success of diverse salmon emigration behaviors in the Stanislaus River.
- Analyzes two decades of Chinook salmon monitoring data to explore the influence of regulated flows on juvenile emigration phenology, abundance, and recruitment.
- Follows seven cohorts into adulthood using otolith (ear stone) chemical archives to identify patterns in time- and size-selective mortality along the migratory corridor.
- Suggests management actions favoring any single phenotype could have negative evolutionary and demographic consequences, potentially reducing adaptability and population stability.
- Suggests that mimicking the natural hydrograph with flow variability should increase trait diversity and juvenile distribution, and that increased flow and habitat restoration should enhance productivity and phenological extremes among other benefits.

Green Sturgeon—Southern Distinct Population Segment

Within this attachment, "Adopted Conservation Plans," and "Regional Conservation Planning References," provide more details.

Anderson, J. T., G. Schumer, P. J. Anders, K. Horvath, and J. E. Merz. 2018. Confirmed Observation: A North American Green Sturgeon Acipenser Medirostris Recorded in the Stanislaus River, California. Journal of Fish and Wildlife Management Volume 9 (Issue 2): Pages 624 to 630.

- Describes evidence of North American green sturgeon in the Stanislaus River based on visual and eDNA evidence.

Ulaski ME, Quist MC. 2021. "Filling Knowledge Gaps for a Threatened Species: Age and Growth of Green Sturgeon of the Southern Distinct Population Segment." Journal of Fish and Wildlife Management Volume 12 (Issue 1): Pages 234 to 240. Fish-Wildlife.

- Analyzes fin rays collected from the Sacramento–San Joaquin River basin, San Francisco Bay, and surrounding area, archived from 1984 to 2016, to explore age structure and growth; finds highly variable growth among individuals.
- Finds growth rates were similar to northern populations and detected age classes from 0 to 26 years.
- Compares age class structure with the Klamath and Oregon Coast River systems.

- Analysis reveals significant information gaps. Suggested research needs included estimating natural mortality, monitoring year-class strength and recruitment, and assessing trends in population abundance.
- Suggests that a lack of basic population information represents a barrier to effective management and recovery of the species.

Giant Gartersnake

Within this attachment, "Adopted Conservation Plans," "Status Reviews and Critical Habitat Designations," and "Regional Conservation Planning References," provide more details.

Halstead BJ, Valcarcel P, Wylie GD, Coates PS, Casazza ML. 2016. "Active Season Microhabitat and Vegetation Selection by Giant Gartersnakes Associated with a Restored Marsh in California." Journal of Fish and Wildlife Management Volume 7 (Issue 2): Pages 391 to 407.

- Examines the selection of microhabitats and vegetation composition by adult female giant gartersnakes (19 radio-tracked females) in restored marshes and rice agriculture in and around Gilsizer Slough, Sutter County.
- Finds that litter, emergent vegetation, terrestrial vegetation, and submerged vegetation microhabitats were positively selected and rock and rice were avoided.
- Finds that aquatic vegetation types were selected more strongly than terrestrial vegetation types. Tules, duckweed, water primrose, forbs, and grasses were positively selected and rice was avoided. Discusses various habitat and vegetation types and their relationships to selection by giant gartersnake and rice cultivation and its relationship to giant gartersnake.
- Lays out five aspects of the relationship between rice cultivation and giant gartersnake in need of future study.
- Suggests that maintaining a mosaic of cover and water is likely beneficial to giant gartersnakes during the active season including:
  - Promoting clumps of and maintaining emergent vegetation along canal and wetland margins; managing for tules; and managing primrose and cattails as habitat but preventing the formation of monocultures.

Halstead JB, Rose JP, Reyes GA, Wylie GD, Casazza ML. 2019. "Conservation Reliance of a Threatened Snake on Rice Agriculture." Global Ecology and Conservation Volume 19:e00681.

- Examines the extent to which giant gartersnakes use rice fields and whether the survival of adult giant gartersnakes was influenced by the amount of rice grown near their home ranges and daily movements.
- Suggests that understanding how surface water distribution in the Sacramento Valley, driven largely by changes in rice agricultural practices, will affect giant gartersnakes is the most pressing concern for the conservation of the species.

- Explains how radio telemetry was used to track 58 snakes at 11 locations on private rice farms in the Colusa, Butte, and Sutter basins.
- Discusses the benefits and detriments of rice cultivation and the rice agroecosystem on giant gartersnakes.
- Discusses the complex nature of rice as a commodity crop and fluctuating water supplies in California and the challenges this presents related to giant gartersnake conservation.
- Suggests that although giant gartersnakes are reliant on the rice agroecosystem, rice agriculture is likely suboptimal habitat for giant gartersnakes. However, the reduction of rice would likely be detrimental to giant gartersnake populations.
- Suggests there may be scenarios that benefit giant gartersnakes and rice farmers.

Halstead BJ, Valcarcel P, Kim R, Jordan AC, Rose JP, Skalos SM, Reyes GA, Ersan JSM, Casazza ML, Essert AM, Fulton AM. 2021 "A Tale of TWO Valleys: Endangered Species Policy and the Fate of the Giant Gartersnake." California Fish and Wildlife Special CESA Issue: Pages 264 to 283.

- Reviews giant gartersnake population, ecology, past and present habitat and conservation status.
- Discusses the influence of listing on giant gartersnake conservation.
- Lays out remaining challenges for protection and recovery.
- Compares and contrasts the Sacramento and San Joaquin Valleys.
- Describes a path forward for giant gartersnake conservation and recovery.

Hansen EC, Schere RD, Fleishman E, Dickson BG, Krolick D. 2017. "Relations between Environmental Attributes and Contemporary Occupancy of Threatened Giant Gartersnakes (*Thamnophis gigas*)." Journal of Herpetology Volume 51 (Issue 2): Pages 274 to 283.

- Explains that the study's objective was to evaluate hypothesized associations between the probability that a waterbody is occupied by giant gartersnake and the attributes of the waterbody and adjacent lands.
- States that the study sampled 159 sites in the American, Yolo, and southern Sutter basins with live traps and characterized the land cover, land use, and soil type at each site.
- Evaluates whether distance to historic tule marsh was associated with occupancy and assesses the strength of support for other hypotheses about components of habitat quality and selection for giant gartersnake.
- Uses statistics to predict the occupancy of giant gartersnake across a large portion of the northern Central Valley at a spatial extent consistent with regional management of the species and agricultural and urban expansion and operations.

- Contains color-coded maps for predicted occupancy and presence of giant gartersnake in the northern Central Valley.
- States that occupancy of giant gartersnake was strongly and negatively associated with elevation and strongly and positively associated with canal density and the proportion of rice and perennial wetland.
- Finds a strong and previously undescribed association between occupancy and soil order.
- Analysis results do not support the hypothesis that the estimated extent of historic tule marsh was the variable most strongly associated with giant gartersnake occupancy. At a finer scale, canal density, the proportion of adjacent rice agriculture and wetlands, and underlying soils appeared to be stronger drivers of occupancy.
- Suggests that the predictions made by the analysis be evaluated with additional data because of some inconsistencies and data gaps.
- Suggests that future work emphasize identification of soil-chemistry metrics, which could facilitate rapid assessment in the field to predict occupancy.

Reyes GA, Halstead BJ, Rose JP, Ersan JSM, Jordan AC, Essert AM, Fouts KJ, Fulton M, Gustafson KB, Wack RF, Wylie GD, Casazza ML. 2017. "Behavioral Response of Giant Gartersnakes (Thamnophis gigas) to the Relative Availability of Aquatic Habitat on the Landscape." U.S. Geological Survey Open-File Report 2017-1141. Viewed online at: Giant-Gartersnake. Accessed: December 30, 2020.

- Examines the relationship between rice fallowing, water availability, and the ecology of giant gartersnakes.
- States that the study aimed to determine how the extent of rice agriculture in the Central Valley landscape affects the spatial ecology (home range area, movement frequency, and movement rate) of radio-tagged giant gartersnakes, their selection of habitat components, health, and survival.
- Goes into great detail in its analysis of methods, statistics, and results.
- Indicates that giant gartersnakes make little use of rice fields themselves and avoid cultivated rice relative to its availability on the landscape, but suggests that rice is a crucial component of the modern landscape for giant gartersnakes.
- Finds that giant gartersnakes are strongly associated with the canals that supply water to and drain water from rice fields—providing a more stable habitat than rice fields because water is maintained longer and they support marsh-like conditions during most of the active giant gartersnake season.
- Suggests that maintaining canals without neighboring rice would be detrimental to giant gartersnake.

- States that rice may provide increased productivity of prey populations, dispersion of potential predators, and more secure water supply.
- Indicates that identifying how rice benefits giant gartersnakes in canals and the extentto which the rice agro-ecosystem could provide these benefits when rice is fallowed would inform the use of water for other purposes without harm to giant gartersnakes.
- Suggests that without this understanding, maintaining rice and associated canals is critical for sustainability of giant gartersnake populations in the Sacramento Valley.

Rose JP, Halstead BJ, Wylie GD, Casazza ML. 2018. "Spatial and Temporal Variability in Growth of Giant Gartersnakes: Plasticity, Precipitation, and Prey." Journal of Herpetology Volume 52 (Issue 1): Pages 40 to 49.

- Analyzes a long-term dataset on the growth of giant gartersnakes to characterize spatial and temporal variability and evaluate potential environmental predictors of growth.
- States that data were collected on snout-vent length over 22 years from eight sites throughout the Sacramento Valley.
- Finds that growth was positively related to the amount of precipitation that fell during the prior water year and the abundance of anurans at a site.
- Finds that fish and frog abundance interacted to affect snake growth.
- Results highlight the plasticity of growth in giant gartersnake, point to potential environmental drivers of growth, and provide valuable data for demographic modeling.

Rose JP, Ersan JSM, Reyes GA, Gustafson KB, Fulton AM, Fouts KJ, Wack RF, Wylie GD, Casazza ML, Halstead BJ. 2018. "Findings from a Preliminary Investigation of the Effects of Aquatic Habitat (Water) Availability on Giant Gartersnake (Thamnophis gigas) Demography in the Sacramento Valley, California, 2014–17." U.S. Geological Survey Open-File Report 2018-1114. Viewed online at: Giant-Gartersnake. Accessed: December 30, 2020.

- Summarizes the methods and findings of a study conducted by the U.S. Geological Survey, in cooperation with the California Department of Water Resources, to investigate the effect of the availability of aquatic habitat on the demography of giant gartersnakes inhabiting rice growing areas in the Sacramento Valley, California.
- Presents estimates of the abundance, somatic growth, fecundity, and survival of giant gartersnakes from eight sites in the Sacramento Valley studied in 2014 to 2017.
- Presents data on the area of rice growing at each of the eight sites in 2014 to 2017.

Rose, JP, Ersan JSM, Wylie GD, Casazza ML, Halstead BJ. 2018. "Construction and Analysis of a Giant Gartersnake (Thamnophis gigas) Population Projection Model." U.S. Geological Survey

Open-File Report 2017-1164. Viewed online at: Gartersnake-Population. Accessed: December 30, 2020.

- Summarizes the methods and findings of a study conducted by the U.S. Geological Survey, in cooperation with the California Department of Water Resources, to investigate the demography of giant gartersnakes in the Sacramento Valley from 1995 to 2016. The report presents vital rate models of growth, fecundity, and survival of giant gartersnakes, as well as an Integral Projection Model that integrates these component models into a demographic population model.

Bank Swallow

Within this attachment, "Adopted Conservation Plans," and "Regional Conservation Planning References," provide more details.

California Black Rail

Within this attachment, "Regional Conservation Planning References," provides more details.

Evens J. 2020. "Temporal Response of California Black Rails to Tidal Wetland Restoration." Western Birds Volume 51: Pages 111 to 121.

- Reports that the study monitored three sites that were formerly isolated from tidal influence and converted to farmland that were restored to tidal wetlands.
- Finds that black rails colonized all three sites within 3 to 10 years.
- Finds that all three sites had sources of prospective colonists adjacent to the restored sites.

Tsao DC, Melcer RE Jr., Bradbury M. 2015. "Distribution and Habitat Associations of California Black Rail (*Laterallus jamaicensis cortuniculus*) in the Sacramento–San Joaquin Delta." San Francisco Estuary and Watershed Science Volume 13 (Issue 4).

- Recognizes the lack of California black rail surveys in the Delta.
- States that call–playback surveys were conducted to assess the status of the taxon within a wide range of wetland habitats of the central Delta region.
- Explains that black rails were detected at 21 of 107 discrete wetland habitats in the Delta.
- States that the study developed a model of habitat suitability and a fine-scale vegetation and land use dataset.
- Finds that black rail presence differed from other regions in California, in that it was positively associated with tall (1- to 5-meter) emergent vegetation interspersed with riparian shrubs.

Greater Sandhill Crane

Within this attachment, "Regional Conservation Planning References," provides more details.

Donnelly JP, King SL, Knetter J, Gammonley JH, Dreitz VJ, Grisham BA, Nowak MC, Collins DP. 2021. "Migration Efficiency Sustains Connectivity Across Agroecological Networks Supporting Sandhill Crane Migration." Ecosphere Volume 12 (Issue 6). e03543. 10.1002/ecs2.3543.

- Examines flyway connectivity and monitors long-term trends in agricultural resources and wetland stopover networks with remote sensing, to identify important ownership and landscape factors structuring bird distributions.

Ivey GL, Herziger CP, Hardt DA, Golet GH. 2016. "Historic and Recent Winter Sandhill Crane Distribution in California." Proceedings of the North American Crane Workshop Volume 13: Pages 54 to 66. Accessed: March 2020.Viewed online at: Sandhill-Crane. Accessed: March 2020.

- Maps the observed flock and night roost locations and reviews records of historical occurrences of cranes in California.
- Discusses the expansion and contraction of the crane's range and the contributing factors.
- Suggests that the primary cause of site abandonment is loss of suitable foraging habitat (small grain crops) and that range expansion is principally attributable to expansion of public wildlife refuges, private sanctuaries, and improvement of management.
- Recommends management actions to improve habitat conditions for cranes across the Central Valley wintering range and lists four priority conservation strategies.

Least Bell's Vireo

Within this attachment, "Adopted Conservation Plans," and "Regional Conservation Planning References," provide more details.

Dybala KE, Walsh RG, Seavy NE. 2016. Monitoring Least Bell's Vireo and Comparing Breeding Landbird Populations at the Dos Rios Ranch Restoration Site and San Joaquin River National Wildlife Refuge 2015–2016. Point Blue Contribution No. 2101. Petaluma (CA): Point Blue Conservation Science.

- Describes monitoring objectives, methods, and results for bird surveys and vegetation monitoring at point count stations; riparian landbird response to restoration; and least Bell's vireo monitoring.
- Offers seven recommendations for riparian restoration and evaluation and the management and monitoring of least Bell's vireo and other species at Dos Rios Ranch.

Preston KL, Kus BE, Perkins E. 2021. *Modeling Least Bell's Vireo Habitat Suitability in Current and Historical Ranges in California.* U.S. Geological Survey Open-File Report 2020-1151. Least-Bell-Vireo.

- Develops habitat suitability model for least Bell's vireo across its current and historical range in California.
- Constructs models based on the current range to predict suitable habitat in historical range; constructs alternative models with different combinations of important environmental variables; and selects best-performing models to predict suitable riparian habitat.

Swainson's Hawk

Within this attachment, "Adopted Conservation Plans," and "Regional Conservation Planning References," provide more details.

Fleishman E, Anderson J, Dickson BG, Krolick D, Estep JA, Anderson RL, Elphick CS, Dobkin DS, Bell DA. 2016. "Space Use by Swainson's hawk (*Buteo swainsoni*) in the Natomas Basin, California." Collabra Volume 2 (Issue 1): Pages 5, 1 to 12.

- Describes how satellite-based remote sensing was used to estimate the home ranges of 23 Swainson's hawks on Natomas Basin breeding grounds.
- Evaluates whether the species' space use intensity was associated with land cover, sex, reproductive success, or life stage of offspring.

Western Yellow-billed Cuckoo

Within this attachment, "Adopted Conservation Plans"; "Status Reviews and Critical Habitat Designations"; and "Regional Conservation Planning References," provide more details.

Johnson JJ, Hatten JR, Holmes JA, Shafroth PB. 2017. "Identifying Western Yellow-billed Cuckoo Breeding Habitat with a Dual Modelling Approach." Ecological Modelling Volume 347: Pages 50 to 62. Viewed online at: Yellow-Billed-Cuckoo. Accessed: March 27, 2020.

- Investigates yellow-billed cuckoo habitat on the Lower Colorado River with aerial- and satellite-based models.
- Uses a dual modeling approach to provide a more complete picture of habitat requirements.
- Discusses the benefits and shortcomings of a satellite-based approach.

Riparian Brush Rabbit

Within this attachment, "Status Reviews and Critical Habitat Designations," provides more details.

Kelly PA. 2018. "Reintroduction of the Riparian Brush Rabbit in the San Joaquin Valley, California, USA." Pages 210–215 *in* Soorae PS (ed.), *Global Reintroduction Perspectives: 2018, Case Studies from Around the Globe.* Gland, Switzerland, and Abu Dhabi, United Arab Emirates: IUCN/SSC Reintroduction Specialist Group and Environment Agency–Abu Dhabi.

- Summarizes the species' history and the captive-breeding and reintroduction program.
- Summarizes major difficulties faced by the captive-breeding and reintroduction program including vulnerability to flooding. Describes measures implemented to reduce threats from flooding: construction and vegetation of 34 flood refugia, and vegetation of 19.3 kilometers of river levees formerly kept free of vegetation other than grasses.
- States that the species easily breeds in large semi-natural outdoor enclosures; a quantitative habitat suitability assessment is warranted before initiating reintroduction; an adaptive management approach should be adopted; the need exists to plan for the long term; and it is necessary to involve all stakeholders.
- Discusses the availability of a second population as a captive-breeding source; the cooperative nature of the effort; the availability of public land to anchor reintroduction program (San Joaquin River NWR); the availability of major funding from supportive programs and agencies; the hard work and dedication by team members and California State University, Stanislaus staff, and the support of the Endangered Species Recovery Program.

Matocq M, Kelly P, Rippert J, Phillips S. 2017. Population Genetic Structure of the Riparian Brush Rabbit (*Sylvilagus bachmani riparius*): Using Multiple Marker Systems to Gain Insight into Historic and Ongoing Genetic Connectivity. Prepared for the CVPIA Habitat Restoration Program. Grant Agreement Award F13AP00564. Stanislaus (CA) and Reno (NV). May 15, 2017.

- Identifies the genetic diversity and population genetic structure of four natural remnant populations of riparian brush rabbit and evaluates structural and functional connectivity across the species' range.
- Finds that management and recovery efforts are increasing both structural and functional connectivity for the species.
- Suggests approaches to measure progress toward the recovery goal of re-establishing connectivity and inform planning.

Rippert J. 2017. Population Genetics and Functional Connectivity of the Riparian Brush Rabbit (*Sylvilagus bachmani riparius*): Implications for the Conservation of an Endangered Lagomorph. Thesis. University of Nevada, Reno.

- Assesses genetic diversity, population genetic structure, and structural and functional connectivity of riparian brush rabbits.
- Presents findings that suggest the presence of three genetic clusters within the subspecies corresponding to geographic locations, indicating limited gene flow caused by habitat fragmentation.
- Finds that the augmented population at San Joaquin River National Wildlife Refuge (NWR) retained high levels of diversity and functional connectivity.
- Discusses the value of patch connectivity and wildlife corridors, and restoration implications as they relate to gene flow between populations of riparian brush rabbit.

Tarcha CM. 2020. Behavior and Ecology of the Riparian Brush Rabbit at the San Joaquin River National Wildlife Refuge as Determined by Camera Traps. Master's thesis, California State University Stanislaus. May 2020.

- States that camera traps were monitored from February to August 2017.
- Investigates activity patterns, behavior, and resource use of riparian brush rabbit at restored plant communities and artificial feed sites.
- Discusses effects of flooding on riparian brush rabbit.

Riparian (San Joaquin Valley) Woodrat

Tarcha CM. 2020. *Behavior and Ecology of the Riparian Brush Rabbit at the San Joaquin River National Wildlife Refuge as Determined by Camera Traps. Master's thesis, California State University Stanislaus*. May 2020.

- States that more than 300 pictures of riparian woodrats were obtained at six locations on the San Joaquin River NWR.

New Target Species for the Conservation Strategy Update

These references for delta smelt and tricolored blackbird are in addition to the references cited in the focused conservation plans prepared for each of these species as part of the 2022 Strategy Update.

Delta Smelt

California Natural Resources Agency. 2016. "Delta Smelt Resiliency Strategy 2016." Viewed online at: Delta-Smelt. Accessed: October 26, 2021.

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Moyle PB, Brown LR, Durand JR, Hobbs JA. 2016. "Delta Smelt: Life History and Decline of a Once-Abundant Species in the San Francisco Estuary." San Francisco Estuary and Watershed Science Volume 14 (Issue 2): Article 6. Viewed online at:Delta-Smelt. Accessed: March 25, 2020.

Moyle PB, Hobbs JA, Durand JR. 2018. "Delta Smelt and Water Politics in California." Fisheries Volume 43: Pages 42 to 51.

Moyle P, Bork K, Durand J, Hung T-C, Rypel A. 2019. "Futures for Delta Smelt." Davis (CA): University of California, Davis, Center for Watershed Sciences. December 2019. Viewed online at: Delta-Smelt. Accessed: March 25, 2020.

Tempel TL, Malinich TD, Burns J, Barros A, Burdi CE, Hobbs JA. 2021. "The Value of Long-term Monitoring of the San Francisco Estuary for Delta Smelt and Longfin Smelt." California Fish and Wildlife Special CESA Issue: Pages 148 to 171.www.doi.org.

Tricolored Blackbird

Within this attachment, "Regional Conservation Planning References," provides more details.

Barr K, Beichman AC, Kalhori P, Rajbhandary J, Bay RA, Ruegg K, Smith TB. 2021. "Persistent Panmixia Despite Extreme Habitat Loss and Population Decline in the Threatened Tricolored Blackbird (*Agelaius tricolor*)". Evolutionary Applications Volume 14: Pages 674 to 684.

Belenky L, Bond M. 2015. A Petition to List the Tricolored Blackbird as Endangered under the California Endangered Species Act and Request for Emergency Action to Protect the Species.

Submitted to California Fish and Game Commission. Oakland (CA): Center for Biological Diversity. August 19, 2015.

California Department of Fish and Wildlife. 2018. *A Status Review of the Tricolored Blackbird in California.* Report to the Fish and Game Commission. Sacramento (CA). February 2018.

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U.S. Fish and Wildlife Service. 2019. "Endangered and Threatened Wildlife and Plants; 12-Month Findings on Petitions to List Eight Species as Endangered or Threatened Species." Federal Register Volume 84: Pages 41,694 to 41,699.

U.S. Fish and Wildlife Service. 2019. *Special Status Assessment for the Tricolored Blackbird (Agelaius tricolor), Version 1.1.* February 2019. Sacramento (CA).

U.S. Fish and Wildlife Service. 2019. "Species Assessment and Listing Priority Assignment Form". Region 8, Pacific Southwest Region, Sacramento (CA).

Yellow-Breasted Chat

No additional references are available for this species beyond those provided in Appendix B.3, "Focused Conservation Plan: Yellow-Breasted Chat," and within this attachment, "Regional Conservation Planning References."

Non-target Species

Because the conservation needs of sensitive species change, as do the habitats on which they depend, the 2016 Strategy included provisions for amending the list of target species as part of the five-year update process, using the same criteria as described in Appendix G. Therefore, the potentially suitable species that were not selected as target species (i.e., non-target species) for the 2016 Strategy have been considered for the 2022 Update if they met the criteria in Appendix G of the 2016 Strategy. These species include but are not limited to the delta smelt, western pond turtle, tricolored blackbird, western red bat (*Lasiurus blossevillii*), yellow--breasted chat, and western burrowing owl. As noted above, three additional species have been added to the list of target species for the 2022 Strategy Update. Updated reference materials for non-target species are provided in the following sections.

Western PondTurtle

Within this attachment, "Regional Conservation Planning References," provides more details.

Davidson KA, Alvarez JA. 2020. "A Review and Synopsis of Nest Site Selection and Site Characteristics of Western Pond Turtles." Western Wildlife Volume 7: Pages 42 to 49.

Thomson RC, Wright AN, Shaffer HB. 2016. *California Amphibian and Reptile Species of Special Concern.* Oakland (CA): University of California Press.

Burrowing Owl

Within this attachment, "Regional Conservation Planning References," provides more details.

Ocken MA. 2017. Seasonal Habitat Requirements and Use by the Western Burrowing Owl (*Athene cunicularia hypugaea*) in the Northern Sacramento Valley, Chico. Thesis. California State University, Sacramento.

Other Non-targetSpecies

Literature searches were conducted for the following non-target species that were designated in Appendix G as "associated with target habitat" and "major potential CVFPP effect." Other than those included in the documents described in the "Regional Conservation Planning References," section of this report, no updated reference materials for these species have become available since the release of the 2016 Strategy:

- Western red bat.
- Redhead.
- Yellow warbler.
- Least bittern (*Ixobrychus exilis*).
- Little willow flycatcher (*Empidonax traillii*).

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Appendix B.1
Focused Conservation Plan: Delta Smelt

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APPENDIX B.1

Focused Conservation Plan: Delta Smelt

Acronym	Description
°F	degree(s) Fahrenheit
CESA	California Endangered Species Act
CPA	Conservation Planning Area
CVFPP	Central Valley Flood Protection Plan
Delta	Sacramento–San Joaquin Delta
ESA	Endangered Species Act
FR	Federal Register
mm	millimeter(s)
SAV	submerged aquatic vegetation
SPA	Systemwide Planning Area
SPFC	State Plan of Flood Control
SRA	shaded riverine aquatic
State	State of California
USFWS	U.S. Fish and Wildlife Service

Conservation Status

As part of the Central Valley Flood Protection Plan (CVFPP) Conservation Strategy Update, this focused conservation plan addresses needs and opportunities to conserve delta smelt (*Hypomesus transpacificus*) in the Systemwide Planning Area (SPA). Within the SPA, delta smelt occupy the Lower Sacramento River Conservation Planning Area (CPA) and the Lower San Joaquin River CPA.

In 1993, delta smelt were State-of-California (State)- and federally listed as threatened under the California Endangered Species Act (CESA) and federal Endangered Species Act (ESA) (58 *Federal Register* [FR] 12854, March 5, 1993). In 2010, the State uplisted the species' CESA status to endangered. That same year, the U.S. Fish and Wildlife Service (USFWS) determined that delta smelt should be reclassified from threatened to endangered under the ESA, but higher-priority actions precluded the promulgation of a formal rulemaking for such a reclassification (75 FR 17667, April 7, 2010).

Recently, USFWS again considered uplisting delta smelt from threatened to endangered status under the ESA. As it had done previously, USFWS determined that delta smelt was warranted for uplisting, but this was precluded by higher-priority actions. The species was assigned a listing priority number of 2, based on the high magnitude and high imminence of threats the species faced rangewide, resulting in mortality or a significant reduction in reproductive capacity (85 FR 73164, Nov. 16, 2020).

Critical habitat for delta smelt was designated in 1994 (59 FR 65256, Dec. 19, 1994). The designated critical habitat includes the following areas:

- The mainstem Sacramento River downstream of Sacramento.
- All of the Yolo Bypass.
- The mainstem San Joaquin River downstream of the San Joaquin County line.
- All river reaches and estuarine areas of the Sacramento–San Joaquin Delta (Delta) (in the Sacramento Delta and San Joaquin Delta hydrologic units).
- All waters of Suisun Bay, including Honker Bay, Grizzly Bay, and connected sloughs.

The following primary constituent elements are considered essential to conserve delta smelt:

- Freshwater or slightly brackish-water spawning sites.
- Larval and juvenile transport from spawning to rearing habitat.
- Rearing habitat.
- Adult migration to spawning habitat.

USFWS developed the *Recovery Plan for Sacramento–San Joaquin Delta Native Fishes* in 1996; however, in its most recent five-year review (2010), USFWS indicated the recovery plan was outdated and was being revised (75 FR 17667, April 7, 2010). The five-year review led to a 12-month finding for a delta smelt uplisting petition. USFWS concluded that changing the status from threatened to endangered was warranted (but precluded), and "that the biological status of this ESU [*sic*] has worsened since the last status review and therefore, we recommend that its status be reassessed in 2–3 years if it does not respond positively to improvements in environmental conditions and management actions" (75 FR 17667, April 7, 2010).

In 2020, USFWS stated the following (85 FR 73164, Nov. 16, 2020):

> "*The primary rationale for reclassifying delta smelt from threatened to endangered was the significant decline in species abundance that have [sic] occurred since 2001, and the continuing downward trend in delta smelt abundance indices supports that finding. Fourteen of the last 15 years have seen fall abundances that have been the lowest ever recorded. 2015 to 2019 results from all four of the surveys analyzed in this review have been the lowest ever recorded for the delta smelt. Delta smelt abundance in fall was exceptionally low between 2004 and 2010, increased during the wet year of 2011, and decreased again to very low levels at present. The latest 2018 and 2019 fall surveys did not detect a single delta smelt, resulting in an abundance index of 0, and the latest 2019 spring survey resulted in an abundance index of 0.4, all of which are the lowest on record*."

Status and Trends

Historical Distribution

Historically, delta smelt were abundant throughout much of their range in San Francisco Bay and the Delta, from San Pablo Bay upstream to Sacramento (on the Sacramento River) and Mossdale (on the San Joaquin River) (75 FR 17667, April 7, 2010).

Current Distribution

Figure B.1-1 the range of delta smelt as determined by the Interagency Ecological Program and Regional Monitoring Program. Delta smelt's extant distribution is mostly restricted to west of the Sacramento and San Joaquin River confluence, although they are found year-round—and sometimes in high numbers—in the North Delta, within the Lower Sacramento River CPA. In particular, the Cache Slough Complex and Liberty Island (downstream portions of the Yolo Bypass) appear to provide important year-round habitat for delta smelt of all life stages (Merz et al. 2011; Sommer et al. 2011; Sommer and Mejia 2013). Delta smelt are found infrequently in the southern and eastern portions of the Delta (i.e., the Lower San Joaquin River CPA) and are largely absent from these areas in summer and fall (Interagency Ecological Program, Management, Analysis, and Synthesis Team 2015).

Based on captures of newly hatched larvae and post-spawn adults, the following are known spawning locations in the Lower Sacramento River and Lower San Joaquin River CPAs:

- The Yolo Bypass, Cache and Lindsey sloughs in the lower Sacramento River.
- Between Sherman Island and Venice Island in the lower San Joaquin River.
- The lower Mokelumne River.
- The South Delta.
- The West Delta.

However, in recent years, the densest concentrations of both spawners and larvae have been recorded in the Cache Slough and Sacramento Deep Water Ship Channel complex in the North Delta (U.S. Fish and Wildlife Service 2017).

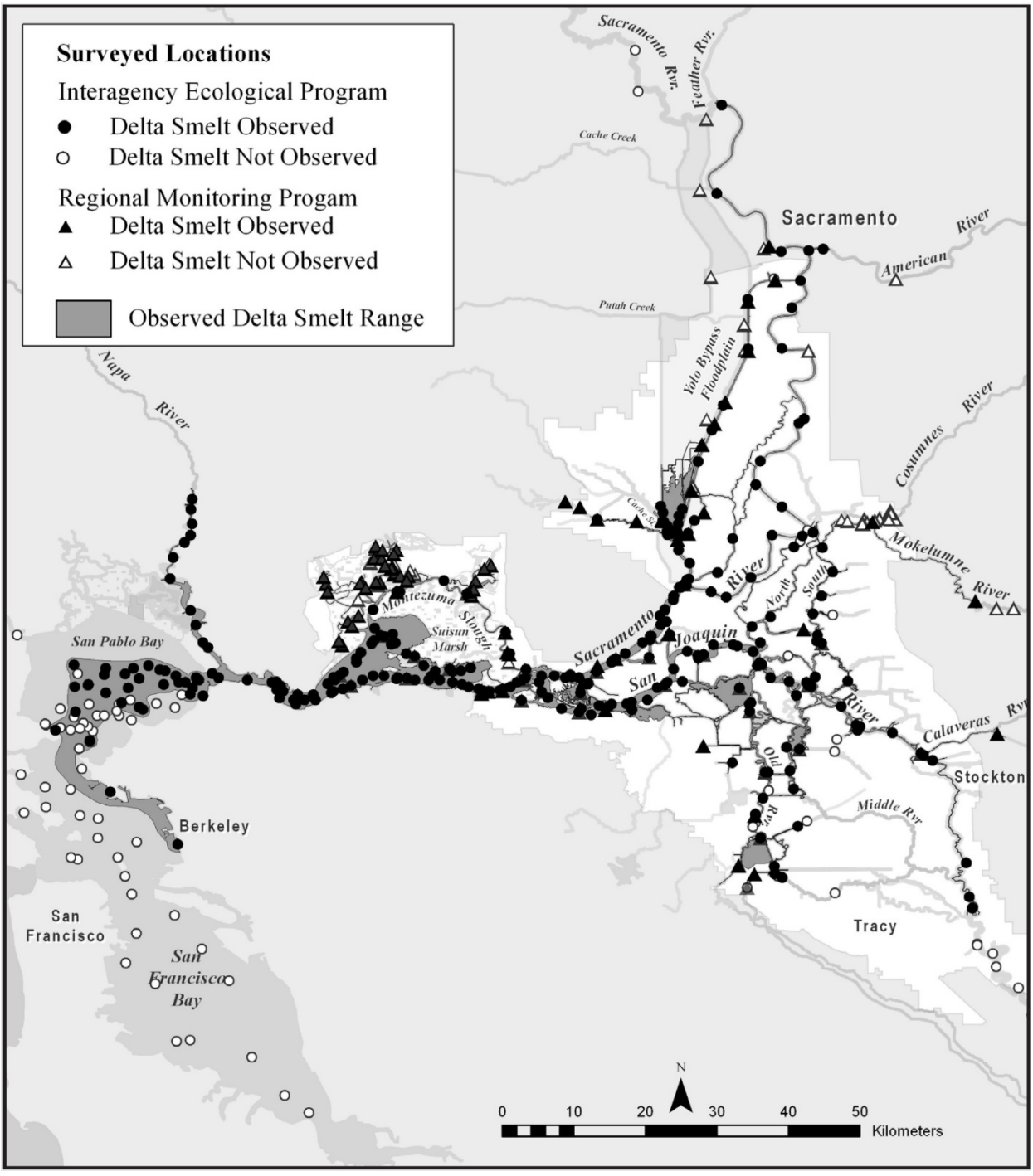
Additional spawning locations occur downstream of these CPAs and include Suisun Bay and Suisun Marsh, and in wet years the Napa River (U.S. Bureau of Reclamation 2007; U.S. Fish and Wildlife Service 2017). The most significant downstream habitat for delta smelt is the lower Napa River (a tributary of San Pablo Bay), although it is typically used only in wet years (Hobbs et al. 2007; Merz et al. 2011; Sommer and Mejia 2013).

