

Attachment 3F.1

Compensatory Mitigation Design Parameters

3F.1.1 Design Commitments and Guidelines

This attachment provides design commitments and guidelines for compensatory mitigation of impacts analyzed in the Final Environmental Impact Report (EIR) for special-status natural communities, wetland and other waters, and special-status species (Chapter 12, *Fish and Aquatic Resources*, and Chapter 13, *Terrestrial Biological Resources*). Avoidance and minimization measures that would apply during construction of the project (including but not limited to construction of the compensatory mitigation sites themselves) are contained in Appendix 3B, *Environmental Commitments and Best Management Practices*.

Table 3F.1-1. Summary List of Compensatory Mitigation Design Commitments and Guidelines

Number	Biological Resource
CMP-0	General Design Guidelines
CMP-1	Tidal Perennial Aquatic Habitat
CMP-2	Tidal Freshwater Emergent Wetlands
CMP-3	Valley/Foothill Riparian Habitat
CMP-4	Nontidal Perennial Aquatic Habitat
CMP-5	Nontidal Freshwater Perennial Emergent Wetland
CMP-6	Nontidal Brackish Emergent Wetland
CMP-7	Alkaline Seasonal Wetland Complex
CMP-8	Vernal Pool Complex
CMP-9	Special-Status Plants
CMP-10	Mason's Lilaeopsis
CMP-11	Vernal Pool Aquatic Invertebrate Habitat
CMP-12	Valley Elderberry Longhorn Beetle Habitat
CMP-13	California Tiger Salamander Habitat
CMP-14	California Red-Legged Frog Habitat
CMP-15	Giant Garter Snake Habitat
CMP-16	Western Yellow-Billed Cuckoo Habitat
CMP-17	California Black Rail Habitat
CMP-18	Sandhill Crane Habitat
CMP-19	Swainson's Hawk Nesting and Foraging Habitat
CMP-20	Occupied Burrowing Owl Habitat
CMP-21	Least Bell's Vireo
CMP-22	Tricolored Blackbird Habitat
CMP-23	Tidal Perennial Habitat Restoration for Construction Impacts on Habitat for Fish and Aquatic Resources

Number	Biological Resource
CMP-24	Channel Margin Habitat Restoration for Construction Impacts on Habitat for Fish and Aquatic Resources
CMP-25	Tidal Habitat Restoration to Mitigate North Delta Hydrodynamic Effects on Chinook Salmon Juveniles
CMP-26	Channel Margin Habitat Restoration for Operations Impacts on Chinook Salmon Juveniles
CMP-27	Tidal Perennial Habitat Restoration for Operations Impacts on Delta Smelt
CMP-28	Tidal Perennial Habitat Restoration for Operations Impacts on Longfin Smelt
CMP-29	Crotch Bumble Bee Habitat

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2 **Table 3F.1-2. Design Commitments and Guidelines for Compensatory Mitigation of Natural**
3 **Communities, Wetlands, and Other Waters**

Number	Habitat	Detailed Description of Measure or Design Guideline
CMP-0	General Design Guidelines	These design guidelines will address critical life functions for special-status species. It will also include a framework to ensure that any substantial habitat loss or conversion associated with compensatory mitigation site development are offset so that there would be no net loss in habitat value for special-status species. Any compensatory mitigation to offset habitat losses (associated with the implementation of compensatory mitigation projects) would be constructed prior to or concurrent with the impact.
CMP-1	Tidal Perennial Aquatic Habitat	Tidal perennial aquatic habitat will be created or acquired and permanently protected to compensate for project impacts to ensure no significant loss of tidal perennial aquatic habitat functions and values. A restoration and monitoring plan will be developed and implemented concurrently with project construction. The plan will describe how tidal perennial aquatic habitat will be created and monitored, including funding mechanisms and appropriate long-term management measures, and agency reporting requirements. See Section 3F.4.3, <i>Tidal Habitat Mitigation Framework</i> ; Section 3F.5, <i>Assurances</i> ; Section 3F.6, <i>Maintenance and Management</i> ; and Section 3F.7, <i>Performance Standards and Monitoring</i> , for additional details.
CMP-2	Tidal Freshwater Emergent Wetland	Tidal freshwater emergent wetland will be created or acquired and permanently protected to compensate for project impacts to ensure no significant loss of tidal freshwater emergent wetland functions and values. A restoration and monitoring plan will be developed and implemented concurrently with project construction. The plan will describe how tidal freshwater emergent wetland will be created and monitored, including funding mechanisms and appropriate long-term management measures, and agency reporting requirements.

