

Appendix 3F

Compensatory Mitigation Plan for Special-Status Species and Aquatic Resources

3F.1 Introduction

This Compensatory Mitigation Plan for Special-Status Species and Aquatic Resources (CMP) identifies compensatory mitigation options to address impacts on habitat for special-status plant and wildlife species (including fish) as well as natural communities (including wetlands and other waters or “aquatic resources”) that may result from the construction and operation of the Delta Conveyance Project (project).¹ The EIR evaluates several potential alternatives for the project, and in order to demonstrate consideration of feasible mitigation for all alternatives, this CMP does not focus on a single alternative but rather considers the maximum mitigation need regardless of alternative. This CMP has been developed using the best available scientific information germane to the Sacramento–San Joaquin Delta (Delta) ecosystem and inclusive of relevant information from multiple disciplines to identify the ecological requirements of wetland communities (Chapter 13, *Terrestrial Biological Resources*), natural history and habitat requirements of special-status species (Chapter 12, *Fish and Aquatic Resources*, Chapter 13, Appendix 13B, *Species Accounts*), and ecological restoration practices.

Specifically, in order to propose feasible mitigation for potential significant impacts on aquatic resources and species habitat, this CMP first identifies several sites that could support habitat creation and enhancement actions. From among those sites where habitat creation and enhancement is deemed feasible, specific mitigation actions would be implemented to reduce the impact on aquatic resources and species habitat to a less-than-significant level under the California Environmental Quality Act (CEQA) or otherwise mitigate significant impacts. This document further explains the methodology used to identify those sites and discusses other approaches that may be used to secure appropriate compensatory mitigation for the project.

The compensatory mitigation approach described herein is based on anticipated mitigation needs for the proposed project and alternatives as presented in Chapter 3, *Description of the Proposed Project and Alternatives*. The project’s final compensatory habitat mitigation needs will be determined once the proposed project or an alternative is approved and all regulatory permits and approvals are secured. The conceptual approaches described herein would contribute to the mitigation of significant impacts of project construction, operation, and maintenance on affected resources, including special-status species and aquatic resources, as described in Chapter 12 and Chapter 13. Although the mitigation approaches described in this appendix (including the mitigation work plan described in Section 3F.4, *Mitigation Work Plan*, and Attachment 3F.1, *Compensatory Mitigation Design Parameters*) are of sufficient detail to meet the requirements of CEQA, National Environmental Policy Act (NEPA), and other laws, it is anticipated that additional design and

¹ Although there are many potential compensatory mitigation needs for resources as described in the Draft Environmental Impact Report, this document focuses on the needs for special-status terrestrial species and aquatic species and for natural communities including aquatic resources (including wetlands and other waters of the United States and waters of the State).

management planning, including additional details on performance standards, monitoring methods, and adaptive management actions, may be added between the project approval under CEQA and NEPA and project initiation. Other mitigation actions, including mitigation/conservation bank credit purchases and habitat protection, may also occur during that time.

The initial sites described herein are proposed to address the compensatory mitigation needs for many terrestrial and aquatic resources (Figure 3F-1). However, not all compensatory mitigation needs would likely be met through these sites; for those additional needs, mitigation credits from approved banks (with service areas that overlap with the location of impact unless otherwise approved by the relevant wildlife agencies) as well as other approaches are expected to be used, including a proposed "Tidal Habitat Mitigation Framework." The effects of mitigation on species are evaluated, to the level of detail available. At this time, siting and design detail is available for the initial mitigation sites. As siting and design detail becomes available for additional restoration sites, the California Department of Water Resources (DWR) will confer with the applicable regulatory agencies regarding the efficacy of these initial site-specific mitigation options as well as the other potential approaches to compensatory mitigation described herein.

Table 3F-1 summarizes the compensatory mitigation approaches that are addressed in this document by resource type. In some cases, multiple approaches may be considered for mitigation, such as the use of mitigation banks in combination with a tidal wetland restoration approach.

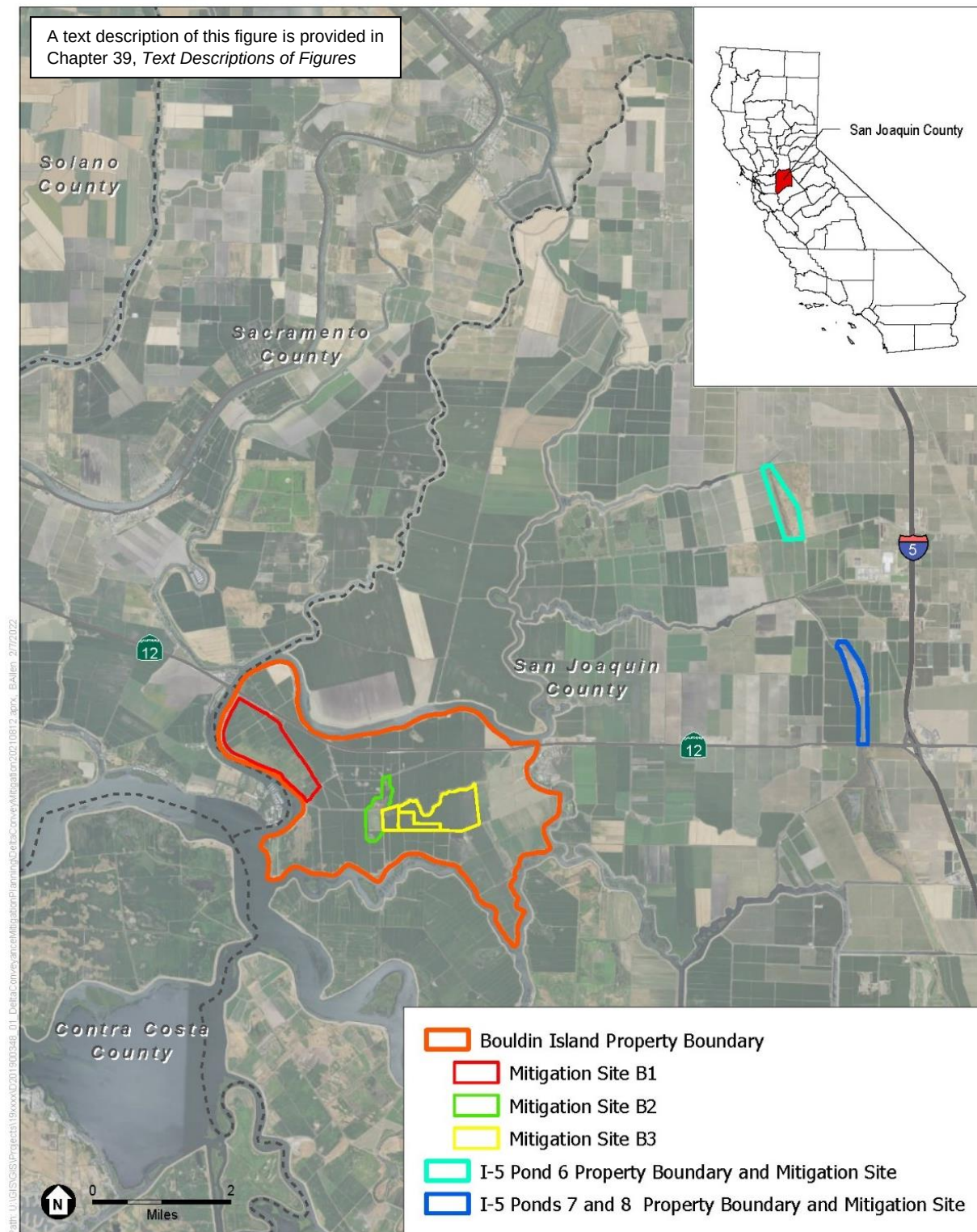


Figure 3F-1. Mitigation Site Location

1 **Table 3F-1. Compensatory Mitigation Approaches**

Aquatic Resources and Species Habitats	Habitat Description	Mitigation Ratio ^a	Initial Mitigation Sites			Mitigation Credits & Site Protection Instruments	Tidal Habitat Mitigation Framework
			Bouldin Island	I-5 Pond 6	I-5 Ponds 7 & 8		
Aquatic Resources							
Wetlands							
Alkaline wetland	–	1.5:1	–	–	–	X	–
Forested and scrub- shrub wetland	–	1:1	X	–	–	X	X
Emergent wetland	–	1:1	X	–	–	–	–
Seasonal wetland	–	1:1	X	–	–	–	–
Vernal pool	–	3:1	–	–	–	X	–
Other Waters							
Agricultural ditch	–	1:1	X	–	–	–	–
Conveyance channel	–	1:1	X	–	–	–	–
Depression (lake/pond)	–	1:1	X	–	–	–	–
Natural channel	–	1:1	X	–	–	–	–
Tidal channel	–	1:1	–	–	–	X	X
Species Habitats							
Special-status plant species	Vernal pool, alkaline seasonal wetland, emergent wetland, perennial aquatic	2:1	–	–	–	X	–
Burrowing owl	Grassland, agriculture	1:1	X	X	X	X	–
California black rail	Tidal wetland	1:1	–	–	–	–	X
California red-legged frog	Aquatic	3:1	–	–	–	X	–
California red-legged frog	Upland	1:1	–	–	–	X	–
California tiger salamander	Aquatic and upland	3:1	–	–	–	X	–
Crotch bumble bee	Grassland, alkaline seasonal wetland, vernal pool complex, other seasonal wetlands	1:1	X	X	X	X	–
Fisheries ^b	Tidal wetland	3:1	–	–	–	–	X
Fisheries ^b	Channel margin	1:1	–	–	–	–	X
Giant garter snake	Aquatic (freshwater marsh)	2:1	–	X	X	–	–
Giant garter snake	Upland (grassland)	2:1	–	X	X	–	–
Greater sandhill crane	Roosting (freshwater marsh, agriculture)	1:1	X	–	–	X	–
Greater sandhill crane	Foraging (freshwater marsh, agriculture)	1:1	X	–	–	X	–

Aquatic Resources and Species Habitats	Habitat Description	Mitigation Ratio ^a	Initial Mitigation Sites			Mitigation Credits & Site Protection Instruments	Tidal Habitat Mitigation Framework
			Bouldin Island	I-5 Pond 6	I-5 Ponds 7 & 8		
Least Bell's vireo	Recolonization (riparian)	2:1	X	–	–	–	–
Tricolored blackbird	Nesting (freshwater marsh)	3:1	X	X	X	X	–
Tricolored blackbird	Foraging (grassland, agriculture)	1:1	X	X	X	X ^c	–
Swainson's hawk	Nesting (riparian)	1:1	X	–	–	X	–
Swainson's hawk	Foraging (grassland/ agriculture)	1:1	X	X	X	X	–
Valley elderberry longhorn beetle	Riparian	2:1	X	–	–	–	–
Vernal pool fairy shrimp, vernal pool tadpole shrimp	Vernal pool complex	1:1 or 2:1	–	–	–	X	–
Western yellow- billed cuckoo	Migration (riparian)	2:1	X	–	–	–	–

I- = Interstate.

^a Mitigation ratio for protected, created, and restored habitat to offset permanent habitat loss.

^b With reference to the covered fish species, "Fisheries" includes tidal wetland for winter-run and spring-run Chinook salmon, delta smelt, and longfin smelt; and channel margin for winter-run and spring-run Chinook salmon.