Population Trends

Delta smelt were once abundant in San Francisco Bay and the Delta (Moyle 2002; Bennett 2005). Their abundance abruptly decreased in the early 1980s, apparently independent of previous or subsequent changes in abundance trends. A stronger negative trend began in the early 2000s; this abundance trend also was observed in other pelagic fishes of the San Francisco Bay estuary, coinciding with the pelagic organism decline (Nobriga and Herbold 2009; Thomson et al. 2010). Notably, however, catch index values in the Yolo Bypass and Cache Slough Complex portions of the Lower Sacramento River CPA have increased substantially since 2008 while continuing to decrease elsewhere (California Department of Water Resources n.d.).

Much of what is known about abundance and trends in delta smelt populations is based on indices derived from regular sampling conducted by several federal and State agencies (e.g., Bennett 2005; Thomson et al. 2010; Sommer et al. 2011; Interagency Ecological Program, Management, Analysis, and Synthesis Team 2015; and U.S. Fish and Wildlife Service 2017).

Figure B.1-1. Observed Range of Delta Smelt and Species Occurrence at Interagency Ecological Program and Regional Monitoring Survey Stations



Source: Merz et al. 2011; reproduced with permission.

Delta smelt abundance indices for four different life stages (post-larval, juvenile, subadult, and adult) were derived from data collected by the five California Department of Fish and Wildlife fish monitoring programs that differ in terms of their duration, time of year (and thus, life stage sampled), sampling intensity, and net type (Polansky et al. 2019). The surveys include the 20 millimeter (mm), which has the smallest (i.e., 20-mm) mesh size; Summer Townet; Fall Midwater Trawl; Spring Midwater Trawl; and Spring Kodiak Trawl (Polansky et al. 2019) (Figure B.1-2). Figure B.1-2 shows a series of four line graphs depicting indices of delta smelt abundance between 1990 and 2015. In order from first to last, these graphs show the respective abundance indices as determined by the 20-mm survey, Summer Townet survey, Midwater Trawl, and Spring Midwater Trawl and Spring Kodiak Trawl. These surveys reflect conditions in May, July and August, October and November, and February and March, respectively.

The best data on the annual abundance of adult delta smelt began to be collected in 2002 with the initiation of the Spring Kodiak Trawl survey, from which an abundance index has been developed. As the last line graph on Figure B.1-2 shows, the values of this index were highest in 2012 and lowest in 2016.

However, an abundance index for juveniles based on the Fall Midwater Trawl survey indicates abundance levels since 2002 are still well-below the levels that were typical before the declining trend of the early 2000s, and particularly well-below abundance levels before the abrupt decrease in the early 1980s (Figure B.1-2) (Polansky et al. 2019). The recent (2018 and 2019) fall surveys detected no delta smelt, resulting in an abundance index of 0, and the latest 2019 spring survey resulted in an abundance index of 0.4; these abundance indices are the lowest on record (85 FR 73164, Nov. 16, 2020).

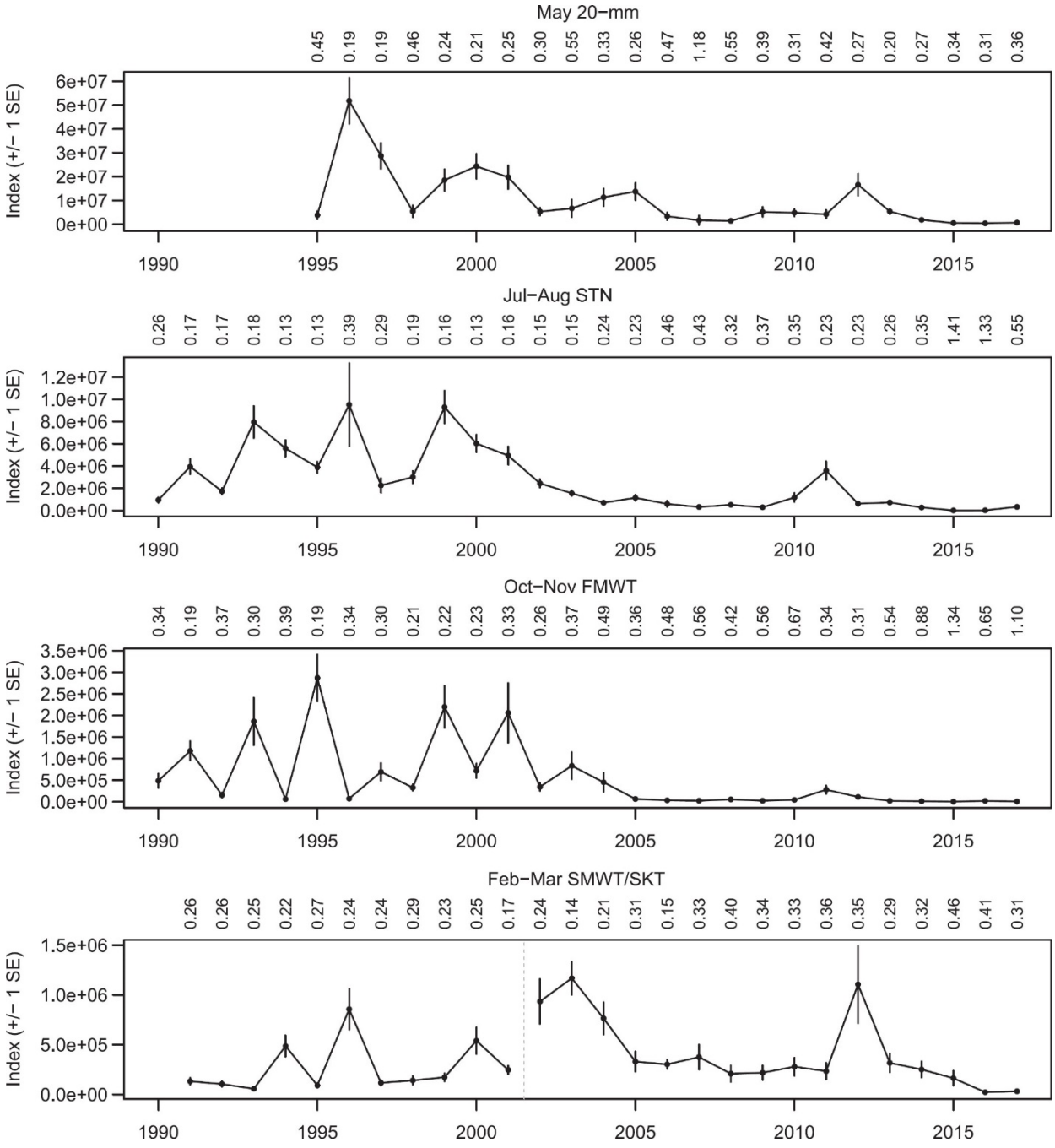
USFWS developed a procedure for estimating delta smelt abundance that is based on Spring Kodiak Trawl data. USFWS's resulting estimates of historical delta smelt abundance in January and February indicate the 2016 population is the lowest between 2002 and 2017, with only 16,000 individuals (95-percent confidence intervals 7,000 to 31,000 individuals) (U.S. Fish and Wildlife Service 2017).

Life History

Delta smelt are an annual estuary-dependent species endemic to San Francisco Bay and the Delta. Adults begin migrating upstream to freshwater spawning grounds with the first flow events in winter. Migration takes one to four weeks, at a rate of approximately 1.1 to 3.9 miles per day, for an average of 2.2 miles per day. Adults appear to hold in the spawning grounds for perhaps one month before initiating spawning (Sommer et al. 2011).

Figure B.1-2. Annual Abundance Indices for Delta Smelt Life Stages

Index of abundance with standard errors are derived for each year from data from five survey types: 20-mm, STN = Summer Townet, FMWT = Fall Midwater Trawl, SMWT = Spring Midwater Trawl, and SKT = Spring Kodiak Trawl.



Source: Polansky et al. 2019.

Most delta smelt spawning occurs in the Lower Sacramento River and Lower San Joaquin River CPAs, in the lower Sacramento River, Yolo Bypass, and San Joaquin River; however, spawning also occurs broadly throughout the Delta, in marsh channels of Suisun Bay, and in wet years in the Napa River (Moyle et al. 1992; Bennett 2005).

Although spawning generally occurs in upstream reaches during dry years, post-spawn adults have been observed in the Sacramento River in at least one wet year (Souza 2002; Bennett 2005). Larval, juvenile, and adult delta smelt have been observed in the Yolo Bypass (California Department of Water Resources n.d.). These observations indicate either some juveniles remain there instead of emigrating to brackish water in the West Delta and Suisun Bay, or fish movement occurs year-round, causing them to be present in the bypass all year (Sommer et al. 2011).

Female delta smelt were thought to spawn only once during their lifetimes; however, recent evidence from laboratory experiments suggests they are capable of spawning multiple clutches within a spawning season, and in the wild they may do so when conditions remain suitable for spawning for a longer period (U.S. Bureau of Reclamation 2007; Interagency Ecological Program, Management, Analysis, and Synthesis Team 2015; USFWS 2017). Although delta smelt are generally considered to be an annual species, a small number of fish may live for two years and either do not spawn in their first year or spawn in both their first and second years (Moyle 2002; Bennett 2005; U.S. Bureau of Reclamation 2007).

Spawning occurs between late February and June, although most occurs from mid-April through May (Bennett 2005). Some evidence exists that delta smelt may spawn primarily below the low-tide level during spring tides, behavior that has been hypothesized to protect eggsfrom desiccation or to take advantage of enhanced aeration provided by higher tidal velocities.

Spawning during spring tides would also mean that eggs hatch during neap tides when tidal velocities are at a minimum, reducing the chance of larvae displacement (Bennett 2005). Adults mature at 1.97 to 2.76 inches (55 to 70 mm) fork length and rarely grow larger than 3.15 inches (80 mm) fork length. Although fecundity is relatively low, it does increase with size (Bennett 2005).

Eggs have not been collected in the wild; however, laboratory experiments and information from closely related species suggest delta smelt are broadcast spawners that deposit eggs on sandy or gravelly substrate (Bennett 2005; U.S. Bureau of Reclamation 2007; Lindberg et al. 2020). Eggs form a stalk that attaches to substrate, and the eggs hatch in nine days at 59.0 to 69.8 degrees Fahrenheit (°F) (U.S. Bureau of Reclamation 2007; U.S. Fish and Wildlife Service 2017).

Much of the current knowledge about the developmental biology of larval delta smelt comes from observations made under laboratory conditions, although field observations have helped biologists to determine the timing and location of rearing larvae. After hatching, larvae likely drift downstream and quickly settle to the bottom of the river. They begin feeding after five to six days, likely remaining bottom-oriented for up to 65 days before developing into juveniles at

approximately 0.8 inch in total length (Interagency Ecological Program, Management, Analysis, and Synthesis Team 2015). However, they may quickly move or be displaced from unsuitable habitat before becoming fully developed (Hobbs et al. 2007). Larval delta smelt less than 0.8 inch long are generally found in tidally influenced freshwater habitat, but move downstream toward the low-salinity zone in late spring (Nobriga and Herbold 2009).

Juvenile delta smelt are most associated with the low-salinity zone (less than 3 practical salinity units), and are thus less widely distributed than adults. Nobriga and Herbold (2009) describe a shift in distribution from the Delta in early summer to the Sacramento River and San Joaquin River confluence as the summer progresses, indicating juveniles escape unfavorable temperatures and seek turbid water. This shift is thought to be a response to changes in habitat quality from historical conditions, because historically, juveniles were found throughout the Delta (Nobriga et al. 2008; Nobriga and Herbold 2009). Juvenile delta smelt spend summer and early fall feeding and growing until the first winter storms trigger the upstream spawning migration of maturing adults (Bennett 2005; Nobriga and Herbold 2009; Interagency Ecological Program, Management, Analysis, and Synthesis Team 2015).

Habitat and Ecological Process Associations

Delta smelt are pelagic (that is, they live near the water surface) and associated with tidally influenced, turbid, low-salinity, and low-velocity water within a moderate temperature range (Swanson et al. [2000], Bennett [2005], Feyrer et al. [2007], Nobriga et al. [2008], Sommer and Mejia [2013], Bennett and Burau [2015], and Bever et al. [2016]).

Turbidity has been hypothesized to play a role in predator avoidance by concealing smelt, and in enhanced feeding opportunities by increasing background contrast and thus improving the visual identification of prey (Sommer and Mejia 2013). Natural sources of turbidity include streambank erosion from channel meander, upslope erosion from rainfall, and primary production. A strong shift toward lower turbidity in the Sacramento River and San Francisco Bay estuary in the late 1990s (Jassby et al. 2002; Glibert 2010; Schoellhamer 2011) has raised concerns regarding effects on habitat conditions for delta smelt (Feyrer et al. 2007; Nobriga et al. 2008).

This species is most often captured when water temperatures are less than 71.6°F, and temperatures above 68°F in spring can increase larval mortality rates (Bennett 2005). The upper temperature threshold is generally considered to be 77°F (Swanson et al. 2000; Nobriga et al. 2008), and capture rates decrease rapidly at temperatures above 75.2°F (Nobriga et al. 2008). Delta smelt are rarely captured when water temperatures are less than 44.6°F, although water temperatures in the Delta seldom become this low (Kimmerer 2004).

Delta smelt have been captured across a range of salinities, from freshwater to brackish water (0 to 18 practical salinity units), and have an upper lethal limit of 19 practical salinity units (Swanson et al. 2000). They are most associated with the low-salinity zone (less than approximately 2 practical salinity units) (Bennett 2005; Feyrer et al. 2007; Nobriga et al. 2008). Thus, the location of the largest fish concentrations in the non-spawning season varies as a

function of the water year (Sommer and Mejia 2013). Delta smelt are distributed more downstream at locations such as the Napa River and Suisun Bay in wet years, and farther upstream in dry years. They likely take advantage of tidal movements to migrate (i.e., they "surf the tide") (Bennett and Burau 2015).

The delta smelt's upstream migration appears to be triggered by attraction flows, particularly "first-flush" events, resulting in a somewhat coordinated migration strategy (Sommer et al. 2011). Average upstream migration rates are approximately 3.6 kilometers per day, and rates are uncorrelated with Delta flow (Sommer et al. 2011).

Typically, December to March flow pulses trigger upstream migration, but spawning typically peaks from March through May, suggesting adult delta smelt hold for periods of at least a month before spawning (Sommer et al. 2011). Delta smelt have three different distinct life-history phenotypes based on otolith microchemistry: freshwater resident, brackish-water resident, and semi-anadromous fish (Hobbs et al. 2019).

Larval and post-larval delta smelt feed almost exclusively on two species of calanoid copepods (Moyle et al. 1992; Nobriga 2002; Slater and Baxter 2014). As delta smelt grow, they expand their diet to include other copepod species, mysid shrimp, cladocerans, and amphipods (Moyle et al. 1992; Slater 2012; Slater and Baxter 2014). The decreased abundance of copepods and mysids in the upper estuary has caused food limitation to be a major stressor for adult delta smelt (Baxter et al. 2010).

Recent findings have indicated delta smelt may be food-limited, particularly in the spring and summer (Hamilton and Murphy 2018). Smelt collected from areas where the influence of tidal wetlands is greater have much greater stomach fullness than smelt collected from areas with little or no tidal wetland influence, suggesting that food resources for delta smelt are more available when near tidal wetlands (Hammock et al. 2019).

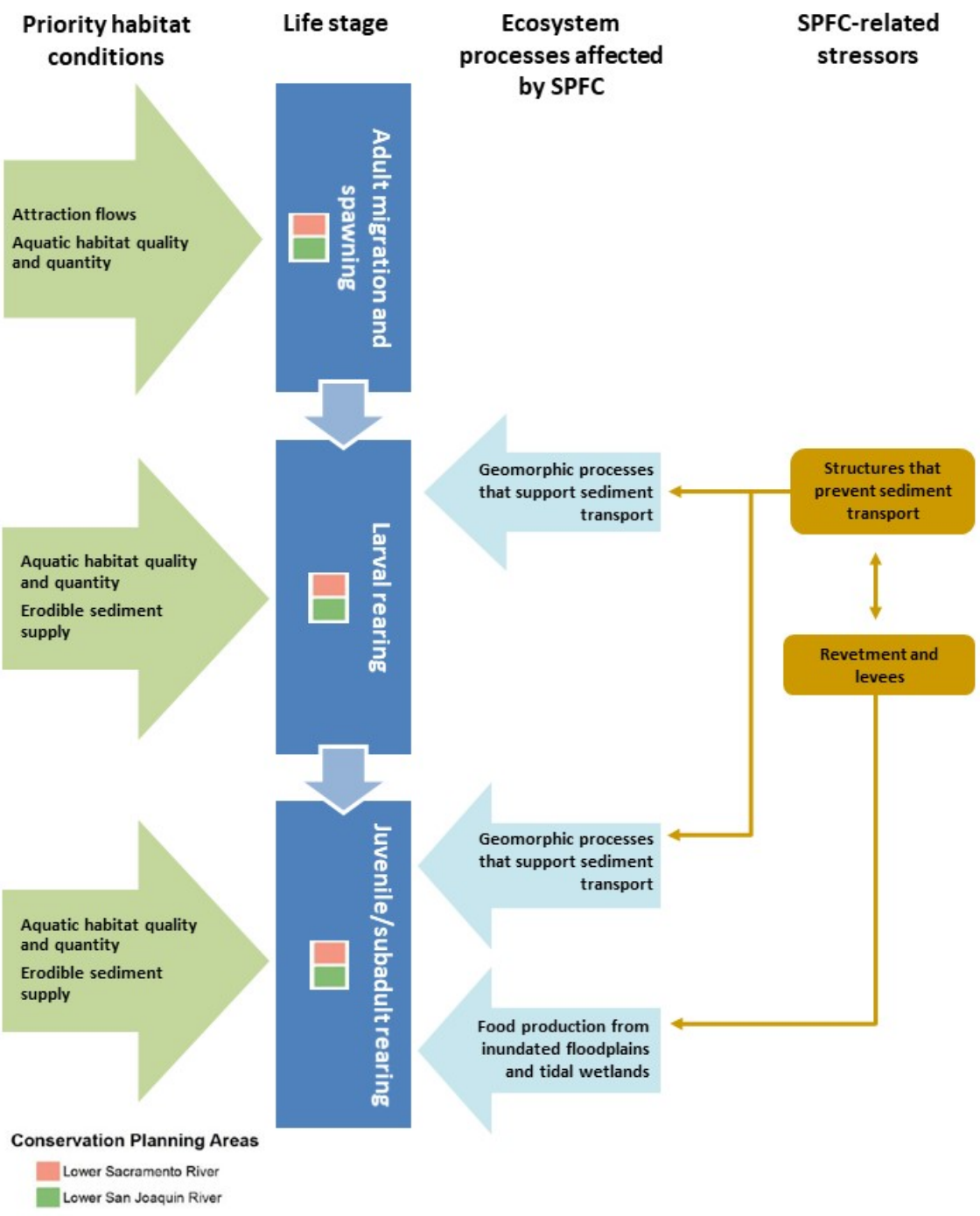
Freshwater-tidal wetlands in the Yolo Bypass may provide a refuge for the delta smelt population during drought conditions, functioning as a critical nursery habitat; particularly when delta smelt are facing serious decline (Mahardja et al. 2019). Delta smelt collected from the Yolo Bypass during the drought were compared to smelt captured elsewhere in the estuary. Smelt from the Yolo Bypass spawned earlier and offspring experienced a higher quality of both feeding conditions and growth rates (Mahardja et al. 2019). During the drought (2012 to 2016), delta smelt abundance in the Yolo Bypass was higher than during the previous 14 years of fish monitoring there, and was at record lows in locations within the estuary where delta smelt were historically found (Mahardja et al. 2019). Delta smelt do not appear to strongly prefer aquatic vegetation or any particular substrate type, although they may avoid concrete structures such as boat ramps (Sommer and Mejia 2013). Even though spawning has not been observed in the wild, many other smelt species are known to use sandy substrate for spawning (Bennett 2005).

Conceptual Models

A conceptual model has been developed to assist in the development of a targeted conservation strategy for delta smelt within the SPA (Figure B.1-3). This model is not intended to be a comprehensive model of all ecological processes, stressors, and other factors that could be relevant for this species. Rather, as Figure B.1-3 shows, the conceptual model specifically depicts all of the following considerations:

- Habitat conditions required by delta smelt within the SPA: attraction flows, and the quantity and quality of aquatic habitat.
- The specific CPAs within which these habitat conditions occur: the Lower Sacramento River and Lower San Joaquin River CPAs.
- Ecosystem processes that are key for riverine systems within the SPA, and thus may be affected by actions that could be implemented as part of the CVFPP and Conservation Strategy. These include flows that attract upstream migration, flows that improve habitat conditions, geomorphic processes that support sediment transport, floodplain inundation, food production from inundated floodplains and tidal wetlands.
- Stressors related to State Plan of Flood Control (SPFC) facilities and their operations and maintenance. These indirect factors include structures that prevent sediment transport, revetment (lack of shaded riverine aquatic [SRA]), and levees.
- Numerous conceptual models have been developed for delta smelt. These conceptual models focus on the "habitat conditions and ecosystem drivers affecting each delta smelt life stage across seasons and how the seasonal effects contribute to the annual success of the species stressors affecting survival from one life stage to the next." The models were used to generate hypotheses about the factors contributing to changes in delta smelt abundance, and to identify important information gaps (Interagency Ecological Program, Management, Analysis, and Synthesis Team 2015).

Figure B.1-3. Conceptual Model for the Delta Smelt within the Systemwide Planning Area



The CVFPP's potential influences on delta smelt and its habitat include:

- Bank protection, which reduces habitat such as SRA; and lack of sediment inputs to the Delta, which affect habitat quality for delta smelt by decreasing turbidity (Feyrer et al. 2007).
- Changes to the Delta's food web that affect delta smelt growth and survival (Interagency Ecological Program, Management, Analysis, and Synthesis Team 2015).
- Flood structures that alter shorelines and adjacent bottom substrates, which could affect spawning habitat for delta smelt (Sommer and Mejia 2013).
- Flood structures that decrease mosaics of floodplain tidal slough habitat that can provide a refuge for delta smelt during drought conditions (Mahardja et al. 2019).

Management Issues

Threats and Sensitivities Rangewide

Historically, the following factors, listed in order of importance, were the causes of decline in delta smelt abundance (58 FR 12854, March 5, 1993):

- Reduced river outflows from the Sacramento and San Joaquin rivers and their tributaries.
- Extreme high outflows in years with unusually high rainfall.
- Entrainment mortality at water diversions.
- Perturbations, both human and natural, to the smelt's food web.
- Presence of toxic substances.
- Loss of genetic integrity because of small population size.

The latest findings on delta smelt (85 FR 73164, Nov. 16, 2020) identify the following primary threats to the delta smelt:

- Direct entrainments by federal and State water export facilities.
- Reduction of suitable habitat by summer and fall increases in salinity and water clarity, resulting from decreases in freshwater flow into the estuary.
- Effects of introduced species.

Other potentially significant threats include ammonia in the form of ammonium, which destabilizes cell membranes, resulting in sublethal effects; predation by striped and largemouth bass and inland silversides; contaminants; climate change; and small population size. Changes to the importance of threats to the decline of delta smelt are associated with advancements in the understanding of effects of human activities on the ecosystem supporting delta smelt, as described here.

Water clarity has increased in the Delta since at least 1975 (Jassby et al. 2002). This increase has been identified as a major stressor for delta smelt (Nobriga and Herbold 2009; 75 FR 17667, April 7, 2010). Decreases in turbidity are strongly correlated with decreases in delta smelt distribution (Feyrer et al. 2007; Nobriga et al. 2008; Bever et al. 2016) and abundance (Thomson et al. 2010; Bever et al. 2016). Nobriga and Herbold (2009) summarized the primary hypothesized causes of this increase in water clarity as follows:

- Sediment has been increasingly trapped behind dams and levees (Jassby et al. 2002; Wright and Shoellhamer 2004).
- Sediment was lost from below dams and between levees as a result of high flows duringthe 1982 to 1983 El Niño event (Jassby et al. 2005), and presumably to a lesser extent, during less extreme high flows in other years.
- More abundant submerged aquatic vegetation (SAV), such as Brazilian waterweed (*Egeria densa*), filters the water (Feyrer et al. 2007).

Levee maintenance and bank protection activities may adversely affect critical habitat for delta smelt (59 FR 65256, Dec. 19, 1994), in part by affecting the natural recruitment of sediments to the stream channel. Channelization within levees has caused a lack of channel meander and associated natural bank, and has converted natural banks with vegetated cover to hardened or revetted banks.

Reduced natural bank erosion in all river reaches upstream of delta smelt habitat likely reduces suspended sediment and turbidity in areas where delta smelt occur. Increases in water clarity may also be attributed to decreases in primary productivity (Jassby et al. 2002), and to a shift from diatoms to cyanobacteria and flagellates in response to increases in ammonium and a shift in the balance of nitrogen and phosphate (Glibert 2010).

Threats from climate change include increases in water temperature and the number of days when mean daily water temperatures exceed 77°F, increased salinity and an eastward shift of the low-salinity zone, and an increase in water clarity (Feyrer et al. 2010; Cloern et al. 2011; Wagner 2012). Greenberg et al. (2012) modeled the influence of riparian habitat on mediating water temperatures in the Lower Sacramento and Lower San Joaquin River CPAs, stressing the importance of maintaining and enhancing riparian habitat on channel banks on a Delta-wide scale to buffer the effects of climate change, especially SRA habitat that may moderate water temperatures.

Delta smelt are vulnerable to entrainment in water diversions, most notably the State Water Project and Central Valley Project diversions; such entrainment has been identified as a major stressor affecting all life stages (Nobriga and Herbold 2009; 75 FR 17667, April 7, 2010). Adults are vulnerable during their winter-spring spawning migrations, and larvae and juveniles are vulnerable from spring to early summer, primarily from March through June (Kimmerer and Nobriga 2008; Nobriga and Herbold 2009). Larvae are most vulnerable in the spring of low-flow years when the low-salinity zone retreats upstream (Kimmerer and Nobriga 2008).

Additional causes of mortality related to human-altered hydrodynamics in the Delta include potential habitat displacement associated with the operation of the Suisun Marsh Salinity Control Gates and entrainment with water used to cool the Mirant power plants (Nobriga and Herbold 2009). However, recently the gates were re-operated to test efficacy of a managed flow pulse into Suisun Marsh, which resulted in benefits to delta smelt and its habitat (Sommer et al. 2020). Also, decreases in abundance index values have been attributed to reduced freshwater outflows associated with statewide water conveyance (Feyrer et al. 2007; Thomson et al. 2010; 75 FR 17667, April 7, 2010).

The introduction of the invasive overbite clam (*Corbula amurensis*) in 1986 substantially reduced phytoplankton biomass throughout the estuary (Jassby et al. 2002; Glibert 2010). The clam affects delta smelt directly by competing with it for food resources (copepods), and indirectly by changing food web dynamics (reduced phytoplankton) (Nobriga and Herbold 2009). The primary food source for larval and juvenile delta smelt, the calanoid copepod (*Eurytemora affinis*), has declined in response to increased predation and competition for food resources (invasive overbite clam), and has been displaced by increasingly abundant non-native copepods of lesser food value (Kimmerer et al. 1994; Bennett 2005; Baxter et al. 2010; Glibert 2010; Winder and Jassby 2011).

The increased occurrence and magnitude of algal blooms (*Microcystis aeruginosa*) have decreased food abundance for delta smelt because the fish's primary prey, the copepods *Pseudodiaptomus forbesi* and *E. affinis*, are highly sensitive to the toxin produced by *M. aeruginosa* (Microcystin) (Ger et al. 2009; Nobriga and Herbold 2009). Further, Microcystin may be more concentrated in prime habitat for delta smelt because *M. aeruginosa* dies at low salinity. However, *M. aeruginosa* blooms occur in the summer and early fall, and thus poses a threat to delta smelt only during that time (Nobriga and Herbold 2009).

Predation by introduced striped bass has also been identified as a stressor for delta smelt (Nobriga and Herbold 2009); however, predation by invasive fish species in general poses only a low to moderate threat to delta smelt (U.S. Fish and Wildlife Service 2010).

The following stressors are attributable to water toxicity:

- The direct and indirect effects (e.g., zooplankton mortality) of pesticides, particularly because pesticide concentrations and delta smelt occurrence are both positively correlated to turbidity.
- The physiological effects of metal toxicity.
- The effects of wastewater and urban runoff (e.g., ammonia and endocrine-disrupting chemicals).
- The effects of toxic algal blooms (Nobriga and Herbold 2009; Sommer and Mejia 2013).

These stressors likely have not directly caused population declines (Sommer and Mejia 2013).

Ongoing and Future Impacts

Ongoing impacts on delta smelt in the SPA include further reductions of the quality and availability of suitable habitat; the effects of climate change, which will likely include degradation of water quality and habitat suitability; and ongoing water diversions that entrain all life stages and affect habitat quality.

- The availability of suitable habitat will likely continue to be the most critical factor for delta smelt. Changes to the species' historical habitat caused by anthropogenic modification of the landscape, alterations to the natural flow regime and water clarity, the introduction of invasive aquatic species, and several other factors have reduced habitat availability and compromised remaining habitat. Substantial reversals of these negative effects are unlikely in the foreseeable future, so these factors will continue to compromise the ability of delta smelt to survive and thrive.

- Climate change will affect delta smelt habitat in the future, but the rate of climate change is uncertain. Many climate change projections predict increases in water temperature, the eastward migration of the low-salinity zone, and increases in water clarity within the species' habitat. Delta smelt show an abrupt negative response to water temperatures above 77°F, have a narrow tolerance for salinity, and are strongly associated with turbid water, all factors that make them particularly vulnerable to these predicted changes to their habitat.

- Because of their small size and the difficulty of screening large diversions to protect small fish, delta smelt remain vulnerable to entrainment at all life stages. Further, delta smelt are much more vulnerable to mortality than some other fishes, so once entrained, they seldom survive.

Key Information Gaps or Uncertainties

To better understand how current and future CVFPP activities affect the conservation and potential recovery of delta smelt, and to help guide future actions of the CVFPP and Conservation Strategy, the following information is needed:

- A better understanding of the scale of tidal marsh and floodplain restoration and SAV removal needed to improve habitat suitability.

- Data on the effects of invasive aquatic plants on delta smelt survival and habitat.

- Data on the effects of predation on delta smelt populations.

Because CVFPP activities are likely to indirectly affect delta smelt and their habitat, these uncertainties focus largely on "bigger-picture" questions, rather than on specific actions taken under the CVFPP during normal operations and maintenance. The data gaps are discussed here.