Number	Habitat	Detailed Description of Measure or Design Guideline
CMP-3	Valley/Foothill Riparian Habitat	Valley/foothill riparian habitat will be created or restored and permanently protected to compensate for project impacts to ensure no significant loss of valley/foothill riparian habitat functions and values. In addition, valley/foothill riparian habitat will be acquired and permanently protected to further compensate for project impacts. A restoration and monitoring plan will be developed and implemented concurrently with project construction. The plan will describe how valley/foothill riparian habitat will be created and monitored, including funding mechanisms and appropriate long-term management measures, and agency reporting requirements.
CMP-4	Nontidal Perennial Aquatic Habitat	Nontidal perennial aquatic habitat will be created or acquired and permanently protected to compensate for project impacts to ensure no significant loss of nontidal perennial aquatic habitat functions and values. A restoration and monitoring plan will be developed and implemented concurrently with project construction. The plan will describe how nontidal perennial aquatic habitat will be created and monitored, including funding mechanisms and appropriate long-term management measures, and agency reporting requirements.
CMP-5	Nontidal Freshwater Perennial Emergent Wetland	Nontidal freshwater perennial emergent wetland will be created or acquired and permanently protected to compensate for project impacts to ensure no significant loss of nontidal freshwater perennial emergent wetland functions and values. In addition, nontidal freshwater perennial emergent wetland will be acquired and permanently protected to further compensate for project impacts. A restoration and monitoring plan will be developed and implemented concurrently with project construction. The plan will describe how nontidal freshwater perennial emergent wetland will be created and monitored, including funding mechanisms and appropriate long-term management measures, and agency reporting requirements.
CMP-6	Nontidal Brackish Emergent Wetland	Nontidal brackish emergent wetland will be created or acquired and permanently protected to compensate for project impacts to ensure no significant loss of nontidal brackish emergent wetland functions and values. In addition, nontidal brackish emergent wetland will be acquired and permanently protected to further compensate for project impacts. A restoration and monitoring plan will be developed and implemented concurrently with project construction. The plan will describe how nontidal brackish emergent wetland will be created and monitored, including funding mechanisms and appropriate long-term management measures, and agency reporting requirements. This mitigation measure does not apply to Alternatives 1, 2a, 2b, and 2c.
CMP-7	Alkaline Seasonal Wetland Complex	Alkaline seasonal wetland complex will be created or acquired and permanently protected to compensate for project impacts to ensure no significant loss of alkaline seasonal wetland complex functions and values. In addition, alkaline seasonal wetland complex will be acquired and permanently protected to further compensate for project impacts. A restoration and monitoring plan will be developed and implemented concurrently with project construction. The plan will describe how alkaline seasonal wetland complex will be created and monitored, including funding mechanisms and appropriate long-term management measures, and agency reporting requirements.

Number	Habitat	Detailed Description of Measure or Design Guideline
CMP-8	Vernal Pool Complex	Vernal pool complex will be created or acquired and permanently protected to compensate for project impacts to ensure no significant loss of vernal pool complex functions and values. In addition, vernal pool complex will be acquired and permanently protected to further compensate for project impacts. A restoration and monitoring plan will be developed and implemented concurrently with project construction. The plan will describe how vernal pool complex will be created and monitored, including funding mechanisms and appropriate long-term management measures, and agency reporting requirements.

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2 **Table 3F.1-3. Design Commitments and Guidelines for Compensatory Mitigation to Compensate for**
3 **Loss of Special-Status Species Habitat**

Number	Species Habitat	Detailed Description of Measure or Habitat Design Guideline
CMP-9	Special-Status Plants	Impacts on special-status plants and their habitat will be offset through restoration of suitable habitat. Suitable habitat is defined as habitat that currently supports the species for which mitigation is being implemented or meets habitat requirements for the species, as identified in the species models used in the impact analysis. Habitat requirements for the species include consideration of factors such as the natural community types associated with the species, soil map units associated with the species, and whether the species is or was known to occur at the proposed mitigation site. Suitable habitat also includes habitat that historically supported the species for which mitigation is being implemented, so long as a good-faith effort is made to identify and address those factors that contributed to the species' absence. In addition to addressing those factors that likely resulted in local extirpation (e.g., ranching, mowing, disking, altered hydrology, presence of invasive species). Reestablishing a plant species into suitable, historically supported habitat may include actions such as transplanting, propagation of seed, weed abatement, restoration of microtopography, and siting near existing occurrences. If propagation of seed is used, it will be conducted with consideration of maintenance of genetic diversity. Any propagation material would be sourced from the population affected by the project. Mitigation habitat will consist of existing, off-site suitable habitat acquired in-fee, through conservation easements, or from a certified conservation bank. Mitigation habitat will consist of existing, off-site suitable habitat acquired in fee, through conservation easements, or from a certified conservation bank. At least 2 acres of habitat will be restored and protected for every 1 acre that would be lost. A restoration and monitoring plan will be developed and implemented concurrently with project construction. The plan will include success criteria, specify the length of the monitoring period, and contain assurances of implementation, monitoring, and maintenance. Restored special-status plant habitat will be carried out concurrently with sensitive natural community mitigation and sited in areas near extant populations of the affected species that could provide vegetative or seed propagules. Restored habitat will be sited in locations subject to CDFW approval. The mitigation habitat will be monitored annually to verify that the habitat suitability is maintained. Annual monitoring reports will be submitted to CDFW for review and determination that the project remains in compliance with the mitigation.