^c Tricolored blackbird foraging habitat protection would be associated with mitigation for impacts to occupied or previously occupied breeding habitat, as described in Table 3F.1-3, CMP-22b: *Tricolored Blackbird Foraging Habitat*.

3F.1.1 Plan Purpose

The purpose of this CMP is to describe the approaches used to provide compensatory aquatic resource and special-status species habitat mitigation for the project, including the associated habitat creation and enhancement actions that would be taken. This CMP does not address other, non-habitat compensatory mitigation needs, such as replacing the loss of agricultural lands. In addition to providing for the compensatory mitigation needs necessary under CEQA, the CMP may be used to support several environmental and regulatory compliance efforts for the project, including the following.

1. Fulfilling the joint requirements of the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (EPA) under Code of Federal Regulations (CFR) Title 33, Parts 325 and 332 (*Compensatory Mitigation for Losses of Aquatic Resources*, or Mitigation Rule).
2. Fulfilling the requirements of the State Water Resources Control Board's (State Water Board) 2019 *State Wetland Definition and Procedures for Discharges of Dredged or Fill Material to Waters of the State* (State Wetland Procedures), particularly Appendix A, Subpart J (*Compensatory Mitigation for Losses of Aquatic Resources*).
3. Supporting applications for incidental take under Section 2081 of the California Endangered Species Act and consultations under Section 7 of the federal Endangered Species Act (ESA), particularly as those consultations relate to the compensatory mitigation needs associated with the loss of habitat for listed species as it relates to the potential for incidental take as defined under the ESA.

4. Supporting the process to develop an agreement with the California Department of Fish and Wildlife (CDFW) under Section 1602 of the California Fish and Game Code, if needed, particularly as it relates to reasonable measures necessary to protect the resource associated with impacts on fish and wildlife resources regulated under that section of code.

3F.1.2 Parties Responsible for Implementation

As the CMP is a component of the project, the primary party responsible for implementing it is DWR. Other parties that may be involved in implementation of the CMP as the landowner include, but are not limited to, the Metropolitan Water District of Southern California (Metropolitan) for the Bouldin Island mitigation sites.

3F.1.3 Document Overview and Organization

This CMP has been prepared to guide planning for the compensatory mitigation needs of the project. It consists of the following sections.

- **Section 3F.1, *Introduction***, provides an overview of the document purpose and parties responsible for implementation.
- **Section 3F.2, *Project Impacts***, summarizes the aquatic resources and listed species habitat potentially affected by the construction and operation of the project.
- **Section 3F.3, *Mitigation Approach***, outlines the approach taken for providing compensatory mitigation for aquatic resources and special-status species.
- **Section 3F.4, *Mitigation Work Plan***, describes the initial compensatory mitigation sites and other potential compensatory mitigation sites that are under consideration. This section also summarizes approaches for providing compensatory mitigation for tidal wetland and channel margin habitats, as well as the potential use of mitigation/conservation banks and site protection instruments.
- **Section 3F.5, *Assurances***, describes DWR's financial commitments associated with construction, operation, and maintenance of the mitigation sites as well as a summary of the site protection instrument.
- **Section 3F.6, *Maintenance and Management***, discusses short- and long-term management actions for the mitigation sites, and adaptive management.
- **Section 3F.7, *Performance Standards and Monitoring***, discusses performance standards, metrics, monitoring, and reporting.
- **Section 3F.8, *References Cited***, provides the full references for the literature and other resources cited in this document.

3F.2 Project Impacts

3F.2.1 Project Overview

The project consists of the construction, operation, and maintenance of new State Water Project (SWP) water diversion and conveyance facilities in the Delta in coordination with the existing SWP

facilities. The new water conveyance facility would create a new conveyance mechanism that would divert water from the north Delta and convey it through a single tunnel to a new Southern Forebay on Byron Tract and from the forebay to existing SWP export facilities (Alternatives 1, 2b, 2c, 3, 4b, and 4c) and potentially to existing Central Valley Project (CVP) export facilities (Alternatives 2a and 4a). The new Southern Forebay would provide an additional isolated south Delta water balancing facility that would also be operated to provide flexibility for operating both the new and existing facilities. These new facilities in the south Delta are collectively called the *Southern Complex*. Alternative 5 (the proposed project) would bring water directly to a new pumping plant along Byron Highway for conveyance to the Bethany Reservoir on an alignment similar to the eastern alignment but without the construction or use of the Southern Complex. Operating the new conveyance facilities in conjunction with SWP's existing south Delta export facilities at Clifton Court Forebay would create a *dual conveyance* system. Please see Chapter 3 for more details on the project and alternatives.

3F.2.1.1 Project Location

The project is located in the Delta and adjacent regions, an expansive inland river delta and estuary in Northern California. Portions of six counties—Alameda, Contra Costa, Sacramento, San Joaquin, Solano, and Yolo—make up the Delta (Figure 3F-2). The Delta is formed at the western edge of the Central Valley by the confluence of the Sacramento and San Joaquin Rivers and lies just east of where the rivers enter Suisun Bay. The watersheds of the Sacramento and San Joaquin Rivers are at the core of California's water system, which conveys water to millions of Californians throughout the San Francisco Bay Area (Bay Area), Central Valley, Central Coast, and Southern California.

The study area, defined as the area in which impacts may occur (Chapter 13, Section 13.1.1, *Study Area*), primarily comprises the statutory Delta, as delineated under the Delta Protection Act (California Water Code [Wat. Code] § 12220) as well as a few areas east of this boundary, to capture project infrastructure and areas southwest of the statutory Delta to include the area around Bethany Reservoir for Alternative 5 (Mapbooks 13-1, 13-2, and 13-3).

3F.2.1.2 Affected Watersheds

Figure 3F-2 displays the hydrologic unit code (HUC) 8 and HUC 10 watersheds that the project alternatives occur within. This includes watersheds associated with the Sacramento and San Joaquin Rivers. As indicated in the figure, the proposed mitigation sites are located within the same watersheds as where impacts would occur under multiple project alternatives.

Basin Plan Considerations

As stated in the EIR, beneficial uses of surface waters are designated by California's nine Regional Water Quality Control Boards (RWQCBs) for waters in their jurisdictions within their respective water quality control plans (WQCPs). In addition, the State Water Board has designated beneficial uses for the statutory Delta in its WQCP for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta WQCP). The Delta also falls within the jurisdictions of the Central Valley and San Francisco Bay RWQCBs, which have designated uses for the Delta within their respective WQCPs. More information regarding Basin Plan considerations, including beneficial uses, can be found in Chapter 9, *Water Quality*.

3F.2.1.3 Mitigation Measures

The EIR describes measures to avoid, minimize, or mitigate impacts on sensitive resources, including aquatic resources and special-status species habitat. This includes siting facilities under each alternative to avoid sensitive resources such as wetlands and suitable habitat to the greatest extent feasible. All the mitigation measures in Chapters 12 and 13 would apply during construction of mitigation sites, as summarized in Executive Summary, Table ES-2.



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Figure 3F-2. Watershed Boundaries

3F.2.2 Impacts on Waters of the United States and State

The term *waters of the United States* is an encompassing term for areas that are subject to federal regulation under the Clean Water Act (CWA), including Section 404 (Chapter 13, Section 13.1.4, *Wetlands and Other Waters of the United States*). For purposes of Section 404, waters of the United States are categorized as wetlands (i.e., wetlands that meet the definition of waters of the United States) or other waters. Wetlands are areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Other waters of the United States are waterbodies but do not typically display all three of the wetland indicators. Linear features and open water habitats that may qualify as other waters of the United States were categorized based on tidal influence as nontidal or tidal. Nontidal waters include natural channels, depressions, and agricultural ditches. Tidal classifications include tidal channel, including major waterways, which was used for conveyance features associated with the SWP and CVP. As described in Chapter 13, Section 13.1.4, an aquatic resources delineation was conducted via aerial imagery interpretation for the study area.

In accordance with the Porter-Cologne Water Quality Control Act and the associated State Wetland Procedures (State Water Resources Control Board 2019), the State Water Board and the RWQCBs also regulate discharges of waste, which includes discharges of dredged and fill material, that may affect the quality of waters of the State. Waters of the State include features that are defined as wetlands, as well as other waters that meet the definition of waters, including the oceans, lakes, and rivers. The wetland definition used by the state encompasses the full range of wetland types commonly recognized in California, including some features not considered in the federal definition of wetlands.

To determine effects on these aquatic resources that may result from project construction, a geographic information system (GIS) layer of potentially jurisdictional wetlands and other waters was intersected with the layer of project footprint surface features for each proposed alternative. The resulting polygons identify the areas of potential impacts on potentially jurisdictional waters. Acreages of each type of affected wetland or other water were calculated for each alternative and are presented in the wetlands and waters impact discussions in Chapter 13. Based on this assessment, the following aquatic resources would be potentially affected by the project and are therefore addressed within this CMP.

- Agricultural ditch
- Alkaline wetland
- Conveyance channel
- Depression (lake/pond)
- Forested and scrub-shrub wetland
- Emergent wetland
- Natural channel
- Seasonal wetland
- Tidal channel

- Vernal pool

Because the delineation includes all aquatic resources in the study area, DWR intended that the delineation also represents what would be considered waters of the State. Therefore, the analyses and conclusions for effects on waters of the United States in Chapter 13 also apply to waters of the State.

3F.2.3 Impacts on Special-Status Species

For the purposes of the EIR (Section 13.1.3, *Special-Status Species*), special-status species are species that are legally protected or otherwise considered sensitive by federal, state, or local resource agencies. Detailed information on the plant and wildlife species habitat requirements, distribution, and occurrences within the study area is presented in the species accounts in Appendix 13B, *Species Accounts*. Species accounts also contain the habitat suitability models, which are GIS-based models used for establishing the amount of potential habitat for a species within the study area and for estimating effects on the species. Permanent and temporary (i.e., generally limited to one construction season) impacts on terrestrial species from construction were quantified in GIS by overlaying the project alternative facility footprints on conservatively modeled habitat for the species and species occurrences (Chapter 13, Section 13.3.1.2, *Evaluation of Construction Activities*). Impacts on aquatic species from construction were analyzed by examining location and type of in-water construction activities (Chapter 12, Impact AQUA-1 and the *Construction—All Project Alternatives* section of Impact AQUA-20), while impacts from operations (such as entrainment of fish) and maintenance were assessed with various qualitative and quantitative analyses (Chapter 12, Impacts AQUA-2 through AQUA-19 and the *Operations and Maintenance* sections of Impact AQUA-20). It is anticipated that preconstruction field surveys will verify habitat suitability for special-status species. Therefore, these preliminary impact estimates may be revised once surveys are completed. Because the modeling is conservative, field surveys likely will result in reduced acreages of impacts. Agency coordination between permitting and final implementation could also lead to changes to the restoration design, location, and construction timing.

The CMP is designed to define compensatory habitat mitigation for impacts on special-status species where compensatory mitigation is proposed as discussed in the Final EIR (Chapters 12 and 13). This includes the species and habitats presented in Table 3F-2.