- **Scale of restoration efforts.** The scale of restoration efforts, such as reconnecting floodplains and tidal marshes, that is necessary to effect observable changes in delta smelt population parameters (e.g., abundance) is currently unknown. Recent studies have suggested that tidal wetlands do not contribute significantly to adjacent pelagic food webs (Lehman et al. 2010). However, the ratio of tidal wetland area to open-water area in the Delta has decreased approximately 80-fold since historical times, from 14 to 1 historically, to 1 to 6 today (Whipple et al. 2012). It is possible that the massive loss of habitat has reduced or eliminated the capacity of tidal wetlands to support pelagic food webs, rather than some inherent lack of connectivity between tidal wetlands and open water. Lehman et al. (2008) found that water passing through the Yolo Bypass contributed more and higher quality phytoplankton than water passing through the mainstem Sacramento River, indicating that large-scale floodplain inundation can have measurable effects on the pelagic food web. Also, recent research has demonstrated that delta smelt benefit more substantially from freshwater-tidal slough complexes such as the Yolo Bypass than from other parts of the Delta, particularly during drought conditions (Mahardja et al. 2019), suggesting that large-scale connectivity to floodplains or tidal marshes may indeed reconnect these habitats to pelagic food webs. Research that can identify the scale of restoration efforts necessary to affect delta smelt through positive contributions to their food web will help inform long-term planning of mitigation efforts.

- **Invasive aquatic plants.** Invasive aquatic plants, especially SAV (e.g., *Egeria densa*), have been implicated in the decline of delta smelt because of their contribution to increased water clarity (the plants trap sediment) (Hestir et al. 2015) and increased predation risk (the plants provide cover for predators) (Ferrari et al. 2014). However, the extent to which removing these plants will have a population-level effect on smelt abundance is unknown; similarly, it is not known what level of invasive-plant management would be needed to benefit delta smelt.

- **Predation risk.** Predators' distribution and diet, as well as the amount of overlap between the habitats of predators and delta smelt, are poorly understood (Interagency Ecological Program, Management, Analysis, and Synthesis Team 2015). In particular, data are lacking for some life stages of striped bass and largemouth bass. Further studies are needed to identify the life stage–specific spatial and temporal habitat overlap of these predators with all life stages of delta smelt. Placing these overlaps in context with key habitat variables (such as temperature, salinity, and turbidity) would provide a link between environmental drivers and predation risk (Interagency Ecological Program, Management, Analysis, and Synthesis Team 2015). Understanding predator and prey interactions would also enable actions that allow the CVFPP to avoid inadvertently enhancing the habitat of any life stage of these predators, which could indirectly affect delta smelt.

Conservation Strategy

Conservation and Recovery Opportunities

The integration of environmental stewardship into all flood management activities (by the California Department of Water Resources and Local Maintaining Agencies) during project planning, design, operations, and maintenance provides an excellent opportunity for the conservation and recovery of sensitive species that are intimately tied to Central Valley riverine ecosystems and the SPFC. The most viable way to support the recovery of delta smelt is to improve habitat for all life stages by encouraging riverine processes that improve natural river morphology and function. Improving the amount and distribution of inundated floodplain and channel-margin restoration would benefit the species. These conservation needs and opportunities are discussed in detail here.

Identified Conservation Needs

1. **Increase the amount and distribution of inundated floodplain habitat throughout the Delta region of the Lower Sacramento River CPA and Lower San Joaquin River CPA:** Inundated off--channel floodplain and tidal slough habitats increase food production rates locally and downstream compared to mainstem channels (Lehman et al. 2008). Such habitats may also contribute to higher growth and survival rates for delta smelt (Mahardja et al. 2019). For delta smelt, inundating the Yolo Bypass more frequently could particularly improve habitat quality in the North Delta. In addition to the more frequent inundation of the Yolo Bypass, floodplain habitat improvements to increase phytoplankton production (Lehman et al. 2008), increase residence time, and improve connectivity through the bypass would benefit delta smelt (Mahardja et al. 2019). Improving the quantity of floodplain and tidal slough habitats would require large-scale restoration actions that include providing connectivity to historical freshwater-tidal habitats that were reclaimed (Mahardja et al. 2019). Increasing the quantity and quality of floodplain and tidal slough habitats in the Lower Sacramento River and Lower San Joaquin River CPAs would improve habitat quality for all life stages of delta smelt.

2. **Improve natural river morphology and function:** Flood control measures downstream of dams, such as bank protection, have affected riparian and instream habitats, particularly in the Lower Sacramento River and Lower San Joaquin River CPAs. Constructed levees that narrow channels have increased flow velocities and channelized rivers so natural geomorphic processes (e.g., channel meander, connectivity to floodplains) are no longer possible. Improving geomorphic processes to support natural bank erosion, sediment deposition, and floodplain inundation is essential for providing habitat for delta smelt.

3. **Decrease the amount of non-native SAV throughout the Delta region of the Lower Sacramento River CPA and Lower San Joaquin River CPA:** SAV affects habitat quality for delta smelt by providing habitat for non-native predators such as largemouth bass and by decreasing turbidity (Hestir et al. 2015). *Egeria densa*, the dominant SAV species, is distributed throughout the Delta; its distribution is affected by light availability, water

depth, substrate type, and water velocity (Hestir et al. 2015). Removing or reducing the extent of SAV would improve habitat conditions for delta smelt.

4. **Improve the distribution and quality of marsh and channel-margin habitat in tidally influenced waterways throughout the Delta region of the Lower Sacramento River CPA and Lower San Joaquin River CPA:** Marsh and channel-margin habitats, including SRA habitat, may provide important food resources for delta smelt and may affect the quality of spawning and larval rearing habitat (Mahardja et al. 2019; Greenberg et al. 2012). The historical reclamation of wetlands and construction of levee systems in the Delta region of the Lower San Joaquin River and Lower Sacramento River CPAs removed most of this habitat. Large-scale restoration of the distribution and amount of tidally influenced channel-margin habitat, particularly in floodplain habitat complexes of the Yolo Bypass, may provide habitat benefits (Herbold et al. 2014; Mahardja et al. 2019).

Integration of Conservation and Restoration in Flood Management

As identified in Table B.1-1, CVFPP management actions have the potential to provide a positive, negative, or neutral contribution to the identified conservation needs of the delta smelt. In many cases, the species' conservation needs can be addressed by implementing management actions that integrate conservation and restoration elements with SPFC operations and maintenance, floodway management, and structural and nonstructural improvements to facilities. The ability to implement some of these actions would depend on operations, maintenance, and floodway management actions and improvements (as described in the following section) to resolve constraints, such as the floodway's existing capacity to convey flood flows, or revetment removal at a site that may depend on levee relocation to allow bank erosion. Wherever feasible, conservation objectives and indicators will inform management actions for adaptive, responsive, and sustainable implementation that avoids and minimizes impacts on species and ecosystems.

Operations, Maintenance, and Floodway Management

Floodwater storage and reservoir forecasting, operations, and coordination: Modifying and coordinating flood operations could include the limited reoperation of reservoirs and weirs.

The reoperation of these facilities could provide flow releases that would improve aquatic habitat conditions by changing the timing and amount of releases and ramping rates from November and early December until the end of April. These modifications could initiate upstream adult migration and generate other environmental benefits, including promoting floodplain connectivity, enhancing meander migration rates, and improving conditions to promote the development of SRA habitat.

Table B.1-1. Summary of the Contributions of CVFPP Management Actions to Identified Conservation Needs of the Delta Smelt

SPFC Activity	Management Actions	Conservation Need 1. Increase Inundated Floodplain	Conservation Need 2. Improve Natural River Function	Conservation Need 3. Decrease Non-native SAV	Conservation Need 4. Increase or Improve Marsh and Channel-margin Habitat
Operations, Maintenance, and Floodway Management	Floodwater storage and reservoir forecasting, operations, and coordination	Positive	Positive	Neutral	Neutral
	Facility maintenance	Neutral	Neutral	Positive	Neutral
	Levee vegetation management	Negative	Neutral	Neutral	Neutral
	Floodway maintenance	Neutral	Neutral	Positive	Neutral
	Floodplain topography modification	Positive	Positive	Positive	Neutral
	Invasive-plant management	Neutral	Positive	Positive	Positive
	Riparian, SRA, and marsh habitat restorations	Neutral	Positive	Positive	Positive
Structural and Nonstructural Improvements	Levee and revetment removal	Positive	Positive	Neutral	Positive
	Levee relocation	Positive	Positive	Positive	Positive
	Bypass expansion and construction	Positive	Neutral	Positive	Positive
	Levee construction and improvement	Neutral	Neutral	Neutral	Neutral
	Flood control structure reconfigurations	Neutral	Neutral	Neutral	Neutral

Notes:
CVFPP management actions are designated as having the potential to provide a positive, negative, or neutral contribution to the identified conservation needs of the species.

SAV = submerged aquatic vegetation

Modifying the operation of weirs that spill floodwater into the bypasses is also being evaluated as a CVFPP management action. For example, lowering the crests of overflow weirs and modifying operations so that bypasses carry flows earlier and longer during high river stages would activate the floodplain more frequently and for longer durations. Such floodplain activation could contribute to food web productivity and improve habitat conditions.

Levee vegetation management: The 2012 CVFPP introduced an interim vegetation management strategy, under which levee vegetation in the vegetation management zone is managed for visibility and accessibility, and to reduce threats to levee integrity (Figures 2-1 and 2-2 in Appendix D of the 2012 Conservation Strategy). Consequently, levee riparian vegetation in the vegetation management zone has been significantly trimmed or removed, reducing inputs of terrestrial insects and leaf litter and thereby reducing food availability and nutrient input. Trimming and removal of waterside vegetation also may have detrimental effects on water temperature (Poole and Berman 2001; Greenberg et al. 2012; Interagency Ecological Program, Management, Analysis, and Synthesis Team 2015).

On the whole, levee vegetation management is likely to negatively affect habitat for delta smelt. However, lower waterside vegetation could be retained below the vegetation management zone of levees when it did not present an unacceptable threat to levee integrity. Allowing vegetation to grow on the waterside of levees where levees are adjacent to the river does not compensate for the lack of fully functioning riparian habitat, but does provide some minimal benefits for aquatic species.

In the near term, this approach would also preserve other vegetation within the vegetation management zone that does not impair visibility and accessibility.

Floodway maintenance: Floodway maintenance actions could sustain or improve the existing mosaic of floodplain habitats. At selected locations, maintenance practices could be changed to facilitate the restoration of riparian habitat, or to otherwise provide greater ecological benefits than found under existing conditions. Native vegetation could be planted after sediment is removed, and large woody material that is cleared from levees could be stockpiled and used to enhance habitat (e.g., during levee erosion repairs). For example, fill-placement and rock-repair projects could incorporate SRA elements, where relevant.

Floodplain topography modification: Floodway topography modifications could increase floodway capacity and the frequency and duration of inundation. Floodplain elevations could be lowered to provide more frequent and sustained inundation. Elevations could also be modified to increase topographic and hydrologic diversity (by creating or opening secondary channels or overflow swales). These actions would increase riverine and floodplain habitat values (e.g., potentially increase turbidity and food production in downstream Delta habitats).

Invasive-plant management: Non-native invasive plants that may be removed from lands and facilities operated and maintained by the State could include SAV (e.g., *Egeria* and parrot's feather [*Myriophyllum aquaticum*]) and terrestrial vegetation that affects river geomorphology (e.g., *Arundo* and saltcedar). Aquatic habitats dominated by non-native SAV generally support

non-native fishes such as centrarchids (Grimaldo et al. 2012), particularly in the Lower Sacramento and Lower San Joaquin River CPAs; these fish may be predators of delta smelt.

Established non-native terrestrial vegetation in riparian areas displaces important native plants (e.g., willows and cottonwoods) that facilitate river meander and natural geomorphic processes. The removal of non-native invasive plants could therefore benefit delta smelt by improving habitat and reducing predation by non-native fishes.

Riparian, SRA, and marsh habitat restoration: Riparian and marsh habitats could be restored at selected locations in the floodway to benefit delta smelt. Opportunities for riparian restoration would generally be found in non-riparian land cover in the floodway, particularly as part of other management actions to increase floodway capacity. Riparian, SRA, and marsh habitat restoration would be most beneficial in areas where restoration expands or connects existing habitat patches in the Delta. In the bypass system, marsh restoration would generally be beneficial to delta smelt and would be implemented in conjunction with bypass expansion and construction.

Structural and Nonstructural Improvements

Levee and revetment removal: Removing levees and revetment that provide little value to local and systemwide flood management would reduce operations and maintenance costs while improving natural geomorphic and inundation processes in the riverine and floodplain environments. This action would have greater ecological benefits if implemented along or upstream of waterways used by delta smelt, and where removal contributes to a larger zone of active river meander migration.

Levee relocation: Relocating levees farther from rivers (i.e., constructing setback levees) is an important approach to increasing floodway capacity, creating space for river meanders, reconnecting floodplains, allowing the transport and deposition of sediment, supporting natural ecosystem disturbance processes, and increasing the diversity of riverine and floodplain habitats. Levee relocation would also provide opportunities to hydraulically connect river systems to mitigation plantings associated with the vegetation management zone, and to improve habitat for delta smelt in the Lower Sacramento River and Lower San Joaquin River CPAs.

Bypass expansion and construction: Bypass expansion could enhance delta smelt habitat (e.g., food resources) by increasing the connectivity of the floodplain to the Delta, thus restoring floodplain ecosystems that contribute to food web productivity. However, bypasses are flooded irregularly. To benefit delta smelt, bypass flooding needs to occur morefrequently (e.g., annually), with the appropriate timing and duration to provide suitable habitat. Modifying bypass weirs (e.g., those in the Yolo Bypass and at Paradise Cut) could improve the timing and duration of inundation to benefit fish, especially if coupled with large-scale restoration efforts to increase habitat complexity.

Levee construction and improvement: One levee construction and reconstruction objective that would benefit the delta smelt is restoring geomorphic processes. In addition, new levees could be designed to accommodate hydrologic changes expected to result from climate change.

Flood control structure reconfiguration: A priority action for State-operated and -maintained diversions in the SPA is to reconfigure the Fremont and Sacramento weirs in the Yolo Bypass (in the Lower Sacramento River CPA) and the weir at Paradise Cut (in the Lower San Joaquin River CPA) to increase floodplain inundation (California Department of Water Resources 2012). As discussed, improved floodplain inundation would benefit the delta smelt.

Recovery Plan Alignment

USFWS developed the *Recovery Plan for Sacramento–San Joaquin Delta Native Fishes* in 1996; however, in its most recent five-year review, USFWS indicated the recovery plan is outdated (U.S. Fish and Wildlife Service 2010). The five-year review included actions that could prevent extinction of the species. Table B.1-2 lists examples of specific near- and long-term restoration and conservation actions identified in the five-year review that could be partially implemented through the CVFPP.

Table B.1-2. Examples of Near- and Long-term Restoration and Conservation Actions, by Region, that Could Be Implemented through the CVFPP

CPA	Restoration Action
Lower Sacramento River	• Increase the area of suitable spawning habitat. • Improve freshwater-tidal slough complexes in the Yolo Bypass and Delta. • Improve connectivity in low-flow channels within the Yolo Bypass.
Lower San Joaquin River	• Increase the area of suitable spawning habitat. • Improve freshwater-tidal slough complexes in the Delta.

Source: U.S. Fish and Wildlife Service (2010)

Notes:
CPA = conservation planning area

Measures of Positive Contribution

A primary goal of the Conservation Strategy is to contribute to the recovery and stability of native species populations and overall biotic community diversity. The objective for this goal is a measurable contribution to the conservation of target species, including the delta smelt.

Therefore, building on the preceding discussion, this section of the delta smelt conservation plan provides measures (i.e., metrics or indicators) that will be used to determine how effectively CVFPP management actions contribute to the conservation needs of this species.

Measures for each target threatened or endangered species are organized around indicators of progress toward the Conservation Strategy's process, habitat, and stressor objectives (Table B.1-3 and Table B.1-4). The species-specific measures provide additional detail on

geographic location, habitat structure, and other attributes important to conservation of the species.

Table B.1-3. Measures of the Contribution of CVFPP Actions to Conservation of the Delta Smelt

Target	Indicator	Selected as Measure of Contribution	Additional Specificity
Riverine Geomorphic Processes	Natural Bank—total length (miles)	Yes	Not applicable.
	River Meander Potential—total amount (acres)	Yes	Not applicable.
SRA Cover	SRA Cover and Bank and Vegetation Attributes of SRA Cover—total length (miles)	Yes	SRA cover in the Lower Sacramento River and Lower San Joaquin River CPAs may help moderate local temperatures by providing shade; therefore, the more shading of aquatic habitat, the greater benefit is likely to be accrued.
	Total Length and Percentage of Bank Affected by Flood Projects that Incorporate SRA Attributes	Yes	Not applicable.
Riparian	Habitat Amount—total amount and total amount on active floodplain (acres)	No	Not applicable.
	Habitat Connectivity—median patch size (acres)	No	Not applicable.
Marsh	Habitat Amount—total amount and total amount on active floodplain (acres)	Yes	Providing marsh habitat that does not include, and minimizes the likelihood of establishment of, non-native SAV is considered an important element for improving growth and survival.
Revetment	Revetment Removed to Increase Meander Potential or Natural Bank—total length (miles)	Yes	Decreasing turbidity in the Delta is considered detrimental to delta smelt. Increasing or restoring erodible banks, particularly in the tidally influenced habitats in the Lower Sacramento River and Lower San Joaquin River CPAs, would provide benefits.

SRA = shaded riverine aquatic

Table B.1-4. Measures of the Contribution of CVFPP Actions to Conservation of the Delta Smelt

Target	Indicator	Selected as Measure of Contribution	Additional Specificity
Levees	Levees Relocated to Reconnect Floodplain or Improved to Eliminate Hydraulic Constraints on Restoration—total length (miles)	Yes	Improving food production for delta smelt is considered an important element for improving growth and survival. Increasing floodplain connectivity, especially in the Yolo Bypass and in tidally influenced habitats of the Lower Sacramento River and Lower San Joaquin River CPAs, may improve system productivity in the Delta.
Fish Passage Barriers	Fish Passage Barriers—modified or removed	No	Not applicable.
Invasive Plants	Invasive-plant-dominated Vegetation—total area reduced (acres)	Yes	Remove or decrease populations of non-native invasive aquatic plants (e.g., *Egeria* sp. and *Myriophyllum aquaticum*) that affect fish habitat, in addition to terrestrial plant species that affect river geomorphology and habitat quality (e.g., *Arundo* and saltcedar).

Notes:
Floodplain inundation potential is the potential of an area to be inundated by a particular flow (e.g., a flow event that occurs about once every two years, or a "50-percent-chance event"). Expected annual habitat units represent the annual average of the area expected to be inundated in general or by flows meeting defined criteria for timing and duration (e.g., sustained spring flows).

Table B.1-3 lists the process, habitat, and stressor targets of the Conservation Strategy; identifies those used to measure the contribution to conservation of delta smelt; and provides additional specificity as necessary to measure this contribution. Management actions intended to benefit delta smelt may simultaneously affect the conservation of other species in the SPA. For this reason, these measures of contribution have been incorporated into each CPA's objectives for the conservation of target species, which are provided in the Conservation Strategy Update. The target species objectives cover multiple species and reflect the interrelated nature of CVFPP flood management and conservation actions.

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Appendix B.2
Focused Conservation Plan: Tricolored Blackbird

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APPENDIX B.2

Focused Conservation Plan: Tricolored Blackbird

Acronym	Definition
CESA	California Endangered Species Act
Conservation Strategy	Central Valley Flood Protection Plan Conservation Strategy
CPA	Conservation Planning Area
CVFPP	Central Valley Flood Protection Plan
ESA	Endangered Species Act
SPA	Systemwide Planning Area
SPFC	State Plan of Flood Control
USFWS	U.S. Fish and Wildlife Service

Conservation Status

As part of the Central Valley Flood Protection Plan (CVFPP) Conservation Strategy Update, this focused conservation plan addresses needs and opportunities to conserve the tricolored blackbird (*Agelaius tricolor*) and its habitat in the Systemwide Planning Area (SPA).

Except for small nesting colonies found locally in Oregon, Washington, Nevada, and Baja California, the tricolored blackbird is restricted to California (Beedy 2008). The global population was estimated at approximately 163,000 adults in 2000 (Beedy 2008), with more than 99 percent in California (Hamilton 2000). A recent Tricolored Blackbird Statewide Survey counted a total of 177,656 birds in 37 counties from 44 counties surveyed (Meese 2017).

As indicated in the 2016 CVFPP Conservation Strategy (Conservation Strategy) (California Department of Water Resources 2016), because the conservation needs of species change, additional species may be added to the list of target species during the five-year update process. When the tricolored blackbird was screened as a potential target species in the first iteration of the Conservation Strategy, it was a California Species of Special Concern and was not included as a target species (Appendix G of the 2016 Conservation Strategy). However, on March 18, 2019,

the species was subsequently elevated from a Species of Special Concern to a threatened species under the California Endangered Species Act (CESA) due to the precipitous population decline (nearly 90 percent since the 1930s).

In 1991, the U.S. Fish and Wildlife Service (USFWS) included the tricolored blackbird as a candidate (Category 2) for listing as either threatened or endangered (59 *Federal Register* 58990, November 15, 1994) under the federal Endangered Species Act (ESA). USFWS policy changes in 1995 eliminated the Category 2 candidate designation nationwide, and because of this policy change, the species was removed from candidacy.

In 2006, USFWS rejected the petition to list the tricolored blackbird as threatened or endangered. This finding was based on a USFWS 90-day review, which determined that the scientific and commercial information presented in the petition did not warrant listing (Tricolored Blackbird Working Group 2007). On August 15, 2019, USFWS again published a finding that listing the tricolored blackbird under ESA was not warranted, because of "high nesting success in both small and large colonies" and existing regulatory mechanisms, including CESA, that "are currently acting to ameliorate the severity of some existing threats" (Meese 2019).

Thus, the tricolored blackbird is not listed under ESA; however, in addition to its listing under CESA (14 California Code of Regulations Section 670.5), this species is also protected by the federal Migratory Bird Treaty Act and California Fish and Game Code (Sections 3503, 3503.5, and 3513).

Status and Trends

Distribution

Figure B.2-1 shows the known distribution of tricolored blackbird in California. This species is restricted to California's Central Valley and surrounding foothills and coastal and inland localities in Southern and Central California, with local populations in northeastern California, Oregon, central Washington, western Nevada, and northwestern Baja California (Beedy et al. 2020). The global population was estimated at approximately 163,000 adults in 2000 (Beedy 2008), with more than 99 percent in California and, in most years, 90 percent of the breeding population occurring in the Central Valley (Hamilton 2000). A recent Tricolored Blackbird Statewide Survey counted a total of 177,656 birds in 37 counties from 44 counties surveyed (Meese 2017).

Tricolored blackbirds also breed locally in other lowland areas west of the Sierra and Cascade ranges and in northeastern California. During winter, most of the population remains within California, where they are joined by the birds that breed north of the state (Beedy 2008).

Figure B.2-1. Known Tricolored Blackbird Distribution in California

Source: California Department of Fish and Wildlife 2020

As a species, tricolored blackbirds are resident throughout the year in California, but individual birds migrate and move extensively within the range (Beedy 2008).

Population Trends

Vast flocks of these birds once occurred in California; however, habitat loss, poisonings and shootings of blackbirds to protect crops, pesticide use, and large, persistent, and ongoing annual losses of nests and nesting habitat have contributed to rapid declines of the species in California (Center for Biological Diversity 2015). Virtually all suitable habitats formerly supported foraging and nesting tricolored blackbirds, including marshlands and riparian woodlands in the Central Valley (Beedy et al. 2020). The most common form of destruction of large nesting colonies (more than 50,000 nests) in the San Joaquin Valley, particularly in the early 1990s, was from harvesting grain and discing weeds on fields that supported nesting colonies of tricolored blackbirds (Beedy et al. 2020).

Recent surveys, combined with historical information, indicate the tricolored blackbird has undergone a long-term population decline (Tricolored Blackbird Working Group 2007). In 2014, the population of this species was the smallest number ever recorded, at only 145,000 birds, and the 2017 Tricolored Blackbird Statewide Survey recorded a total of 177,656 birds from 37 counties. By comparison, in 1934, Neff (1937) observed as many as 736,500 from just eight Central Valley counties, and 19th century accounts described flocks of thousands "numbering so many thousands as to darken the sky for some distance by their masses" (Heermann [1859] as conveyed by Beedy 2008). In 1931–1936, Neff (1937) found 252 colonies in 26 California counties, with the largest colony estimated to contain more than 200,000 nests and several others with more than 100,000 (Beedy 2008).

Statewide censuses have revealed steep declines in tricolored blackbird numbers in the Central Valley (Beedy and Hamilton 1997; Hamilton et al. 1999; Hamilton 2000; Green and Edson 2004; Cook and Toft 2005, Meese 2017). Studies conducted in the 1970s revealed that the overall population decreased substantially from the 1930s; more recently, intensive surveys identified a decline of 37 percent between 1994 and 1997 and a 63-percent decline between 2008 and 2014, followed by an increase of 22 percent in 2017 (Beedy et al. 2020).

Life History

The tricolored blackbird diverged from its closest related taxon, the red-winged blackbird (*A. phoeniceus*), more than 3 million years ago (Yasukawa and Searcy 1995). As is the case with red-winged blackbirds, tricolored blackbirds are sexually dimorphic in plumage and size, with males being the larger sex. However, contrary to the variation in California populations of the red-winged blackbird, tricolored blackbirds do not vary in either plumage or body size across the breeding range, and their vocalizations are not regionally distinct (Beedy et al. 2020).

Tricolored blackbirds are colonial breeders, forming the largest colonies of any North American songbird, and breeding colonies have historically consisted of tens to hundreds of thousands of birds (Beedy et al. 2020). Males defend the immediate nesting area and territory size ranges from 6 to 11.5 square feet (Orians 1961). Like red-winged blackbirds, tricolored blackbirds have a polygynous breeding system; one study reported two to three females per territorial male (Collier 1968).

The basic requirements for tricolored blackbird breeding habitat are open, accessible water; a secure nesting substrate; and close foraging habitat with adequate food resources. All of these elements must be present for successful breeding (Beedy and Hamilton 1999; Meese and Beedy 2015). Historically, most colonies were located in freshwater marshes dominated by cattails (*Typha* spp.) or tules (*Schoenoplectus* spp.), with some in nettles (*Urtica* spp.), thistles (*Cirsium* spp.), and willows (*Salix* spp.) (Tricolored Blackbird Working Group 2007). This species also nests in riparian scrub and forests (Beedy and Hamilton 1999); for example, a large colony currently breeds in riparian scrub in the Panoche Valley (Shearwater pers. comm. May 23, 2020). In recent years, large numbers of tricolored blackbirds have also bred in agricultural (e.g., silage) fields.

Nesting tricolored blackbirds prefer large, continuous blocks of cattails and tules (often in the first or second year of growth), and optimal marsh conditions include emergent vegetation at least 4.3 feet high and submerged in shallow water 6 to 18 inches deep (Meese and Beedy 2015). Cattail stands must be at least 50 feet wide to support successful nesting (Meese and Beedy 2015).

With the loss of natural flooding processes and the riparian succession and wetlands sustained by such processes, tricolored blackbirds in the Central Valley forage primarily in managed habitats, including agricultural crops, such as alfalfa, irrigated pastures, grain fields; and in other areas, such as annual grassland, cattle feedlots, and dairies (Tricolored Blackbird Working Group 2007). Tricolored blackbirds continue to forage in remnant native habitats, including riparian scrub, open marshes, and seasonal wetlands.

Typically, tricolored blackbirds forage within approximately 3 to 4 miles of the nesting colony (Orians 1961; Beedy and Hamilton 1997; Tricolored Blackbird Working Group 2007; Beedy et al. 2020). The proximity to suitable foraging habitat appears to be extremely important in establishing breeding colony sites.

The following prey items are important for feeding nestlings (Crase and DeHaven 1977; Tricolored Blackbird Working Group 2007):

- Beetles (Coleopterans).
- Grasshoppers and locusts (Orthopterans).
- True bugs (Hemipterans).
- Spiders (Arachnids).
- Larval insects.

Nest heights typically range from a few inches to about 5 feet above water or ground level in freshwater marshes, and up to 10 feet in the canopies of willows and other riparian trees (Neff 1937; Beedy 2008).

Tricolored blackbirds can attempt to breed more than once per season. Many birds appear to exhibit this behavior by breeding early in the season in the San Joaquin Valley, and then moving to the Sacramento Valley to breed later in the season (Tricolored Blackbird Working Group 2007).

During the non-reproductive season, tricolored blackbirds form huge mixed-species flocks that include red-winged blackbirds, Brewer's blackbirds (*Euphagus cyanocephalus*), European starlings (*Sturnus vulgaris*), and brown-headed cowbirds (*Molothrus ater*). These mixed-species flocks forage in grasslands, in agricultural fields with low-growing vegetation, and at dairies and feedlots (Meese and Beedy 2015). In February, tricolored blackbirds segregate into pure tricolored blackbird flocks before the breeding season (Beedy 2008). Figure B.2-2 shows the *Birds of The World* annual cycle for the tricolored blackbird. As the figure shows, peak molting occurs between the latter part of June and early to mid-September; peak breeding occurs between late March and late June; and peak migration occurs from late March through mid-June.

Habitat and Ecological Process Associations

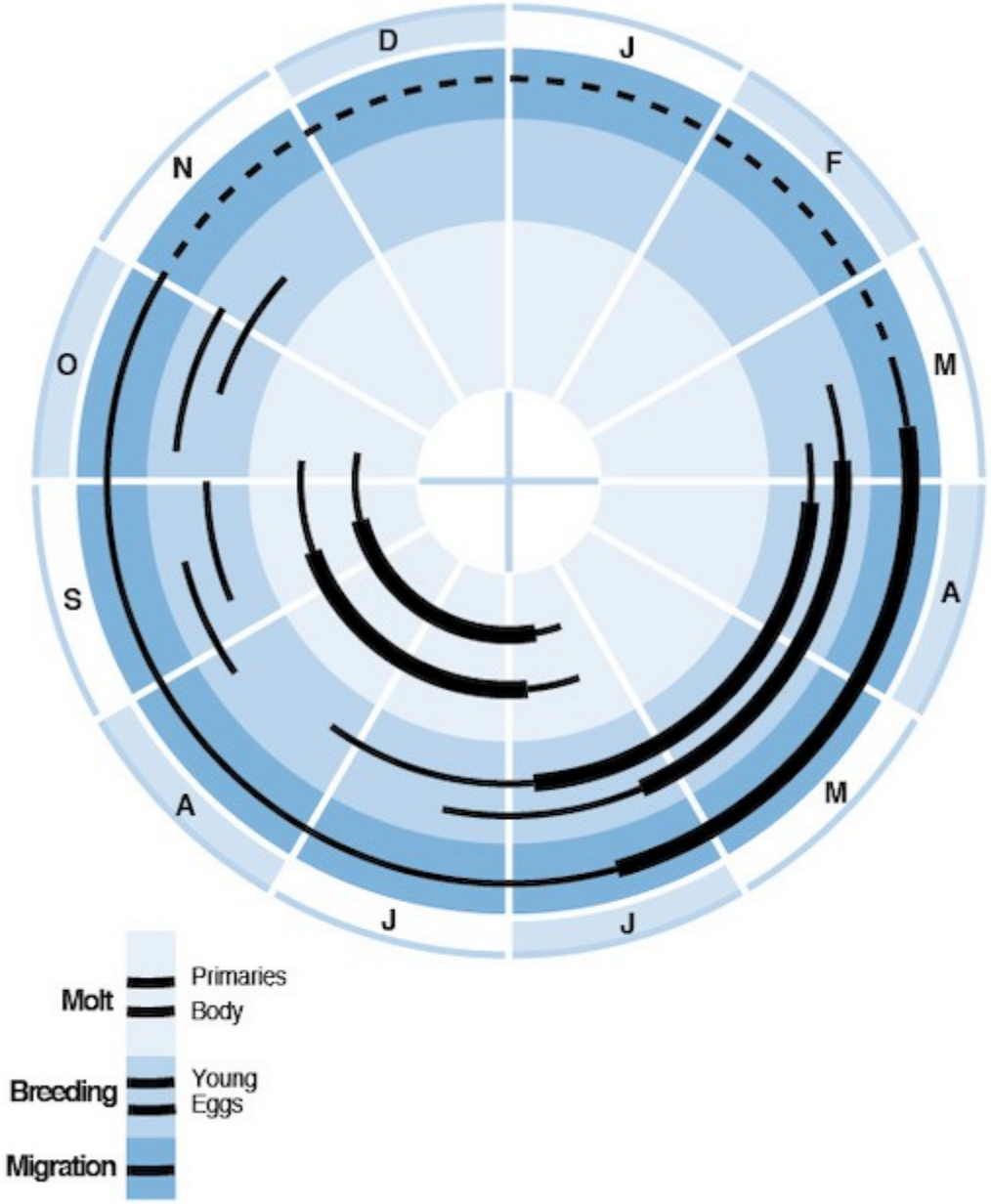
Conceptual Models

A conceptual model has been designed to assist in the development of a targeted conservation strategy for the tricolored blackbird within the SPA (Figure B.2-3). This model is not intended to be a comprehensive model of all ecological processes, stressors, and other factors that could be relevant for this species. Rather, as Figure B.2-3 shows, the conceptual model specifically depicts all of the following considerations:

- Habitat conditions required by tricolored blackbirds within the SPA: early successional marsh and riparian habitat, open accessible water, protected nesting substrate (thorny or flooded vegetation), and adequate insect prey within a few kilometers.
- The specific Conservation Planning Areas (CPAs) within which tricolored blackbirds breed: The Upper and Lower Sacramento and San Joaquin River CPAs and the Feather River CPA.
- Key ecosystem processes of riverine systems within the SPA potentially affected by actions associated with the CVFPP and Conservation Strategy: Riverine geomorphic processes and floodplain inundation that sustains and renews marsh and riparian habitat; loss of the nesting colony or nesting habitat; and herbicide impacts.
- Stressors related to State Plan of Flood Control (SPFC) facilities and their operations and maintenance: Revetment and levees, floodway management and maintenance, and agricultural operations.