Number	Species Habitat	Detailed Description of Measure or Habitat Design Guideline
CMP-10	Mason's Lilaeopsis	Impacts on Mason's lilaeopsis habitat will be offset through restoration of suitable habitat. Restored Mason's lilaeopsis habitat will be a subset of tidal restoration mitigation and sited in areas near extant populations of Mason's lilaeopsis that could provide vegetative or seed propagules. Restored habitat will be sited in locations subject to CDFW approval.
CMP-11	Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp Habitat	Compensatory mitigation for vernal pool fairy shrimp and vernal pool tadpole shrimp habitat directly or indirectly affected will consist of the preservation of habitat and the creation of habitat at either a USFWS-approved mitigation bank or at a non-bank site approved by USFWS supporting habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp. Mitigation at a non-bank location will be prioritized in the Altamont Hills recovery area, which is one of the core recovery areas identified in the <i>Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon</i> (U.S. Fish and Wildlife Service 2005).
CMP-12	Valley Elderberry Longhorn Beetle Habitat	Generally following the guidance in USFWS's <i>Framework for Assessing Impacts on Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)</i> (U.S. Fish and Wildlife Service 2017a), the permanent loss of suitable riparian habitat will be offset with riparian creation and enhancement consistent with the restoration guidance in the Framework. All temporarily affected areas will be restored on-site and where on-site restoration is not possible the habitat will be replaced. All elderberry shrubs that are 1 inch or more in diameter at ground level in riparian habitat that will be affected will be transplanted to mitigation areas identified in the CMP. All elderberry shrubs in non-riparian areas that will be affected will be transplanted to mitigation areas identified in the CMP if they contain exit holes. All transplanted shrubs will be monitored and adaptively managed for survivorship as part of the site-specific maintenance and management plan and the monitoring and adaptive management plan as described in Section 3F.7 and Section 3F.6.4, <i>Adaptive Management</i> , respectively.
CMP-13	California Tiger Salamander Habitat	To the extent possible, California tiger salamander habitat protection will be located in a mitigation bank (with a service area that overlaps with the impact area) or other site protection instrument in the geographically appropriate management unit of the Central Valley, which is identified in USFWS's <i>Recovery Plan for the Central California Distinct Population Segment of the California Tiger Salamander (Ambystoma californiense)</i> (U.S. Fish and Wildlife Service 2017b). If a mitigation bank is not used, land acquisition for California tiger salamander will be prioritized based on the following characteristics. • Large contiguous landscapes that consist of grasslands, vernal pool complex, and alkali seasonal wetland complex and encompass the range of vegetation, hydrologic, and soil conditions that characterize these communities. • Lands that maintain connectivity with protected grassland, vernal pool complex, and alkali seasonal wetland complex landscapes near proposed construction sites, including connectivity with lands that have been protected or may be protected in the future under the East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan. • Grasslands containing stock ponds and other aquatic features that provide aquatic breeding habitat for California tiger salamander.

Number	Species Habitat	Detailed Description of Measure or Habitat Design Guideline
		• Adjacent or connected to occupied California tiger salamander upland or aquatic habitat.
CMP-14	California Red-Legged Frog Habitat	To mitigate for the loss of California red-legged frog aquatic and upland habitat, DWR will protect suitable habitat. California red-legged frog aquatic breeding and upland habitat will be prioritized for protection within the East San Francisco Bay core recovery area as described in the <i>Recovery Plan for the California Red-Legged Frog (Rana aurora draytonii)</i> (U.S. Fish and Wildlife Service 2002), at a location subject to USFWS approval. All lands protected and restored for compensation of effects on California red-legged frog habitat will be protected and managed in perpetuity. Land acquisition for California red-legged frog habitat management lands will be prioritized based on the following characteristics. • Lands that connect with existing protected grassland, vernal pool complex, and alkali seasonal wetland complex landscapes, including those in the East San Francisco Bay core recovery area for California red-legged frog.
CMP-15	Giant Garter Snake Habitat	Where identified and delineated giant garter snake habitat cannot be avoided, compensation for the loss of the habitat will occur for aquatic and upland habitat, with in-kind habitat type compensation. The following measures will be considered when selecting mitigation sites. • Giant garter snake upland mitigation will be placed and protected adjacent to aquatic habitat protected for giant garter snake. The upland habitat will not exceed 200 feet from protected aquatic habitat (unless research shows a larger distance is appropriate and USFWS and CDFW agree). • Incidental injury or mortality of giant garter snakes within protected and restored habitat will be avoided and minimized by establishing 200-foot buffers between protected giant garter snake habitat and roads (other than those roads primarily used to support adjacent cultivated lands and levees). • Protected and restored giant garter snake habitat will be at least 2,500 feet from urban areas or areas zoned for urban development. • Characteristics of restored and protected habitat may change from the above descriptors if new information and best available science indicate greater benefits as agreed upon by USFWS and CDFW. Siting and design requirements for the restoration and protection of giant garter snake nontidal wetland habitat are listed below. • For in-kind mitigation sites, the aquatic and upland habitat quality, character, and location must be of equal or greater value than the habitat quality that was lost. • Conservation mitigation sites will be characterized as nontidal marsh and will meet the following design criteria. ○ Restored nontidal marsh will be characterized by sufficient water during the giant garter snake's active summer season (May 1–October 1) to supply constant, reliable cover and sources of food such as small fish and amphibians. ○ Restored nontidal marsh will consist of still or slow-flowing water over a substrate composed of soil, silt, or mud characteristic of those observed in marshes, sloughs, or irrigation canals.