Table 3F-2. Special-Status Fish and Wildlife Species and Habitats

Species	Life Stage/ Habitat Function	Habitats
Burrowing owl	Nesting and foraging	Grassland, vernal pool complex, agricultural (pasture, alfalfa, grain, annual crops)
California black rail	Nesting and foraging	Tidal and nontidal freshwater emergent wetland, tidal and nontidal brackish emergent wetland
California red-legged frog	Aquatic	Nontidal perennial aquatic (depression/pond)
California red-legged frog	Upland	Grassland, alkaline seasonal wetland, valley/foothill riparian
California tiger salamander	Aquatic and upland	Vernal pool complex
Crotch bumble bee	All	Grassland, vernal pool complex, alkaline seasonal wetland

Species	Life Stage/ Habitat Function	Habitats
Fisheries ^a	Migration/rearing	Tidal perennial aquatic, tidal freshwater emergent wetland
Fisheries ^a	Migration/rearing	Channel margin/riparian (linear feet)
Giant garter snake	Aquatic	Nontidal and tidal freshwater emergent wetland (freshwater marsh), nontidal perennial aquatic (depression), tidal perennial aquatic, agricultural (ditch/drain, rice)
Giant garter snake	Upland	Grassland, agricultural (upland herbaceous, mixed pasture), valley/foothill riparian
Greater sandhill crane	Roosting	Nontidal and tidal freshwater perennial emergent wetland, agricultural (flooded post-harvest corn or rice), vernal pool complex, alkaline seasonal wetland, other seasonal wetland
Greater sandhill crane	Foraging	Freshwater perennial emergent wetland, grassland, agricultural (corn, rice, wheat, pasture)
Least Bell's vireo	Recolonization	Valley/foothill riparian
Swainson's hawk	Nesting	Valley/foothill riparian
Swainson's hawk	Foraging	Grassland agricultural (alfalfa, dry pasture, grain, hay), vernal pool complex, alkaline seasonal wetland, other seasonal wetland
Tricolored blackbird	Nesting	Nontidal and tidal freshwater perennial emergent wetland (freshwater marsh), valley/foothill riparian
Tricolored blackbird	Foraging	Grassland agricultural (grain, pasture, alfalfa), vernal pool complex, alkaline seasonal wetland, other seasonal wetland
Valley elderberry longhorn beetle	All	Valley/foothill riparian
Vernal pool fairy shrimp, vernal pool tadpole shrimp	All	Vernal pool complex
Western yellow-billed cuckoo	Migration	Valley/foothill riparian (forested)

^a With reference to the covered fish species, "Fisheries" includes tidal wetland for winter-run and spring-run Chinook salmon, delta smelt, and longfin smelt; and channel margin for winter-run and spring-run Chinook salmon.

3F.2.4 Mitigation Design Parameters

Design commitments and guidelines for compensatory mitigation are provided in Attachment 3F.1. These design parameters address critical life functions for certain species. These provisions also describe a framework to ensure that any habitat conversions associated with site development are accounted for so adverse effects related to these conversions are avoided or minimized.

In addition to these parameters, DWR will request input from California Native American Tribes that are traditionally and culturally affiliated with the project area and chose to consult with DWR about the project on siting, design, construction, management and stewardship of compensatory

mitigation sites. The “good neighbor” policies in the *Agriculture and Land Stewardship Framework and Strategies* (California Department of Water Resources 2018:8, 31–39) would also be implemented; these include the creation of buffer zones between habitat preserves and farmland, which would help to reduce or eliminate exposure to pests and diseases on neighboring lands, prevent overspray of chemicals onto habitat lands, and assist with a successful transition between different land uses.

3F.3 Mitigation Approach

This CMP outlines three primary approaches in providing compensatory mitigation to mitigate impacts associated with the construction and operation of the project alternatives. The first approach is to develop and implement several initial mitigation actions at specific sites that would provide compensatory mitigation for many of the affected special-status species habitats and aquatic resources. The second approach is to use existing or proposed mitigation banks to secure credits for certain types of habitats and natural communities, including vernal pools and alkaline seasonal wetlands, as well as species habitat such as California tiger salamander (*Ambystoma californiense*) and California red-legged frog (*Rana draytonii*). This second approach also includes the potential use of site protection instruments, such as conservation easements, to protect or enhance existing land uses that provide habitat function for certain species, such as Swainson’s hawk (*Buteo swainsoni*), greater sandhill crane (*Antigone canadensis tabida*), and tricolored blackbird (*Agelaius tricolor*), that may use certain agricultural crops or other habitat types for foraging or roosting and manage those lands for the target species into perpetuity. The third approach, a combination of these, is to propose a mitigation framework under which future compensatory mitigation actions may be delivered for tidal freshwater perennial aquatic (tidal channel), tidal freshwater emergent wetland, and channel margin communities. Each of these approaches is described in greater detail in Section 3F.4, *Mitigation Work Plan*.

Compensatory mitigation, either protection, creation, or enhancement, will stay ahead of the cumulative, permanent suitable habitat loss by 10%. Documentation demonstrating that this stay-ahead provision has been met for the previous year will be provided in an annual status report. If the 10% stay-ahead requirement cannot be met and habitat is protected or restored after the impact occurs, then the mitigation amount would be increased by 5% for every year protection is delayed to offset the temporal loss of habitat. For example, if protection, creation, or enhancement occurs 2 years after the impact occurs, mitigation would be 10% greater than that required if protection, creation, or enhancement occurs prior to or concurrent with the impact.

3F.3.1 Applicable Policies and Guidance Documents

The selection of potential mitigation sites described in this appendix was informed by the mitigation policies and guidance documents from several resource agencies, including the following.

- USACE and EPA’s joint requirements under 33 CFR Parts 325 and 332 (*Compensatory Mitigation for Losses of Aquatic Resources*, or Mitigation Rule)
- The State Water Board’s State Wetland Procedures, particularly Appendix A, Subpart J (*Compensatory Mitigation for Losses of Aquatic Resources*) (State Water Resources Control Board 2019:25–42)

- U.S. Fish and Wildlife Service (USFWS) Mitigation Policy (*Federal Register*, Vol. 46, No. 15, January 23, 1981, as corrected in the *Federal Register* of February 4, 1981)

In addition to these general guidance documents and policies, several additional resources such as the *Delta Plan* (Delta Stewardship Council 2013) were reviewed to guide the site selection and design criteria for special-status species presented in Attachment 3F.1.

3F.3.2 Approach to Aquatic Resources Mitigation

3F.3.2.1 Hierarchal Approach

For aquatic resources, including mitigation for impacts on waters of the United States and State, the approach to compensatory mitigation considered the requirements of 33 CFR Section 332.3(b), including the hierarchal order when considering compensatory mitigation options, as follows: (1) mitigation bank credits; (2) in-lieu fee program credits; (3) permittee-responsible mitigation under a watershed approach; (4) permittee-responsible mitigation through on-site and in-kind mitigation; and (5) permittee-responsible mitigation through off-site and/or out-of-kind mitigation. The last option, off-site and/or out-of-kind mitigation, although reflected in this hierarchical order is not proposed in this CMP.

When considering options, credit or site availability was often a controlling factor. For example, where the compensatory mitigation need for an aquatic resource type (e.g., vernal pools) was expected to be relatively small and mitigation banks with agency-approved service areas (typically based on watersheds and eco-regions for aquatic resources) covering the impact footprint that are known to have available credits for the aquatic resource type to be affected, option 1 was selected. However, in many circumstances, the compensatory mitigation needs of the project are such that mitigation banks or in-lieu fee programs are not an option due to lack of credit availability based on the number of credits that are potentially needed. In these cases, and as noted in 33 CFR Section 332.3(b)(4), compensatory mitigation may then be provided through option 3, permittee-responsible mitigation under a watershed approach. Therefore, compensatory mitigation for aquatic resources would be provided in accordance with the procedures set forth in 33 CFR Section 332.3(b), and would be provided for through either mitigation bank credits or permittee-responsible mitigation under a watershed approach.

3F.3.2.2 Watershed Approach

A watershed approach was used to avoid a net loss in the overall abundance, diversity, and condition of aquatic resources within the watershed profile. Because compensatory mitigation for aquatic resources would be typically located within the same watersheds as where project impacts would occur, no net loss is anticipated on a watershed basis. Per the State Wetland Procedures, “[i]f the compensatory mitigation and project impacts are located in multiple watersheds, no net loss will be determined considering all affected watersheds collectively” (State Water Resources Control Board 2019:8). Figure 3F-1 shows the location of proposed mitigation sites for several aquatic resources. Figure 3F-2 shows the location of these sites in relation to local watersheds and project alternatives.

3F.3.2.3 Emergent Wetland, Seasonal Wetlands, Valley/Foothill Riparian, and Other Non-Tidal Waters

Compensatory mitigation for these aquatic resources would be located on Bouldin Island at Mitigation Site B1 (detailed in Section 3F.4.1.3, *Bouldin Island Mitigation Sites*) (Figure 3F-1). This site includes areas that already exhibit wetland characteristics due to a high groundwater table, seepage, site elevation, and drainage patterns, as explained further in Section 3F.4.1.3. In addition, peat soils are prevalent at the site, providing a suitable combination of surface and subsurface hydrology as well as hydric soils. Lastly, the majority of project impacts on these aquatic resource types occur in similar ecological conditions to those found at Bouldin Island; namely, remnant wetlands and human-made channels found adjacent to existing agricultural fields.

The design approach to Mitigation Site B1 was to develop an analog of a remnant oxbow of the Mokelumne River near the junction of the San Joaquin River, including open water, valley riparian habitat (including scrub-shrub and forested), freshwater emergent wetland, and seasonal wetlands. This mix of wetland habitats once dominated the Delta (Whipple et al. 2012:xx-xxiii), and the re-creation of these aquatic resources at the mitigation site would result in compensatory mitigation that has a higher number of functions and services than the affected resources.

3F.3.2.4 Vernal Pools and Alkaline Wetlands

Compensatory mitigation for impacts on vernal pools and alkali seasonal wetlands would be provided through purchasing wetland creation credits at an approved mitigation bank. Several existing and proposed mitigation banks have available or soon-to-be-available credits with service areas that encompass the project. In the instance that bank credits are not available, a non-bank site approved by the relevant regulatory agencies supporting the necessary habitat would be used as mitigation.

3F.3.2.5 Tidal Wetlands and Waters

Compensatory mitigation for tidal emergent wetlands and tidal channel would be provided by the proposed Tidal Habitat Mitigation Framework (Section 3F.4.3, *Tidal Habitat Mitigation Framework*). A secondary option that may be used is to purchase wetland creation credits at an approved mitigation bank. Several existing and proposed mitigation banks have available or soon-to-be-available credits with service areas that encompass the project's impacts on this habitat type.

3F.3.3 Approach to Special-Status Species Mitigation

The general approach to identifying suitable mitigation sites and developing conceptual restoration plans for special-status species included reviewing life history information for affected species, with a specific emphasis on federally listed and state-listed species. Design parameters were also considered in the siting and design of compensatory mitigation (Attachment 3F.1). In addition, recovery plans (where available), mitigation plans, and conservation guidance documents were reviewed, including the following.