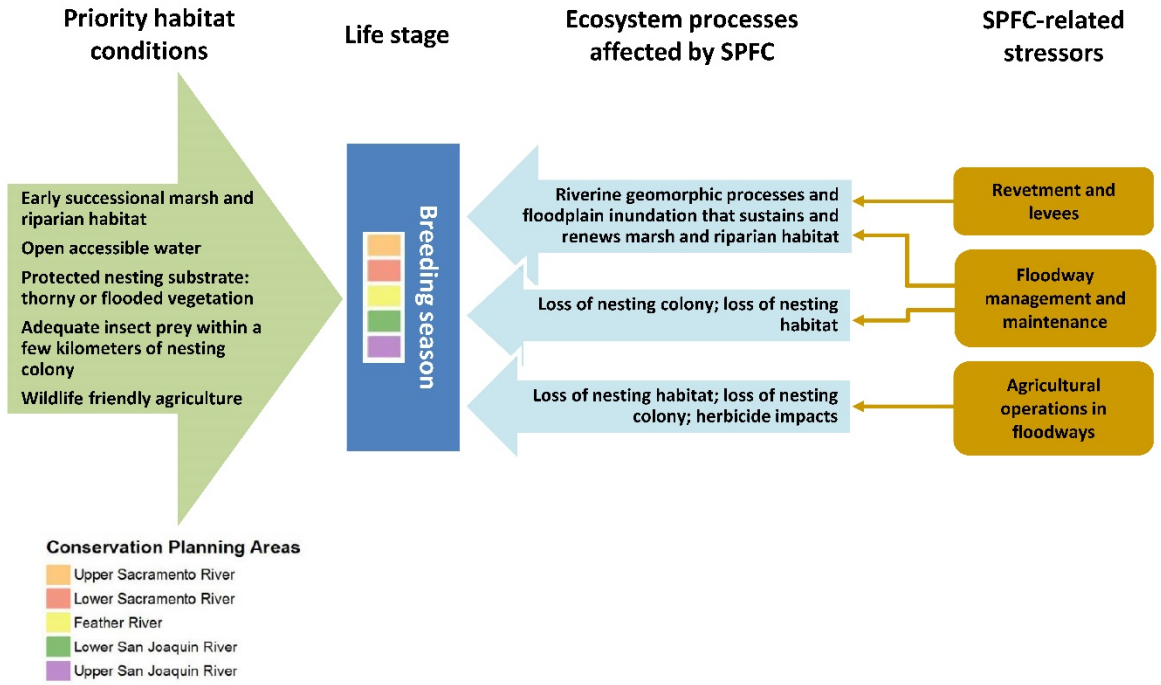
Figure B.2-2. Annual Cycle of the Tricolored Blackbird in California's Central Valley

Thick lines show peak activity; thin lines, off-peak.



Source: Beedy et al. 2020; reproduced with permission.

Figure B.2-3. Conceptual Model for the Tricolored Blackbird within the Systemwide Planning Area



Management Issues

Threats and Sensitivities Rangewide

The greatest effects of anthropogenic activity on tricolored blackbirds are related to habitat loss and the direct disturbance of active nest colonies (Beedy et al. 2020). Suitable habitats in the Central Valley (riparian habitat, marshlands, and perennial grasslands) formerly supported nesting and foraging tricolored blackbirds, but most of the valley has been converted to agriculture and urban development.

The historical—and still preferred—breeding habitat for tricolored blackbirds is freshwater emergent wetland vegetation (Neff 1937; DeHaven et al. 1975; Beedy and Hamilton 1999; Tricolored Blackbird Working Group 2007). In the past, most nesting colonies were in freshwater marshes (Beedy 2008). Water diversions and the loss of natural riverine processes have resulted in the large-scale loss and fragmentation of preferred breeding and foraging habitat for the tricolored blackbird; most researchers consider losses of natural breeding and foraging habitats to be the most important causes of the documented population declines (Tricolored Blackbird Working Group 2007). Before damming, water diversion, and flood control infrastructure and management were implemented, the Central Valley flooded during many years, forming a vast mosaic of riparian forests, freshwater marshes, seasonal wetlands, alkali flats, and upland habitats (including native grasslands and oak savannas) that supported large numbers of tricolored blackbirds (Beedy 2008).

The small percentage of California's original freshwater wetlands remaining in the Central Valley often occurs in small, isolated patches that also support high densities of predators (Tricolored Blackbird Working Group 2007). The shift in the Central Valley during the past century from marsh nesting to silage and rice field nesting is likely related to the loss of freshwater marshes.

Based on the importance of foraging habitat close to potential breeding sites, land uses within 3 to 4 miles of a breeding colony site—which in turn influences the local prey base—determine colony occupation and reproductive success at the particular potential breeding site (Tricolored Blackbird Working Group 2007). Agricultural crops not favorable for foraging tricolored blackbirds (e.g., vineyards and nut trees) have replaced, and continue to replace, grasslands and other more favorable crops (e.g., row and field crops) throughout the Central Valley. This conversion has resulted in decreased foraging opportunities for tricolored blackbirds near otherwise favorable breeding locations, reducing the number of nesting locations and overall foraging area.

Many of the Central Valley's freshwater marshes are managed for waterfowl and other marsh--dependent species. For tricolored blackbirds, water levels need to be deep enough to deter predators, but not deep enough to flood nests—both of which lead to nest loss (Tricolored Blackbird Working Group 2007). Frequent disturbances by predators during nesting may cause mass desertions of breeding colonies at sensitive phases of the breeding cycle; thus, marsh management that does not address the tricolored blackbird's nesting requirements is also a threat.

A major deleterious, rangewide, population-level impact has resulted from agricultural land uses involving grain harvesting and discing in fields occupied by breeding colonies of tricolored blackbirds, causing the loss of some of the largest colonies in California (Beedy et al. 2020).

Because this species nests in large, dense colonies, it is more vulnerable to nest failures that can affect large numbers of nests in a single colony. Large colonies (more than 50,000 nests) in the San Joaquin Valley were destroyed in the 1990s and the first decade of the 2000s. Shooting by farmers attempting to reduce crop damage has been documented in the Sacramento Valley since 2007 (Beedy et al. 2020). Although tricolored blackbirds are listed as threatened under CESA, other blackbird species exempted from protection under federal and state law are often shot in large numbers when depredating rice. During that time of year (autumn), tricolored blackbirds occur in mixed blackbird flocks, and thus, an unknown number of tricolored blackbirds is shot each fall (Meese and Beedy 2015).

Pesticides and other contaminants also affect, or may affect, tricolored blackbirds. For example, selenium contamination is known to decrease hatchability in the closely related red-winged blackbird; and in 1986, nearly complete nesting failure was observed at Kesterson Reservoir in Merced County, which contained water contaminated by high concentrations of selenium from agricultural drainwater (Beedy et al. 2020). Other examples include eggs sprayed with mosquito abatement oil that have failed to hatch and loss of colonies because of the aerial application of herbicides (Beedy et al. 2020).

Concerns have arisen regarding the effects of newly developed water-soluble pesticides targeting insect populations—neonicotinoids and pyrethroids—on the availability of insect food required to raise tricolored blackbird young, and recent declines in tricolored blackbirds breeding in the Sacramento Valley (Beedy et al. 2020).

Ongoing and Future Impacts

- Losses of breeding and foraging habitat related to conversion of agricultural and urban land uses in the Central Valley has resulted in significant negative impacts on the tricolored blackbird population, and continues to do so. This is considered the most significant factor in the long-term reduction of this species' population (Beedy and Hamilton 1997; Hamilton et al. 1999; Hamilton 2000; Tricolored Blackbird Working Group 2007).

- Direct impacts of anthropogenic activities, including harvesting, plowing, burning, and water management, have included the loss of nesting substrate and nests. (In some cases, large numbers of nests have been lost in a single event.) In the SPA, ongoing floodway maintenance, weed eradication, and other ground-disturbing activities can destroy or degrade nesting substrate or result in the loss of active nesting colonies. Ground disturbance can also degrade tricolored blackbird foraging habitat by disrupting soils and reducing prey availability. The use of revetment and other bank protection measures may eliminate the species' habitat.

- Urbanization, agricultural expansion, and other land conversion practices are increasing the abundance of predators by providing anthropogenic food sources and increasing the suitability of habitat for predatory species. Also, the presence of infrastructure such as roadways facilitates predator access into wetland areas.

- The burning and discing of marshes at Central Valley ranches and duck clubs during the spring decreases the number of suitable spring breeding sites for tricolored blackbird, resulting in a temporary loss of breeding habitat in those areas. Water management at freshwater marshes managed for species other than tricolored blackbirds can result in a loss of nests and nesting habitat.

Key Information Gaps or Uncertainties

- **Breeding biology.** Many aspects of tricolored blackbird breeding biology require further study (Beedy et al. 2020). Of these aspects, perhaps most relevant to this focused conservation plan is the need to more precisely determine the factors that lead to nest-site selection, especially the roles of nest-substrate characteristics versus insect abundance in local foraging areas. Another prioritized research area is an assessment of relationships between habitat suitability, foraging ecology, and site philopatry (the tendency of a species to stay in or regularly return to a particular habitat). Further research needs also include assessing the effects of land use characteristics on colony size and reproductive success within colonies, and identifying the ecological factors responsible for multiple breeding attempts in a single breeding season and the relative reproductive success of those attempts.

- **Foraging ecology and pesticides.** Further research is needed on foraging ecology, including quantifying the food supply; identifying the environmental factors that result in an abundance of grasshoppers and other large insect prey in grasslands; and assessing their variability in time and space (Beedy et al. 2020). Also necessary are associated assessments of the relative abundance of insects in organic (unsprayed) versus conventional (sprayed) fields of alfalfa, rice, and sunflowers, and of the potential effects of different pesticides on prey availability.

- **Habitat and predation impacts.** Significant land use changes in the Central Valley have not only led to large-scale losses of breeding and foraging habitats, but also have increased both numbers of tricolored blackbird predators and their access to tricolored blackbird colonies. Research priorities include quantifying recent and projected habitat losses from shifts in agriculture from row crops to orchards and vineyards, or other land uses such as urban (Beedy et al. 2020). Data gaps to close involve prioritizing and managing nesting habitat; assessing the best means to establish alternative freshwater breeding habitat to draw birds away from nesting in silage fields; and comparing differential predation rates by nesting substrate.

- **Distribution and population status.** Monitoring the population trends and distribution of the tricolored blackbird will enable researchers to determine relative contributions of habitat loss and degradation, and to relate changes in population size and locations of tricolored blackbirds to landscape-level changes in habitats. Documenting the effects of restored natural river system dynamics, marshes, and riparian habitats on tricolored blackbirds will further inform ongoing and future implementation and management strategies. Understanding these dynamics is important for identifying and prioritizing sites for conservation and management of this species.

Conservation Strategy

Conservation and Recovery Opportunities

A primary conservation priority for tricolored blackbirds is to create new areas of appropriate habitat and to maintain, enhance, and protect existing habitat suitable for nesting, foraging, and wintering (Tricolored Blackbird Working Group 2007). In the CPAs, the most viable way to increase the population of this species is to create and maintain shallowly inundated emergent wetland habitat and riparian scrub and woodland with native vegetation suitable for foraging and nesting by tricolored blackbirds, and to maintain practices that do not result in nest destruction in agricultural lands in the floodplain.

Nesting colonies can be protected by harvesting crops outside the nesting season or conducting nesting surveys just before harvest to ensure that no nesting tricolored blackbirds are present. The same approach should be applied to vegetation management on levees and within the floodplain. (For example, tricolored blackbirds have nested in thistle on flood control levees in the South Bay region of the San Francisco Bay Area [personal observations by Scott Terrill,

principal, wildlife ecology, HT Harvey & Associates, 1990s;] and in mustard, Brassicaceae, stands adjacent to the South Bay Aqueduct [D. Tsao pers. comm. February 10, 2021]). In the CPAs, this species would benefit from management and restoration activities that encourage the expansion of emergent wetlands and riparian habitats, and agricultural practices and maintenance activities (e.g., vegetation clearing) that are modified to avoid the destruction or abandonment of nests.

Like several other target species (e.g., least Bell's vireo and yellow-breasted chat), tricolored blackbirds would benefit from the restoration of natural riverine processes that promote early successional habitat and the implementation of riparian habitat restoration to increase and sustain suitable nesting habitat throughout the SPA.

Identified Conservation Needs

1. **Increase and sustain nesting habitat:** Habitat loss and degradation and nest destruction by anthropogenic activities are the primary threats to the tricolored blackbird (Beedy and Hamilton 1999). Successful nesting requires appropriate water levels and suitable nesting habitat consisting of freshwater marsh with native cattails and tules. To the extent possible, these wetlands should be placed, designed, and managed to minimize predation. In addition, riparian scrub with native willows and other vegetation should be established to provide important nesting habitat.

   Removing non-native, invasive vegetation would also improve opportunities for native vegetation to colonize these areas. However, some introduced plants do provide favorable habitat for breeding and foraging tricolored blackbirds; among these are Himalayan blackberry (*Rubus armeniacus*) and introduced thistles (Beedy 2008). Creating setback levees and facilitating natural processes that lead to relatively continuous, dynamic riparian successional stages within the system would provide opportunities to renew, expand, and sustain nesting habitats. Decommissioning levees should also contribute to geomorphic processes that create diverse riparian ecosystems including early successional habitat and marsh. Creation and expansion of both habitats would be important contributions toward increasing tricolored blackbird populations and the overall recovery of the species.

   Ideal management involves actions that return the marsh to an early stage of dense, rapidly growing stems through effective water management, coupled with the removal of dead stems through burning, grazing, discing, or masticating, or by restoring the natural floodplain conditions that lead to emergent marsh regeneration naturally. Burning is the preferred method of maintaining optimal wetland vegetation: It removes old stems while releasing nutrients supporting the growth of new stems (Meese and Beedy 2015).

   A water management approach of perennial flooding that provides optimal vegetation conditions that may last for four or five years is optimal (Meese and Beedy 2015). Seasonally flooded wetlands, must, however, be managed in an annual or biennial cycle to provide the lush, young cattails preferred by nesting tricolored blackbirds. Management, including seasonal flooding, should be timed so cattails and tules are at least 4 feet tall by

April 1 in the San Joaquin Valley and by May 1 in the Sacramento Valley. This growth requires saturated soils from winter through spring that result from inundation (Meese and Beedy 2015). Management recommendations also include maintaining standing water 6 to 18 inches deep throughout the breeding season to minimize predation by mammals and to cool the microhabitat temperature around nests.

2. **Increase and sustain foraging habitat:** Increasing habitat types that expand the invertebrate prey base—especially grasshoppers, locusts, and other large insects used to raise young—is an important conservation need. Spraying crops that provide a prey basefor nesting tricolored blackbirds should be avoided because it negatively affects food availability and could reduce reproductive success.

3. **Minimize nest loss associated with anthropogenic activities:** Nesting colonies could be protected by clearing potential tricolored nesting habitat outside the nesting season or by completing pre-clearing nesting surveys to ensure no nesting tricolored blackbirds are present. Other anthropogenic activities could result in nest loss, such as the inappropriate management of water levels that causes wetlands to drain or floods nests, or construction activities at or near colonies. Wetlands appropriate for breeding should notbe drained during the breeding season, and water levels should be managed to avoid causing nest loss in wetlands that support breeding tricolored blackbirds.

Integration of Conservation and Restoration in Flood Management

As Tables B.2-1 and B.2-2 identified, CVFPP management actions have the potential to provide positive, negative, or neutral contributions to the identified conservation needs of the tricolored blackbird. In many cases, the species' conservation needs could be positively addressed by implementing management actions that integrate conservation and restoration elements with SPFC operation and maintenance, floodway management, and other structural and nonstructural improvements. The ability to implement some of these actions would depend on operations, maintenance, and floodway management actions and other structural and nonstructural improvements (as described in the following section) to resolve constraints, such as the floodway's existing capacity to convey flood flows, or revetment removal at a site that may depend on levee relocation to allow for bank erosion. Wherever feasible, conservation objectives and indicators will inform management actions for adaptive, responsive, and sustainable implementation that avoids and minimizes impacts on species and ecosystems.

Table B.2-1. Summary of the Contributions of CVFPP Management Actions to Identified Conservation Needs of the Tricolored Blackbird

SPFC Conservation Actions – Operations, Maintenance, and Floodway Management	Conservation Need 1. Increase Inundated Floodplain	Conservation Need 2. Improve Natural River Function	Conservation Need 3. Decrease Non-native SAV
Floodwater storage and reservoir forecasting, operations, and coordination	Neutral	Neutral	Neutral
Facility maintenance	Neutral	Neutral	Neutral
Levee vegetation management	Negative	Negative	Negative
Floodway maintenance	Negative	Neutral	Negative
Modification of floodplain topography	Positive	Positive	Neutral
Support of floodplain agriculture	Negative	Negative	Negative
Invasive-plant management	Positive	Positive	Neutral
Restoration of riparian, SRA, and marsh habitats	Positive	Positive	Neutral
Wildlife-friendly agriculture	Positive	Positive	Positive

Notes:
SAV = submerged aquatic vegetation
SPFC = State Plan of Flood Control

Table B.2-2. Summary of the Contributions of CVFPP Management Actions to Identified Conservation Needs of the Tricolored Blackbird

SPFC Conservation Actions – Structural and Nonstructural Improvements	Conservation Need 1. Increase Inundated Floodplain	Conservation Need 2. Improve Natural River Function	Conservation Need 3. Decrease Non-native SAV
Levee and revetment removal	Positive	Positive	Neutral
Levee relocation	Positive	Positive	Neutral
Bypass expansion and construction	Positive	Positive	Neutral
Levee construction and improvement	Positive	Positive	Neutral
Flood control structures	Neutral	Neutral	Neutral

Notes:
CVFPP management actions are designated as having the potential to provide a positive, negative, or neutral contribution to the identified conservation needs of the species.

SAV = submerged aquatic vegetation
SPFC = State Plan of Flood Control

Operations, Maintenance, and Floodway Management

Levee vegetation management: Tricolored blackbirds will nest in vegetation on flood control levees, including several types of introduced plants, if the vegetation is attractive for nesting (e.g., Himalayan blackberry, thistle). To avoid direct losses of active nests, any vegetation management of potential breeding habitat on levees should take place outside the tricolored blackbird's nesting season. If this is not possible, pre-clearing nesting surveys should be conducted immediately before the management is scheduled for implementation. If active nests are found, management efforts should be delayed until the colony has fledged.

Floodway maintenance: The floodway supports breeding habitat for tricolored blackbirds, including wetlands with emergent vegetation and riparian scrub and woodlands. Maintenance activities that result in the clearing of nesting habitat (or that otherwise substantially affect such habitat) should occur outside the tricolored blackbird's breeding season. This approach applies not only to vegetation clearing, but also to activities such as demolition or construction, and to other activities near a colony that might disturb the birds to the point of nest abandonment. To avoid direct losses of active nests, vegetation management in potential breeding habitat in the floodplain should occur outside the tricolored blackbird's nesting season. If this is not possible, pre-clearing nesting surveys should be conducted immediately before the management is scheduled for implementation. If active nests are found, management efforts should be delayed until the colony has fledged and then can begin immediately. In addition, preconstruction surveys should be conducted before the start of other types of activities during the breeding season that might result in nest abandonment if appropriate nesting habitat occurs within a given distance of the project (to be determined in consultation with the California Department of Fish and Wildlife).

Modification of floodplain topography: Floodway modifications in strategic locations may provide emergent freshwater marsh habitat and allow for greater topographic and hydrologic diversity, creating habitat conditions that support tricolored blackbirds. Floodplain surfaces could be lowered by excavating benches or swales that allow for more frequent and sustained inundation, which would facilitate marsh formation and may allow additional riparian vegetation to grow along channel margins.

Support of floodplain agriculture: Although tricolored blackbirds do nest and forage in appropriate agricultural crops (i.e., row and field crops), agriculture has replaced vast amounts of native habitat for tricolored blackbirds. However, major nesting colonies have been lost during harvesting, meaning agriculture can represent a significant population sink—and agriculture has replaced much of the historical and preferred habitats occupied by tricolored blackbirds (Beedy 2008). However, some aspects of agriculture that are "friendly" to the species can be applied to agriculture in the CPAs to benefit the species ("Wildlife-friendly agriculture," later in this section, provides more details).

Invasive-plant management: New weed infestations could negatively affect the emergent marsh and early successional riparian habitats, which are the historical and preferred nesting habitats of the tricolored blackbird. Native vegetation provides breeding habitat and is an

important food source for tricolored blackbirds because it supports populations of native invertebrates. In general, invasive plants displace native plant species, often over substantial areas. Managing and controlling invasive plants would minimize these impacts. In addition, habitat restoration actions that involve planting native species have been shown to reduce colonization by invasive species in newly planted sites (McClain et al. 2011; Moore et al. 2011; Tjarks 2012). However, after losing preferred native vegetation breeding sites in marshes and riparian areas, tricolored blackbirds have increasingly switched to breeding in some types of non-native-dominated vegetation including Himalayan blackberry and introduced thistle patches, and within row crops (Beedy 2008).

Because tricolored blackbirds will nest in non-native vegetation, an important aspect of the invasive-plant management process is to avoid nest loss by clearing non-native vegetation during the nonbreeding season, or conducting pre-clearing nesting surveys during the breeding season to ensure no active nests are present. If nests are present, clearing should not occur until all nests have fledged.

Restoration of riparian, SRA, and marsh habitats: Restoring emergent marsh and riparian habitat would increase the amount of available breeding habitat for tricolored blackbirds throughout the SPA.

Wildlife-friendly agriculture: Tricolored blackbirds breed and forage in appropriate agricultural fields, such as row and field crops; however, vineyards and orchards do not provide appropriate habitat and are not considered wildlife-friendly for this species. Harvesting should occur outside the tricolored blackbird's breeding season; or if harvesting is necessary during the breeding season, pre-harvest surveys should be conducted to ensure there are no active nests in the fields. If active nests are found, the harvest should wait until the birds are fledged and could then proceed immediately. Pesticide application should not take place near an active breeding colony.

Structural and Nonstructural Improvements

Levee and revetment removal: Revetment removal would provide an opportunity to improve natural erosional and geomorphic processes important to sustaining and creating habitats along rivers. These processes could help create emergent marsh and riparian scrub habitats if elevations are appropriate for those habitats (e.g., by forming meander bends and cutoffs or new floodplain surfaces). Restoring natural riverine processes may also enhance existing habitat; for instance, scouring could support the regeneration of riparian scrub habitat that provides nesting and foraging habitat for tricolored blackbirds. This approach will reduce habitat fragmentation and increase the extent of early successional habitats, and overall diversity in the floodplain.

Levee relocation: Relocating levees farther from rivers (i.e., constructing setback levees) creates space for rivers to meander, reconnects floodplains, allows the transport and deposition of sediment, supports natural ecosystem disturbance processes, and increases the diversity of riverine and floodplain habitats. These processes would help create new suitable

habitat for tricolored blackbirds. In newly reconnected floodplains, emergent wetland and riparian scrub habitat can be restored to provide habitat for this species. In addition, expanding floodways through levee relocation would provide opportunities to improve ecosystem function and increase the extent, quality, and connectivity of habitat.

Bypass expansion and construction: Expanding bypasses would protect large areas of land from development, add agricultural land and natural vegetation to the floodway, and result in the periodic, prolonged inundation of land that was previously isolated from the river system by levees. This agriculture should be limited to row crops favorable to tricolored blackbirds and able to withstand frequent inundation (e.g., rice), as opposed to vineyards and orchards that do not provide suitable habitat and may impede water flows. An expanded, frequently activated floodplain in the bypasses may support the restoration of floodplain ecosystems and may provide suitable habitat for the tricolored blackbird, ideally comprising target areas that are shallowly flooded and dominated by native plant species.

Levee construction and improvement: New or reconstructed levees restrict the floodway. They prevent natural geomorphic processes from creating and sustaining the marsh and early successional riparian habitats the tricolored blackbird relies on for nesting and foraging habitat. Therefore, levees should not be constructed or reconstructed where they would prevent geomorphic processes in areas with the potential to provide substantial amounts of suitable nesting habitat.

Recovery Plan Alignment

There is no ESA recovery plan for tricolored blackbird because it is not federally listed; however, the Tricolored Blackbird Working Group (2007) has developed a conservation plan for this species. The fundamental elements of that plan have been incorporated into this focused conservation plan. Tricolored blackbirds are protected under the CESA and, and, like all native birds in California, are also protected under the federal Migratory Bird Treaty Act and the California Fish and Game Code. The conservation needs of this species in the SPA are addressed in previous sections of this focused conservation plan.

Measures of Positive Contribution

One goal of the Conservation Strategy is to contribute to the recovery and stability of native species populations and overall biotic community diversity. The objective for this goal is a measurable contribution to the conservation of target species, including the tricolored blackbird. Therefore, building on the preceding discussion, this section of the tricolored blackbird conservation plan provides measures (i.e., metrics or indicators) that will be used to determine how effectively CVFPP management actions contribute to the conservation needs of this species.

Measures for each targeted threatened or endangered species are organized around indicators of progress toward the Conservation Strategy's process, habitat, and stressor objectives. The species-specific measures provide additional detail on geographic location, habitat structure,

and other attributes important to conserving the species. For example, the acreages of riparian and marsh restoration are an indicator of progress toward the Conservation Strategy's habitat objectives. To measure how CVFPP actions contribute to the conservation of tricolored blackbirds, requirements would be added to increase the quantity and quality of emergent wetland and appropriate riparian habitat and minimize environmental stressors, such as nesting habitat and nests from anthropogenic activities.

Tables B.2-3 through B.2-5 list the Conservation Strategy's process, habitat, and stressor targets; identify those used to measure the contribution to conservation of tricolored blackbirds; and provide additional specificity, as needed, to measure this contribution.

Because management actions intended to benefit the tricolored blackbird may simultaneously affect conservation of other species in the SPA, these measures of contribution have been incorporated into each CPA's objectives to conserve target species. The target species objectives cover multiple species and reflect the interrelated nature of CVFPP flood management and conservation actions.

Table B.2-3. Measures of the Contribution of CVFPP Actions to Conservation of the Tricolored Blackbird

Target	Indicator	Selected as Measure of Contribution	Additional Specificity
Inundated Floodplain [a]	Inundated Floodplain—total amount (acres, EAH units) with sustained spring and 50% frequently activated floodplain, and total amount of expected annual inundated floodplain habitat[a]	Yes	Saturate soil in winter and spring to achieve the target emergent vegetation height of 4 feet tall by April 1 in the San Joaquin Valley and by May 1 in the Sacramento Valley. Maintain shallow inundation (6 to 18 inches) throughout the breeding season to protect nest colonies from predators and avoid submerging nests.
Riverine Geomorphic Processes	Natural Bank—total length (miles)	No	Not applicable.
	River Meander Potential—total amount (acres)	Yes	None.
SRA Cover	SRA Cover and Bank and Vegetation Attributes of SRA Cover—total length (miles)	No	Not applicable.

Target	Indicator	Selected as Measure of Contribution	Additional Specificity
SRA Cover	Total Length and Percentage of Bank Affected by Flood Projects that Incorporate SRA Attributes	No	Not applicable.
Riparian	Habitat Amount—total amount and total amount on active floodplain (acres)	Yes	Include appropriate riparian breeding habitat.
	Habitat Connectivity—median patch size (acres)	Yes	None.

[a] Floodplain inundation potential is the potential of an area to be inundated by a particular flow (e.g., a flow event that occurs about once every two years, or a "50-percent-chance event"). Expected annual habitat units represent the annual average of the area expected to be inundated in general or by flows meeting defined criteria for timing and duration (e.g., sustained spring flows).

Notes:

EAH = expected annual habitat

SRA = shaded riverine aquatic

Table B.2-4. Measures of the Contribution of CVFPP Actions to Conservation of the Tricolored Blackbird

Target	Indicator	Selected as Measure of Contribution	Additional Specificity
Marsh	Habitat Amount—total amount and total amount on active floodplain (acres)	Yes	• Maintain emergent wetlands in a state of dense stems with minimal accumulation of dead stems from previous years by restoring natural floodplain processes or by managed disturbances (fire, mastication, discing grazing) at intervals of five years for perennially flooded marshes or every one to two years for seasonal wetlands. For seasonal wetlands, sustain shallow inundation (6 to 18 inches) through April. (San Joaquin Valley) or May (Sacramento Valley) to protect nest colonies from predators while not destroying nests. • Restore patches of emergent wetland vegetation at least 50 feet wide to support successful nesting.
Floodplain Agriculture	Habitat Amount—total amount of floodplain agriculture providing habitat for target species (acres)	No	Not applicable.
Revetment	Revetment Removed to Increase Meander Potential or Natural Bank—total length (miles)	Yes	None.
Levees	Levees Relocated to Reconnect Floodplain or Improved to Eliminate Hydraulic Constraints on Restoration—total length (miles)	Yes	None.
Fish Passage Barriers	Fish Passage Barriers—modified or removed	No	Not applicable.

Table B.2-5. Measures of the Contribution of CVFPP Actions to Conservation of the Tricolored Blackbird

Target	Indicator	Selected as Measure of Contribution	Additional Specificity
Invasive Plants	Invasive-plant-dominated Vegetation—total area reduced (acres)	Yes	When removing non-native vegetation in suitable tricolored blackbird nesting habitat (e.g., patches of Himalayan blackberry), replace with native plants that will offset the loss of nesting habitat.

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Appendix B.3
Focused Conservation Plan: Yellow-breasted Chat

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APPENDIX B.3

Focused Conservation Plan: Yellow-breasted Chat

Acronym	Definition
CPA	Conservation Planning Area
CVFPP	Central Valley Flood Protection Plan
SPA	Systemwide Planning Area

Conservation Status

As part of the Central Valley Flood Protection Plan (CVFPP) Conservation Strategy Update, this focused conservation plan addresses needs and opportunities for conserving the yellow-breasted chat (*Icteria virens*) and its habitat in the Systemwide Planning Area (SPA).

The yellow-breasted chat, a California Species of Special Concern, breeds in dense, shrubby, open habitats in North America and winters from northern Mexico to Central America (Billerman 2020). In California, where this species occurs as a migrant and summer resident, it breeds primarily in early successional riparian habitat with a well-developed shrub layer and open tree canopy bordering streams, creeks, sloughs, and rivers (Comrack 2008).

This species has an interesting taxonomic history. It was long considered an aberrant member of the New World warbler family, the Parulidae. Recently, the yellow-breasted chat has been recognized as a quite distinct taxon and placed in a monotypic family, *Icteriidae* (Billerman 2020).

Yellow-breasted chats are widespread, but between 1966 and 2014, their numbers declined throughout the range by an estimated 37 percent (Cornell Lab of Ornithology 2020). Although this species is not listed as threatened or endangered at the federal or state level, it is listed as threatened, endangered, or of special concern in multiple states and Canadian provinces. The yellow-breasted chat is still widely distributed in California but is now rare or absent from much of the Central Valley, with an approximately 35-percent reduction in its breeding range (Comrack 2008). Destruction of riparian habitat is implicated in the decline of this species in the state (Remsen 1978).

Including the yellow-breasted chat as a target species aligns the goals and objectives of the CVFPP Conservation Strategy with those of the Central Valley Joint Venture's Implementation Plan for riparian habitat avian conservation and this species (Central Valley Joint Venture 2006). The yellow-breasted chat was selected as one of seven riparian, breeding focal songbirds for the avian conservation population and habitat objectives in the Central Valley based on the species' ability to meet the following criteria:

- Uses riparian vegetation as principal breeding habitat.
- Warrants special management status or has experienced population declines or reductions in the Central Valley breeding range.
- Is useful for monitoring the effects of management actions in Central Valley riparian ecosystems.

Dybala et al. (2017) added five species to the seven focal species covered by the Central Valley Joint Venture (2006). The yellow-breasted chat was thus included as one of 12 focal species in the *Population and Habitat Objectives for Avian Conservation in California's Central Valley Riparian Ecosystems* (Dybala et al. 2017).

Dybala et al. (2017) established long-term population objectives for each focal species in each region, based on principles of conservation biology; these were intended to meet the goals of establishing genetically robust, self-sustaining, resilient populations. They considered the yellow-breasted chat population in the Sacramento Valley to be small (fewer than 10,000 individuals) and the population in the Yolo-Delta, San Joaquin, and Tulare regions to be very small (fewer than 1,000 individuals). As assessed by Dybala et al. (2017), a "small population" may be below a minimum viable population level and vulnerable to extirpation, and a "very small population" is expected to be well-below a minimum viable population level. The analysis by Dybala et al. (2017) was published after the 2016 Conservation Strategy had been completed.