Number	Species Habitat	Detailed Description of Measure or Habitat Design Guideline
		- Restoration designs will not create large areas of deep, perennial open water that would support nonnative predatory fish. The restored marsh will be characterized by a heterogeneous topography providing a range of depths and vegetation profiles consisting of emergent, herbaceous aquatic vegetation that will provide suitable foraging habitat and refuge from predators. - Aquatic margins or shorelines will transition to uplands consisting of grassy banks, with the dense grassy understory required for sheltering. These margins will consist of approximately 200 feet of high ground or upland habitat above the annual high-water mark to provide cover and refugia from floodwaters during the dormant winter season. - The upland habitat will have ample exposure to sunlight to facilitate giant garter snake thermoregulation and will be characterized by low vegetation, bankside burrows, holes, and crevices providing critical shelter for snakes throughout the day. All giant garter snake upland and aquatic habitat will be established at least 2,500 feet from urban areas or areas zoned for urban development. - The loss of tidal aquatic habitat for giant garter snake may be mitigated through restoration of tidal habitat with a design that provides equal or greater habitat value for the species as agreed upon by USFWS and CDFW. - Topography of the restored wetlands will be designed to provide adjacent terrestrial refuge persisting above the high-water mark. Terrestrial features will be sited within 200 feet of aquatic foraging areas at all tide levels, with slopes and grading designed to avoid exposing largely denuded intertidal mud flats during low tide.
CMP-16	Western Yellow-Billed Cuckoo Habitat	DWR will offset the loss of western yellow-billed cuckoo habitat through the creation or restoration of riparian habitat in the study area. DWR will develop a riparian restoration plan that will identify the location and methods for riparian creation or restoration, and this plan will be subject to USFWS approval.
CMP-17	California Black Rail Habitat	DWR will offset the loss of California black rail habitat through the creation or restoration of tidal emergent wetland habitat in the study area. DWR will develop a restoration plan that will identify the location and methods for tidal emergent wetland creation or restoration, and this plan will be subject to CDFW approval.
CMP-18a	Sandhill Crane Roosting Habitat	Create suitable sandhill crane roosting habitat in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area with consideration of sea level rise and local seasonal flood events. Roosting habitat may be created on Bouldin Island or in suitable lands that provide connectivity between the Stone Lakes National Wildlife Refuge boundary and the Cosumnes River Preserve, subject to CDFW approval.
CMP-18b	Sandhill Crane Foraging Habitat	Protect high- to very high-value foraging habitat for greater sandhill crane (corn, rice, wheat, and freshwater emergent wetlands), with at least 80% maintained in very high-value types (corn and rice) in any given year, subject to CDFW approval. This foraging habitat will be within 2 miles of new project roost sites and will consider sea level rise and local seasonal flood events, and the location of foraging habitat loss. The patch size of protected cultivated lands will be at least 160 acres.

Number	Species Habitat	Detailed Description of Measure or Habitat Design Guideline
CMP-19a	Swainson's Hawk Nesting Habitat	Swainson's hawk nesting habitat will be restored and protected at a location agreed upon in writing by CDFW at that time. Lands protected and restored as compensatory mitigation for impacts on Swainson's hawk foraging habitat will meet the following criteria. - Swainson's hawk suitable nesting habitat includes mature trees (20 feet or greater) in riparian systems as well as in single, isolated, and roadside trees. - Nest sites are generally adjacent to or within easy flying distance to alfalfa or hay fields or other habitats or agricultural crops which provide an abundant prey source. - The following tree types are known to be preferred by Swainson's hawk: - Valley oak (<i>Quercus lobata</i>) - Freemont cottonwood (<i>Populus fremontii</i>) - Willows (<i>Salix</i> spp.) - Sycamores (<i>Platanus</i> spp.) - Walnuts (<i>Juglans</i> spp.) <u>Nest Site Replacement</u> In addition to the compensatory mitigation listed above, DWR will compensate for the temporal loss of suitable Swainson's hawk nest sites (defined as a 125-acre area where more than 50% of suitable nest trees [20 feet or taller] within the 125-acre block are removed). To establish a new nest site, DWR will transplant five mature suitable nest trees (at least 20 feet tall) and 15 five-gallon-container-sized suitable nest trees to a location specified in a Vegetation Restoration Plan that is within preserved mitigation lands and approved in writing by CDFW. Planting larger, mature trees, including transplanting trees scheduled for removal, and supplemented with additional saplings, is expected to accelerate the development of potential replacement nest sites, offset the temporal loss of habitat, and compensate for the impact on Swainson's hawk populations in the Delta. DWR may obtain transplanted mature trees from nursery stock or trees transplanted from construction sites. DWR will plant a combination of five mature trees and 15 saplings at each replacement nest site to provide longevity to the nest site and ensure a sufficient number of trees will meet replacement nest tree success criteria and will survive to continue to provide Swainson's hawk nesting habitat over the long term. To determine the number of affected suitable nest sites, a grid of 125-acre blocks will be placed over each component of project footprint in which trees are to be removed. The grid will be overlain in a manner that places the most complete squares of the grid in the project footprint (i.e., the grid will be adjusted so that, to the extent possible, entire squares rather than portions of squares will overlap with the project footprint). To ensure that transplanted trees and saplings establish new Swainson's hawk nest sites, DWR will: - Establish replacement nest sites at least 0.5 mile apart - Establish replacement nest sites at least 0.25 mile from any existing suitable nest tree and at least 0.5 mile from any existing occupied nest tree - Establish replacement nest sites as close as possible to the impacted nest site, unless such location would have low long-term conservation value