- *Recovery Plan for the Giant Garter Snake (Thamnophis gigas)* (U.S. Fish and Wildlife Service 2017a:II-1–II-11)
- *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)* (U.S. Fish and Wildlife Service 2017b)

- 1 • *Recovery Plan for the California Red-legged Frog (Rana aurora draytonii)* (U.S. Fish and Wildlife
2 Service 2002:12–16)
- 3 • *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and
4 Wildlife Service 2005)
- 5 • *Recovery Plan for the Central California Distinct Population Segment of the California Tiger*
6 *Salamander (Ambystoma californiense)* (U.S. Fish and Wildlife Service 2017c:II-3–II-6)
- 7 • *Staff Report regarding Mitigation for Impacts to Swainson’s Hawks (Buteo swainsoni) in the*
8 *Central Valley of California* (California Department of Fish and Game 1994)
- 9 • *Staff Report on Burrowing Owl Mitigation* (California Department of Fish and Game 2012)
- 10 • *Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook*
11 *Salmon and Central Valley Spring-run Chinook Salmon and the DPS of California Central Valley*
12 *Steelhead* (National Marine Fisheries Service 2014:128–142)
- 13 • *Final Recovery Plan for the Southern Distinct Population Segment of North American Green*
14 *Sturgeon (Acipenser medirostris)* (National Marine Fisheries Service 2018:12–13, 18)
- 15 • *Sacramento–San Joaquin Delta Native Fishes Recovery Plan* (U.S. Fish and Wildlife Service
16 1995:27–29, 48–49)
- 17 • *Guidance for Assessing Pesticide Risk to Bees* (U.S. Environmental Protection Agency 2014:6, 31–
18 41)

19 The mitigation needs for special-status species may be addressed through the creation or
20 enhancement of natural communities so they may provide suitable conditions for various life
21 functions of the species. Often these communities can provide benefits for more than one species.
22 For example, freshwater marsh habitat hydrologically connected or adjacent to open water can
23 provide suitable aquatic habitat for giant garter snake (*Thamnophis gigas*) while also providing
24 suitable breeding (nesting) habitat for tricolored blackbird. This correlation makes it possible to
25 provide compensatory habitat for more than one species at a particular mitigation site.

26 The final designs for targeted habitats will be informed by species-specific parameters. This includes
27 design parameters that target key life cycle needs for the targeted species, such as water (including
28 water quality), cover, and foraging habitat. It also includes parameters that enhance the long-term
29 resiliency of the created habitat, such as buffer distances, consideration of predators, and
30 hydrological factors. Lastly, other design parameters consider landscape and movement/migration
31 dynamics to ensure species can both access the created habitat as well as disperse to adjacent
32 suitable habitat. Measures that specifically address design goals for targeted species are highlighted
33 in Attachment 3F.1.

34 Mitigation sites will be designed, managed, and maintained to support multiple special-status
35 species and will incorporate species-specific habitat requirements such as structural complexity and
36 patch size. See Appendix 13B, *Species Accounts*, for detailed special-status species habitat
37 requirements. For example, the enhancement and management of grasslands will focus on
38 maintaining a mosaic of grassland alliances and vegetation heights to increase biological and
39 structural diversity for targeted species (Fuhlendorf and Engle 2001). Structural heterogeneity of
40 riparian vegetation will be maintained and enhanced and structural complexity—including
41 understory (low shrubs), midstory (large shrubs and small trees), and overstory (upper canopy

formed from large trees)—will be maintained to provide habitat requirements for a diversity of targeted wildlife species.

3F.3.3.1 Freshwater Marsh and Riparian Terrestrial Species

The Interstate (I-) 5 pond mitigation sites were selected as the primary location for developing compensatory mitigation for species dependent on freshwater marsh and associated uplands, including giant garter snake. The sites are located within the White Slough Management Unit of the Delta Basin Recovery Unit for giant garter snake (U.S. Fish and Wildlife Service 2017a:II-10–II-11), and would extend connectivity between occupied sites at Stone Lakes National Wildlife Refuge and the CDFW Woodbridge Ecological Reserve further south with the creation of protected suitable habitat (Pond 6 is approximately 0.7 mile southeast and Ponds 7 and 8 are approximately 2 miles south of Woodbridge). The location also has suitable elevations, water supply, and access. These mitigation sites would also provide suitable breeding and foraging habitat for tricolored blackbird.

Significant impacts on riparian-dependent species, including valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), Swainson's hawk nesting, least Bell's vireo (*Vireo bellii pusillus*), and western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), would be mitigated by the creation of habitat at Bouldin Island Mitigation Sites B1 and B2. Mitigation Site B1 would also provide additional suitable freshwater marsh habitat for tricolored blackbird.

3F.3.3.2 Grassland Species and Agricultural Lands

Bouldin Island Mitigation Site B3 would provide suitable mitigation for grassland species, including burrowing owl (*Athene cunicularia*). It would also provide suitable foraging habitat for bird species such as Swainson's hawk and tricolored blackbird. It would also provide suitable foraging habitat and nest and overwintering sites for invertebrate species such as Crotch bumble bee.

Grassland mitigation could also occur at sites disturbed by the project and no longer needed following construction completion, including at the proposed intake sites, Twin Cities Complex, Lower Roberts Island, and the Bethany Complex.

In addition, as described in more detail below, site protection instruments may also be used to protect and enhance agricultural and other lands that provide suitable habitat for species such as greater sandhill crane, burrowing owl, Swainson's hawk, tricolored blackbird, and Crotch bumble bee.

3F.3.3.3 Vernal Pool Species, California Tiger Salamander, and California Red-Legged Frog

For species associated with the vernal pool complexes and alkali wetland habitats, as well as perennial pond features and grasslands in the south Delta, compensatory mitigation would be provided in the form of species conservation credits at a USFWS- and CDFW-approved mitigation/conservation bank. This includes mitigation credits for vernal pool invertebrates, California tiger salamander, and California red-legged frog. Several existing and proposed mitigation banks have available or soon-to-be-available credits with service areas that encompass the project. Credits for California tiger salamander will be prioritized in the Concord/Livermore Recovery Unit, if possible. Mitigation bank credits purchased for these species would also provide suitable foraging habitat for bird species such as Swainson's hawk and tricolored blackbird.

Creation and enhancement of vernal pool complexes and alkali wetland habitats would likely support flowering plants along their margins during the spring and at the deeper portions during the summer as they dry down; these mitigation areas could provide foraging resources for Crotch bumble bee and support habitat for these species.

3F.3.3.4 Fisheries and California Black Rail

Compensatory mitigation for fisheries, including salmonids, delta smelt (*Hypomesus transpacificus*), longfin smelt (*Spirinchus thaleichthys*), and green sturgeon (*Acipenser medirostris*), as well as California black rail (*Laterallus jamaicensis coturniculus*), would be provided through the Tidal Habitat Mitigation Framework (Section 3F.4.3), which includes the development of tidal wetland mitigation sites and channel margin habitat. These sites would be constructed ahead of project impacts on these habitat types.

3F.4 Mitigation Work Plan

Four general types of mitigation are proposed under this CMP: initial mitigation sites, mitigation credits and site protection instruments, and tidal habitat. Each of these types are described in the following sections of the same names.

3F.4.1 Initial Mitigation Sites

3F.4.1.1 Purpose

The purpose of the initial compensatory mitigation actions is to partially offset impacts on federal and state wetlands and a subset of terrestrial species. The initial mitigation projects will create and enhance freshwater emergent wetland, riparian, and seasonal wetland natural community types, among others. These mitigation sites will also create and enhance compensatory habitat for several special-status species including giant garter snake, tricolored blackbird, Swainson's hawk, valley elderberry longhorn beetle, least Bell's vireo, and Crotch bumble bee. For the giant garter snake and valley elderberry longhorn beetle, initial mitigation sites are expected to fully offset impacts. For other special-status species (e.g., Swainson's hawk, tricolored blackbird, and Crotch bumble bee), initial mitigation sites are expected to partially offset effects and will have to be combined with other mitigation types such as site protection instruments to fully offset the effects. Finally, there are a number of special-status species such as California tiger salamander or Central Valley steelhead for which the initial mitigation sites will contribute no acres of mitigation. For a full list of mitigation ratio requirements see Table 3F-1.

Initial compensatory mitigation actions for the project are focused on lands owned by DWR (I-5 Ponds 6, 7, and 8) or partners (Bouldin Island). This approach allows compensatory mitigation for many resources to be quickly advanced following final designs and receipt of permits and approvals, thereby in many cases allowing establishment of created and enhanced habitats ahead of impacts.

The net gain in habitat, once changes from existing land cover are accounted for, are summarized for wetlands and other waters in Table 3F-3. As noted previously, mitigation sites on Bouldin Island (specifically Mitigation Sites B1 and B2) would be designed to provide compensatory mitigation for aquatic resources impacts. The mitigation acres provided below (Table 3F-3) include habitat creation for species (Table 3F-4), hence the additional acreage shown for some habitat types that far

exceed the anticipated compensatory mitigation needs for federal and state wetlands (e.g., freshwater emergent wetland). Compensatory mitigation for special-status species, which would be constructed at all the proposed mitigation sites, is summarized in Table 3F-4. Site protection instruments, including conservation easements, may also be implemented at or near the sites.

The detailed restoration design work and management planning, which will include fully detailing performance standards, monitoring methods, and adaptive management actions, will occur between the project permitting phase and project completion. Other mitigation actions, including bank credit purchases and habitat protection, will also occur between permitting and project construction completion. To inform the mitigation planning process between permit issuance and mitigation land construction or preservation, DWR will prepare Draft and Final Habitat Mitigation Plans for affected species and wetlands. Compensatory mitigation would be secured in phases in accordance with the progress of construction.

Table 3F-3. Summary of Compensatory Mitigation for Wetlands and Other Waters Created at Bouldin Island Mitigation Sites B1 and B2

Aquatic Resources	Created (Loss) (Acres) ^a
Wetlands	
Alkaline seasonal wetland	0
Nontidal freshwater emergent wetland	49.87
Valley/foothill riparian (forested and scrub-shrub) ^b	193.94
Seasonal wetland	92.22
Tidal freshwater emergent wetland	0
Vernal pool	0
Total wetlands	336.03
Other Waters	
Agricultural ditch	(13.32)
Conveyance channel	0
Depression (lake/pond)	10.29
Natural channel	0
Tidal channel	0
Total other waters	(3.03)
Total all aquatic resources (net gain)	333.0

^a Land cover types with a negative value reflect conversion to another type of wetland and other waters (not to uplands). Acreage subject to rounding.

^b Valley/foothill riparian, as a natural community, could include a subset of jurisdictional waters, namely forested and scrub-shrub wetland.