The restoration of Central Valley riparian habitat is critical to achieving the long-term goal of genetically robust, self-sustaining populations. Dybala et al. (2017) evaluated the current sizes of the Central Valley's yellow-breasted chat populations and the projected population statuses if 10-year and 100-year objectives for riparian habitat and density are reached. Riparian habitat objectives are based on the addition of restored riparian vegetation relative to existing conditions in the four planning regions, and are presented in units of thousands of hectares.

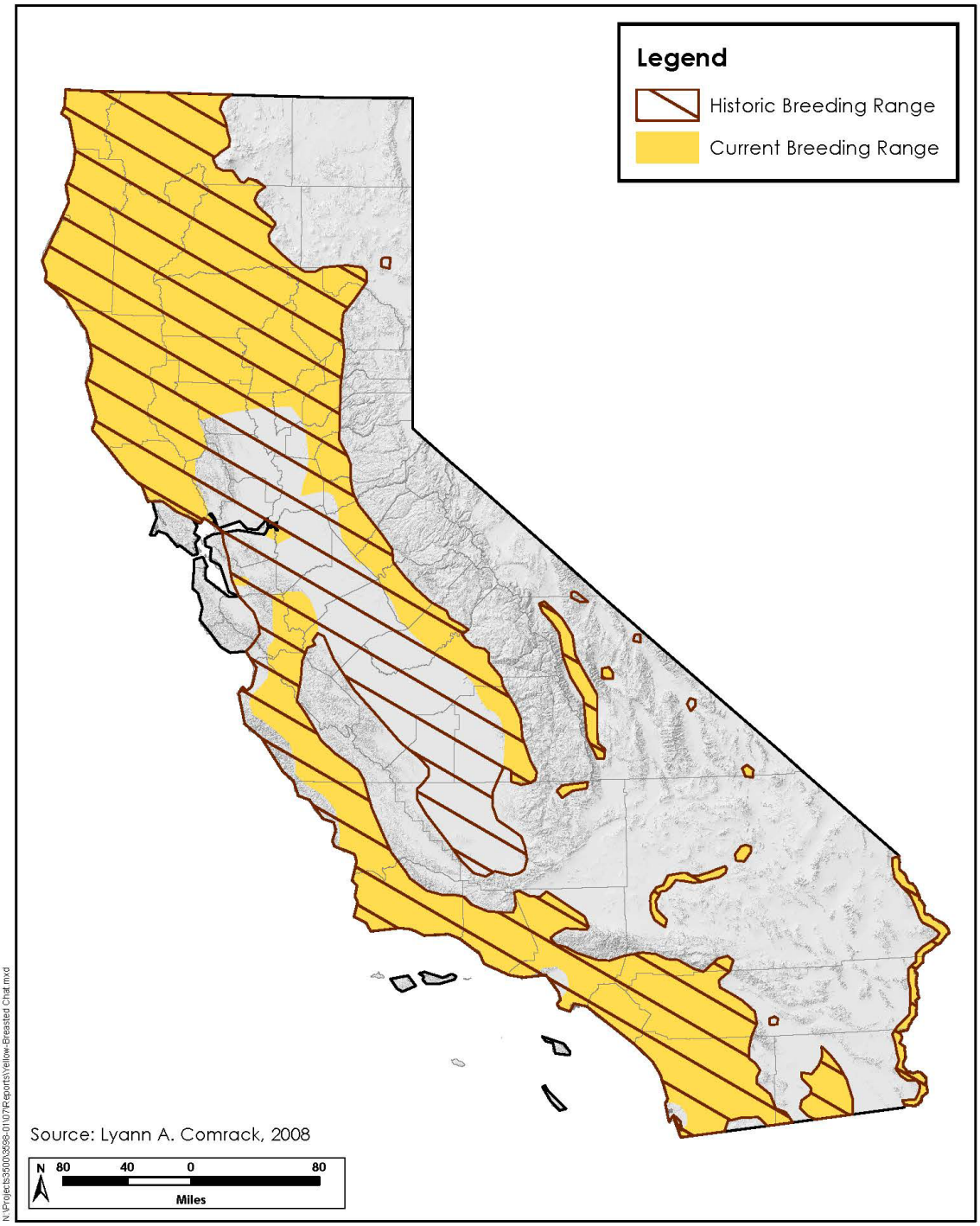
Status and Trends

Distribution

Figure B.3-1 shows the current and historical distributions in California, as well as breeding records, for the yellow-breasted chat. The yellow-breasted chat has two subspecies. The nominate subspecies, *I. v. virens*, breeds in the eastern portion of the range from the eastern Great Plains (and locally north to extreme southeastern Canada) and central Texas eastward. The western subspecies, *I. v. auricollis* (also known as the "long-tailed chat"), breeds in the western portion of the range from the western portion of the Great Plains (locally north to southwestern

Canada) south through the western United States to west Texas (Eckerle and Thompson 2020); thus, this subspecies represents the taxon that breeds in California's Central Valley. Both subspecies winter primarily from Mexico south to Central America.

Figure B.3-1. Recent and Historic Distributions in California and Locations of Breeding Records for Yellow-breasted Chat



In California, the yellow-breasted chat is a migrant and summer visitor from late March to late September, with a breeding period from late April through early August (Garrett and Dunn 1981; Eckerle and Thompson 2001; Unitt 2004). Breeding bird survey data indicate that northwestern rivers, including the Klamath, Trinity, and Eel, support the highest breeding densities in the state (Sauer et al. 2005). The yellow-breasted chat population has declined over much of the California breeding range (the following section, "Population Trends," provides more details). Winter records are quite rare in the state (eBird 2020), with the closest "normal" wintering area in central Baja California and coastal west Mexico (Dunn and Alderfer 2011).

Population Trends

The yellow-breasted chat was formerly a fairly common to common species that bred throughout the state below elevations of approximately 5,000 feet (Grinnell and Miller 1944). Although still widely distributed in California, the yellow-breasted chat has declined significantly throughout much of the state, particularly the Central Valley and much of Southern California (Remsen 1978; Garrett and Dunn 1981; Comrack 2008). The yellow-breasted chat is now rare or absent from much of the Central Valley, with an approximately 35-percent reduction in its breeding range (Comrack 2008). The destruction of riparian habitat has been implicated in the decline of this species in the state (Remsen 1978). Most of the remaining Central Valley birds currently breed in the northern Sacramento Valley. The species is still considered to be breeding in a few locations in the San Joaquin Valley, and also breeds in the Sacramento–San Joaquin Delta (Comrack 2008; Dybala et al. 2017).

In addition to experiencing habitat loss, chats are frequent hosts to brood parasitism by the brown-headed cowbird (*Molothrus ater)* (Ehrlich et al. 1988; Comrack 2008). This is likely to have contributed to the overall reduction in California's chat population, although the actual impact of cowbirds is less well-established than for some other riparian species (e.g., least Bell's vireo). Indirect evidence of the negative relationship between cowbirds and chats includes a lack of chats in apparently suitable habitat (Comrack 2008). Chats have become quite numerous at Camp Pendleton, in San Diego County, where cowbird management has been conducted for years (Comrack 2008), indicating that cowbird management is likely to aid in increasing chat reproductive success. Cowbird management has been successfully implemented as a management strategy to reduce brood parasitism rates (Griffith and Griffith 2000; Famolaro 2006), although cowbird management can be labor-intensive and expensive (Robinson et al. 1993). However, restoring and maintaining suitable habitat and the riverine processes that renew early successional habitat may be a more sustainable method of maximizing breeding opportunities, because the yellow-breasted chat's preferred dense habitat (like the least Bell's vireo) provides a buffer from brown-headed cowbirds (Sharp and Kus 2006).

Another factor contributing to the decline in the chat population is impacts on understory and shrubby riparian habitat, caused by vegetation clearing for flood control maintenance and by urban development, agriculture, and livestock grazing (Comrack 2008).

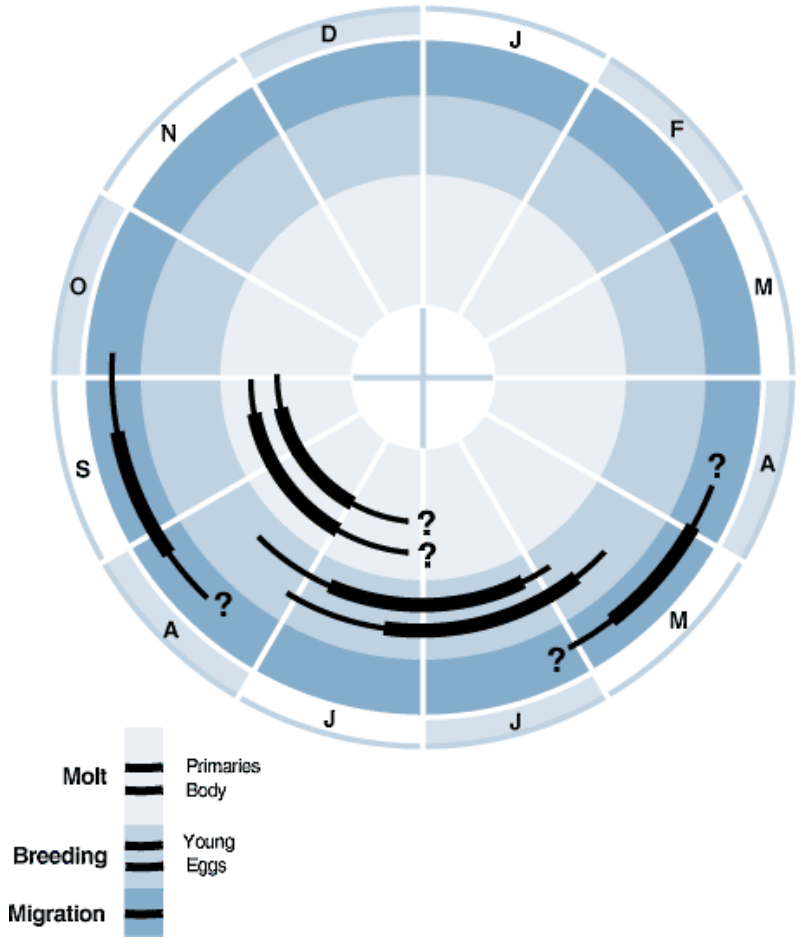
Life History

The yellow-breasted chat is an entirely migratory species, with no resident populations. The species breeds from central Mexico north throughout much of North America, reaching southwestern and extreme southeastern Canada, and winters from coastal Mexico south into Central America (Eckerle and Thompson 2020).

Yellow-breasted chats are known for their extremely shy, retiring, and skulking nature, except when males sing from exposed perches or when giving display flight songs (Dunn and Garrett 1997). Foraging takes place in dense thickets and consists primarily of gleaning insects from foliage. Figure B.3-2 shows the *Birds of North America* annual cycle for the yellow-breasted chat. As the figure shows, peak molting occurs from August through mid-September; peak breeding occurs between late May and late July; and peak migration occurs in early to mid-May and late August to mid-September.

Figure B.3-2. Annual Cycle of Breeding, Molt, and Migration in the Yellow-breasted Chat

Thick lines show peak activity; thin lines, off-peak.



Source: Eckerle and Thompson 2020; reproduced with permission.

Nests are constructed 1 to 8 feet above ground level and are well concealed in dense shrubs or tangled vines. They are built of an outer base of dead leaves and weeds, with an inner cup of tightly woven vine bark, lined with fine stems and grass (Kaufman 1996). This species typically lays three or four (but up to six) creamy white eggs with brown spots. Yellow-breasted chats lay one or two broods per season, with an incubation period of 1 to 12 days and a nestling period of seven to 10 days.

Habitat and Ecological Process Associations

Yellow-breasted chats occupy early successional riparian habitats with a well-developed shrub layer and an open canopy (Comrack 2008). In the western portion of the range, nesting habitat typically include riparian areas associated with the narrow borders of waterways. Early successional riparian habitats are ephemeral, productive communities and require periodic disturbance to renew and maintain the vegetative structural components and species composition used by the yellow-breasted chat. Plants typical of yellow-breasted chat habitat include blackberry, wild grape, willows, and cottonwood. A dense understory is an essential habitat requirement for the species, but as early successional habitat matures, the understory thins and does not provide adequate cover for this species. Active riverine processes, such as periodic inundation, erosion and deposition, lateral channel migration, and avulsion (i.e., channel cutoff), promote the establishment and growth of the early successional plant communities required by yellow-breasted chats. As these natural processes continue, they generate new floodplain surfaces and create a mosaic of vegetation that supports suitable nesting habitat for the species.

Yellow-breasted chats forage primarily on invertebrates, especially during the breeding season, to provide amino acids for egg formation and the growth and development of nestlings, as is the case with most birds (Eckerle and Thompson 2020). For yellow-breasted chats, these invertebrates include beetles, ants, bees, mayflies, cicadas, moths, and caterpillars (Cornell Lab of Ornithology 2020). Nestlings are fed insects, primarily; particularly, orthopterans and larval lepidopterans (Eckerle and Thompson 2020).

However, like many migrants, this species feeds largely on fruit in late summer and fall. In California, these late-summer and fall-ripening fruits include native elderberries, wild grape, honeysuckle, wild strawberry, blackberry, and chokecherry (Dunn and Garrett 1997; Cornell Lab of Ornithology 2020). Wild fruits are an important food source for many north temperate breeding birds during late-summer and fall migration. This consumption is critical for migratory birds that rely on the energy provided by fruit to store fat and fuel for migration, such as yellow-breasted chats (Gallinat et al. 2020). In turn, birds disperse seeds for the plants by consuming the fruits. Thus, the availability and synchronization of native plant species to provide fruit during the appropriate periods is critical to support local populations of migratory birds.

Many non-native invasive plant species are from different families or genera than native species and differ in many of their biochemical and structural traits. Although some non-native invasive plant species have small, fleshy fruits, they may not be as suitable as a food source as native species. In one study, Gallinat et al. (2020) found that although invasive shrubs fruited later than

native plants on average, and they produced a large proportion of the total fruits available in late autumn, birds primarily consumed the fruits of native species throughout the autumn. These results and the importance of late-summer and fall fruits as a food source support the incorporation of native species with small, fleshy fruits (such as elderberry and native blackberry) into riparian habitat restoration projects in the Central Valley.

In addition, landscapes dominated by non-native plants are unlikely to support the same diversity and biomass of insect herbivores as landscapes dominated by native host plants; as such, it follows that populations of insectivores, such as birds, will be compromised (Burghardt et al. 2009).

Conceptual Models

A conceptual model has been designed to assist in the development of a targeted conservation strategy for the yellow-breasted chat within the SPA (Figure B.3-3). This model is not intended to be a comprehensive model of all ecological processes, stressors, and other factors that could be relevant for this species. Rather, as Figure B.3-3 shows, the conceptual model specifically depicts the following considerations:

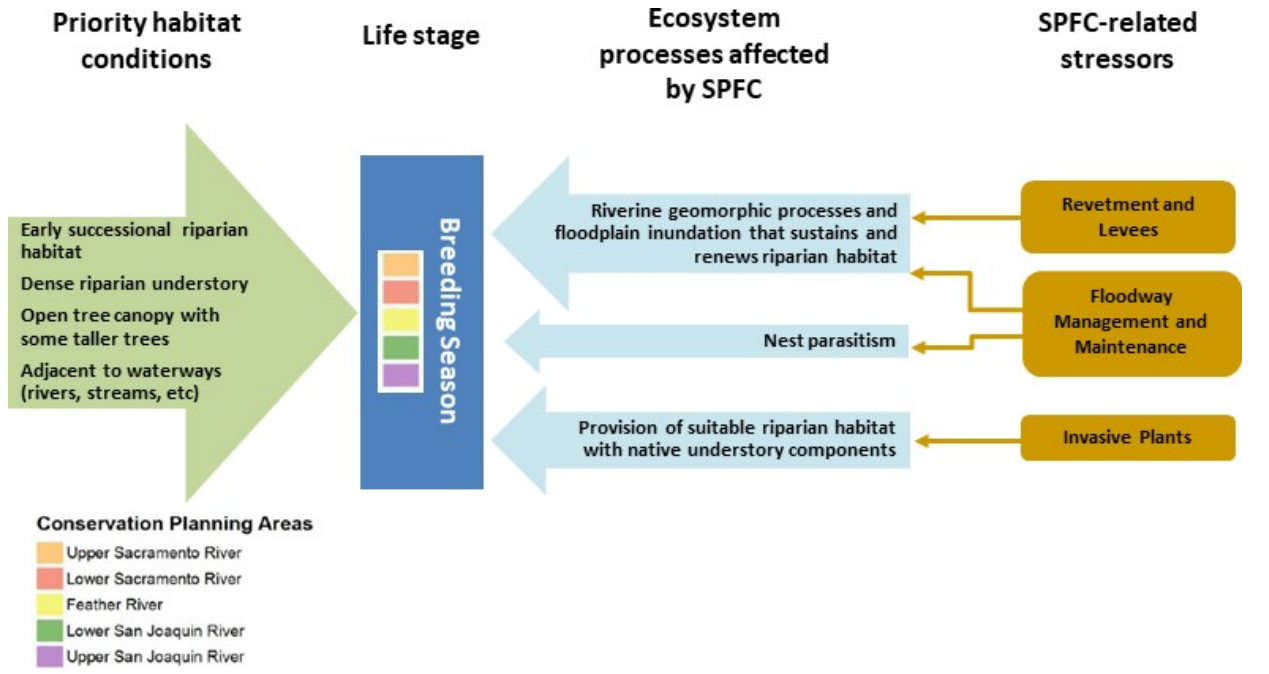
- Habitat conditions required by yellow-breasted chat within the SPA: Early successional riparian habitat, a dense riparian understory, an open tree canopy with some taller trees, and a location adjacent to a waterway. (Nesting habitat is usually restricted to the borders of streams, creeks, and rivers.) “Early successional riparian habitat” refers to a well-developed shrub layer and open canopy with taller trees such as cottonwoods for singing perches. Food includes invertebrates, especially terrestrial insects and fruit produced by native plants in the late-summer and fall.

- The specific Conservation Planning Areas (CPAs) the yellow-breasted chat may breed in, under suitable habitat conditions: The Upper and Lower Sacramento Rivers and San Joaquin River CPAs and the Feather River CPA.

- Key ecosystem processes of riverine systems within the SPA potentially affected by actions associated with the CVFPP, including the Conservation Strategy: Riverine geomorphic processes and floodplain inundation that sustains and renews riparian habitat; nest parasitism; and the provision of suitable riparian habitats with native understory components.

- Stressors related to State Plan of Flood Control facilities and their operations and maintenance: Revetment and levees, floodway management and maintenance, and invasive plants.

Figure B.3-3. Conceptual Model for the Yellow-breasted Chat within the Systemwide Planning Area



Management Issues

Threats and Sensitivities Rangewide

The population decline of yellow-breasted chats in the Central Valley and elsewhere in California is largely a function of the following factors:

- Loss and degradation of early successional riparian habitat
- Alteration and loss of river processes that renew and maintain these habitats
- Brood parasitism by brown-headed cowbirds
- Habitat effects caused by invasive, exotic vegetation

Riparian habitat is estimated to have declined in California by up to 95 percent since European contact (The Bay Institute 1998).

Dams, water diversions, levees, and other flood control structures reduce channel migration and natural disturbances, which initiate the development of early successional vegetation that provides suitable habitat. Instead, these structures lead to a predominance of mature riparian forests with dense canopies and open understories, which represent unsuitable breeding habitat for this species.

The yellow-breasted chats' dependence on understory and shrubby riparian vegetation for nesting makes them vulnerable to habitat loss from vegetation removal along river channels during flood control maintenance, which often occurs during the breeding season (Comrack 2008). In addition to direct impacts during the breeding season, on the whole, levee and floodplain vegetation management may negatively affect habitat for chats through the direct loss of suitable riparian habitat and by fragmenting existing patches of habitat. Because early successional habitat is already greatly reduced within the SPA, maintenance activities contribute to the overall decline of this habitat-dependent bird species, such as the chat.

The conversion of riparian habitat to agriculture also contributes to habitat loss and fragmentation. In addition, riparian habitat fragmentation and the establishment of agricultural lands adjacent to yellow-breasted chat breeding sites may increase nest parasitism by brown-headed cowbirds. If agricultural land or developed areas surround suitable nesting habitat, brown-headed cowbirds can become more abundant and, consequently, lower the breeding success of riparian-breeding avian species, including the yellow-breasted chat. Another tool to reduce parasitism rates could include minimizing the availability of food sources for the brown-headed cowbird (e.g., grass seeds, crop grains, insects disturbed by domestic ungulates), especially near suitable habitat for the yellow-breasted chat, which could also serve as the primary method of controlling cowbirds. Yellow-breasted chats are also affected by grazing. Ohmart (1994) found that chat densities increased fourfold in six years in response to the removal of livestock along the San Pedro River in Arizona.

In addition to threats to their breeding grounds, migratory birds experience threats during migration and on their wintering grounds (Kirby et al. 2008). Reductions in migratory stopover habitat and habitat on the wintering grounds can contribute substantially to reductions in migratory bird populations (Bairlein 2016).

Ongoing and Future Impacts

The most important ongoing and likely future issues for sustaining viable breeding populations of yellow-breasted chats in the Central Valley are the current low availability of suitable breeding habitat and continued loss of suitable habitat, the lack of river processes that sustain early successional habitat, and nest parasitism by brown-headed cowbirds.

Key Information Gaps or Uncertainties

To better understand factors affecting the Central Valley's yellow-breasted chat population, more information is needed regarding the local population trends, migratory routes, and wintering areas of Central Valley breeding chats; pesticide effects; patch sizes required for breeding; and brown-headed cowbird parasitism.

- **Regional population trends.** Monitoring population trends for the yellow-breasted chat at a regional level will enable researchers to identify the sites of population increases or declines, and help determine the relative contributions of habitat loss and degradation, cowbird parasitism, and other factors that influence the population. In addition, monitoring the effects of the Conservation Strategy on yellow-breasted chats in the Central Valley related to the

restoration and management of riparian habitat and the increased incorporation of natural river system dynamics will further inform ongoing and future implementation and management strategies. Understanding these dynamics will be the key to identifying and prioritizing sites for conservation and management of this species.

- **Migration and wintering grounds.** Very little information exists regarding the wintering range and migratory routes of chats that breed in California. Observations of wintering yellow-breasted chats have been recorded from Baja California Sur, Mexico, and Central America. Understanding conditions in the wintering grounds and identifying key stopover locations will help identify the habitats and threats this species may encounter during migration and on the wintering grounds, and could help determine the relative importance of management actions on the breeding grounds versus the migratory and wintering areas.

- **Pesticides**. Pesticides may affect yellow-breasted chat behavior or cause fatalities, either through direct contact or by reducing or contaminating prey populations, but the extent to which pesticides affect chat populations is unknown. Pesticide and herbicide use on agricultural lands adjacent to habitat may also reduce insect abundance in chat foraging areas.

- **West Nile virus.** West Nile virus–positive dead birds have been found in the CPAs (Wheeler et al. 2009). The yellow-breasted chat was shown to have a significant negative population interaction between the presence of West Nile virus and human land use (agricultural or urban and suburban lands near Monitoring Avian Productivity and Survivorship Program stations throughout the United States), but not a significant direct negative effect from only the presence of the virus (George et al. 2015). The authors concluded a negative interaction between land use and West Nile virus suggests the virus's effects may be amplified with increased agriculture and urban development around the habitat of species showing this negative relationship. The degree to which West Nile virus may affect yellow-breasted chats in the Central Valley is currently unknown.

- **Breeding habitat patch size**. More data on the relationship between (appropriate) habitat patch size and shape and the chats' reproductive success and breeding densities in Central Valley riparian habitat would help inform habitat restoration and management for chats.

- **Brood parasitism by brown-headed cowbirds.** Further and more detailed information regarding the impacts of brown-headed cowbirds on the reproductive success of yellow-breasted chats would help to inform the degree to which cowbird control benefits chats.

Conservation Strategy

Conservation and Recovery Opportunities

The most viable ways to support the recovery of the yellow-breasted chat are to encourage natural riverine processes that promote early native successional riparian habitat, and to restore native riparian habitat to increase and sustain suitable nesting habitat throughout the SPA, while reducing occurrences of brood parasitism by the brown-headed cowbird. Creating patches of suitable breeding habitat and connecting those patches to existing or new suitable habitat will increase opportunities for the yellow-breasted chat breeding populations to recover along waterway margins in the SPA. Connecting riparian habitat and increasing cottonwood-willow habitat between riparian forest patches may also benefit many other bird species, including special-status species (e.g., western yellow-billed cuckoo and least Bell's vireo) (Kleinschmidt Associates 2008).

Improving ecosystem function and restoring natural riverine geomorphology through the implementation of appropriate management actions would create the disturbance regimes necessary to create and maintain this suitable habitat. Incorporating early successional plant species with a dense understory into riparian restoration efforts and restoring river processes throughout the Central Valley may be the key to maximizing opportunities for the valley's yellow-breasted chat population to recover. Cowbird management could also be used as a tool to prevent nest parasitism in areas where yellow-breasted chat populations are monitored and low productivity is documented. All such conservation and restoration initiatives could incorporate the vegetative and structural components identified in the "Conceptual Models" section.

Identified Conservation Needs

1. **Increase and sustain nesting habitat:** The yellow-breasted chat is a riparian obligate, dependent on early successional to mid-seral riparian habitat with a dense understory and the natural hydrologic and geomorphic processes that create and sustain it. Creating setback levees and facilitating natural flood processes that lead to relatively continuous, dynamic riparian successional stages within the system will provide opportunities to renew, expand, and sustain nesting habitat. Decommissioning levees may also contribute to geomorphic processes that create diverse riparian ecosystems, including early successional habitat. Restoring riparian habitat in core population areas would provide habitat connectivity that is important to increasing the species' numbers and facilitating colonization in the SPA. Removing exotic vegetation would also improve opportunities for native vegetation to colonize these areas, limiting the spread of undesirable species in the SPA and enhancing the outcomes of riparian restoration efforts.

2. **Reduce nest parasitism:** Brood parasitism by brown-headed cowbirds lowers the breeding success of the yellow-breasted chat. Sustaining dense, early successional habitat with a dense understory may naturally minimize rates of nest parasitism (Siegle and Ahlers 2004). Reducing cowbird food sources by reducing row-crop waste grain and reducing domestic ungulate presence, especially feedlots and dairies, near chat breeding habitat may reduce local cowbird

populations, which may lower parasitism rates (Robinson et al. 1993). Conducting surveys for brown-headed cowbirds in areas where breeding populations of yellow-breasted chats occur would inform targeted conservation efforts. To ensure yellow-breasted chats have the opportunity to successfully breed and disperse, brown-headed cowbirds may need to be removed, but this should not be the primary management method. This approach to cowbird management would also significantly benefit other riparian avian species, many of which are heavily exploited by cowbird brood parasitism—especially another target species, the least Bell's vireo.

Integration of Conservation and Restoration in Flood Management

As identified in Table B.3-1, CVFPP management actions have the potential to provide a positive, negative, or neutral contribution to the identified conservation needs of the yellow- breasted chat. In many cases, the species' conservation needs can be positively addressed by implementing management actions that integrate conservation and restoration elements with State Plan of Flood Control operations and maintenance, floodway management, and structural and nonstructural improvements. The ability to implement some of these actions would depend on operations, maintenance, and floodway management actions and improvements (as described in the following section) to resolve constraints, such as the floodway's existing capacity to convey flood flows, or revetment removal at a site that may depend on levee relocation to allow bank erosion. Wherever feasible, conservation objectives and indicators will inform management actions for adaptive, responsive, and sustainable implementation that avoids and minimizes impacts on species and ecosystems.

Table B.3-1. Summary of the Contributions of CVFPP Management Actions to Identified Conservation Needs of the Yellow-breasted Chat

SPFC Activity	Management Actions	Conservation Need 1. Increase and Sustain Nesting Habitat	Conservation Need 2. Reduce Nest Parasitism
Operations, Maintenance, and Floodway Management	Floodwater storage and reservoir forecasting, operations, and coordination	Neutral	Neutral
	Facility maintenance	Neutral	Neutral
	Levee vegetation management	Neutral	Neutral
	Floodway maintenance	Neutral	Neutral
	Modification of floodplain topography	Positive	Neutral
	Support of floodplain agriculture	Neutral	Negative

SPFC Activity	Management Actions	Conservation Need 1. Increase and Sustain Nesting Habitat	Conservation Need 2. Reduce Nest Parasitism
Operations, Maintenance, and Floodway Management	Invasive-plant management	Positive	Positive
	Restoration of riparian, SRA, and marsh habitats	Positive	Positive
	Wildlife-friendly agriculture	Neutral	Negative
Structural and Nonstructural Improvements	Levee and revetment removal	Positive	Neutral
	Levee relocation	Positive	Neutral
	Bypass expansion and construction	Positive	Negative
	Levee construction and improvement	Negative	Neutral
	Flood control structures	Neutral	Neutral

Notes:
CVFPP management actions are designated as having the potential to provide a positive, negative, or neutral contribution to the identified conservation needs of the species.

SRA = shaded riverine aquatic

Operations, Maintenance, and Floodway Management

Modification of floodplain topography: Lowering floodplain elevations would provide more frequent and sustained inundation, which may promote the growth of additional riparian vegetation (i.e., more suitable yellow-breasted chat habitat) along channel margins.

Support of floodplain agriculture: Agricultural lands provide habitat for the brown-headed cowbird. Providing scrub habitat or other vegetative buffers between agricultural lands and riparian breeding habitat for yellow-breasted chat would be important to protect and conceal nests from brown-headed cowbirds.

Invasive-plant management: New or expanded weed infestations could negatively affect the early successional riparian habitat on which the yellow-breasted chat relies during the breeding season. Native vegetation provides an important food source for yellow-breasted chats, both by supporting native invertebrate populations and by providing fruit during key periods. In general, invasive plants have been shown to significantly displace native plant species.

Managing and controlling invasive plants would minimize these impacts. In addition, habitat restoration actions that involve planting native species have been shown to reduce colonization by invasive species in newly planted sites (McClain et al. 2011; Moore et al. 2011; Tjarks 2012).

Restoration of riparian, SRA, and marsh habitats: Riparian restoration would increase the amount of riparian habitat available for yellow-breasted chats, and would be fundamental to bringing Central Valley chat populations to viable population levels throughout the SPA (Dybala et al. 2017). Providing corridors of suitable habitat throughout the SPA would maximize opportunities for this species to expand. Dense, contiguous early successional habitat would also protect nests from the brown-headed cowbird.

Incorporating a planting palette that includes Great Valley willow-scrub, cottonwood forest, and mixed riparian forest vegetation, including native fruiting riparian vegetation, would create nesting and foraging habitat for the yellow-breasted chat (U.S. Fish and Wildlife Service 2005); this diversified habitat would also provide corridors that accommodate other riparian-obligate species. Dybala et al. (2017) demonstrated the critical importance of increasing riparian habitat over existing conditions to increasing and maintaining a viable yellow-breasted chat population in the Central Valley. Further, because this species is adapted to exploiting successional habitats, it rapidly colonizes newly created habitat areas. This bodes well for positive population-level responses to management actions that create additional areas of suitable habitat (Eckerle et al. 2020).

Wildlife-friendly agriculture: Wildlife-friendly agriculture is an important conservation tool that can benefit many target species, but the brown-headed cowbird prefers expanses of open habitat. Establishing agricultural lands next to known or potential yellow-breasted chat breeding locations may inadvertently lead to nest parasitism by cowbirds.

Structural and Nonstructural Improvements

Levee and revetment removal: Removing levees and revetment would create opportunities to improve the riverine geomorphic and floodplain inundation processes that are important to sustaining habitats along rivers. Encouraging river meander and natural erosional processes that deposit soils and facilitate the establishment of early successional riparian habitat would benefit the yellow-breasted chat by providing and maintaining suitable nesting and foraging habitats. This approach will reduce the fragmentation of riverine habitat and increase habitat succession, native plant populations, and overall diversity in the floodplain.

Levee relocation: As discussed, improving ecosystem function and restoring natural riverine geomorphology by relocating levees would create opportunities to establish and sustain early successional riparian habitat. Specifically, an expanded floodway that is reconnected to the river channel would allow for river meander, sediment erosion and deposition, and natural ecosystem disturbance processes. Each of these processes could help create new suitable habitat and renew early successional habitat that is important for sustaining populations of the yellow-breasted chat. In addition, floodways that are expanded through the relocation of levees would provide opportunities to improve ecosystem function and increase the extent, quality, and connectivity of habitat.

Bypass expansion and construction: Expanding bypasses would add agricultural land and natural vegetation to the floodway and would result in the periodic, prolonged inundation of land that was previously isolated from the river system by levees. An expanded, frequently activated floodplain in the bypasses may support some restoration of floodplain ecosystems, and may provide suitable nesting habitat for the yellow-breasted chat. However, expanding bypasses would also add agricultural land, potentially providing habitat for the brown-headed cowbird.

Agricultural land should be sited away from areas that could support nesting habitat for the yellow-breasted chat.

Levee construction and improvement: New or improved levees could restrict the floodway, preventing natural geomorphic processes from creating and sustaining the early successional riparian habitat upon which the yellow-breasted chat relies as nesting habitat. New levees should not be constructed adjacent to rivers and near areas that have the potential to support suitable nesting habitat.