Number	Species Habitat	Detailed Description of Measure or Habitat Design Guideline
		due to threats such as ongoing disturbance, seasonal flooding, or sea level rise - Plant the five mature trees and 15 saplings in sites within 3 miles of conserved suitable foraging habitat - Plant mature nest trees and saplings before impacts on suitable nest sites to reduce temporal impacts resulting from the loss of mature nest trees <u>Compensation for Lost Suitable Nest Trees</u> For each suitable nest tree removed for the project, DWR will plant five native trees (5-gallon container size) suitable for Swainson's hawk nesting to replace lost suitable nest trees at sites within 3 miles of conserved foraging habitat. <u>Replacement Nest Tree Monitoring and Success Criteria</u> DWR will monitor and maintain all replacement nest trees (mature trees and saplings) for a period of 10 years to assure survival and appropriate growth and development. Success will be measured as an 80% survival rate of mature trees and saplings at 5 and 10 years after planting. After the first 10 years, DWR will monitor replacement nest trees every 5 years to verify their continued survival and growth. For every tree lost during the 10-year time period, DWR will immediately plant a replacement tree upon the detection of failure. DWR will provide all necessary maintenance (i.e., fertilizing, irrigation) to ensure successful establishment. DWR will irrigate trees for a minimum of 5 years after planting, and then gradually wean the trees off the irrigation during a period of approximately 2 years. If larger stock is planted, DWR may reduce the number of years of irrigation accordingly. If the 80% establishment success criteria cannot be met, DWR will coordinate with CDFW to determine additional measures.
CMP-19b	Swainson's Hawk Foraging Habitat	Swainson's hawk foraging habitat will be protected at locations subject to CDFW approval and will meet the following criteria. - Foraging habitat will be protected within 3 miles of a known Swainson's hawk nest tree and within 50 miles of the project footprint. - Where feasible, protected foraging habitat will have land surface elevations equal to or greater than -1 foot NAVD88 to minimize the risk of flooding and loss of suitable habitat due to future sea level rise. Where protected foraging habitat is located at elevations lower than -1 foot NAVD88, DWR will ensure that levees are maintained around protected habitat. - Individual patches of foraging habitat will be at least 40 acres in size. - Swainson's hawk prey populations will be supported by establishing 20- to 30-foot-wide hedgerows along field borders and roadsides at a minimum rate of 400 linear feet per 100 acres of protected cultivated lands. - The use of rodenticide will be prohibited on compensation lands to mitigate for Swainson's hawk foraging habitat. - Mitigation acres will be provided for all acres of habitat lost in the very high, high, medium, and low value classes (see Table 13B.72-1 in Appendix 13B, <i>Species Accounts</i>, Section 13B.72.5.3, <i>Habitat Value Categories</i>, for definitions of Swainson's hawk foraging habitat value). Lands that are fallowed in any given season or year will be assigned the same habitat value as the dominant crop type on those lands. Cultivated lands will be maintained in nonpermanent crop types as follows:

Number	Species Habitat	Detailed Description of Measure or Habitat Design Guideline
		○ At least 37.5% of Swainson's hawk mitigation lands will be in very high-value foraging habitat on an annual basis. ○ The amount of very high-value habitat used for mitigation will increase to at least the amount lost to project activities, if it is more than 37.5% of the total affected Swainson's hawk foraging habitat. ○ At least 25% of Swainson's hawk mitigation lands will be in high-value foraging habitat and other grasslands managed for Swainson's hawk use on an annual basis. ○ At least 22.5% of Swainson's hawk mitigation lands will be in medium-value foraging habitat. ○ No more than 15% of Swainson's hawk mitigation lands will be in low-value foraging habitat on an annual basis. ○ No Swainson's hawk mitigation lands will be placed on a site that does not have one of the above-listed assigned habitat values (or their equivalent).
CMP-20	Occupied Burrowing Owl Habitat	If burrowing owls have been documented to occupy burrows at a project site in the last 3 years, current scientific literature supports the conclusion that the site should be considered occupied and mitigation is required (California Department of Fish and Game 2012:11). Suitable burrowing owl habitat will be protected, using the best practices described in the Staff Report on Burrowing Owl Mitigation (California Department of Fish and Game 2012:11–14). If construction activities result in take or if an active burrow must be relocated, as appropriate, DWR will consult with CDFW to develop effective mitigation alternatives.
CMP-21	Least Bell's Vireo	DWR will offset the loss of least Bell's vireo habitat through the creation or restoration of riparian habitat in the study area. DWR will develop a riparian restoration plan that will identify the location and methods for riparian creation or restoration, and this plan will be subject to USFWS approval.
CMP-22a	Tricolored Blackbird Nesting Habitat	To offset the loss of occupied tricolored blackbird nesting habitat, or previously occupied tricolored blackbird colonies (colonies that have been active within the past 15 years) will be permanently protected or restored and managed at a location subject to CDFW approval, and within 5 miles of the nearest breeding colony observed within the past 15 years if possible. Protected or restored nesting habitat will be managed to provide young, lush stands of bulrush/cattail emergent vegetation and prevent vegetation senescence; or other nesting substrate determined to be location and use appropriate and agreed to by CDFW. Nesting habitat protection or restoration will be prioritized based on the following characteristics. Alternative nesting habitat can be considered based on best available science (e.g., protection of upland tricolored blackbird nesting habitat including blackberries or some of the other upland vegetation species frequently used by tricolored blackbirds for nesting) and CDFW approval. • Occupied or recently occupied (i.e., within the last 15 years) stands of bulrush/cattail emergent vegetation. • Wetland marsh habitat that contains standing water to a depth of approximately 1 foot in most years from late January through late July to encourage dense development of cattail and bulrush vegetation and to provide protection from predators until nesting is completed; and that is