1 **Table 3F-4. Summary of Special-Status Species Habitat That Will Be Created or Enhanced with Full Implementation of the Initial Mitigation**
 2 **Sites (acres) ^a**

Species (Habitat Type)	Land cover Types	Created at Initial Sites?	Total Habitat Created or Enhanced (acres) ^b						Total by Species Habitat Type
			B1	B2	B3	I-5 Pond 6	I-5 Ponds 7/8	Total by Land Cover	
Burrowing owl ^c (High value habitat)	Grassland	Bouldin, I-5 Ponds	68.84	0	309.78	114.14	67.78	560.54	561.09
	Agricultural	Bouldin, I-5 Ponds	0	0	0	0.55	0	0.55	
	Vernal pool complex, alkaline seasonal wetland	N/A	–	–	–	–	–	0	
California black rail	Nontidal freshwater emergent wetland, tidal freshwater emergent wetland	N/A	–	–	–	–	–	0	0
California red-legged frog (aquatic)	Nontidal perennial aquatic (depression), tidal perennial aquatic, nontidal freshwater emergent wetland, tidal freshwater emergent wetland	N/A	–	–	–	–	–	0	0
California red-legged frog (upland)	Grassland, valley/foothill riparian, Alkaline seasonal wetland	N/A	–	–	–	–	–	0	0
California tiger salamander (aquatic)	Vernal pool complex	N/A	–	–	–	–	–	0	0
California tiger salamander (upland)	Grassland, vernal pool complex, Alkaline seasonal wetland	N/A	–	–	–	–	–	0	0
Crotch bumble bee	Grassland	Bouldin, I-5 Ponds	68.84	0	309.78	114.14	67.78	560.54	560.54
	Vernal pool complex, alkaline seasonal wetland	N/A	–	–	–	–	–	0	
Fisheries	Tidal emergent wetland	N/A	–	–	–	–	–	0	0
Fisheries	Channel margin	N/A	–	–	–	–	–	0	0

Species (Habitat Type)	Land cover Types	Created at Initial Sites?	Total Habitat Created or Enhanced (acres) ^b						Total by Species Habitat Type
			B1	B2	B3	I-5 Pond 6	I-5 Ponds 7/8	Total by Land Cover	
Giant garter snake (aquatic) ^d	Nontidal freshwater emergent wetland	I-5 Ponds	-	-	-	40.68	59	99.68	150.54
	Nontidal perennial aquatic (depression)		-	-	-	14.23	30.55	44.78	
	Tidal freshwater emergent wetland		-	-	-	0	0	0	
	Tidal perennial aquatic		-	-	-	0.8	0	0.80	
	Agricultural ditch/ drain		-	-	-	3.32	1.96	5.28	
Giant garter snake (upland) ^e	Agricultural	I-5 Ponds	-	-	-	0.55	0	0.55	189.81
	Grassland		-	-	-	114.14	67.78	181.83	
	Valley/foothill riparian		-	-	-	5.38	1.96	7.34	
Greater sandhill crane (roosting) ^c	Nontidal freshwater emergent wetland	Bouldin	72.39	0	0	-	-	72.39	72.39
Greater sandhill crane (foraging) ^c	Nontidal freshwater emergent wetland	Bouldin	72.39	0	0	-	-	72.39	451.01
	Agricultural	Bouldin	0	0	0	-	-	0	
	Grassland	Bouldin	68.84	0	309.78	-	-	378.62	
	Tidal freshwater emergent wetland, vernal pool complex, alkaline seasonal wetland	N/A	-	-	-	-	-	0	
	Other seasonal wetland	Bouldin	0	0	0	-	-	0	
Least Bell's vireo ^b	Valley/foothill riparian	Bouldin, I-5 Ponds	103.15	94.3	0	5.38	1.96	204.79	204.79
Swainson's Hawk (foraging) ^c	Grassland	Bouldin, I-5 Ponds	68.84	0	309.78	114.14	67.78	560.54	561.09
	Agricultural	Bouldin, I-5 Ponds	0	0	0	0.55	0	0.55	
	Other seasonal wetland	N/A	-	-	-	-	-	0	
	Vernal pool complex, alkaline seasonal wetland	N/A	-	-	-	-	-	-	
Swainson's hawk (nesting) ^c	Valley/foothill riparian	Bouldin, I-5 Ponds	103.15	94.3	0	5.38	1.96	204.79	204.79

Species (Habitat Type)	Land cover Types	Created at Initial Sites?	Total Habitat Created or Enhanced (acres) ^b						Total by Species Habitat Type
			B1	B2	B3	I-5 Pond 6	I-5 Ponds 7/8	Total by Land Cover	
Tricolored blackbird (Nesting & colony)	Nontidal freshwater emergent wetland	Bouldin, I-5 Ponds	72.39	0	0	40.68	59	172.07	376.86
	Tidal freshwater emergent wetland	N/A	-	-	-	-	-		
	Valley/foothill riparian	Bouldin, I-5 Ponds	103.15	94.3	0	5.38	1.96	204.79	
Tricolored blackbird (foraging)	Grassland	Bouldin, I-5 Ponds	68.84	0	309.78	114.14	67.78	560.54	560.54
	Vernal pool complex, alkaline seasonal wetland, other seasonal wetland	N/A	-	-	-	-	-	0	
Valley elderberry longhorn beetle	Valley/foothill riparian	Bouldin, I-5 Ponds	103.15	94.3	0	5.38	1.96	204.79	204.79
Vernal pool fairy shrimp/ tadpole shrimp (Direct effect)	Vernal pool complex	N/A	-	-	-	-	-	0	0
Vernal pool fairy shrimp/ tadpole shrimp (Direct & indirect effect)	Vernal pool complex	N/A	-	-	-	-	-	0	0
Western yellow-billed cuckoo (migration)	Valley/foothill riparian	Bouldin, I-5 Ponds	103.15	94.3	0	5.38	1.96	204.79	204.79

N/A = Suitable habitat not created at site.

^a This table shows the total acreages of special-status species habitat provided with full implementation of the initial mitigation sites. This table does not include habitat that will be created, enhanced, or protected under mitigation credits or site protection instruments, as described under Section 3F.4.2, *Mitigation Credits and Site Protection Instruments*, or created as part of the tidal habitat mitigation framework described in Section 3F.4.3, *Tidal Habitat Mitigation Framework*.

^b Acreage subject to rounding.

^c Conversion of agriculture to other habitat types (wetlands, grassland) would result in a net decrease of foraging habitat for burrowing owl, greater sandhill crane, and Swainson's hawk. The actual decrease would be somewhat less than estimated because not all agricultural land is in crops used by these wildlife species.

^d Bouldin Island is not being designed specifically for the giant garter snake, although Bouldin Island could potentially be used by the species.

3F.4.1.2 Natural Communities Targeted at Initial Mitigation Sites

The initial mitigation sites are designed to compensate for several types of aquatic and upland habitats that may be affected by the project. This section provides a general description of the major habitat types that were targeted for creation and enhancement at the initial sites. The descriptions below are based on the Final EIR (Chapter 13, Section 13.1.2.2, *Natural Community Descriptions*, Section 13.1.4, *Wetlands and Other Waters of the United States*). Types used in the wetland delineation are shown in parentheses, where applicable.

Aquatic Resources

Valley/Foothill Riparian (Forested and Scrub-Shrub)

Riparian habitats are plant communities that support woody vegetation. Scrub-shrub wetlands within the study area are dominated by woody vegetation less than 20 feet tall, often forming dense thickets. Shrubs include sandbar willow (*Salix exigua*), Himalayan blackberry (*Rubus armeniacus*), red twig dogwood (*Cornus sericea* [syn. *C. alba*]) buttonwillow (*Cephalanthus occidentalis*), and California wild rose (*Rosa californica*). Fremont's cottonwood (*Populus fremontii* [syn. *P. deltoides*]) seedlings or saplings may also be present. Herbaceous species are generally lacking or are a minor component of the vegetation assemblage, as the canopy cover in scrub-shrub wetlands is high and low-growing herbaceous species do not receive sufficient light for survival.

Forested wetlands are defined by woody vegetation that is 20 feet tall or taller with a tree canopy cover equal to or greater than 25%. Riparian trees common in the study area include Goodding's black willow (*Salix gooddingii*), red willow (*S. laevigata*), box elder (*Acer negundo*), Oregon ash (*Fraxinus latifolia*), Fremont's cottonwood, white alder (*Alnus rhombifolia*), black walnut (*Juglans hindsii*), and valley oak (*Quercus lobata*). Forested wetlands generally have a shrub component, typically in canopy openings and along the forested edge. The presence of an herbaceous layer is variable.

The valley/foothill riparian natural community usually occurs as long, linear patches separating other terrestrial biological communities and agricultural or urban land, or in low-lying, flood-prone patches near river bends, canals, or breached levees. Patches of riparian vegetation are also found on the interior of leveed Delta islands, along drainage channels and pond margins, and in abandoned low-lying fields.

Riparian habitat provides important food, nesting habitat, cover, and movement corridors. Over 135 species of California birds such as the willow flycatcher (*Empidonax traillii*), western yellow-billed cuckoo, and red-shouldered hawk (*Buteo lineatus*) completely depend upon riparian habitats or may use them preferentially at a particular stage of their life history. Riparian habitat also provides riverbank protection, erosion control, and improved water quality.

Nontidal Freshwater Emergent Wetland

Nontidal freshwater emergent wetlands, including freshwater marshes, are perennial wetlands frequently or continually inundated with water, and dominated by herbaceous emergent plants such as California tule (*Schoenoplectus californicus*), hard-stem tule (*S. acutus*), narrow-leaf cattail (*Typha angustifolia*), broad-leaf cattail (*T. latifolia*), and floating water primrose (*Ludwigia peploides*). Shallow emergent wetlands (water less than 3 feet deep) are dominated by thick, tall, highly productive stands of tules and cattails. The higher elevation edges of freshwater marsh gradients

may be characterized by abrupt transitions to terrestrial vegetation, or they may transition into vegetation of alkali seasonal wetlands, riparian woodland, or riparian scrub. These perennial wetlands are among the most productive habitats for wildlife. Covered wildlife species that depend on nontidal freshwater marsh include giant garter snake, tricolored blackbird, and western pond turtle (*Emys marmorata*).

Proposed freshwater marshes would maximize localized topography and hydrology to limit the amount of grading. Freshwater marsh habitat would be interwoven with seasonal wetlands, riparian, and grassland habitats as conditions allow.

Seasonal Wetland

Seasonal wetlands are areas that may only be saturated or hold water from late fall to late spring. In the Central Valley and Delta, seasonal inundation events are typically associated with winter storms or Sierra snowmelt. The hydrology of these features is driven by winter storm events or when increased flows raise the water table to an elevation sufficient to wet the area. By midsummer, most seasonal wetlands are dry or moist. Numerous seasonal wetlands were mapped in active agricultural fields in the Delta. Although groundwater levels are controlled on many Delta islands, including Bouldin, using a system of pumps and drainage ditches to maintain water levels on the subsided islands, a high water table persists in some areas.

At the landscape level, most seasonal wetlands are less than an acre (or even a half-acre) in size. Vegetation tends to be dominated by hydrophytic grasses, sedges (*Carex* spp.), or rushes (*Juncus* spp.). Seasonal wetlands provide an important food source for migratory birds, waterfowl, breeding and feeding areas for amphibians and reptiles, and critical winter food supplies for birds and mammals that may be present.

Depression (Lake/Pond)

Depressions are nontidal open-water features that are permanently or seasonally inundated, with little to no rooted vegetation on an unconsolidated or mud bottom. At the mitigation sites, these features may be artificially created as a result of borrow material excavations, agricultural activities, or for stormwater detention, or may result from a high water table. Depressions are generally less than 20 acres in size and have a water depth of less than 6 feet. These waterbodies are often created by excavation and are diked or otherwise artificially impounded.

Depressions may be colonized by floating plant species such as common duckweed (*Lemna minor*), mosquito fern (*Azolla* spp.), or water hyacinth (*Eichhornia crassipes*), but generally lack rooted vegetation except on depression margins. Waterfowl in particular use this habitat type for foraging and rest.