Measures of Positive Contribution

One goal of the Conservation Strategy is to contribute to the recovery and stability of native species populations and overall biotic community diversity. The objective for this goal is a measurable contribution to the conservation of target species, including the yellow-breasted chat. Therefore, building on the preceding discussion, this section of the yellow-breasted chat conservation plan provides measures (i.e., metrics or indicators) that will be used to determine how effectively CVFPP management actions contribute to the conservation needs of this species.

Measures for each target species are organized around indicators of progress toward the Conservation Strategy's process, habitat, and stressor objectives (Table B.3-2). The species-specific measures provide additional detail on geographic location, habitat structure, and other attributes important to conservation of the species. For example, the acreage of riparian restoration is an indicator of progress toward the Conservation Strategy's riparian habitat objective. To measure the contribution of CVFPP actions to the conservation of the yellow-breasted chat, requirements would be added to increase acreage that makes a positive contribution to the early successional riparian habitat required by the species for nesting.

Table B.3-2 lists the process, habitat, and stressor targets of the Conservation Strategy; identifies those used to measure the contribution to conservation of yellow-breasted chat; and provides additional specificity as necessary to measure this contribution. Table B.3-3 provides the target, indicator, and selected measure of contribution.

Table B.3-2. Measures of the Contribution of CVFPP Actions to Conservation of the Yellow-breasted Chat

Target	Indicator	Selected as Measure of Contribution	Additional Specificity
Inundated Floodplain	Inundated Floodplain—total amount (acres, EAH units) with sustained spring and 50% frequently activated floodplain, and total amount of expected annual inundated floodplain habitat [a]	Yes	None.
Riverine Geomorphic Processes	Natural Bank—total length (miles)	No	None.
	River Meander Potential—total amount (acres)	Yes	Nesting habitat requires adjacency to water.
SRA Cover	SRA Cover and Bank and Vegetation Attributes of SRA Cover—total length (miles)	Yes	Nesting and foraging habitats require adjacency to natural rivers or streams.
SRA Cover	Total Length and Percentage of Bank Affected by Flood Projects that Incorporate SRA Attributes	Yes	None.
Riparian	Habitat Amount—total amount and total amount on active floodplain (acres)	Yes	Nesting and foraging habitats require dense thickets of early successional riparian habitat (willows and other low shrubs), with a dense shrub layer, including native fruiting vegetation, and an open tree canopy with scattered tall trees, and presence of a water edge.
	Habitat Connectivity—median patch size (acres)	Yes	Nesting and foraging habitats require a tree and water edge or shrub and water edge.
Marsh	Habitat Amount—total amount and total amount on active floodplain area (acres)	No	Not applicable.

[a] Floodplain inundation potential is the potential of an area to be inundated by a particular flow (e.g., a flow event that occurs about once every two years, or a "50-percent-chance event"). Expected annual habitat units represent the annual average of the area expected to be inundated in general or by flows meeting defined criteria for timing and duration (e.g., sustained spring flows).

Notes:
EAH = expected annual habitat
SRA = shaded riverine aquatic

Table B.3-3. Target, Indicator, and Selected Measure of Contribution for the Yellow-breasted Chat

Target	Indicator	Selected as Measure of Contribution	Additional Specificity
Floodplain Agriculture	Habitat Amount—total amount (acres) of floodplain agriculture providing habitat for target species	Yes	Breeding success would be increased by reducing cowbird food sources by reducing non-native grass and row-crop seeds and reducing domestic ungulate presence, especially feedlots and dairies near chat breeding habitat.
Revetment	Revetment Removed to Increase Meander Potential or Natural Bank—total length (miles)	Yes	None.
Levees	Levees Relocated to Reconnect Floodplain or Improved to Eliminate Hydraulic Constraints on Restoration—total length (miles)	Yes	None.
Fish Passage Barriers	Fish Passage Barriers—modified or removed	No	Not applicable.
Invasive Plants	Invasive-plant-dominated Vegetation—total area reduced (acres)	Yes	None.

Because management actions intended to benefit the yellow-breasted chat may simultaneously affect the conservation of other species in the SPA (e.g., least Bell's vireo), these measures of contribution have been incorporated into each CPA's objectives for the conservation of target species, which are provided in the Conservation Strategy Update. The target species objectives cover multiple species and reflect the interrelated nature of CVFPP flood management and conservation actions.

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Appendix C
Updates to 2016 Conservation Strategy Appendix J, "Existing Conservation Objectives from Other Plans"

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APPENDIX C

Updates to 2016 Conservation Strategy Appendix J, "Existing Conservation Objectives from Other Plans"

Acronym	Acronym
BRCP	Butte Regional Conservation Plan
CCP	comprehensive conservation plan
CDFW	California Department of Fish and Wildlife
Conservation Strategy (or Strategy)	Central Valley Flood Protection Plan Conservation Strategy
CVFPP	Central Valley Flood Protection Plan
Delta	Sacramento–San Joaquin Delta
DWR	California Department of Water Resources
Flood-MAR	flood-managed aquifer recharge
HCP	habitat conservation plan
LCP	local conservation plan
NCCP	natural community conservation plan
NMFS	National Marine Fisheries Service
Portfolio	Water Resilience Portfolio
RCIS	conservation investment strategy and
State Water Board	State Water Resources Control Board
Strategy (or Conservation Strategy)	Central Valley Flood Protection Plan Conservation Strategy
USFWS	U.S. Fish and Wildlife Service
WMA	Wildlife Management Area

Introduction

Regional planning efforts such as the Central Valley Flood Protection Plan (CVFPP) Conservation Strategy (Conservation Strategy or Strategy) are most effective when coordinated with other regional conservation plans and programs. For example, the knowledge gained by implementing existing plans has refined the Conservation Strategy's objectives and approaches. Coordination with other planning efforts during the Strategy's implementation will provide greater opportunities for effective, integrated, landscape-level conservation.

A collaborative approach will enable the Conservation Strategy to contribute to the shared objectives of other regional conservation plans and programs (e.g., improving habitat connectivity) while achieving its own specific objectives.

The 2016 Strategy, Appendix J, "Existing Conservation Objectives from Other Plans," described the completed and ongoing conservation planning efforts in the Sacramento and San Joaquin valleys that had regional, geographically based, or quantifiable conservation measures that could be relevant to the Strategy. The completed regional conservation planning efforts included several habitat conservation plans (HCPs) and natural community conservation plans (NCCPs) (e.g., Natomas Basin HCP, East Contra Costa County HCP and NCCP); large-scale conservation programs (e.g., the Ecosystem Restoration Program's Conservation Strategy for Restoration of the Sacramento–San Joaquin Valley Regions); and refuge comprehensive conservation plans (CCPs) (e.g., Sacramento River National Wildlife Refuge CCP).

When the 2016 Conservation Strategy was prepared, the ongoing conservation planning efforts included the Butte Regional Conservation Plan, California EcoRestore, Placer County Conservation Plan, South Sacramento HCP, and Yolo HCP and NCCP. This appendix provides the following information:

- Proposed modifications to the conservation plans described in Appendix J of the 2016 Strategy.
- New planning efforts undertaken since the 2016 Strategy's completion.
- An updated summary of the relationships of geographically overlapping conservation plans to the Strategy's target ecosystem processes, habitats, and species.

Modifications to Relevant Conservation Plans

California EcoRestore

The EcoRestore Program is tracking 30 projects that are at various stages of development, from conceptual to completed. The California Department of Water Resources (DWR) is the lead agency for 28 of the 30 EcoRestore projects, including five that launched in 2018 (California Natural Resources Agency 2020a). The following progress has been made to date:

- *Fish passage improvement projects:* Three completed and two being planned or permitted.
- *Upland and riparian forest restoration:* 559 acres completed, 368 acres under construction, and 727 acres being planned or permitted.
- *Floodplain restoration:* 115 acres completed; 1,050 acres under construction; and 17,320 acres being planned or permitted.
- *Tidal and subtidal restoration:* 4,212 acres completed; 2,290 acres under construction; and 7,479 acres being planned or permitted.
- *Emergent (managed) wetland restoration:* 1,542 acres completed; 643 acres under construction; and 1,350 acres being planned or permitted.

To develop a comprehensive, science-based adaptive management approach that would support the achievement of the Sacramento–San Joaquin Delta (Delta) conservation goals, the Delta Science Program initiated the Interagency Adaptive Management Integration Team in 2016 (California Natural Resources Agency 2020b). This team serves as a technical coordinating body to strengthen interagency collaboration; it also provides resources, input, and guidance on adaptive management for current and future Delta conservation efforts. The team consists of scientific and technical staff members from federal, state, and local agencies, other interagency programs and workgroups, universities, and nongovernmental organizations, who plan, facilitate, implement, fund, or regulate habitat restoration projects in the Delta and Suisun Marsh.

California WaterPlan

The California Water Plan was updated in June 2019 (California Department of Water Resources 2019), and is currently undergoing further updates along with the CVFPP. The following goals of the updated plan are relevant to the Conservation Strategy:

- Improve integrated watershed management.
- Restore critical ecosystem functions.
- Improve interagency alignment and address persistent regulatory challenges.
- Support real-time decision-making, adaptive management, and long-term planning.

San Joaquin River Restoration Program–Fisheries Framework

As part of the San Joaquin River Restoration Program, the Fisheries Framework was completed in 2018 (San Joaquin River Restoration Program 2018). This document provides the following information:

- An outline of the goals and objectives for establishing populations of spring-run and fall-run Chinook salmon (*Oncorhynchus tshawytscha*) in the Restoration Area.
- The necessary habitat that will support naturally reproducing, self-sustaining salmon populations.
- The science behind these planned management actions.
- An outline of the proposed adaptive management process and implementation plan for fishery actions.

Central Valley Project–State Water Project Operations Plan and Associated Biological Opinions

In August 2016, the U.S. Bureau of Reclamation and DWR began to develop a new operations plan and undertake a review of that plan's effects on numerous species listed for protection under the federal Endangered Species Act, particularly delta smelt (*Hypomesus transpacificus*), green sturgeon (*Acipenser medirostris*), and salmon and steelhead species (*Oncorhynchus mykiss*). In October 2019, after conducting robust scientific reviews, the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) released biological opinions on the new Central Valley Project–State Water Project operations (U.S. Fish and Wildlife Service 2019a; National Marine Fisheries Service 2019). These opinions found the revised proposed operations would not jeopardize threatened or endangered species, or adversely modify their critical habitat. These findings were reached in large part as a result of significant investments in science, habitat restoration, conservation facilities (including hatcheries), and protective measures built into the operations plan (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2019).

Central Valley Project Improvement Act Programs

Enacted in response to substantial declines in populations of anadromous fish, the Central Valley Project Improvement Act provided for all reasonable efforts to double the sustainable natural production of anadromous fish stocks including the four runs of Chinook salmon (fall, late fall, winter, and spring), steelhead trout, and green sturgeon, among others. From 2017 through 2019, under the Central Valley Project Improvement Act, the Anadromous Fish Restoration Program completed fisheries investigations on several waterways and facilities in the Strategy's Plan Area (Anadromous Fish Restoration Program 2018a, 2018b, 2019).

Central Valley Joint Venture

The Central Valley Joint Venture is one of 21 habitat-based Migratory Bird Joint Ventures in North America, all of which work to protect and restore bird habitat. The Central Valley Joint Venture is currently administered through a coordination office within the USFWS. It is guided by a management board that receives input and recommendations from four standing committees and a variety of working groups and ad hoc committees. Its management board is composed of representatives from 19 partner organizations, including nongovernmental organizations, state and federal agencies, and one regulated utility. The board members work cooperatively to address the habitat needs of migratory and resident bird species in California's Central Valley. Originally focused exclusively on waterfowl, the Central Valley Joint Venture's mission has expanded over time to also encompass the conservation needs of shorebirds, waterbirds, landbirds, and at-risk bird species.

The Central Valley Joint Venture released an updated implementation plan in 2020 (Central Valley Joint Venture 2020). The implementation plan builds on previous plans (Central Valley Joint Venture 1990, 2006) and identifies biologically-based conservation objectives for the eight bird groups, which include five target species: greater sandhill crane (*Grus canadensis tabida*), California black rail (*Laterallus jamaicensis coturniculus*), least Bell's vireo (*Vireo bellii pusillus*), western yellow-billed cuckoo (*Coccyzus americanus*), and bank swallow (*Riparia riparia*). One non-target species is also included: western burrowing owl (*Athene cunicularia hypugaea*).

Final Comprehensive Conservation Plan for the Butte Sink, Willow Creek–Lurline, and North Central Valley Wildlife Management Areas

The Final Comprehensive Conservation Plan for the Butte Sink, Willow Creek–Lurline, and North Central Valley Wildlife Management Areas (WMAs) guides management of these units (U.S. Fish and Wildlife Service 2020). USFWS manages the WMAs as part of the Sacramento National Wildlife Refuge Complex, which is headquartered in the Sacramento Valley, approximately 90 miles north of the city of Sacramento. The WMAs consist primarily of private lands protected by perpetual conservation easements, and also include some USFWS-owned lands.

Butte Regional Conservation Plan

The final Butte Regional Conservation Plan (BRCP) was submitted to USFWS, NMFS, and California Department of Fish and Wildlife on June 28, 2019, for final inspection (Butte County Association of Governments 2019), and has not yet been adopted by Butte County and the other plan partners. The BRCP covers 13 of the Conservation Strategy's target species: valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), Central Valley steelhead, spring-run and fall-run Chinook salmon, green sturgeon, giant gartersnake (*Thamnophis gigas*), bank swallow (*Riparia riparia*), California black rail (*Laterallus jamaicensis coturniculus*), greater sandhill crane (*Grus canadensis tabida*), Swainson's hawk (*Buteo swainsoni*), tricolored blackbird (*Agelaius tricolor*), western yellow-billed cuckoo (*Coccyzus americanus*), and yellow-breasted chat (*Icteria virens*). The BRCP also covers two non-target species considered for inclusion in the Strategy: western burrowing owl, and western pond turtle (*Actinemys marmorata*).

Placer County Conservation Program

The updated Placer County Conservation Program was released in February 2020, and the associated final environmental impact statement and environmental impact report was released in May 2020 (Placer County 2020a). The program was adopted by Placer County in September 2020, and the other plan partners (City of Lincoln, Placer County Water Agency, South Placer Transportation Agency) are also expected to adopt the plan (Placer County 2020b). This program covers seven of the Conservation Strategy's target species: valley elderberry longhorn beetle, Central Valley steelhead, Central Valley fall- and late fall-run Chinook salmon, giant gartersnake, California black rail, Swainson's hawk, and tricolored blackbird. The Placer County Conservation Program also covers two non-target species: western burrowing owl and western pond turtle.

South Sacramento Habitat Conservation Plan

The South Sacramento HCP was adopted by the participating agencies in 2018 (County of Sacramento et al. 2018). This document covers five of the Strategy's target species: valley elderberry longhorn beetle, giant gartersnake, greater sandhill crane, Swainson's hawk, and tricolored blackbird. The South Sacramento HCP also covers three non-target species: western burrowing owl, western pond turtle, and western red bat (*Lasiurus blossevillii*).

Yolo Habitat Conservation Plan and Natural Community Conservation Plan

The Yolo HCP and NCCP (ICF International 2018a) was adopted in 2018, and its implementation began on January 11, 2019 (Yolo Habitat Conservancy 2020). USFWS issued a biological and conference opinion and Section 10(a)(1)(B) permit on August 2, 2018 (U.S. Fish and Wildlife Service 2018). This document covers seven of the Strategy's target species: valley elderberry longhorn beetle, giant gartersnake, bank swallow, least Bell's vireo, Swainson's hawk, tricolored blackbird, and western yellow-billed cuckoo. It also covers two non-target species: western burrowing owl and western pond turtle.

State and Regional Water Board Plans

Several state and regional water board plans have been updated since the 2016 Conservation Strategy, or are currently being updated. The *Water Quality Control Plan for the Sacramento and San Joaquin River Basins* was updated in May 2018 (Central Valley Regional Water Quality Control Board 2018). The Wetland and Riparian Area Protection Policy was updated and adopted by the State Water Resources Control Board (State Water Board) in 2019 and became effective in May 2020 (State Water Resources Control Board 2019). Finally, the Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary was amended in 2019 (State Water Resources Control Board 2018) and other amendments are being considered (State Water Resources Control Board 2020).

Recovery Plan for the Giant Gartersnake

The recovery plan for the giant gartersnake was released in 2017 (U.S. Fish and Wildlife Service 2017). This plan focuses on identifying and protecting areas for habitat restoration, enhancement, or creation, including connectivity between populations. Nine recovery units are defined, corresponding with geographically and genetically distinct populations: the Butte Basin, Colusa Basin, Sutter Basin, American Basin, Yolo Basin, Delta Basin, Cosumnes-Mokelumne Basin, San Joaquin Basin, and Tulare Basin. The recovery plan includes the following objectives and criteria for achieving the objectives:

- Establish and protect self-sustaining populations.
- Restore and conserve healthy Central Valley wetland ecosystems.
- Ameliorate or eliminate current and future threats.

Revised Recovery Plan for the Valley Elderberry Longhorn Beetle

A revised recovery plan for valley elderberry longhorn beetle was released in 2019 (U.S. Fish and Wildlife Service 2019b). The plan focuses on loss and degradation of habitat and defines three management units: Sacramento River, San Joaquin River, and Putah Creek. There are two recovery objectives: preserve resilient populations across the historical range by maintaining occupancy in at least 80 percent of major river system subbasins; and protect and manage a system of connected habitat patches along each river or major drainage within subbasins.

New Relevant Conservation Plans

California Biodiversity Initiative

In 2017, a group of 26 scientific experts from across the state's universities, herbaria, and conservation organizations created the "Charter to Secure the Future of California's Native Biodiversity," a call to action to secure and recover the abundance and richness of native plants and animals in California, under current and changing climate conditions. Governor Edmund G. Brown Jr. responded in 2018 by launching the California Biodiversity Initiative (California Natural Resources Agency et al. 2018). The goal of the California Biodiversity Initiative is to secure the future of California's biodiversity by integrating biodiversity protection into the state's environmental and economic goals and efforts. The following broad goals are identified as a starting point:

- Protect 20 percent of each terrestrial, freshwater, coastal, and marine ecosystem type.
- Recover and restore 15 percent of each ecosystem type from its degraded or disturbed status.

Future actions are grouped into seven focal areas:

1. Help the government coordinate on biodiversity goals.
2. Improve the understanding of California's biodiversity.
3. Improve the understanding and protection of the state's native plants.

4. Manage land and waters to achieve biodiversity goals.
5. Restore and protect lands and waters to achieve biodiversity goals.
6. Educate Californians about biodiversity.
7. Prioritize collaboration and partnership.

Water Resilience Portfolio

Replacing the California Water Action Plan that guided the 2016 Conservation Strategy and 2017 CVFPP Update, Executive Order N-10-19, issued by Governor Gavin Newsom on April 29, 2019, called for a portfolio of actions to ensure the state's long-term water resilience and ecosystem health. In response, state agencies have released a Water Resilience Portfolio (Portfolio) with a suite of recommended actions to help California cope with more extreme droughts and floods, rising temperatures, declining fish populations, aging infrastructure, and other challenges (California Natural Resources Agency et al. 2020). The executive order identified seven principles on which to base the Portfolio. Of those, the following principles are most relevant to the Conservation Strategy:

- Prioritize multi-benefit approaches that meet several needs at once.
- Use natural infrastructure such as forests and floodplains.

The Portfolio provided proposals that detail how state agencies can support the principles. Several of these are consistent with the Conservation Strategy:

- *"10. Reconnect aquatic habitat to help fish and wildlife endure drought and adapt to climate change.*

- *11.3. Support expansion of multi-benefit floodplain projects across the Central Valley and coastal regions, including projects that reduce flood risk and restore or mimic historical river and floodplain processes, such as the Yolo Bypass and Cache Slough Partnership program.*

- *12. Curb invasive species altering California waterways.*

- *13. Align and improve permitting to help launch and incentivize more restoration, multibenefit, and multi-partner projects.*

- *13.1. Coordinate grant and loan programs across state agencies to make funding for multibenefit projects, including restoration, easier to arrange and leverage.*

- *13.2. Support the development of expedited and cost-effective permitting mechanisms for common types of restoration and enhancement projects.*

- *13.3. Expand use of the Regional Conservation Investment Strategies approach established in 2017 under Assembly Bill (AB) 2087 to guide mitigation needs for water-related projects.*

- *13.4. Incorporate strategically designed conservation planning and other resource protection and recovery plans into mitigation approaches for levee modifications, operations, and maintenance.*

- *25.1. Support implementation of the Central Valley Flood Protection Plan and its "state systemwide investment approach" to protect urban areas, small communities, and rural areas; improve operations and maintenance of the flood system; better coordinate reservoir operations; improve the flood emergency response system; and integrate natural systems into flood risk reduction projects.*

- *25.2. Review state, federal, and local permitting processes for flood risk reduction projects and operations and maintenance and recommend ways to improve permitting processes.*

- *25.4. Update and refine the regional flood management strategy in the CVFPP to account for the projected impacts of climate change in order to protect vulnerable communities and infrastructure and restore floodplains along the San Joaquin River and its tributaries."*

Cutting the Green Tape Initiative

The California Natural Resources Agency developed the Cutting the Green Tape Initiative to help implement environmentally beneficial work more quickly, simply, and cost-effectively. Between December 2019 and April 2020, this initiative convened regulatory agency staff members, representatives from local governments and environmental conservation groups, and a range of other stakeholders and experts from across California to improve permitting and funding efficiencies for ecological restoration and stewardship projects. These roundtables developed specific recommendations to improve on existing programs and program delivery in 2020 and beyond, and the report *Cutting the Green Tape: Regulatory Efficiencies for a Resilient Environment* was released in November 2020 (California Landscape Stewardship Network 2020).

Delta Smelt Resiliency Strategy

Under a comprehensive strategy, federal and state agencies are working to rapidly improve conditions for the endangered delta smelt, which is close to extinction (California Natural Resources Agency 2016). The strategy represents a management shift for federal and state water and wildlife agencies, which are addressing multiple stressors on delta smelt in a systematic way while studying the synergy of the actions. In total, 13 near- and mid-range actions are aimed at creating better habitat, more food, and higher turbidity, along with reduced levels of weeds, predators, and harmful algal blooms to help reduce the mortality of delta smelt and boost the rate at which the fish grow, reproduce, and survive.

Feather River Conceptual Plan

The Feather River Conceptual Plan identifies immediate, high-priority projects that DWR and the community may undertake cooperatively while DWR completes necessary facility repairs and improvements, and completes measures that may become part of the Federal Energy Regulatory Commission's license related to the 2017 Oroville Dam spillways emergency event

(Supplemental Benefits Fund Steering Committee 2018). The following recommended projects are relevant to the Conservation Strategy.

- In Reach 3:
  - Develop in-channel morphologic features (artificial bedrock, natural boulders, and augmented wood and sediment) to improve instream habitat, increase gravel retention in riffles, and create whitewater kayak play features.
  - Improve spawning and rearing habitat with the targeted (riffle construction) and also significant (bulk) augmentation of sediment (spawning-sized, and other) to recover from the deficit caused by upstream dams and exacerbated by recent high-flow events.
  - Coordinate the design of habitat and recreation features with development of the gravel augmentation plan, the gravel budget, and the construction and maintenance of side channels.
- In Reaches 3, 4, and 5, develop floodplain and side-channel habitat on the right bank.

Flood-managed Aquifer Recharge

Flood-managed aquifer recharge, or Flood-MAR, is an integrated and voluntary resource management strategy that uses floodwater resulting from—or in anticipation of—rainfall or snowmelt for managed aquifer recharge on agricultural lands and working landscapes, such as refuges, floodplains, and flood bypasses (California Department of Water Resources 2020).

Flood-MAR can be implemented at multiple scales, from individual landowners using existing infrastructure to divert floodwater, to the use of extensive detention and recharge areas and the modernization of flood management infrastructure and operations. Flood-MAR could overlap with multi-benefit flood projects, such as building setback levees where soils are suitable and flows during wet years could be stored. For example, the Merced River Flood-MAR Reconnaissance Study is studying the use of flood waters for managed aquifer recharge that can reduce flood risk, increase supply reliability, support groundwater sustainability, and enhance ecosystems in the Merced River Basin. Multiple floodplain and riparian species, including Conservation Strategy target species, could benefit by reconnecting floodplains and creating new transitory storage.

Sacramento Valley Salmon Resiliency Strategy

Through the Sacramento Valley Salmon Resiliency Strategy (California Natural Resources Agency 2017), state agencies have committed to a suite of actions to improve survival rates, including restoring habitat, improving streamflow, removing stream barriers, and reintroducing species to ideal habitat for California's native salmon and steelhead species.

Voluntary Agreements

State agencies have developed a framework for voluntary agreements outlining a multi-year program to improve environmental conditions in an adaptive way, through new flows dedicated to the environment and the most extensive habitat creation in California history (California Natural Resources Agency 2020c). Building on years of work, the team has developed a science-driven framework that holds the promise to improve environmental conditions and meet the State Water Board's legal requirement to provide for the reasonable protection of beneficial uses. The framework provides for up to 900,000 acre-feet of new flows for the environment above existing conditions in dry, below-normal, and above-normal water-year types, and over 100,000 acre-feet in critical and wet years, to help recover fish populations. It also provides for thousands of acres of new habitat, from targeted improvements in tributaries to large landscape-level restoration in the Sacramento Valley. Habitat improvements include the following actions:

- The creation of spawning and rearing habitat for salmon and smelt.
- The completion of high-priority fish screen projects.
- The restoration and reactivation of floodplains.
- The initiation of projects to address predation.
- Improvements to fish passages.

The framework outlines several billion dollars in investments funded by water users and the federal and state governments to improve environmental conditions and science and adaptive management. It also establishes a governance program to strategically deploy flows and habitat, implement a science program, and develop strategic plans and annual reports. The California Natural Resources Agency and California Environmental Protection Agency are working with water users and other participants to refine the proposed framework into a legally enforceable program. The refined document will then be submitted to the State Water Board, where it will undergo a third-party scientific review, an environmental review, and a public comment process.

Yolo Regional Conservation Investment Strategy and Local Conservation Plan

A draft regional conservation investment strategy (RCIS) and local conservation plan (LCP) for Yolo County was released in 2018 (ICF International 2018b), and the California Department of Fish and Wildlife (CDFW) approved the final document was in 2020 (ICF International 2020a). The Yolo RCIS/LCP is a regional conservation planning effort to provide mitigation and stewardship-driven conservation in Yolo County. It describes the existing condition for the amount, location, and type of natural communities and focal species habitat in the document's strategy area.

The Yolo RCIS/LCP recommends conservation actions for focal species and land cover types to direct project planning and conservation efforts. There are 40 focal species and 97 conservation species. The list of focal species includes 16 of the 2022 Conservation Strategy's target species: valley elderberry longhorn beetle, Central Valley steelhead, Central Valley spring-run and

fall-run Chinook salmon, Sacramento River winter-run Chinook salmon, delta smelt, green sturgeon, giant gartersnake, bank swallow, California black rail, greater sandhill crane, least Bell's vireo (*Vireo bellii pusillus*), Swainson's hawk, tricolored blackbird, western yellow-billed cuckoo, and yellow-breasted chat. Six non-target species are identified as either focal or conservation species: western burrowing owl, western pond turtle, western red bat, least bittern (*Ixobrychus exilis*), redhead (*Aythya americana*), and yellow warbler (*Setophaga petechial*).

Mid-Sacramento Valley Regional Conservation Investment Strategy

A public draft RCIS for the Mid-Sacramento Valley was released in 2019 (ICF International 2019), and CDFW approved the final document in 2020 (ICF International 2020b). The Mid-Sacramento RCIS is based primarily on the Mid- and Upper Sacramento Regional Flood Management Plan and the Feather River Regional Flood Management Plan. Those documents provide regional frameworks for integrating conservation into the flood management system and its operations. This RCIS identifies conservation and habitat enhancement actions that can be used to provide compensatory mitigation for flood management and other infrastructure projects in the regions.

The Mid-Sacramento RCIS identifies 12 focal species, 11 of which overlap the 2022 Conservation Strategy's target species: valley elderberry longhorn beetle, Central Valley steelhead, Central Valley spring-run and fall-run Chinook salmon, Sacramento River winter-run Chinook salmon, green sturgeon, giant gartersnake, bank swallow, Swainson's hawk, tricolored blackbird, and western yellow-billed cuckoo. The RCIS also identifies one non-target species: western pond turtle.

Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon

The recovery plan for green sturgeon was released in 2018 (National Marine Fisheries Service 2018). This plan presents 20 recovery actions aiming to restore passage and habitat; reduce mortality from fisheries, entrainment, and poaching; and address threats from contaminants, climate change, predation, sediment loading, and oil and chemical spills. The recovery plan identifies 17 priority recovery actions and three secondary priority actions, as well as 16 research priorities. It also proposes monitoring and education and outreach programs.

Executive Order N-82-20 ("30 by 30")

On October 7, 2020, Governor Gavin Newsom signed Executive Order N-82-20, which calls for the conservation of 30 percent of land and coastal waters by 2030 to combat climate change and protect biodiversity. The order enlists California's natural and working lands—forests, rangelands, farms, wetlands, coast, deserts and urban greenspaces—to act as carbon storage.

It directs state agencies to implement innovative strategies to remove carbon from the atmosphere through actions such as:

- Healthy soils management, including planting cover crops, hedgerows and compost applications.
- Wetlands restoration to protect coastal areas.
- Active forest management to reduce catastrophic risk and restore forest health.
- Green infrastructure boost (like trees and parks) in urban areas.

The executive order also directs the California Natural Resources Agency to form a California Biodiversity Collaborative to bring together experts, leaders, and communities to both pursue a unified approach to protecting biodiversity and develop strategies to support the 30 by 30 goal. A coalition of state agencies is also ordered to develop a Natural and Working Lands Climate Smart Strategy within one year of the signing of the executive order, which will serve as a framework to advance the state's carbon neutrality goal and builds climate resilience.

Summary of the Relationship of Other Conservation Plans to Conservation Strategy Targets

As described here and in Appendix J of the 2016 Conservation Strategy, multiple conservation plans overlap the Strategy, and many of the plans have addressed the Strategy's targets. Tables C-1 and C-2 summarize the relationships of these plans to the Strategy's target habitats and target species, respectively. The tables include the plans described in Appendix J of the 2016 Conservation Strategy, as well as the new plans described in this appendix.

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Table C-1. Relationship of Conservation Objectives of Other Plans to Conservation Strategy Target Habitats

Plan Type	Plan Name	Target Habitat Riparian or Shaded Riverine Aquatic	Target Habitat Wetland	Target Habitat Seasonal Floodplain	Target Habitat Riverine Aquatic	Geographic Overlap Systemwide Planning Area
Plans with Quantified Conservation Measures	Butte Regional Conservation Plan Butte Sink, Willow	Probable	Probable	Probable	Probable	Probable
	Creek–Lurline, and North Central Valley WMA CCP	Probable	Probable	None	Probable	Probable
	California EcoRestore	Significant	Significant	Significant	Significant	Significant
	California Water Action Plan	None	Significant	None	Significant	Significant
	California Water Plan	Probable	Probable	Probable	Probable	Significant
	Central Valley Joint Venture	Significant	Significant	None	None	Significant
	Central Valley Project Improvement Act Programs	Significant	None	Probable	Significant	Significant
	Central Valley Project–State Water Project OCAP and Associated BOs	Probable	None	Probable	Significant	Significant
	Cosumnes River Preserve Management Plan	Probable	Probable	Significant	Probable	Probable
	Delta Smelt Resiliency Strategy	None	Significant	None	Significant	Significant
	DWR's Oroville FERC license	Probable	Probable	Probable	Significant	Probable
	East Contra Costa County HCP/NCCP	Probable	Probable	None	None	Probable
	Ecosystem Restoration Program	Significant	Significant	Significant	Significant	Significant
	Executive Order N-82-20 ("30 by 30")	Probable	Significant	Probable	Significant	Probable
	Natomas Basin HCP	None	Probable	None	None	Significant
	PG&E O&M HCP	Probable	Probable	Probable	Probable	Significant
	Placer County Conservation Plan	Probable	Probable	None	Probable	Probable
	Recovery Plan for Sacramento River Winter-Run Chinook Salmon and Central Valley Spring-Run Chinook Salmon ESUs and Central Valley Steelhead DPS	Significant	None	Significant	Significant	Significant
	Recovery Plan for the Southern DPS of North American Green Sturgeon	None	None	None	Significant	Significant
	Sacramento, Delevan, Colusa, and Sutter NWR CCP/EA	Probable	Probable	Significant	Probable	Probable
	Sacramento River NWR CCP	Significant	Probable	Probable	Probable	Probable
	Sacramento Valley Salmon Resiliency Strategy	Significant	None	Significant	Significant	Significant
	San Joaquin County Multi-Species HCP and Open Space Plan	Probable	Probable	None	None	Probable
	San Joaquin River Restoration Program– Fisheries Framework	Probable	None	Significant	Significant	Significant
	Solano Multi-Species HCP	Probable	Probable	None	Probable	Probable
	South Sacramento HCP	Probable	Probable	Probable	Probable	Probable
	Voluntary Agreements	None	None	Significant	Significant	Significant
	Yuba-Sutter Regional Conservation Plan	Probable	Probable	None	None	Probable
	Yolo HCP/NCCP	Significant	Significant	None	None	Probable

Plan Type	Plan Name	Target Habitat Riparian or Shaded Riverine Aquatic	Target Habitat Wetland	Target Habitat Seasonal Floodplain	Target Habitat Riverine Aquatic	Geographic Overlap Systemwide Planning Area
Plans without Quantified Conservation Measures	Bank Swallow Conservation Strategy for California	Probable	Probable	Probable	Probable	Significant
	Bank Swallow Recovery Plan	Probable	Probable	Probable	Probable	Significant
	California Biodiversity Initiative	None	Probable	None	Probable	Probable
	California Red-Legged Frog Recovery Plan	Probable	Probable	Probable	Probable	Probable
	CMP for the Sacramento River Wildlife Area	Significant	Significant	Significant	Significant	Significant
	Cutting the Green Tape Initiative	None	None	None	None	Probable
	Mid-Sacramento Valley RCIS/LCP	Significant	Significant	Significant	Significant	Significant
	Draft Recovery Plan for the Least Bell's Vireo	Significant	None	None	None	Probable
	Yolo RCIS/LCP	Significant	Significant	Significant	Significant	Significant
	Feather River Conceptual Plan	None	None	Significant	None	Probable
	Flood-MAR	Significant	Significant	Significant	Probable	Probable
	Recovery Plan for Upland Species of the San Joaquin Valley, California	Probable	None	None	None	Probable
	Revised Draft Recovery Plan for the Giant Gartersnake	None	Significant	None	None	Significant
	Sacramento River Conservation Area Forum	Significant	Probable	Probable	Probable	Significant
	State Water Resources Control Board Plans	None	None	None	Probable	Probable
	The Nature Conservancy Sacramento River Project	Significant	Probable	Probable	Significant	Significant
	VELB Recovery Plan	Significant	None	None	None	Significant
	Water Resilience Portfolio	None	Probable	Significant	Probable	Significant
	Yolo Bypass Wildlife Area LMP	Significant	Significant	Significant	Probable	Probable

Source: California Department of Water Resources 2016, updated with data compiled by H. T. Harvey & Associates in 2020

Notes:
Magnitude of relationship between the CVFPP and other conservation plan or program specified as follows:

None = No relationship exists.