Number	Species Habitat	Detailed Description of Measure or Habitat Design Guideline
		within 6 kilometers of high- or very high-quality foraging habitat. High or very high-quality breeding season foraging habitat includes native pasture, nonirrigated native pasture, annual grassland, vernal pool grassland, alkali grassland, unsprayed alfalfa, unsprayed sunflower, and unsprayed mixed alfalfa, sunflower, alfalfa, mixed alfalfa, mixed pasture, and induced high water table native pasture, and nonirrigated mixed pasture, and dairies, as described in Appendix 13B, Section 13B.85.5.3, <i>Breeding Foraging Habitat Value Categories</i>, Table 13B.85-1. • Management and enhancement of tricolored blackbird nesting habitat will be consistent with the recommendations provided by Kyle (2011). The following criteria will guide site selection and management of emergent wetland habitat to benefit tricolored blackbird. ○ Burn, mow, or graze bulrush/cattail vegetation every 2 to 5 years, or an appropriate interval necessary and agreed to by CDFW to remove dead growth and encourage the development of new vegetative structure. ○ Maintain large continuous stands of bulrush/cattail that are at least 30 to 45 feet wide to provide adequate space for breeding as well as protection from predators. ○ Establish seasonal buffer zones (consistent with buffers described in Chapter 13, Mitigation Measure BIO-33) around restored tricolored blackbird nesting habitat to reduce disturbance and improve foraging habitat for tricolored blackbirds. Where conditions permit, stands of emergent vegetation, native blackberry, or other native vegetation will be established along ditches and canals to provide suitable nesting substrate for tricolored blackbird. These stands will be located near foraging sites and DWR will prioritize sites located within the dispersal range of existing tricolored blackbird nesting colonies.
CMP-22b	Tricolored Blackbird Breeding Foraging Habitat	To support protected or restored tricolored blackbird nesting habitat, or to offset the loss of breeding foraging habitat (i.e., foraging habitat used during the breeding season), breeding foraging habitat will be protected using a site protection instrument as described in Section 3F.4.2.2, <i>Site Protection Instruments</i>. Breeding foraging habitat will be protected at a location subject to CDFW approval within 6 kilometers of (1) protected or restored nesting habitat that is managed for tricolored blackbird or (2) a recently or historically (to encourage recolonization) occupied tricolored blackbird nesting habitat. To allow for normal crop rotation, 50% of land protected as tricolored blackbird breeding foraging habitat must be planted in high- and very high-value crop types in any given year (see Appendix 13B, Section 13B.85.5.3, Table 13B.85-1, for definitions of foraging habitat values). Foraging habitat protection will be prioritized based on the following characteristics. • Large contiguous landscapes that consist of high- or very high-value cultivated lands, grasslands, vernal pool complex, and alkali seasonal wetland complex. • Cultivated lands that incorporate riparian corridors, water conveyance channels, grasslands, and wetlands. • Cultivated lands that provide opportunities to maintain a mosaic of crop types and allow for the periodic rotation of essential crop types (those

Number	Species Habitat	Detailed Description of Measure or Habitat Design Guideline
		crop types with very high, high, and moderate foraging habitat values) to nonessential crop types to ensure acreage commitments. • Cultivated lands that expand upon or provide connectivity between existing conservation lands. Small patches of important wildlife habitats associated with protected cultivated lands will be maintained, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands. On cultivated lands managed as high- to very high-value foraging habitat for tricolored blackbirds, insecticide use will be minimized to the greatest extent practicable during the spring growing season until tricolored blackbird nestlings have fledged or it is documented that no nearby nesting is occurring. This is to ensure that an abundant insect prey population is available to support egg development and feeding of the young, as well as to minimize the risk of pesticide toxicity effects. Site protection instruments developed to protect tricolored blackbird breeding foraging habitat would include site management and site use restrictions, including the application of insecticide, as described in Section 3F.4.2.2.
CMP-23	Tidal Perennial Habitat Restoration for Construction Impacts on Habitat for Fish and Aquatic Resources	Tidal perennial habitat (e.g., including consideration of shallow water habitat components consistent with agency/regulatory requirements) would be restored to mitigate for both temporary and permanent construction impacts. Tidal perennial habitat restoration site selection and design will occur in coordination with CDFW, USFWS, and NMFS. Restoration will primarily occur through breaching or setback of levees, thereby restoring tidal fluctuation to land parcels currently isolated behind those levees. Factors to be considered when evaluating sites for potential location and design of tidal perennial habitat restoration include provision of suitable habitat features such as those suggested by the San Francisco Estuary Institute (2020) and Sommer and Mejia (2013).¹ Where practicable and appropriate, portions of restoration sites will be raised to elevations that will support tidal marsh vegetation following levee breaching. Depending on the degree of subsidence and location, lands may be elevated by grading higher elevations to fill subsided areas, importing clean dredged or fill material from other locations, or planting tules or other appropriate vegetation to raise elevations in shallowly subsided areas over time through organic material accumulation. Surface grading will create a shallow elevation gradient from the marsh plain to the upland transition habitat if not already present on a restoration site. Based on assessments of local hydrodynamic conditions, sediment transport, and topography, restoration activities may be designed and implemented in a manner that accelerates the development of tidal channels within restored marsh plains. Following reintroduction of tidal exchange, tidal marsh vegetation is expected to establish and maintain itself naturally at suitable elevations relative to the tidal range. Depending on site-specific conditions and monitoring results, patches of native emergent vegetation may be planted to accelerate the establishment of native marsh vegetation on restored marsh plain surfaces. Siting, design, and performance criteria for tidal perennial habitat restoration will be developed based on assessments of topography, local hydrodynamic