Upland Communities

Grasslands

The grassland natural community is dominated by introduced or native annual and perennial grasses and herbaceous forbs. Native perennial grasses are generally found only in areas that have not been converted to agricultural uses. Native grasslands support over 300 species of native grasses and about 40% of California's total native plant species. Grasslands provide important breeding and foraging habitat for many species of wildlife, including covered wildlife species such as tricolored blackbird, Swainson's hawk, burrowing owl, giant garter snake, and Crotch bumble bee.

3F.4.1.3 Bouldin Island Mitigation Sites

Site Objectives

The proposed compensatory mitigation actions to be undertaken on Bouldin Island would create or enhance habitat in areas where it could be sustained with little maintenance. The Bouldin Island mitigation sites would support multiple habitat types, including freshwater marsh, seasonal wetland, riparian, ponds (depressions), and grasslands.

Three separate mitigation sites are proposed on Bouldin Island: B1, B2, and B3. Sites B1 and B2 would support the creation and enhancement of extensive wetland habitat and other aquatic resources and would provide compensatory mitigation for losses to waters of the United States and State. They would be designed and managed specifically to fulfill federal and state wetland mitigation requirements, while also providing suitable habitat for several special-status species. Mitigation Site B3 would support the creation of native perennial grassland habitat where reusable tunnel material (RTM) would be stored under the central alignment alternatives (Alternatives 1, 2a, 2b, and 2c).

Site Selection Criteria and Baseline Conditions

Site Selection Criteria

Bouldin Island was selected because it is located within the same watersheds where impacts would occur and because existing soils and hydrology provide ideal conditions for the establishment of wetland habitats. Bouldin Island is owned by Metropolitan, who was coordinated with in selecting the sites and developing the habitat restoration concepts. Therefore, construction activities to enhance and create aquatic resources could begin shortly after project approval, once an agreement between Metropolitan and DWR for the mitigation sites is finalized. The existing land cover, hydrology (high water table), and soils (hydric soils) would facilitate creation and enhancement of wetland habitats. Habitat creation and enhancement would result in the establishment of sustainable aquatic resources, while also benefitting species such as tricolored blackbird, western yellow-billed cuckoo, least Bell's vireo, valley elderberry longhorn beetle, and Swainson's hawk. It was also noted that areas that have become too wet to farm over the years have reverted in many cases to wetland habitat (primarily riparian and seasonal wetland), as observed in several areas within Mitigation Sites B1 and B2 (Figures 3F-3 and 3F-4).

Property Location and Description

Bouldin Island is an approximately 5,900-acre island that is bounded to the north by the South Mokelumne River, to the east by Little Potato Slough, to the south by Potato Slough, and to the west by the Mokelumne and San Joaquin Rivers (Figure 3F-5). State Route (SR) 12 crosses the northern part of Bouldin Island. A swing bridge over the Mokelumne River on SR 12 connects the northwestern part of the island to Andrus Island. Near the northeastern tip of Bouldin Island, a high-level bridge on SR 12 spans Little Potato Slough, connecting the island to the small community of Terminous. Currently the island consists of roughly 98% farmland with the remaining 2% being wetlands, riparian, or open water habitat. Site elevations on Bouldin Island range from -24 feet North American Vertical Datum of 1988 (NAVD 88) to 19 feet NAVD 88, with an average elevation of -13 feet NAVD 88. Current land use is predominately agricultural, including corn, alfalfa, and row crops. The land is leased to farmers for this production, with primary farming activities taking place

1 between March and November of each year. Fields are typically flooded in the winter months for soil
2 management, weed control, stubble decomposition, and duck hunting.

3
A text description of this figure is provided in
Chapter 39, *Text Descriptions of Figures*



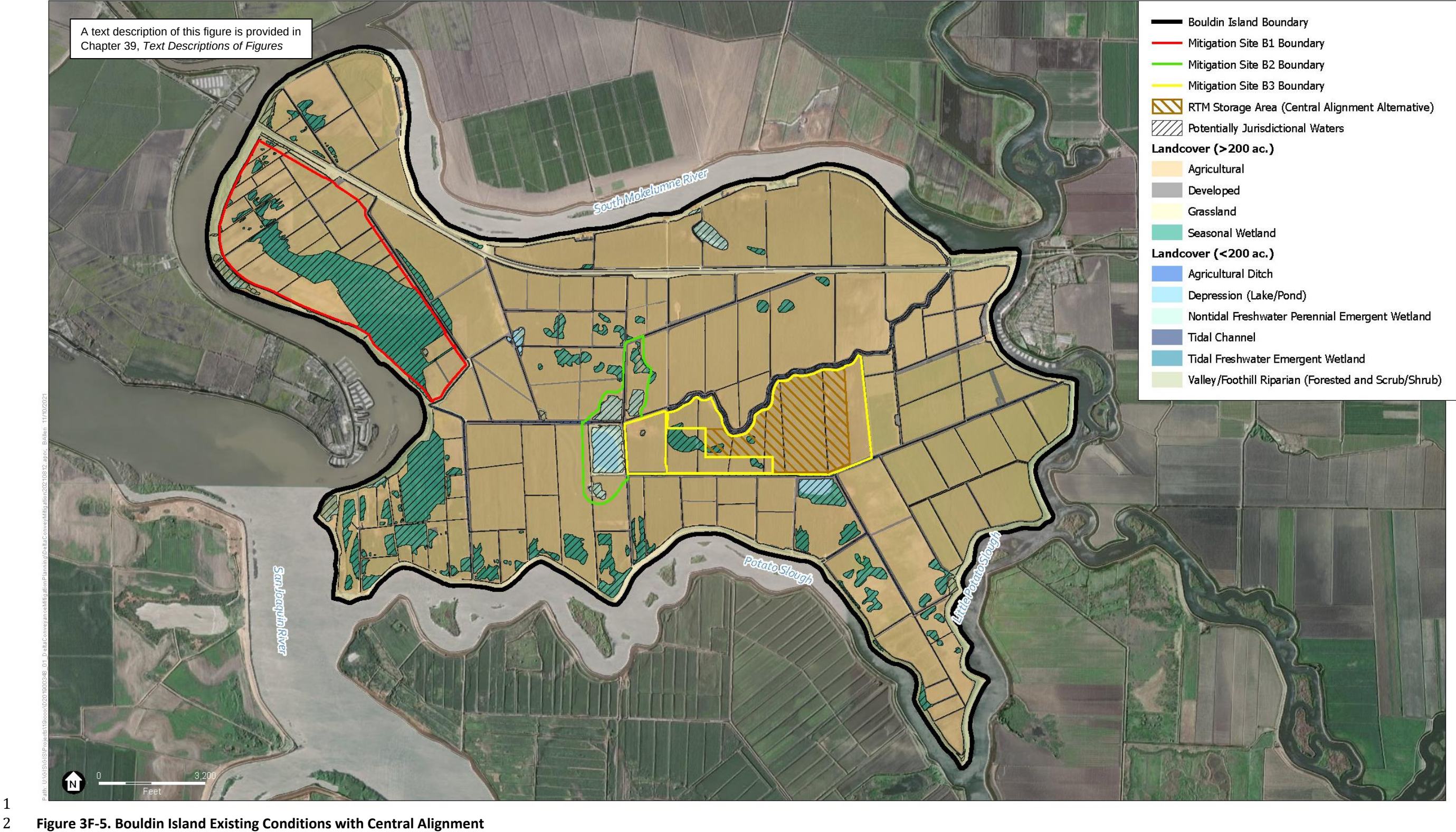
4
5 **Figure 3F-3. Emergent and Forested Wetland Habitat on Bouldin Island**

6
A text description of this figure is provided in
Chapter 39, *Text Descriptions of Figures*



7 **Figure 3F-4. Emergent, Scrub-Shrub, and Seasonal Wetland Habitat on Bouldin Island**

8 There are three mitigation sites being proposed for Bouldin Island: B1, B2, and B3 (Figure 3F-5).
9 Mitigation Site B1 is near the northwest corner of the island, just south of SR 12. The site is currently
10 dominated by agricultural fields (primarily row crops) as well as seasonal wetlands within the
11 farmed fields. Ditches and maintenance roads are also present. It is bounded by the perimeter levee
12 to the west, SR 12 to the north, and irrigation ditches to the south and east. Mitigation Site B2 and
13 Mitigation Site B3 are near the center of the island. Mitigation Site B2 contains a mixture of
14 agricultural fields, patches of valley/foothill riparian habitat, and open water (remnants of a borrow
15 pit). Mitigation Site B3 includes agricultural fields and roads.



1

2

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Soils

Soils on the sites primarily consist of muck, including Rindge muck, Valdez silt loam, and Ryde clay loam (Natural Resources Conservation Service 2021:11). The soils on Bouldin Island consist of organic and highly organic mineral soils. All of the soils are hydric.

Existing Land Cover

The proposed mitigation sites include agricultural fields, roads, irrigation ditches and canals, borrow pits, and several wetland features. Existing aquatic features mapped for the project consist of farmed seasonal wetlands, forested and scrub-shrub riparian, perennial depressions (ponds), and ditches. Table 3F-5 summarizes the approximate acreages of existing land cover types at Bouldin Island, which are also shown in Figure 3F-5.

Table 3F-5. Bouldin Island Baseline Land Cover (acres)

Land Cover	Mitigation Site			Remainder on Bouldin	Total for Bouldin ^a
	B1	B2	B3		
Agricultural	337.52	42.77	291.13	3,697.28	4,368.70
Agricultural ditch	8.60	3.51	1.93	95.03	109.06
Developed ^b	8.77	12.21	11.86	337.96	370.79
Grassland	0	7.13	0	446.45	453.58
Nontidal freshwater emergent wetland	0	22.49	0.03	25.85	48.37
Nontidal perennial aquatic (depression, lake/pond)	0	0	0	32.56	32.56
Seasonal wetland	196.71	3.52	4.37	293.54	498.14
Tidal channel	0	0	0	18.89	18.89
Tidal freshwater emergent wetland	0	0	0	2.54	2.54
Valley/foothill riparian ^c	0.61	2.67	0.46	93.60	97.34
Total	552.21	94.30	309.79	5,043.6746	5,999.97

^a Acreages to the nearest 0.01, may be subject to rounding.

^b Baseline developed land cover includes project infrastructure that would occur under the central alignment (e.g., tunnel shaft, access road improvements, RTM storage), as well as existing roadways and structures.

^c Valley/foothill riparian vegetation community includes potentially jurisdictional wetlands (forested and scrub-shrub) and other riparian vegetation.

Potential Waters of the United States and State

A delineation of potentially jurisdictional wetlands and other waters mapped from aerial imagery for Bouldin Island (California Department of Water Resources and GEI Consultants 2020; California Department of Water Resources 2020, 2021) is summarized in Table 3F-6. For additional information about the methods used to delineate aquatic resources, see the *Aquatic Resources Delineation Data* portion of Chapter 13, Section 13.1.2.1, *Land Cover Mapping Methods*.