Probable = A probable or potential relationship exists. The Conservation Strategy is not likely to significantly contribute to the other conservation plan's conservation objectives, or the conservation target is a secondary focus of the conservation plan. For geographic overlap, there is a minor spatial overlap between the conservation plan area and one of the CVFPP planning boundaries.

Significant = A significant relationship exists. The Conservation Strategy could significantly contribute to the other conservation plan's conservation objectives. For geographic overlap, there is a large spatial overlap between the conservation plan and one of the CVFPP planning boundaries.

BO = Biological Opinion
CCP = Comprehensive Conservation Plan
CMP = Comprehensive Management Plan
CVFPP = Central Valley Flood Protection Plan
DPS = Distinct Population Segment
DWR = California Department of Water Resources
EA = Environmental Assessment
ESU = Evolutionarily Significant Unit
FERC = Federal Energy Regulatory Commission
HCP = Habitat Conservation Plan
LMP = land management plan
NCCP = Natural Communities Conservation Plan
NWR = National Wildlife Refuge
OCAP = operations criteria and plan
O&M = operations and maintenance
PG&E = Pacific Gas and Electric Company
VELB = valley elderberry longhorn beetle

Table C-2. Relationship of Conservation Objectives of Other Plans to Conservation Strategy Target Species

Plan Type	Plan Name	Target Species Delta Button-Celery	Target Species Slough Thistle	Target Species Salmonids	Target Species Green Sturgeon	Target Species Delta Smelt	Target Species Giant Garter-snake	Target Species VELB	Target Species Western Yellow-Billed Cuckoo	Target Species Bank Swallow	Target Species Swainson's Hawk	Target Species Least Bell's Vireo	Target Species Greater Sandhill Crane	Target Species California Black Rail	Target Species Tricolored Blackbird	Target Species Yellow-Breasted Chat	Target Species Riparian Brush Rabbit	Target Species Riparian Woodrat	Geographic Overlap Systemwide Planning Area
Plans with Quantified Conservation Measures	Butte Regional Conservation Plan	None	None	Probable	Probable	None	Probable	Probable	Probable	Probable	Probable	None	Probable	Probable	Probable	Probable	None	None	Probable
	Butte Sink, Willow Creek–Lurline, and North Central Valley WMA CCP	None	None	None	None	None	None	None	None	None	None	None	None	None	Probable	None	None	None	Probable
	California EcoRestore	Significant	Probable	Significant	Probable	Probable	Significant	Probable	Significant	Probable	Significant	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Significant
	California Water Action Plan	None	None	Significant	Probable	Probable	None	None	None	None	None	None	Probable	None	None	None	None	None	Significant
	California Water Plan	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Significant
	Central Valley Joint Venture	None	None	None	None	None	None	None	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	None	None	Significant
	Central Valley Project Improvement Act Programs	None	None	Significant	None	None	Probable	Probable	Probable	Probable	Probable	Probable	None	None	None	None	Probable	Probable	Significant
	Central Valley Project–State Water Project OCAP and Associated BOs	None	None	Significant	Probable	Probable	None	None	None	None	None	None	None	None	None	None	None	None	Significant
	Cosumnes River Preserve Management Plan	None	None	Significant	None	None	Probable	Probable	None	None	Probable	Probable	Probable	None	None	None	None	None	Probable
	Delta Smelt Resiliency Strategy	None	None	Probable	Probable	Significant	None	None	None	None	None	None	None	None	None	None	None	None	Significant
	DWR's Oroville FERC license	None	None	Significant	None	None	Probable	Probable	None	None	None	None	None	None	None	None	None	None	Probable
	East Contra Costa County HCP/NCCP	None	None	None	None	None	Probable	None	None	None	Probable	None	None	None	None	None	None	None	Probable
	Ecosystem Restoration Program	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	None	Significant	Significant	Significant
	Natomas Basin HCP	None	None	None	None	None	Probable	Probable	None	Probable	Probable	None	None	None	Probable	None	None	None	Significant
	PG&E O&M HCP	Probable	Probable	None	None	None	Probable	Probable	None	Probable	Probable	None	None	None	None	None	Probable	Probable	Significant
	Placer County Conservation Plan	None	None	Probable	None	None	Probable	Probable	Probable	Probable	Probable	None	None	Probable	Probable	None	None	None	Probable

Plan Type	Plan Name	Target Species Delta Button-Celery	Target Species Slough Thistle	Target Species Salmonids	Target Species Green Sturgeon	Target Species Delta Smelt	Target Species Giant Garter-snake	Target Species VELB	Target Species Western Yellow-Billed Cuckoo	Target Species Bank Swallow	Target Species Swainson's Hawk	Target Species Least Bell's Vireo	Target Species Greater Sandhill Crane	Target Species California Black Rail	Target Species Tricolored Blackbird	Target Species Yellow-Breasted Chat	Target Species Riparian Brush Rabbit	Target Species Riparian Woodrat	Geographic Overlap Systemwide Planning Area
Plans with Quantified Conservation Measures	Recovery Plan for Sacramento River Winter-Run Chinook Salmon and Central Valley Spring-Run Chinook Salmon ESUs and Central Valley Steelhead DPS	None	None	Significant	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Significant
	Recovery Plan for the Southern DPS of North American Green Sturgeon	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Significant
	Sacramento, Delevan, Colusa, and Sutter NWR CCP/EA	None	None	Probable	None	None	Probable	None	Probable	None	Probable	None	Probable	None	Probable	None	None	None	Probable
	Sacramento River NWR CCP	None	None	Probable	None	None	Probable	Probable	Probable	Probable	Probable	Probable	None	None	Probable	Probable	None	None	Probable
	Sacramento Valley Salmon Resiliency Strategy	None	None	Significant	Probable	None	None	None	None	None	None	None	None	None	None	None	None	None	Significant
	San Joaquin County Multi-Species HCP and Open Space Plan	Probable	Probable	None	Probable	Probable	Probable	Probable	Probable	Probable	Probable	None	Probable	Probable	Probable	Probable	Probable	Probable	Probable
	San Joaquin River Restoration Program–Fisheries Framework	None	None	Significant	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Significant
	Solano Multi-Species HCP	None	None	Probable	Probable	Probable	Probable	Probable	None	None	Probable	None	None	Probable	Probable	None	None	None	Probable
	South Sacramento HCP	None	None	None	None	None	Probable	Probable	None	None	Probable	None	Probable	None	Probable	None	None	None	Probable
	Voluntary Agreements	None	None	Significant	Probable	None	None	None	None	None	None	None	None	None	None	None	None	None	Significant
	Yuba-Sutter Regional Conservation Plan	None	None	Probable	None	None	Probable	Probable	Probable	Probable	Probable	None	Probable	Probable	Probable	None	None	None	Probable
	Yolo HCP/NCCP	None	None	None	None	None	Probable	Probable	Probable	Probable	Probable	Probable	None	None	Probable	None	None	None	Probable
	Bank Swallow Conservation Strategy for California	None	None	None	None	None	None	None	None	Significant	None	None	None	None	None	None	None	None	Significant

Plan Type	Plan Name	Target Species Delta Button-Celery	Target Species Slough Thistle	Target Species Salmonids	Target Species Green Sturgeon	Target Species Delta Smelt	Target Species Giant Garter-snake	Target Species VELB	Target Species Western Yellow-Billed Cuckoo	Target Species Bank Swallow	Target Species Swainson's Hawk	Target Species Least Bell's Vireo	Target Species Greater Sandhill Crane	Target Species California Black Rail	Target Species Tricolored Blackbird	Target Species Yellow-Breasted Chat	Target Species Riparian Brush Rabbit	Target Species Riparian Woodrat	Geographic Overlap Systemwide Planning Area
Plans without Quantified Conservation Measures	Bank Swallow Recovery Plan	None	None	None	None	None	None	None	None	Significant	None	None	None	None	None	None	None	None	Significant
	California Biodiversity Initiative	Probable	Probable	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Probable
	California Red-Legged Frog Recovery Plan	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Probable
	CMP for the Sacramento River Wildlife Area	None	None	Probable	Probable	None	Probable	Probable	Probable	Probable	None	None	None	None	Probable	Probable	None	None	Significant
	Cutting the Green Tape Initiative	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Probable
	Draft Mid-Sacramento Valley RCIS/LCP	None	None	Significant	Significant	None	Significant	Significant	Significant	Significant	Significant	None	None	None	Significant	None	None	Significant	Significant
	Draft Recovery Plan for the Least Bell's Vireo	None	None	None	None	None	None	None	None	None	None	Probable	None	None	None	None	None	None	Probable
	Draft Yolo RCIS/LCP	None	None	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	Significant	None	None	Significant
	Executive Order N-82-20 ("30 by 30")	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable
	Feather River Conceptual Plan	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Probable
	Flood-MAR	None	None	Probable	Probable	None	None	None	None	None	None	None	Probable	None	None	None	None	None	Probable
	Recovery Plan for Upland Species of the San Joaquin Valley, California	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Significant	Significant	Probable
	Revised Draft Recovery Plan for the Giant Gartersnake	None	None	None	None	None	Probable	None	None	None	None	None	None	None	None	None	None	None	Significant
	Sacramento River Conservation Area Forum	None	None	Significant	None	None	None	Significant	Significant	Significant	Probable	Significant	None	None	None	None	None	None	Significant
	State Water Resources Control Board Plans	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	Probable

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Plans without Quantified Conservation Measures	The Nature Conservancy Sacramento River Project	None	None	Significant	None	None	None	Significant	Significant	Significant	Probable	Significant	None	None	Probable	Probable	None	None	Significant
	VELB Recovery Plan	None	None	None	None	None	None	Significant	None	None	None	None	None	None	None	None	None	None	Significant
	Water Resilience Portfolio	None	None	Probable	Probable	Probable	None	None	None	None	None	None	None	None	None	None	None	None	Significant
	Yolo Bypass Wildlife Area LMP	None	None	Significant	None	Probable	Significant	None	Probable	None	Significant	None	None	None	Probable	None	None	None	Probable

Source: California Department of Water Resources 2016, updated with data compiled by H. T. Harvey & Associates in 2020 Magnitude of relationship between the CVFPP and other conservation plan or program specified as follows:

Notes:
None = No relationship exists.

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LMP = land management plan
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NWR = National Wildlife Refuge
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OCAP = operations criteria and plan
PG&E = Pacific Gas and Electric Company
VELB = valley elderberry longhorn beetle

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Appendix D
Updates to 2016 Conservation Strategy Appendix A, "Regulatory Setting"

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APPENDIX D

Updates to 2016 Conservation Strategy Appendix A, "Regulatory Setting"

Acronym	Definition
BO	biological opinion
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
Conservation Strategy (or Strategy)	Central Valley Flood Protection Plan 2016 Conservation Strategy
CVFPB	Central Valley Flood Protection Board
CVFPP	Central Valley Flood Protection Plan
CWA	Clean Water Act
Delta Plan	long-term management plan for the Sacramento–San Joaquin Delta
DWR	California Department of Water Resources
EA	environmental assessment
EIR	environmental impact report
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
HCP	habitat conservation plan
MND	mitigated negative declaration
MOU	memorandum of understanding

Acronym	Definition
National Register	National Register of Historic Places
NCCP	natural community conservation plan
ND	negative declaration
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPPA	Native Plant Protection Act
NWPR	Navigable Waters Protection Rule
regional water board	regional water quality control board
SHA	Safe Harbor Agreement
SHPO	State Historic Preservation Officer
SLC	California State Lands Commission
State	State of California
State Water Board	State Water Resources Control Board
Strategy (or Conservation Strategy)	Central Valley Flood Protection Plan 2016 Conservation Strategy
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
WDR	waste discharge requirements

Introduction

Appendix A, "Regulatory Setting," of the Central Valley Flood Protection Plan (CVFPP) 2016 Conservation Strategy (Conservation Strategy or Strategy) described the federal and state regulatory approvals required to implement the CVFPP, including the Conservation Strategy. This appendix provides an updated description of these regulatory approvals. Table D-1 lists these authorizations and approval actions by agency and statute, first for federal and then for state agencies.

Table D-1. Typical Authorizations Required by Multi-Benefit Flood Projects

Agency	Agency—Statute	Authorization or Approval Action
Federal agencies	Lead federal agency—NEPA	• Record of decision
	USACE— Section 404 of the CWA	• Individual (standard) permit • Letter of permission • General permit (nationwide, regional, or programmatic basis)
	USACE— Section 9 of the Rivers and Harbors Act of 1899	• Individual (standard) permit • General permit (nationwide, regional, or programmatic basis)
	USACE— Section 10 of the Rivers and Harbors Act of 1899	• Individual (standard) permit • Letter of permission • General permit (nationwide, regional, or programmatic basis)
	USACE— Section 14 of the Rivers and Harbors Act of 1899 (33 USC 408)	• Letter of permission
	USFWS/ NMFS— ESA, Section 7	• Biological opinion • Incidental take statement
	USFWS/NMFS— ESA, Section 10	• Incidental take permit • Enhancement of survival permit • Recovery and interstate commerce permit
	National Marine Fisheries Service—Magnuson-Stevens Fishery Conservation and Management Act[a]	• Consultation
State Agencies	Lead state or local agency—CEQA	• Notice of determination
	CDFW—Section 1600 of the California Fish and Game Code	• Lake and streambed alteration agreement • Master agreement • Routine maintenance agreement
	CDFW—CESA	• Section 2081(a) MOU • Section 2081(b) incidental take permit • Section 2080.1 consistency determination • Natural community conservation plan • Safe harbor agreement • Voluntary local program
	State Water Resources Control Board—Sections 1200 and 1201 of the California Water Code	• Water right permit

Agency	Agency—Statute	Authorization or Approval Action
State Agencies	Central Valley Regional Water Quality Control Board—Porter-Cologne Water Quality Control Act	• WDR
	Central Valley Regional Water Quality Control Board—CWA (Section 401)	• Water quality certification
	Central Valley Regional Water Quality Control Board—CWA Section 402	• NPDES permit and WDR
	California Office of Historic Preservation—Section 106 of the National Historic Preservation Act	• Consultation with the SHPO
	Central Valley Flood Protection Board—California Water Code Section 8608	• Encroachment permit
	California State Lands Commission—Public Resources Code Section 6009	• Lease
	Delta Stewardship Council —Sacramento–San Joaquin Delta Reform Act of 2009	• Certification of consistency[b]

[a] Consultations on actions that may adversely affect essential fish habitat (required by the Magnuson-Stevens Fishery Conservation and Management Act) may be conducted in conjunction with NEPA compliance, ESA compliance, USACE permitting, or as a separate consultation.

[b] Filed by the lead State or local agency.

Notes:
CDFW = California Department of Fish and Wildlife
CEQA = California Environmental Quality Act
CESA = California Endangered Species Act
CFR = Code of Federal Regulations
CWA = Clean Water Act
ESA = Endangered Species Act
MOU = memorandum of understanding
NEPA = National Environmental Policy Act
NMFS = National Marine Fisheries Service
NPDES = National Pollutant Discharge Elimination System
SHPO = State Historic Preservation Officer
USACE = U.S. Army Corps of Engineers
USC = United States Code
USFWS = U.S. Fish and Wildlife Service
WDR = waste discharge requirements

Federal Authorizations

National Environmental Policy Act

The NEPA requires federal agencies to assess the environmental effects of their proposed actions before making decisions. The NEPA process involves three levels of analysis: categorical exemption, environmental assessment (EA), and environmental impact statement (EIS). Unless a federal action is determined to be categorically excluded, federal agencies are required to prepare an EA assessing the environmental impacts and related social and economic effects of the proposed action and alternatives. If an EA concludes with a finding of no significant impact, no further NEPA documentation is required. If the EA determines the project may result in significant environmental effects, or if significant effects are presumed initially, an EIS must be prepared to achieve NEPA compliance. The EIS process also provides opportunities for public review and comment. The EIS process ends with the issuance of a Record of Decision by the lead federal agency. Specific procedures for NEPA compliance vary by lead agency because many federal agencies have developed their own supplemental procedures that support the agency's specific mission and activities.

U.S. Army Corps of Engineers

Section 404 of the Clean Water Act

Through its regulatory program, USACE administers and enforces Section 404 of the CWA. Under Section 404, a permit must be obtained to discharge dredged or fill material into waters of the United States, unless the activity is exempt (e.g., some agricultural activities).

The Navigable Waters Protection Rule (NWPR) became effective in 2020 and established the scope of federal regulatory authority under the CWA. The NWPR included four simple categories of jurisdictional waters, and provided specific exclusions for many water features that have not traditionally been regulated. In June 2021, the U.S. Environmental Protection Agency (EPA) and Department of the Army announced their intent to revise the definition of "waters of the United States" to better protect our nation's vital water resources that support public health, environmental protection, agricultural activity, and economic growth. In September 2021, the NWPR was vacated and remanded in the case of *Pascua Yaqui Tribe v. U.S. Environmental Protection Agency*. In light of this order, EPA and USACE have halted implementation of the NWPR and are interpreting "waters of the United States" consistent with the pre-2015 regulatory regime until the definition of "waters of the United States" is revised.

USACE regulations provide for the issuance of general (nationwide, regional, or programmatic basis) and individual permits. General permits may be issued to authorize specific types of activities that would have minimal individual and cumulative adverse environmental effects or would avoid the unnecessary duplication of the regulatory control exercised by another federal, state, or local agency, provided it has been determined that the environmental consequences of the action are individually and cumulatively minor. General permits can be issued for a period of no more than five years. A letter of permission is a type of individual permit issued through an abbreviated processing procedure that includes coordination with relevant federal and state agencies. An individual (standard) permit must be obtained for a specific proposed activity that cannot be authorized under a general permit or letter of permission. These activities may have more than minimal individual or cumulative environmental impacts.

Related EPA and USACE regulations require the filling of wetlands and other waters of the United States to be avoided and minimized to the maximum extent practicable. Compensatory mitigation is required for unavoidable impacts to the waters of the United States. EPA and USACE have adopted regulations and guidelines that define compensatory mitigation and required mitigation plan contents, guide the determination of mitigation amounts, and address the timing of mitigation relative to impacts (33 CFR 332, Final Regional Compensatory Mitigation and Monitoring Guidelines of the South Pacific Division, January 12, 2015).

These regulations define “compensatory mitigation” as “the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, or, in certain circumstances, preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.” Mitigation options are preferred in the following order, from most preferred to least: mitigation bank credits, in-lieu fee program credits, and permit-responsible mitigation in consideration of a watershed approach. Compensatory mitigation should be commensurate with the amount and type of impact, and should be sufficient to replace the lost aquatic resource functions.

Mitigation plans must describe objectives, site selection criteria, site protection instruments, baseline information, credit determinations, mitigation work plan, maintenance plan, ecological performance standards, monitoring requirements, long-term management plan, adaptive management plan, and financial assurances. Generally, financial assurances are provided as either bonds or letters of credit, although other types may be acceptable. Financial assurances should in place before the permitted activity begins.

Section 9 of the Rivers and Harbors Act of 1899

Section 9 of the Rivers and Harbors Act of 1899 prohibits the construction of any dam or dike across any navigable water of the United States, without congressional consent and approval of the plans by the Chief of Engineers and the Secretary of the Army. Where the navigable portions of the waterbody lie wholly within the limits of a single state, the structure may be built under the authority of that state’s legislature, if the Chief of Engineers and the Secretary of the Army approve the location and plans or any modifications. Section 9 also pertains to

bridges and causeways, but the authority of the Secretary of the Army and Chief of Engineers over bridges and causeways was transferred to the Secretary of Transportation (U.S. Coast Guard) under the Department of Transportation Act of October 15, 1966.

Section 10 of the Rivers and Harbors Act of 1899

Through the regulatory program, USACE administers and enforces Section 10 of the Rivers and Harbors Act of 1899. Under Section 10, a permit is required for work or structures (e.g., levees or piers) in, over, or under navigable waters of the United States. Navigable waters of the United States are defined as waters that have been used in the past, are now used, or are susceptible to use for the transportation of interstate or foreign commerce up to the head of navigation. Typical activities requiring a permit include the installations of piers, docks, and other structures; dredging and excavation; and bank stabilization.

Section 14 of the Rivers and Harbors Act of 1899

Section 14 of the Rivers and Harbors Act (USC Title 33, Section 408 [33 USC 408], or "Section 408") states that the Secretary of the Army may, on recommendation of the Chief of Engineers, grant permission for the alteration or permanent occupation of a public work (e.g., a levee or dam) as long as that alteration or occupation is not injurious to the public interest and will not impair the usefulness of the work. Permission for certain alterations (which include changes to the authorized purpose, scope, or functioning of a project) must be obtained from USACE Headquarters. The primary focus of USACE's Section 408 review is to ensure there will be no impacts to the flood risk reduction system. For USACE projects with a nonfederal sponsor, that sponsor must provide a written Statement of No Objection if they are not the requester. Nonfederal sponsors typically have operations and maintenance responsibilities; have a cost-share investment in the USACE project; or hold the real property for the USACE project (or a combination).

In 2019, the USACE Sacramento District established 25 "categorical permissions" to expedite the review of Section 408 requests that are similar in nature and have similar impacts. Examples of these categorical permissions include wells, ditches and canals, bridges, roads, borrow areas, seepage and stability berms, and environmental restoration (e.g., plantings or placement of spawning gravels). For an alteration to be approved through a categorical permission, it must be consistent with the category's description, have no disqualifying circumstances (e.g., inducing floodplain development or causing a net loss in riparian habitat), and adhere to a set of standard engineering and environmental conditions.

U.S. Fish and Wildlife Service and National Marine Fisheries Service

Endangered Species Act

The purpose of the ESA is to protect and recover imperiled species and the ecosystems they depend on. Under the ESA, species may be listed as either endangered or threatened. Once a fish or wildlife species is listed as endangered or threatened under the federal ESA, the act prohibits take of the species. To "take" a species means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." "Harm" is

defined as an act that actually kills or injures wildlife, and can include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns. Listed plants are not protected from take.

In addition, the ESA prohibits the destruction or adverse modification of designated critical habitat. Designated critical habitat encompasses areas that are essential to the conservation of threatened and endangered species, and includes geographic areas "on which are found those physical or biological features essential to the conservation of the species and which may require special management considerations or protection" (ESA Section 3[5][A]). Generally, the USFWS (under the U.S. Department of the Interior) administers the ESA for terrestrial and freshwater species, and the NMFS (under the U.S. Department of Commerce) administers the ESA for marine and anadromous species.

Endangered Species Act Section 7

ESA Section 7(a)(2) requires federal agencies that are undertaking, funding, permitting, or authorizing actions to consult with USFWS or NMFS, or both, to ensure the action is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of designated critical habitat of such species. The issuance of a permit by a federal agency provides a federal nexus for a nonfederal agency action or project thus allowing ESA compliance through Section 7 consultation. For example, when issuing a CWA Section 404 permit, which may provide a federal nexus for at least a portion of a project, USACE would initiate Section 7 consultation with both USFWS and NMFS.

Section 7 consultations lead to the following general outcomes:

- If an action has no potential to affect species listed under the ESA or critical habitat, the federal agency undertaking or permitting the action makes a "no effect" determination and is not obligated to contact USFWS or NMFS for concurrence.

- Informal consultation and a concurrence letter from USFWS and/or NMFS are needed if the action may affect but is not likely to adversely affect ESA-listed species or critical habitat.

- Formal consultation is required if adverse effects to listed species or critical habitat are expected. If based on a biological assessment or equivalent document, the action is likely to adversely affect species listed under the ESA or critical habitat, a formal consultation occurs between the federal agency proposing the action (e.g., USACE) and USFWS and/or NMFS. Formal consultation concludes within 90 calendar days after all required information is provided unless the process is extended. USFWS or NMFS issues a biological opinion (BO) within 45 calendar days of the formal consultation's completion.

  - If the BO makes a "no jeopardy" finding for the ESA-listed species considered, incidental take may be authorized through an incidental take statement that sets forth "reasonable and prudent measures" and terms and conditions to minimize the potential take. Measures are considered reasonable and prudent when they are consistent with

the proposed action's basic design, location, scope, duration, and timing (50 CFR 402.14[i][v][2]).

- If the BO makes a "jeopardy" finding for the species, the BO must identify "reasonable and prudent alternatives" to prevent jeopardy or state why there are no alternatives. The federal agency proposing the action must consider the reasonable and prudent alternatives. If no reasonable and prudent alternatives exist, the federal agency with a nexus to the action or the project proponent may apply for an exemption from the Endangered Species Committee.

A consultation can be programmatic and lead to a programmatic BO. A programmatic consultation addresses an agency's multiple actions on a program or regional basis. A programmatic approach streamlines the procedures and time involved in consultations for broad agency programs or multiple similar, frequently occurring, or routine actions with predictable effects on listed species and/or critical habitat, thus reducing the amount of time spent on individual project-by-project consultations.

Endangered Species Act Section 10

Proponents of any activity without a federal nexus (e.g., through USACE or another federal agency) cannot consult under Section 7 of the ESA. Instead, ESA compliance for incidental take needs to be achieved under ESA Section 10(a)(1)(B), primarily through the preparation of a habitat conservation plan (HCP) and subsequent issuance of an incidental take permit. An HCP is a planning document prepared by a nonfederal party as part of an incidental take permit application for incidental take authorization. An HCP must include an assessment of impacts likely to result from the proposed taking of one or more federally listed species; measures to monitor, minimize, and mitigate impacts; funding for the proposed measures; and alternatives to the take being considered.

Upon an HCP's approval, USFWS or NMFS issues an incidental take permit. In addition to issuing the incidental take permit, USFWS and NMFS prepare a BO and provide appropriate NEPA documentation. HCPs can vary in their scale and complexity, from regional conservation plans for multiple parties and projects to Low-Effect HCPs for projects involving minor or negligible direct, indirect, and cumulative effects. Low-Effect HCPs do not require a NEPA document because the project must qualify for a categorical exclusion under NEPA. Unlike the Section 7 consultation process, there are no statutory limits on the duration of steps in the HCP development process.

Safe Harbor and Conservation Agreements

A Safe Harbor Agreement (SHA) is a tool available under the ESA. An SHA is a voluntary agreement between private or nonfederal landowners whose actions contribute to the recovery of listed species and USFWS or NMFS. Because only the landowner can enter into an SHA, a maintaining agency cannot obtain such an agreement with an easement for maintenance (as is typical for the California Department of Water Resources [DWR]).

Under an SHA, participating private and nonfederal property landowners voluntarily undertake activities on their property to enhance, restore, or maintain habitat benefiting listed species. SHAs and the subsequent enhancement of survival permits that are issued encourage property owners to implement conservation efforts for listed species. They are assured they will not be subjected to increased land use restrictions as a result of their efforts to attract listed species to their property or to increase the numbers or distribution of listed species already on their property. In 2016, NMFS completed its first SHA in the United States in the Dry Creek watershed. This was a partnership among NMFS, USACE, Sonoma County Water Agency, CDFW, and private landowners in the Dry Creek Valley, and supports the recovery of endangered coho salmon, and threatened Chinook salmon and steelhead.

A candidate conservation agreement is an agreement between landowners (including federal land management agencies) and USFWS or NMFS. A candidate conservation agreement covers species that are candidates for listing or are otherwise at risk. As part of this agreement, the landowner voluntarily commits to actions to reduce threats and help stabilize or restore a species, with the goal that listing will become unnecessary. A candidate conservation agreement with assurances provides regulatory assurances that if the candidate species becomes listed, the agreement becomes a permit authorizing the landowner's incidental take of the species. In 2016, USFWS and NMFS revised the candidate conservation agreement with assurances policy, to be clearer and more transparent about the level of conservation effort required for each candidate conservation agreement, and with assurances to be approved and be consistent with the criteria used for SHAs.

Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act makes it illegal to pursue, hunt, take, capture, kill, or sell birds that are listed in the act. Under certain circumstances, a waiver can be obtained that allows for these actions: for example, for hunting, scientific collection, and if required, to address a health or public safety concern.

State Authorizations

California Environmental Quality Act

Projects by public agencies and private entities that are subject to discretionary approvals by government agencies must go through the environmental review process required by the CEQA. CEQA defines a "project" as a "whole action" that may cause either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment. "Projects" consist of discretionary activity by a public agency, a private activity that receives public funding, or activities that involve the public agency's issuance of a discretionary approval and is not statutorily or categorically exempt (Public Resources Code Section 21065).

Flood management projects may qualify for CEQA exemptions under two categories: statutory exemptions or categorical exemptions. Statutory exemptions are created by the Legislature, and projects that fall under these are generally not subject to CEQA, regardless of their impact on the environment. Categorical exemptions are created through the regulatory process and will not apply if one of three conditions exist: there is a reasonable possibility of a significant effect on the environment; significant cumulative impacts from projects of the same type will result; or the project will impact a uniquely sensitive environment (CEQA Guidelines Sections 15300 to 15333). Projects that are exempt from CEQA are not necessarily exempt from other federal, state, or local permits and authorizations.

The following types of projects may be exempt from CEQA:

- Emergency repairs necessary to maintain service essential to the public health, safety, or welfare (Section 15269[b]).
- Maintenance dredging where the spoil is deposited in a spoil area authorized by all applicable federal and state regulatory agencies (Section 15304[g]).
- Repairs, maintenance, or minor alterations of existing public structures that involve negligible or no expansion of an existing use (Section 15301).

If a project does not qualify for an exemption, an initial study is initiated. The initial study is prepared by the lead agency (usually the city or county with primary jurisdiction over the project, but this may also be state agencies) to determine whether there may be a significant environmental impact. Depending on the initial study, a negative declaration (ND), mitigated negative declaration (MND), or environmental impact report (EIR) may be required. An ND is prepared when there is no substantial evidence that a significant effect on the environment will occur. An MND is prepared when conditions are attached to an ND stating revisions were made to the project to avoid potentially significant impacts, and there is no substantial evidence that the revised project will have a significant effect on the environment. An EIR is prepared when, based on substantial evidence, a project may have a significant environmental effect.

California Department of Fish and Wildlife

Lake and Streambed Alteration Agreement

Section 1600 of the California Fish and Game Code requires that project proponents (any person, state or local governmental agency, or public utility) notify the CDFW before conducting activities that will substantially obstruct or divert the natural flow of any river, stream, or lake; substantially change or use any material from the bed, channel, or bank of any river, stream, or lake; or deposit or dispose of debris, waste, or other material where it may pass into a river, stream, or lake. Following the notification, CDFW determines whether the planned activities require a lake or streambed alteration agreement (agreement) as described in California Fish and Game Code Sections 1600 to 1616. An agreement will be required if the project may substantially adversely affect an existing fish, wildlife, or plant resource, and will include measures necessary to protect those resources. There are different types of

agreements depending on the type of project and duration of the agreement (e.g., standard; long-term; gravel, sand, or rock extraction; routine maintenance). A master agreement covers multiple projects where specific detailed plans have not been prepared at the time of the original notification, and describes a procedure the entity must follow for construction, maintenance, or other covered projects.