¹ Examples of habitat features for consideration include shallow water for juvenile Chinook salmon (San Francisco Estuary Institute 2020:14) and low salinity and high turbidity for delta smelt (Sommer and Mejia 2013:17).

Number	Species Habitat	Detailed Description of Measure or Habitat Design Guideline
		conditions, and sediment transport. As necessary and reflecting permitting requirements, a collaborative technical team including DWR and fishery agency representatives will be formed to select the most biologically appropriate and cost-effective restoration sites, design the restoration plan, set performance criteria, and develop the restoration unit management plan for the sites. Construction may involve the following activities: • Prior to breaching, recontouring the surface to maximize the extent of surface elevation suitable for establishment of tidal marsh vegetation by scalping higher elevation land to provide fill for placement on subsided lands to raise surface elevations. • Prior to breaching, importing dredge or fill material and placing it in shallowly subsided areas to raise ground surface elevations to a level suitable for establishment of tidal marsh vegetation. • Excavating channels to encourage the development of sinuous, high-density dendritic channel networks within restored marsh plain. • Revegetation through active planting and/or passive establishment of native marsh vegetation. • Modifying ditches, cuts, and levees to encourage more natural tidal circulation and better flood conveyance based on local hydrology. • Removal or breaching of existing levees or embankments or creation of new structures to allow restoration to take place while protecting adjacent land. • Constructing dikes, relocating water diversion infrastructure, or other activities as necessary to maintain agricultural activity in lands adjacent to tidal habitat restoration.
CMP-24	Channel Margin Habitat Restoration for Construction Impacts on Habitat for Fish and Aquatic Resources	Channel margin habitat would be restored to mitigate construction impacts for both temporary and permanent impacts. Channel margin restoration will be accomplished by improving channel geometry and restoring riparian, marsh, and mudflat habitats on the water side of levees along channels that provide rearing and outmigration habitat for juvenile salmonids in particular, similar to what is currently done by the USACE and others when implementing levee improvements. Channel margin restoration associated with federal project levees will not be implemented on the levee, but rather on benches to the waterward side of such levees, and flood conveyance will be maintained as designed. Channel margin enhancements associated with federal project levees may require permission from USACE in accordance with USACE's authority under the Rivers and Harbors Act (33 USC § 408) and USACE levee vegetation policy. Sites for channel margin restoration will be subject to approval by NMFS and CDFW. Any restoration will be designed, constructed, and maintained to ensure no reduction in performance of the federal flood project. As necessary and reflecting permitting requirements, a collaborative technical team including DWR and fishery agency representatives will be formed to identify the most biologically appropriate and cost-effective restoration sites, design the restoration plan, set performance criteria, and develop the restoration unit management plan for the sites for DWR's selection. Types of channel margin enhancement actions may include the following:

Number	Species Habitat	Detailed Description of Measure or Habitat Design Guideline
		• Remove riprap from channel margins. • Modify the channel margin side of levees or setback levees to create low floodplain benches with variable surface elevations that create hydrodynamic complexity and support emergent vegetation. • Install large woody material (e.g., tree trunks and stumps) into constructed low benches or into existing riprapped levees to provide physical complexity. • Plant riparian and emergent wetland vegetation on created benches.
CMP-25	Tidal Habitat Restoration to Mitigate North Delta Hydrodynamic Effects on Chinook Salmon Juveniles	DWR will undertake tidal habitat restoration in the north Delta to mitigate for potential hydrodynamics-related effects such as a greater frequency of Sacramento River reverse flows below Georgiana Slough compared to existing conditions, as reflected in the results of the hydrodynamic analyses and through-Delta juvenile Chinook salmon survival modeling. The mitigation approach will be focused on offsetting the incremental effects of the project alternatives. The extent of this tidal habitat restoration will be determined in coordination with CDFW, NMFS, and FWS and in consideration of the following factors. 1) The extent to which required or planned restoration under other projects or programs (e.g., as summarized by CDFW [2020:127] for restoration related to SWP/CVP operations and by DWR [2023] for restoration under the EcoRestore program) and required restoration mitigation for other impacts of the alternatives minimizes hydrodynamic differences between existing conditions and the project alternatives to standards established during federal Endangered Species Act/California Endangered Species Act permitting. 2) The efficacy of the required Georgiana Slough Salmonid Migratory Barrier under the SWP Incidental Take Permit (California Department of Fish and Wildlife 2020:94–95). 3) Sea level rise, climate change, and associated changes in north Delta hydrodynamics projected to occur at the commencement of operation of the north Delta intakes. This may include evaluating relationships between flow and hydrodynamic changes at various downstream locations (e.g. Georgiana Slough junction) to help isolate potential effects of the project alternatives. Restoration opportunities for this measure will align with species recovery needs and be guided by information in the Sacramento Valley Salmon Resiliency Strategy (California Natural Resources Agency 2017). A monitoring program will be included to assess the performance of the mitigation and modify the mitigation approach as necessary through the Adaptive Management Program to offset the effects of the project alternatives as they become better understood. The efficacy of tidal habitat restoration in affecting north Delta hydrodynamics has been demonstrated through modeling studies (Resource Management Associates 2020). 4) The extent to which tidal habitat restoration to mitigate for DCP operational changes identified for both delta and longfin smelt can contribute to the appropriate type and degree of hydrodynamic mitigation necessary to address the modeled, project-driven, flow changes (e.g., changes in frequency of Sacramento River reverse flows below Georgiana Slough).