Table 3F-6. Bouldin Island Baseline Potentially Jurisdictional Wetlands and Other Waters (acres)

Aquatic Resource	Mitigation Site ^a			Remainder on Bouldin	Total for Bouldin
	B1	B2	B3		
Wetlands					
Nontidal freshwater emergent wetland	0	22.49	0.03	25.85	48.37
Forested and scrub-shrub wetland	0.61	2.48	0.42	24.34	27.85
Seasonal wetland	196.71	3.52	4.37	293.54	498.14
Tidal freshwater emergent wetland	0	0	0	2.54	2.54
Other Waters					
Agricultural ditch	8.60	3.51	1.93	95.02	109.06
Depression (lake/pond)	0	<0.01	0	32.55	32.55
Tidal channel	0	0	0	18.52	18.52
Total	205.92	32.00	6.75	492.36	737.03

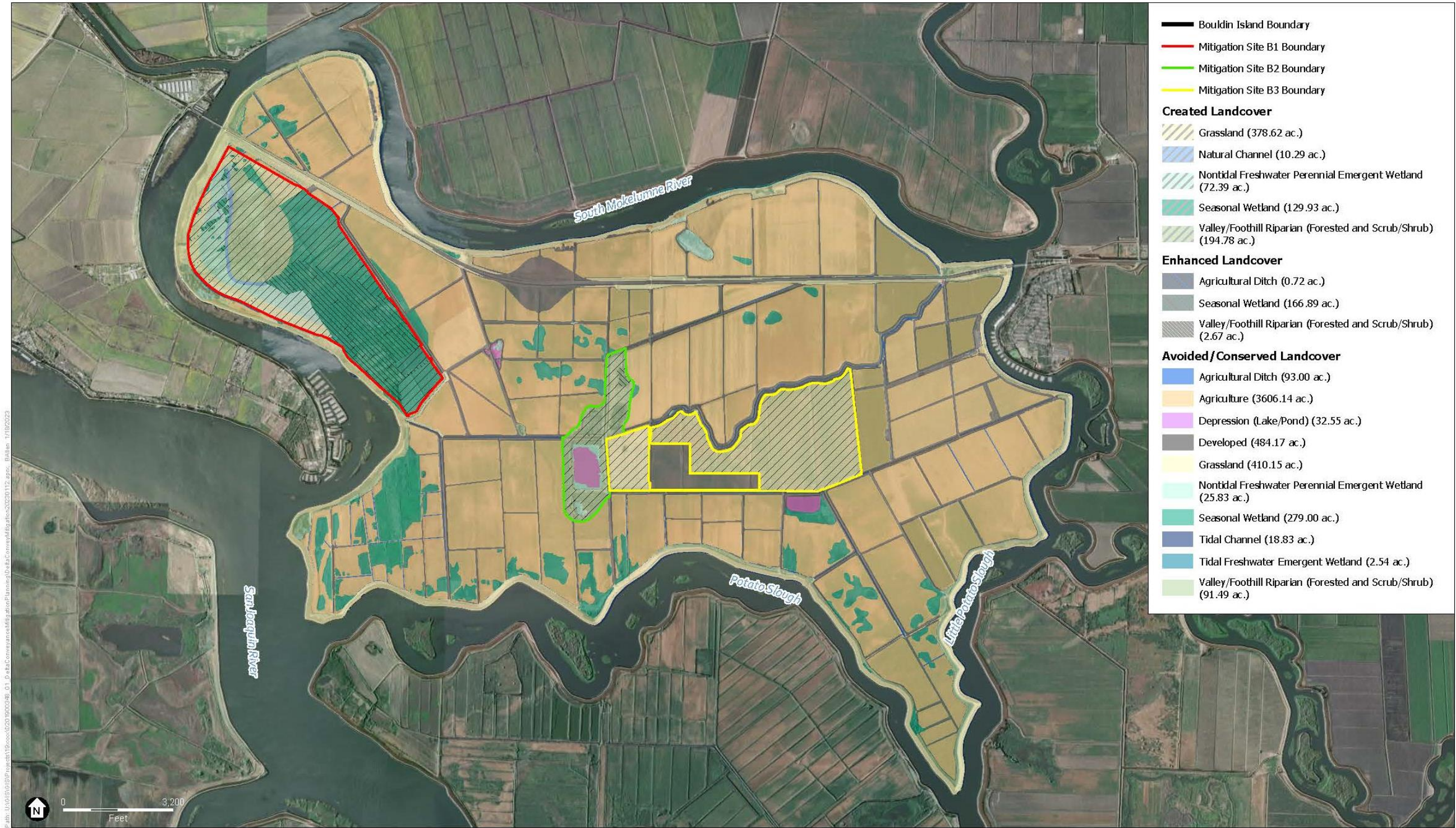
Sources: California Department of Water Resources and GEI Consultants 2020; California Department of Water Resources 2020, 2021.

^a Acreages to the nearest 0.01, may be subject to rounding

Site Design and Development

Conceptual plans for Mitigation Sites B1, B2 and B3 are shown in Figure 3F-6. Mitigation Site B1 would include a mosaic of open water, nontidal freshwater emergent wetland, scrub-shrub wetland, forested wetland, and seasonal wetland habitats. This habitat complex would be designed to provide habitat diversity and complexity to support multiple target species, including tricolored blackbird, western yellow-billed cuckoo, Swainson's hawk, least Bell's vireo, western pond turtle, and Crotch bumble bee. Aquatic features would be designed to sustain wetland hydrology through considering existing elevations and drainage infrastructure.

In general, target habitats would be created through grading (at Mitigation Site B1), planting, adjusting water management and active maintenance in the establishment period. Habitat creation and enhancement at Mitigation Sites B2 and B3 would require minimal, if any, grading. Mitigation Site B1 would require more extensive earthwork to create the targeted habitats (Figure 3F-7). The proposed land cover (created and enhanced) and the changes to existing conditions that would occur at all of the proposed mitigation sites are summarized in Table 3F-7.

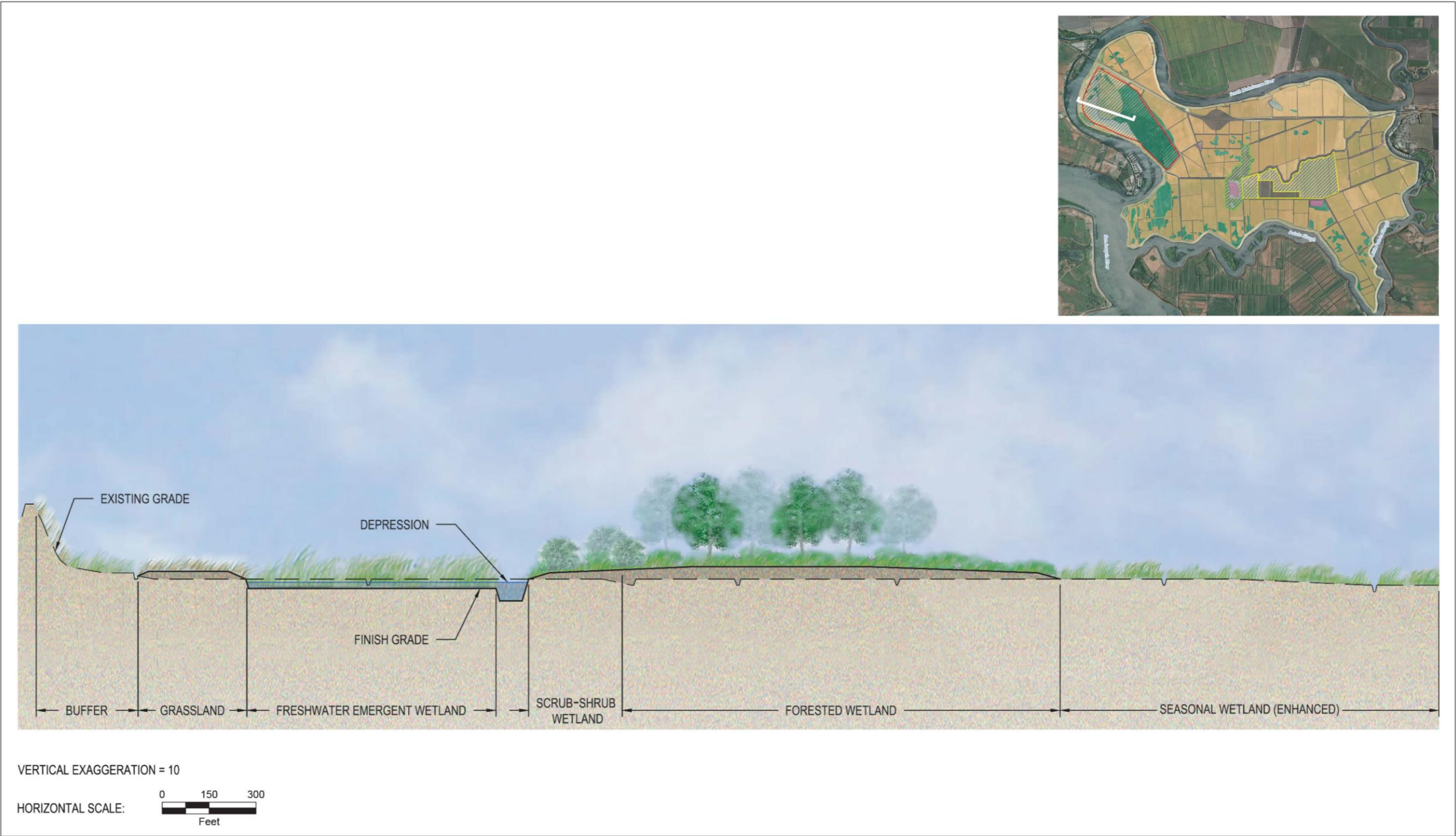


1 SOURCE: Esri, 2018; GEI, 2020; DWR, 2021; ESA, 2021

2 Note: A text description of this figure is provided in Chapter 39, *Description of Figures*.

3 **Figure 3F-6. Bouldin Island Conceptual Design**

Delta Conveyance Mitigation Planning



1 SOURCE: ESA, 2021

2 Note: A text description of this figure is provided in Chapter 39, *Description of Figures*.

3 **Figure 3F-7. Bouldin Island Conceptual Section**

Delta Conveyance Mitigation Planning

1 **Table 3F-7. Comparison of Bouldin Island Sites B1, B2 and B3 Existing Land Cover with Total Created or Enhanced Habitat with Full**
 2 **Implementation (acres)**

Existing Land Cover Class Acres ^a		Habitat Created or Enhanced (acres)												
		Agricultural	Agricultural Ditch	Deve loped	Grassland	Nontidal Freshwater Emergent Wetland	Nontidal Perennial Aquatic	Seasonal Wetland	Tidal Freshwater Emergent Wetland	Tidal Perennial Aquatic	Valley/ Foothill Riparian ^b	Subtotal Habitat Loss	Subtotal Habitat Gain	Total Post-Project Habitat
SITE B1														
Agricultural	337.52	0	0	0	68.53	70.20	7.78	119.82	0	0	71.19	-337.52	0	0
Agricultural Ditch	8.60	0	0.72	0	0	1.15	0.5	4.25	0	0	1.98	-7.88	0	0.72
Developed	8.77	0	0	0	0.29	0.59	0.06	5.25	0	0	2.58	-8.77	0	0
Grassland	0	0	0	0	0	0	0	0	0	0	0	0	68.84	68.84
Nontidal Freshwater Emergent Wetland	0	0	0	0	0	0	0	0	0	0	0	0	72.39	72.39
Nontidal Perennial Aquatic (depression, lake/pond, natural channel)	0	0	0	0	0	0	0	0	0	0	0	0	10.29	10.29
Other Seasonal Wetlands	196.71	0	0	0	0.02	0.45	1.95	166.89	0	0	27.40	-29.82	129.93	296.82
Valley/ Foothill Riparian ^b	0.61	0	0	0	0	0	0	0	0	0	0	-0.61	103.15	103.15
Site B1 Total	552.21	0	0.72	0	68.84	72.39	10.29		0	0	103.15			552.21
SITE B2														
Agricultural	42.77	0	0	0	0	0	0	0	0	0	42.77	-42.77	0	0
Agricultural Ditch	3.51	0	0	0	0	0	0	0	0	0	3.51	-3.51	0	0
Developed	12.21	0	0	0	0	0	0	0	0	0	12.21	-12.21	0	0
Grassland	7.13	0	0	0	0	0	0	0	0	0	7.13	-7.13	0	0
Nontidal Freshwater Emergent Wetland	22.49	0	0	0	0	0	0	0	0	0	22.49	-22.49	0	0
Nontidal Perennial Aquatic (depression, lake/pond, natural channel)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Seasonal Wetlands	3.52	0	0	0	0	0	0	0	0	0	3.52	-3.52	0	0