The required content of a notification (i.e., application) includes the location (including site maps and aerial photos); a detailed description of the project (including timing and duration; construction equipment, plans, and specifications; volume and area of alterations such as material fill or removal; and permanent and temporary impacts to the waterway and associated habitats and vegetation); measures to protect fish, wildlife, and plant resources (including erosion control, avoidance and minimization measures, and compensatory measures); and a copy of the project's CEQA document and any other relevant biological resource documents or permits. CDFW may also require additional information and suggest ways to modify the project that would eliminate or reduce harmful effects to fish, wildlife, and plant resources.

Statutory requirements limit the duration of standard agreement development. Once a notification and the applicable fees have been received, CDFW has 30 calendar days to determine whether it is complete and to notify the applicant either that the application is complete or that additional information is required. Upon receipt of a complete application, CDFW provides the applicant with a draft agreement within 60 calendar days (California Fish and Game Code Section 1603[a]). The applicant then has 30 calendar days to accept, reject, or negotiate revisions to the draft agreement. If CDFW determines an activity may substantially adversely affect an existing fish or wildlife resource, an agreement will include reasonable measures to protect these resources. Reasonable measures can include best management practices and avoidance, minimization, and compensatory mitigation measures.

Protection of Bird Nests, Eggs, and Birds of Prey

Under Sections 3503 and 3503.5 of the California Fish and Game Code, it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, or to do so to any birds in the orders Falconiformes or Strigiformes (birds of prey). CDFW frequently includes conditions in lake and streambed alteration agreements, or suggests specific language for a CEQA document, to protect bird nests, eggs, and birds of prey. This language usually includes avoidance and minimization measures, including specified timing for tree and shrub removal and maintenance of no disturbance buffers, to protect all nesting birds.

Fully Protected Species

The California Fish and Game Code designates 37 fully protected species and prohibits the take or possession at any time of such species, with certain limited exceptions. State law defines "take" as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill" (California Fish and Game Code Section 86). This definition of take does not include habitat modification, harm, or harassment.

Fully protected species are described in California Fish and Game Code Sections 3511 (birds), 4700 (mammals), 5050 (reptiles and amphibians), and 5515 (fish). These code sections state that "…no provision of this code or any other law shall be construed to authorize the issuance of permits or licenses to take any fully protected [bird], [mammal], [reptile or amphibian], [fish]." Fully protected species in the Central Valley include the blunt-nosed leopard lizard, golden eagle, white-tailed kite, American peregrine falcon, bald eagle, California black rail, greater sandhill crane, and ring-tailed cat.

California Endangered Species Act

The CESA states that "all native species of fishes, amphibians, reptiles, birds, mammals, invertebrates, and plants, and their habitats, threatened with extinction and those experiencing a significant decline which, if not halted, would lead to a threatened or endangered designation, will be protected or preserved." CDFW works with all interested persons, agencies, and organizations to protect and preserve such sensitive resources and their habitats, and-prohibits activities that will result in take of State-of-California (State)-listed and candidate species without prior authorization. Section 86 of the California Fish and Game Code defines "take" as "hunt, pursue, catch, capture, or kill or attempt to hunt, pursue, catch, capture, or kill." CDFW may authorize the take of any such species if certain conditions are met.

CDFW may authorize take of State-listed and candidate species by issuing an MOU, SHA, voluntary local program, incidental take permit, consistency determination, or natural community conservation plan (NCCP). These mechanisms for authorizing incidental take are described below.

Native Plant Protection Act

In addition to CESA, plants designated as endangered are also protected under the Native Plant Protection Act (NPPA). The NPPA protects plants designated as endangered or rare. There are currently 64 species, subspecies, and varieties of plants that are protected as rare under the NPPA. The NPPA prohibits the take, possession, propagation, transportation, exportation, importation, or sale of endangered or rare native plants. However, it includes some exceptions for agricultural and nursery operations, emergencies, and in certain other situations. CDFW may authorize the take of any such species by permit pursuant to the conditions set forth in Fish and Game Code Section 2081, subdivisions (b) and (c) for endangered plants or California Code of Regulations, Title 14, Section 786.9, subdivision (b) for rare plants.

California Fish and Game Code Section 2081(a): Memorandums of Understanding

California Fish and Game Code Section 2081(a) includes MOUs. An MOU authorizes individuals, public agencies, universities, zoological gardens, and scientific or educational institutions to import, export, take, or possess endangered, threatened, or candidate species for scientific, educational, or management purposes.

California Fish and Game Code Section 2089.2–2089.26 Safe Harbor Agreements

SHAs authorize the incidental take of a species listed as endangered, threatened, candidate, or a rare plant, if the agreement is reasonably expected to provide a net conservation benefit to the species, among other provisions. SHAs are intended to encourage landowners to voluntarily manage their lands to benefit CESA-listed species. California SHAs are analogous to the federal SHA program, and CDFW has the authority to issue a consistency determination based on a federal SHA. The State program has the same limitations for use by DWR as described for the federal program ("Safe Harbor and Conservation Agreements" provides more details). Only a private landowner, not an easement holder, can initiate participation in the SHA program.

California Fish and Game Code Section 2081(b): Incidental Take Permit

A California Fish and Game Code Section 2081(b) incidental take permit may authorize the take of endangered, threatened, or candidate species if all of the following conditions are met:

> *"(1) the take is incidental to an otherwise lawful activity;*
>
> *(2) the impacts of the authorized take shall be minimized and fully mitigated. The measures required to meet this obligation shall be roughly proportional in extent to the impact of the authorized taking on the species, maintain the applicant's objectives to the greatest extent possible, and be capable of successful implementation;*
>
> *(3) the applicant shall ensure adequate funding to implement the minimization and mitigation measures and to monitor compliance with and effectiveness of those measures; and*
>
> *(4) [the] issuance of the permit will not jeopardize the continued existence of the species.*"

CDFW may determine that permanent protection and perpetual management of compensatory habitat is necessary and required, pursuant to CESA, to fully mitigate project-related impacts of the taking on the covered species. Determinations are based on factors such as the importance of that habitat in the project area, the extent to which covered activities will impact the habitat, and CDFW's estimate of the acreage required to provide to adequately mitigate the impacts of the taking. Compensatory habitat requirements may be met by purchasing species credits from a CDFW-approved conservation bank or through purchase, transfer, and/or permanent protection of habitat lands (including funding for monitoring and management in perpetuity).

If mitigation will not be completed before the start of activities that will affect CESA-listed species, a trust account or other form of security acceptable to CDFW must be established to ensure funding is available to carry out mitigation measures and monitoring requirements in case the applicant fails to complete these activities. CDFW generally requires the performance security to be in the form of an irrevocable letter of credit, surety bond, bank trust (or escrow) account, or another form of security approved in writing in advance by CDFW's Office of General Counsel.

Once an application and the applicable fees have been received, CDFW has 30 calendar days to determine whether it is complete and notify the applicant either that the application is complete or that additional information is required. If CDFW takes no action within 30 days of receipt, the application is deemed complete. CDFW may require supplementary information during the application review process after the application is determined to be complete, or is deemed complete. Upon receipt of a complete application, CDFW issues the permit either 90 calendar days from the lead agency's approval of the activity or 90 calendar days from the time the application was deemed complete, whichever is later (14 CCR Section 783.5[c][1]). CDFW may extend application processing an additional 60 calendar days from the later of the two dates as necessary, for 150 days total from the date of a complete application. Pursuant to State Bill (SB) 473 (Hertzberg, Ch. 329, Stats. 2018; Fish and Game Code Section 2081[e]), commencing January 1, 2019, CDFW is required to post each new incidental take permit issued on CDFW's website on the CESA Incidental Take Permitting Documents page.

California Fish and Game Code Section 2080.1: Consistency Determination

If a species is listed by both the federal ESA and CESA, Fish and Game Code Section 2080.1 allows an applicant who has obtained a federal incidental take statement (federal Section 7 consultation) or a federal incidental take permit (federal Section 10(a)(1)(B)) to request that the Director of CDFW find the federal documents consistent with CESA. If the federal documents are found to be consistent with CESA, a consistency determination is issued and no further authorization or approval is necessary under CESA.

Natural Community Conservation Plan

CDFW administrates the NCCP program pursuant to Sections 2800 to 2835 of the California Fish and Game Code (i.e., the Natural Community Conservation Planning Act of 2003), with the primary objective of conserving natural communities at the ecosystem level while accommodating compatible land use. CDFW may issue an incidental take permit authorizing the take of species covered in an NCCP, pursuant to California Fish and Game Code Section 2835. The NCCP development and permit processing phases do not have statutory timeframes, but the time required to complete NCCPs in the Sacramento region has been longer than five years. NCCPs are developed in coordination with HCPs that authorize the same covered activities.

Fish and Game Code Section § 2086: Voluntary Local Program

This program is designed to encourage farmers and ranchers that are engaged in agricultural activities to voluntarily enhance and maintain habitat for State-listed endangered, threatened, and candidate species. The regulations for implementing Voluntary Local Programs can be found in the California Code of Regulations Title 14 Section 786. The program was authorized by Senate Bill 231 (Costa 1997), which required CDFW, in cooperation with the California Department of Food and Agriculture, to adopt regulations to create locally designed voluntary programs for routine and ongoing agricultural activities on farms or ranches that will encourage habitat conservation and minimize the take of threatened, endangered, and candidate species, and wildlife in general. Farmers and ranchers who follow the wildlife-friendly agricultural practices prescribed by a voluntary local program receive an exemption from CESA's prohibition

against the take of certain State-listed endangered or threatened species. They may also withdraw from the program without penalty.

State Water Resources Control Board and Regional Water Quality Control Boards

Water Rights

A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, nonwasteful use. Under Sections 1200 and 1201 of the California Water Code, the diversion of surface water for a beneficial use is an appropriation of water and requires a water right permit. In California, water right permits or licenses are administered by the State Water Resources Control Board (State Water Board) Division of Water Rights. An application must be filed with the Division of Water Rights specifying the proposed project's course, place of use, purpose, and point(s) of diversion, as well as the quantity to be diverted. Additionally, applicants proposing changes to current water right permits or licenses must submit a change petition to the Division of Water Rights. Some diverters claim rights to divert independent of a permit, license, registration, or certification issued by the State Water Board, such as diversions under riparian or pre-1914 rights. These types of water rights can only be confirmed by the courts.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act governs water quality regulation in California. It is administered regionally, through the State Water Board and California's nine regional water quality control boards (regional water boards). The State Water Board is responsible for water rights and statewide water quality control plans and policies, whereas the regional water boards develop and enforce water quality control plans, called "Basin Plans," within their boundaries. The Systemwide Planning Area for the CVFPP falls within the Central Valley Regional Water Board's authority. The regional water boards have the authority to enforce the Basin Plan objectives by issuing and enforcing permits containing WDRs, which decide when the discharge is to take place, for how long, and how much waste is released into the water. WDRs under the Porter-Cologne Water Quality Control Act are issued for discharges of dredged or fill material to waters of the state.

Clean Water Act Section 401 and Section 402

The State Water Board and the regional water boards issue CWA Section 401 water quality certifications to applicants for a federal license or permit for activities that may result in a discharge into waters of the United States, including but not limited to the discharge or dredged or fill material, to ensure that State water quality standards are met. Applications for a water quality certification must be submitted to the State Water Board for projects that meet any of the following criteria:

- Fall under the jurisdiction of more than one regional water board.
- Involve or are associated with an appropriation of water (California Water Code Part 2, Division 2, Section 1200 et seq.).

- Involve or are associated with a hydroelectric facility, and the proposed activity requires a Federal Energy Regulatory Commission (FERC) license or amendment to a FERC license.
- Involve or are associated with any other diversion of water for domestic, irrigation, power, municipal, industrial, or other beneficial use.

Applications for all other water quality certifications are submitted to the regional water boards.

In April 2019, the State Water Board adopted the State Wetland Definition and Procedures for Discharges of Dredged or Fill Material to Waters of the State (formally known as the Wetland Riparian Area Protection Policy). These procedures went into effect in May 2020. The procedures consist of four major elements, including a wetland definition; a framework to determine whether a feature that meets the wetland definition is a water of the state; wetland delineation procedures; and procedures for the submittal, review, and approval of applications for water quality certifications and WDRs for dredge or fill activities.

In addition, the regional water boards have been delegated permitting authority for the NPDES permit program (i.e., CWA Section 402), which regulates point-source discharges to waters of the United States and State. "Point sources" are discrete conveyances, such as pipes or human-made ditches. Examples of pollutants include rock, sand, dirt, and agricultural, industrial, and municipal waste discharged into waters of the United States. Discharges regulated by the NPDES program include drinking water systems; stormwater discharges; sanitary sewer systems; pesticide applications; vessel discharges; and others. In California, NPDES permits are also referred to as WDRs that regulate discharges to waters of the United States.

The State Water Board also designates beneficial uses for water bodies and establishes water quality standards to protect those uses. Water quality monitoring data for California's surface waters is assessed every two years to determine whether pollutant levels violate protective water quality standards. If a pollutant exceeds the standard threshold, the waterbody and pollutant are placed on the 303(d) list. When a waterbody and pollutant are placed on the 303(d) list, a total maximum daily load is developed to address the impairment. Projects that may affect the total maximum daily load may have to comply with a regulatory program for that waterbody and pollutants. The Systemwide Planning Area includes water bodies on the 303(d) list.

State Office of Historic Preservation

National Historic Preservation Act

Historic properties are considered through the National Historic Preservation Act of 1966 (NHPA), as amended through 2016, and its implementing regulations. The NHPA establishes the federal government's policy on historic preservation and the programs, including the National Register of Historic Places (National Register), through which that policy is implemented. Under the NHPA, historic properties include "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on, the National Register" (54 USC

300308). Types of cultural resources that may qualify as historic properties include artifacts, records, and material remains relating to the district, site, building, structure, or object.

Under Section 106 of the NHPA (Section 106), before implementing an undertaking (e.g., issuing a federal permit), federal agencies must consider the effects of the undertaking on historic properties, in consultation with the SHPO, Native American Tribes, and other interested parties (e.g., historical societies or groups with potential ties to historic properties that could be affected by an undertaking). Section 106 applies when two thresholds are met: there is a federal or federally licensed action, including grants, licenses and permits; and the action has the potential to affect properties listed on or eligible for listing on the National Register.

In addition, the agencies must also afford the Advisory Council on Historic Preservation and the SHPO a reasonable opportunity to comment on any undertaking that would adversely affect properties eligible for listing in the National Register. Section 101(d)(6)(A) of the NHPA allows properties of traditional religious and cultural importance to a Native American Tribe or Native Hawaiian organization to be determined eligible for inclusion in the National Register.

Central Valley Flood Protection Board

Encroachment Permit Program

The Central Valley Flood Protection Board (CVFPB) is the regulatory agency responsible for ensuring the State and federal levees and the facilities of the State Plan of Flood Control are operated and maintained in a manner that reduces the risk of catastrophic flooding. The CVFPB is required to enforce, on behalf of the State, the erection, maintenance, and protection of levees, embankments, and channel rectification. In accordance with California Water Code Section 8608, the CVFPB is charged with establishing and enforcing standards for the operations and maintenance of levees, channels, and other flood control works of an authorized project or an adopted plan, including standards for encroachment, construction, vegetation, and erosion control.

An encroachment permit is required for any work to be done in or near a regulated stream, designated floodway, or on any federal flood control project levee to include the area 10 feet landward of the landside levee toe. As part of the permitting process, letters are sent to adjacent landowners to ensure there are no flood control concerns related to the proposed project. In addition, the permit application is sent to the USACE Levees and Channels Branch (Section 408) for their review and comment. Encroachment permits are subject to conditions the CVFPB deems reasonable and appropriate, and conditions requested by USACE or the local maintaining agency. The issuance of an encroachment permit requires review for compliance with CEQA, and no proposed project or work will be approved and issued an encroachment permit until the requirements of CEQA have been met.

California State Lands Commission

The California State Lands Commission (SLC) has jurisdiction and management control over certain public lands the State received from the United States. When California became a state in 1850, it acquired approximately 4 million acres of land underlying its navigable and tidal waterways. Known as sovereign or Public Trust lands, these lands include the beds of California's navigable natural rivers, lakes, streams, bays, estuaries, inlets, and straits, as well as the State's tidal and submerged lands along California's more than 1,100 miles of coastline and offshore islands, from the mean high-tide line to three nautical miles offshore. A lease from the SLC is required if an action plans to use or construct any type of structure on lands under the SLC's jurisdiction, or develop any resources or minerals located on, or otherwise occupying any lands under the SLC's jurisdiction.

The issuance of any SLC lease, permit, or other entitlement for use of State lands, is reviewed for compliance with CEQA. Additionally, if the application involves lands found to contain "significant environmental values" within the meaning of Public Resources Code Section 6370 et seq., the consistency of the proposed use with the identified values must also be determined through the CEQA review process. Pursuant to its regulations, the SLC may not issue a lease for use of "significant lands" if such proposed use is detrimental to the identified values. In 2018, the SLC adopted a comprehensive environmental justice policy intended to improve public access to open space and recreation for disadvantaged or marginalized communities, achieve more equity in the distribution of environmental benefits and burdens, and increase inclusive decision-making.

Delta Stewardship Council

The Delta Stewardship Council is a state agency established by the Sacramento–San Joaquin Delta Reform Act of 2009 to create a comprehensive, long-term management plan for the Sacramento–San Joaquin Delta (Delta Plan), which was formally adopted by the Delta Stewardship Council in 2013. The Delta Plan has two co-equal goals: providing a more reliable water supply for California; and protecting, restoring, and enhancing the Delta ecosystem. The Delta Plan includes policies, recommendations, and performance measures that are enforceable through regulatory authority in the Delta Reform Act of 2009, which requires state and local agencies to be consistent with the Delta Plan. State and local agencies proposing to undertake a project covered by the Delta Plan must prepare and file a consistency determination with the Delta Stewardship Council demonstrating the project is consistent with requirements in the Delta Plan. Any person may challenge a consistency determination by bringing an appeal to the Delta Stewardship Council no later than 30 calendar days after the submission of the certification of consistency. If there are no appeals, the State or local public agency may proceed to implement the covered action.

Other StateAuthorization

In addition to obtaining state permits under the programs listed here, future projects may need to comply with other permitting requirements, including the following:

- Surface Mining and Reclamation Act.
- California Wild and Scenic Rivers Act.
- California air pollution control laws.

Flood management projects undertaken by federal entities generally are not subject to state authorizations.

Local Authorizations

Flood management activities may also require local authorizations, including the following:

- Grading permits.
- Tree removal permits.
- Burning permits.

However, flood management projects undertaken by federal or state entities generally are not subject to local authorizations.

Appendix E
Mitigation Availability

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APPENDIX E

Mitigation Availability

Acronym	Definition
CVFPP	Central Valley Flood Protection Plan
DWR	California Department of Water Resources
RIBITS	Regulatory In-Lieu Fee & Bank Tracking System
SPFCC	State Plan of Flood Control

This appendix describes the status of advance mitigation projects funded by the California Department of Water Resources (DWR) to support implementation of the Central Valley Flood Protection Plan (CVFPP) and the Conservation Strategy. It also describes the availability of compensatory mitigation at mitigation and conservation banks for the Conservation Strategy's target habitats and species.

As described in the 2016 Conservation Strategy (DWR 2016), when compensatory mitigation is not available, project approvals and construction can be delayed by the lengthy procedures involved in mitigation development. Such procedures can entail legal, financial, planning, and restoration implementation actions. In addition to project delays and inflated costs, habitat can be lost between the time when projects are constructed and the time when habitat is re-established. The resulting mitigation may have less long-term viability and may be more poorly integrated with regional conservation priorities than mitigation developed in advance for multiple projects.

In light of these issues related to mitigation availability, DWR funded several projects from 2012 to 2020 to mitigate the future effects of State Plan of Flood Control (SPFC) improvements, many of which have not yet been identified. DWR prepared funding guidelines for such advance mitigation projects and issued a Proposal Solicitation Package in 2012. This package solicited proposals to mitigate unavoidable impacts from the future evaluation, repair, reconstruction, or replacement of SPFC levees, weirs, bypasses, and other facilities. Four advance mitigation projects were funded. Each project was carefully selected in collaboration with the wildlife resource agencies to meet the expected mitigation needs for future improvements to SPFC facilities. DWR also made direct expenditures to secure mitigation credits in advance of project mitigation needs and impacts.

As Table E-1 describes, four projects were funded; mitigation credits are available from two of these four projects and are anticipated to soon be available from a third. It is uncertain when the fourth project will provide mitigation credits.

Table E-1. Advance Mitigation Projects and Mitigation/Conservation Banks Funded 2012–2020

Project Title and Applicant	Proposal Process (Total Project Cost)	Project Description and Status as of November 1, 2020
Grasslands Mitigation Bank *Westervelt Ecological Services*	Direct expenditure $4,164,000, of which $3,164,000 is from Proposition 1E[a] *($9,050,372)*	This 281-acre mitigation bank in the San Joaquin Valley is to provide 130 giant gartersnake credits (from USFWS and CDFW), which will be used to offset impacts on giant gartersnakes from SPFC and Delta Levees Program activities. **This project is complete.** DWR has received the giant gartersnake credits, which are available for use by projects in the bank's service area.
Hidden Valley Ranch Acquisition *Reclamation District 2092*	Direct expenditure $3,900,000 from Proposition 1E and direct expenditure amendment of existing agreement $2,400,000 $3,000,000 from Wildlife Conservation Board, Proposition 1E *($9,300,000)*	The acquisition of this 497-acre property in the lower San Joaquin River Conservation Planning Area adds to the flood benefits currently being realized at the adjacent Dos Rios Ranch and the San Joaquin River National Wildlife Refuge. Approximately 191 acres of this property could be used for advance mitigation. Cumulatively, these properties will provide river-floodplain connectivity to more than 1,000 acres, absorb approximately 10,000 acre-feet of floodwaters, and increase flood protection for downstream communities. Phase 2 will focus on achieving mitigation. **The project is in progress.** The land acquisition is complete. It has not yet been determined how ecological enhancements at the site will be developed into mitigation credits.

Project Title and Applicant	Proposal Process (Total Project Cost)	Project Description and Status as of November 1, 2020
Bullock Bend Mitigation Bank *Westervelt Ecological Services*[b]	State contracting process: secondary request for proposals to the original PSP $4,656,867.50 *(Unknown)*	This 119.65-acre mitigation bank along the Sacramento River created 116.15 acres of salmonid (for 4 ESU and steelhead) (NMFS and CDFW credits), floodplain (USACE, NMFS, and CDFW credits), riparian (USCACE, NMFS, and CDFW), and Swainson's hawk foraging and nesting credits (CDFW), 57.5 credits of which are reserved for DWR to offset impacts from SPFC activities along the Sacramento River. **This project is complete.** The bank has met performance standards over a period of time. DWR has received all 57.5 salmonid credits and several credits have been used by projects in the bank's service area.
Feather River Conservation Bank *Three Rivers Levee Improvement Authority*	PSP (grant) of $4,440,000 and a direct expenditure from State of California General Fund *($6,482,501)*	Funding is to enhance 500 acres of a 1,600 -acre levee setback area by creating mixed riparian habitats. This project is expected to generate advance mitigation credits from CDFW (for riparian habitat and possibly for western yellow-billed cuckoo) and USFWS (for valley elderberry longhorn beetle and possibly for western yellow-billed cuckoo). **Planting for this project is complete.** The 500 acres have been planted in mixed riparian forest and scrub. Discussions are ongoing with CDFW and USFWS to finalize bank documents that will provide assurances of mitigation credits at the site from CDFW (riparian to mitigate for Section 1600 impacts) and USFWS (VELB).

Source: California Department of Water Resources 2016

[a] $1 million of the $4,164,000 was provided by the Delta Levees Program

[b] Project originally approved under the PSP, but it was withdrawn and then resubmitted as a direct expenditure.

Notes:
CDFW = California Department of Fish and Wildlife
DWR = California Department of Water Resources
ESU = Evolutionarily Significant Unit
NMFS = National Marine Fisheries Service
PSP = proposal solicitation package
SPFC = State Plan of Flood Control
TRLIA = Three Rivers Levee Improvement Authority
USACE = U.S. Army Corps of Engineers
USFWS = U.S. Fish and Wildlife Service
VELB = valley elderberry longhorn beetle

These projects represent a considerable contribution to the supply of mitigation for flood projects and operations and maintenance. Furthermore, by funding the mitigation projects in Table E-1, DWR has secured a supply of mitigation credits that is allocated and tracked by DWR staff, providing DWR project managers with certainty regarding the availability and cost of these types of mitigation.

Table E-2 summarizes the mitigation credits available from conservation and mitigation banks in October 2021 for the target habitats (riparian, shaded riverine aquatic, marsh, and other wetland habitats) and the federally listed or State-listed target species of this Conservation Strategy. Several different types of credits could apply to each target habitat and species; these credit types are listed in Table E-2 along with the banks that provide them. These tables are based on the credits listed as available in the Regulatory In-Lieu Fee & Bank Tracking System (RIBITS) (U.S. Army Corps of Engineers 2021). Available credits change as projects purchase credits and as new banks are approved and credits released, but the credits available on October 22, 2021, summarized in Tables E-2 and E-3, indicate the general level of credit availability.

Table E-2. Available Compensatory Mitigation for Target Habitats and Federally Listed or State-listed Species Available at Mitigation and Conservation Banks

Category	Credit Type	Credits[a]	Notes
Species	Giant gartersnake	181	Colusa Basin Mitigation Bank (SV), Gilsizer Slough South Giant Gartersnake Conservation Bank (SV), Grasslands Mitigation Bank (SJV), Ridge Cut Giant Garter Snake Conservation Bank (SV), Sutter Basin Conservation Bank (SV)
	Salmonid	4	Bullock Bend Mitigation Bank (SV)
	Salmonid (preservation)	55	Liberty Island Conservation Bank (SV)
	Salmonid (restoration)	2	Liberty Island Conservation Bank (SV)
	Swainson's hawk	859	Laguna Creek Mitigation Bank (SV)[c], Meridian Ranch Mitigation Bank (SV)[c], Van Vleck Ranch Mitigation Bank (SV)[c]
	Swainson's hawk nesting tree use (restored)	2	Bullock Bend Mitigation Bank (SV)
	Tricolored blackbird	17	Antonio Mountain Ranch Mitigation Bank (SV)[c], SMUD Nature Preserve Mitigation Bank (SV)[c]

Category	Credit Type	Credits[a]	Notes
Species	Valley elderberry longhorn beetle	1,060	Laguna Creek Mitigation Bank (SV), French Camp Conservation Bank (SJV), Nicolaus Ranch VELB Conservation Bank (SV), River Ranch VELB Conservation Bank (SV), Stillwater Plains Mitigation Bank (SV)[c] One credit is approximately 1,800 square feet
Habitats	Seasonal wetland[b]	31	Colusa Basin Mitigation Bank (SV), Grasslands Mitigation Bank (SJV), Laguna Creek Mitigation Bank (SV)[c] Does not include vernal pools or seasonal wetlands of vernal pool landscapes
	Seasonal wetland (Preservation)	Less than 1	SMUD Nature Preserve Mitigation Bank (SV)[c]
	Emergent marsh (federal)	Less than 1	Stillwater Plains Mitigation Bank (SV)[c]
	Emergent marsh (nonfederal)	Less than 1	Stillwater Plains Mitigation Bank (SV)[c]
	Emergent marsh creation	Less than 1	Stillwater Plains Mitigation Bank (SV)[c]
	Floodplain mosaic wetland (re-establishment)	4	Cosumnes Floodplain Mitigation Bank (SV)
	Freshwater emergent marsh (preservation)	8	Elsie Gridley Mitigation Bank
	Freshwater emergent marsh	1	Seigler Valley Wetland Mitigation (SV)[c]
	Freshwater marsh complex (creation)	8	River Ranch Wetland Mitigation Bank (SV)
	Open water (preservation)	4	SMUD Nature Preserve Mitigation Bank (SV)[c]
	Riparian (preservation)	5	Noonan Ranch Conservation Bank (SV), SMUD Nature Preserve Mitigation Bank (SV)[c]
	Riparian (creation)	Less than 1	Beach Lake Mitigation Bank (SV), River Ranch Wetland Mitigation Bank (SV)
	Riparian 404 (establishment)	4	Markham Ravine – Western Placer County ILF Site, Seigler Valley Wetland Mitigation (SV)[c]
	Riparian floodplain forest	15	Fremont Landing Conservation Bank (SV)
	SRA (re-establishment)	13,803	Cosumnes Floodplain Mitigation Bank (SV) Credit units are linear feet

Category	Credit Type	Credits[a]	Notes
Habitats	SRA preservation	32,758	Cosumnes Floodplain Mitigation Bank (SV) Credit units are linear feet
Groups	Swainson's hawk and burrowing owl	177	Dolan Ranch Conservation Bank (SV), Elsie Gridley Mitigation Bank (SV)
	Delta smelt and longfin smelt	7	Liberty Island Conservation Bank (SV)
	Open water and tricolored blackbird	Less than 1	SMUD Nature Preserve Mitigation Bank (SV)[c]
	Perennial stream (CDFW enhancement) and tricolored blackbird habitat	2	Antonio Mountain Ranch Mitigation Bank (SV)[c]
	Salmonid, floodplain riparian, and Swainson's hawk nest buffer (enhanced)	10	Bullock Bend Mitigation Bank (SV)
	Salmonid, floodplain riparian, and Swainson's hawk nest buffer (re-established)	10	Bullock Bend Mitigation Bank (SV)
	Salmonid and riverine riparian (enhanced)	Less than 1	Bullock Bend Mitigation Bank (SV)
	Salmonid and riverine riparian (re-established)	18	Bullock Bend Mitigation Bank (SV)
	Salmonid, riverine riparian, and Swainson's hawk nest buffer (re-established)	35	Bullock Bend Mitigation Bank (SV)
	Swainson's hawk foraging and tricolored blackbird foraging	14	Antonio Mountain Ranch Mitigation Bank (SV)[c]
	Riparian floodplain forest and off-channel SRA habitat	8	Fremont Landing Conservation Bank (SV)
	Riparian floodplain forest and riverbank SRA habitat	Less than 1	Fremont Landing Conservation Bank (SV)
	Tule marsh SRA and salmonid-smelt restoration	Less than 1	Liberty Island Conservation Bank (SV)

Source: U.S. Army Corps of Engineers 2021.

[a] Credit units are acres unless otherwise noted.
[b] Does not include seasonal wetlands of banks in vernal pool landscapes.
[c] Located outside of the Systemwide Planning Area.

Notes:
SJV = San Joaquin Valley
SRA = shaded riverine aquatic
SV = Sacramento Valley

Table E-3. Summary of Available Compensatory Mitigation by Target Habitats and Species

Habitat[a]	Species[a]	Credits[b]
Riparian Habitat	Acres	109
SRA Habitat	SRA—acres	9
	SRA—miles	8.8
Marsh and Other Wetlands Habitat	Marsh—acres	19
	Seasonal wetlands—acres	32
	Floodplain wetland mosaic—acres	4
Species—Acres	Delta button-celery	0
	Valley elderberry longhorn beetle[c]	1,060
	Green sturgeon	0
	Salmonids	135
	Delta smelt	7
	Giant gartersnake	181
	Bank swallow	0
	California black rail	0
	Greater sandhill crane	0
	Least Bell's vireo	0
	Tricolored blackbird	20
	Swainson's hawk—nest tree and nest buffer	57
	Swainson's hawk—foraging	1,050
	Western yellow-billed cuckoo	0
	Riparian brush rabbit	0
	Riparian woodrat	0

Source: U.S. Army Corps of Engineers 2021.

[a] Only federally listed or State-listed target species are included in the table.
[b] Credit types grouped at the bank are included in totals for each species or habitat in the group.
[c] Unit is approximately 1,800 square feet.

Note:
SRA = shaded riverine aquatic

Despite the mitigation provided by DWR-funded mitigation projects, there is limited mitigation available to compensate for unavoidable impacts on this Conservation Strategy's target habitats and species. As Table E-3 shows, mitigation credits are not available for half of the target species; and as Table E-2 shows, the vast majority of available mitigation is located in the

Sacramento Valley, with much less mitigation available in the San Joaquin Valley. Although many established banks have the potential to develop and release additional credits, these are at the same locations and generally of the same types as currently available credits. Therefore, future credit releases will not provide additional types or geographic availability of mitigation. Furthermore, much of the available mitigation is located relatively far from the major rivers, bypasses, and floodplains of the Sacramento and San Joaquin rivers, and thus may not be acceptable as mitigation for the impacts of flood projects.

In summary, the advance mitigation projects funded by DWR have made a considerable contribution to the supply of mitigation available for mitigating unavoidable impacts of flood projects. However, the supply remains limited and multiple types of mitigation are not available in many areas. Consequently, given the current state of mitigation availability, mitigation planning and development will likely continue to complicate project implementation, increase project costs, and lengthen project schedules. These impediments to implementing the CVFPP could be reduced by funding additional advance mitigation projects, and tracking of anticipated demand for mitigation and its supply could focus this funding on the most needed types of mitigation.

References

California Department of Water Resources. 2016. *Central Valley Flood Protection Plan Conservation Strategy*. Sacramento (CA).

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