Number	Species Habitat	Detailed Description of Measure or Habitat Design Guideline
CMP-26	Channel Margin Habitat Restoration for Operations Impacts on Chinook Salmon Juveniles	DWR will undertake channel margin habitat restoration to mitigate for potential flow-related impacts on riparian and wetland bench habitat used by juvenile Chinook salmon for rearing. The extent of this mitigation was calculated by multiplying the largest negative deficits in bench inundation index between each alternative and existing conditions in each geographic group (Chapter 12, <i>Fish and Aquatic Resources</i>, Table 12-33) by the total length of benches in each geographic group, which gives a total length of deficit (Table 12-34). This channel margin habitat restoration will be in addition to the channel margin habitat restoration included to mitigate construction impacts on channel margin habitat. The efficacy of channel margin habitat restoration has been demonstrated by studies in the Sacramento River documenting occurrence and abundance of juvenile Chinook salmon that is greater than at riprapped sites and similar to natural sites (Hellmair et al. 2018).
CMP-27	Tidal Habitat Restoration for Operations Impacts on Delta Smelt	DWR will mitigate potential project-related impacts on delta smelt by restoring tidal habitat, concentrated within the north Delta Arc or other areas deemed appropriate through consultation with USFWS and CDFW. The main objective of this restoration would be to increase the extent of suitable delta smelt habitat (e.g., intertidal and subtidal habitat) (California Department of Fish and Game 2011) with appropriate parameters (e.g., turbidity) providing habitat for occupancy (e.g., Sommer and Mejia 2013) or higher food availability in the vicinity (e.g., Hammock et al. 2019). This mitigation measure's effectiveness will be subject to long-term monitoring and assessed in coordination with USFWS and CDFW as part of the Adaptive Management Program.
CMP-28	Tidal Habitat Restoration for Operations Impacts on Longfin Smelt	DWR will undertake tidal habitat restoration to mitigate for potential flow-related impacts on longfin smelt. The extent of this mitigation was calculated using the method of Kratville (2010), as recently applied by DWR (2019:5-5). The method is described in more detail in Appendix 12B, <i>Bay-Delta Methods and Results</i>, Section 12B.19, <i>Smelt Tidal Habitat Restoration Mitigation Calculation</i>. With the concurrence of USFWS and CDFW, this habitat restoration mitigation requirement may be partly or fully met by tidal perennial or shallow water habitat restoration for construction effects.
CMP-29	Crotch Bumble Bee Habitat	Impacts on Crotch bumble bees and their habitat will be offset either through creation or enhancement of suitable habitat, land preservation through site protection instruments, the purchase of credits through a CDFW-approved mitigation bank, or the creation of non-bank site approved by CDFW. Bumble bee habitat has three main habitat requirements: flowering resources that provide pollen and nectar throughout the duration of the colony period (spring, summer, and fall), nest sites for the colony, and overwintering sites for dispersing queens (Hatfield et al. 2012). Mitigation sites will include flower rich natural habitats, grassland, and scrub habitats that include underground cavities (e.g., animal burrows) for nesting and overwintering and aboveground undisturbed areas with nesting resources, such as leaf litter or other complex habitat such as wood piles, tufts of grass, or rock walls for additional overwintering habitat (Xerces Society et al. 2018). Site protection instruments developed to protect Crotch bumble bee habitat would include site management and site use restrictions, including the application of insecticides, as described in U.S. Environmental Protection Agency <i>Guidance for Assessing Pesticide Risks to Bees</i> (U.S. Environmental Protection Agency 2014) (also see Section 3F.4.2.2). To offset the unsuccessful relocation of a

Number	Species Habitat	Detailed Description of Measure or Habitat Design Guideline
		nest, as determined by a qualified biologist, suitable habitat will be created, enhanced, or protected, using the mitigation mechanisms described above. Suitable habitat is defined as habitat that is suitable for foraging, nesting, or overwintering within a 1.8 km buffer ² around the lost nest that is permanently affected.

CDFW = California Department of Fish and Wildlife; CMP = Compensatory Mitigation Plan; DWR = California Department of Water Resources; EIR = Environmental Impact Report; NMFS = National Marine Fisheries Service; USACE = U.S. Army Corps of Engineers; USC = United States Code; USFWS = U.S. Fish and Wildlife Service.

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