Existing Land Cover Class	Acres ^a	Habitat Created or Enhanced (acres)												Total Post-Project Habitat
		Agricultural	Agricultural Ditch	Developed	Grassland	Nontidal Freshwater Emergent Wetland	Nontidal Perennial Aquatic	Seasonal Wetland	Tidal Freshwater Emergent Wetland	Tidal Perennial Aquatic	Valley/ Foothill Riparian ^b	Subtotal Habitat Loss	Subtotal Habitat Gain	
Valley/ Foothill Riparian	2.67	0	0	0	0	0	0	0	0	0	2.67	0	91.63	94.30
Site B2 Total	94.30	0	0	0	0	0	0	0	0	0	94.30			94.30
SITE B3														
Agricultural	291.13	0	0	0	291.13	0	0	0	0	0	0	-291.13	0.00	0.00
Agricultural Ditch	1.93	0	0	0	1.93	0	0	0	0	0	0	-1.93	0.00	0.00
Developed	11.86	0	0	0	11.86	0	0	0	0	0	0	-11.86	0.00	0.00
Grassland	0.00	0	0	0		0	0	0	0	0	0	0.00	309.78	309.78
Nontidal Freshwater Emergent Wetland	0.03	0	0	0	0.03	0	0	0	0	0	0	-0.03	0.00	0.00
Nontidal Perennial Aquatic (depression, lake/pond, natural channel)	0.00	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00
Other Seasonal Wetlands	4.37	0	0	0	4.37	0	0	0	0	0	0	-4.37	0.00	0.00
Valley/ Foothill Riparian	0.46	0	0	0	0.46	0	0	0	0	0	0	-0.46	0.00	0.00
Site B3 Total	309.78	0	0	0	309.78	0	0	0	0	0	0			309.78

^a Acreages to the nearest 0.01, may be subject to rounding.

^b Grassland creation at Mitigation Site B3 is proposed only under the central alignment alternatives (Alternatives 1, 2a, 2b, and 2c).

^c Valley/foothill riparian vegetation community includes potentially jurisdictional wetlands (forested and scrub-shrub) and other riparian vegetation.

Mitigation Site B1 Design and Development

The following outlines the general sequence of anticipated construction activities for Mitigation Site B1.

- **Weed Control:** Herbicide application and mowing would begin several seasons before site grading commences to remove several crops of nonnative annual grass weed seed from the soil's seed bank.
- **Wildlife Protection:** Before commencement of ground-disturbing activities, suitable wildlife avoidance and minimization measures (e.g., pond dewatering, exclusion fencing) would be implemented to protect wildlife. See Attachment 3F.1 for additional measures to protect wildlife during construction.
- **Site Preparation:** An on-site staging area would be established that would include a construction trailer, staging of any delivered materials, and an equipment refueling area. On-site utilities would be protected or relocated as needed.
- **Earthmoving:** Existing vegetation would be removed (grubbed) prior to grading. Large equipment would excavate material and move material to create desired elevations. Soils may be temporarily stored on-site in stockpiles. Ditches would be rerouted where necessary to protect adjacent farming operations.
- **Planting and Seeding:** All disturbed areas would be revegetated with native plants. Plants and seeds would be sourced locally to the greatest extent possible. Temporary irrigation equipment would be installed for select plantings for the first 3 to 5 years of plant establishment.
- **Access Improvements:** Improvements would be needed for access during construction, as well as for future site access.
- **Optional Water Control Structures:** Improvements such as temporary pumps and piping may be installed to connect the habitat creation areas with existing drainage ditches or siphons to support target habitats and provide flexibility in future water management.

Portions of this site would be graded to support target habitats. The natural variability in the land surface, existing hydrology, and existing habitat features would be considered in the design to limit the amount of earthwork needed. The most significant earthmoving would be associated with excavations to create freshwater emergent wetland and depressions (lake/pond). Excess fill material would be placed on-site to create suitable elevations to support forested wetland and grassland habitat, resulting in a balanced earthwork site. Existing drainages and canals would be incorporated into the design to support wetland hydrology and site drainage. A large area of the existing farmed seasonal wetlands would not be graded, but rather would be enhanced with plantings and long-term management such as weed control.

Planting palettes would be developed based upon the habitat goals, localized topography, and hydrology. Freshwater wetlands would be planted with native sedges, grasses, and emergent plants, with the most hydrophytic species placed in the most frequently inundated locations. Forested wetland areas would include a mix of overstory and understory species, dominated by Fremont cottonwood and willow, to create structural diversity to support Swainson's hawk, yellow-billed cuckoo, and least Bell's vireo. Seasonal wetlands (newly created and/or enhanced existing) would be planted with grasses, sedges, or rushes.

Vegetation, soil, and hydrologic components of created aquatic resources would be supported by existing soil and groundwater conditions (i.e., peat soils with a high water table). During the interim establishment period, the site may experience additional irrigation in the summer months using existing siphons and pumps to pull water from adjacent waterways under existing water rights. This water would be provided by Metropolitan through an agreement with DWR. It is anticipated that the volume of water needed for the establishment period would not exceed that used for existing agricultural practices. Existing intakes would be screened where needed to prevent entrainment of protected fish species from Delta waterways. Additional modifications may be made to the drainage system adjacent to the site to further support habitat creation goals during the establishment period. It is anticipated that agricultural land uses would continue surrounding the site, and that the pumping of water on and off the island at large would continue as it has for decades, including pumping water onto the island in fall for weed control and off the island in late winter for planting.

Based on the existing on-site conditions and site hydrology, including existing elevations, drainage patterns, and groundwater conditions, it is anticipated that Mitigation Site B1 will be self-sustaining after the establishment period and not reliant on the adjacent irrigation system or other artificial hydrology outside of the existing pumping system used for the entire island. As noted in both federal and state wetland regulations for creating compensatory mitigation sites, long-term sustainability is critical for mitigation site success. In particular, assurances are needed to demonstrate that wetland hydrology will be achieved in the long term, especially when that hydrology is supported by pumping actions. In this case, Mitigation Site B1 would be constructed in a location that would largely revert to wetland habitats absent farming practices based on existing soils, elevation, and hydrology. Nevertheless, when considering long-term sustainability for Mitigation Site B1, site maintenance needs for the existing drainage systems and siphons will be considered as needed to ensure habitats are maintained in perpetuity.

Once constructed, the mitigation site will be monitored on an annual basis during the establishment period (generally 3–5 years) to ensure performance criteria, including wetland hydrology and water quality, are being met. Water supply and drainage management practices may be altered at this time if monitoring indicates improvements are needed. Most of the water would be retained on-site, although during high-flood conditions in winter, some water may be discharged from the wetlands to adjacent Delta waterways through existing drains or outfalls. Based on existing groundwater conditions, water management is not anticipated. Following the establishment period, long-term monitoring would continue to occur on a more infrequent basis (typically once every 5 years).

Creation of freshwater emergent perennial wetlands, seasonal wetlands, and tidal habitats has the potential to affect water quality within the Delta relative to existing conditions (Chapter 9). Mercury methylation occurs under anoxic conditions in sediments, flooded shoreline soils, and, to a lesser degree, in the water column. Increased methylmercury is also associated with wetting and drying cycles. These new sources of methylmercury could result in higher methylmercury concentrations in adjacent Delta waters and uptake into the tissues of fish residing within and immediately adjacent to these wetland habitats where elevated levels of methylmercury could be created.

Several factors would minimize the potential impact of the initial Bouldin Island compensatory mitigation sites on methylmercury within the Delta. First, the freshwater emergent perennial wetlands and seasonal wetlands on Bouldin Island would not be directly connected hydrodynamically with adjacent Delta waters; instead, discharge from the site would be circulated through the island's large ditch drainage system. Second, the source water for these wetlands would be predominantly groundwater, which is expected to have a lower mercury concentration than

Delta surface water. Third, as part of adaptive management, monitoring of the discharge from the wetlands to the existing island drainage system would be conducted and the discharges modified if necessary (e.g., to a detention basin), should monitoring results show the wetland discharges to be a net exporter of methylmercury to Delta waters. Mitigation Measure WQ-6: *Develop and Implement a Mercury Management and Monitoring Plan* (described in Chapter 9) would minimize generation of methylmercury in new habitats. Thus, the wetlands to be created on Bouldin Island would not contribute to measurable increases in methylmercury concentrations in waters and biota of the Delta or make the existing mercury-related CWA Section 303(d) impairment within the Delta measurably worse.

Mitigation Sites B2 and B3 Design and Development

Two additional mitigation sites near the center of Bouldin Island would be restored without excavation or grading (Figure 3F-8). Mitigation Site B2 would expand and enhance existing riparian vegetation around an existing depression to create a larger patch of forested wetland through plantings. Under the central alignment alternatives (Alternatives 1, 2a, 2b, and 2c), Mitigation Site B3 near the center of Bouldin Island would include the restoration of sites that may be disturbed as a result of tunnel shaft construction and the storage of RTM. The area surrounding the proposed tunnel facility would serve as a temporary construction staging and RTM handling and long-term storage area. Grasslands would be created at Mitigation Site B3 through vegetation clearing and grubbing, soil preparation, and planting with native grasses (Figure 3F-8). The exact location of grassland creation areas on Bouldin Island may change during further design refinement, particularly if an alternative that does not use the central alignment is selected (i.e., Alternative 3, 4a, 4b, 4c, or 5).

Construction Methods and Equipment

Wetland grading at Mitigation Site B1 would entail up to approximately 500,000 cubic yards of excavation and fill, assuming 10% losses between cut and fill. The material would be placed to construct a riparian planting island, seasonal wetlands, and grasslands. Large land-based earthmoving equipment like bulldozers, excavators, loaders, dump trucks, water trucks, scrapers, and compactors would move earth around the sites to meet finish grades. Earthwork volumes are approximate and may change as necessary to meet site design requirements in later design phases.

Nontidal Freshwater Emergent and Seasonal Wetlands

Earthmoving and targeted active revegetation are the primary activities needed for habitat creation. The most significant construction activity would be earthmoving, including excavating existing ground to create open water channels and freshwater emergent wetland. Open water channels would be excavated to an average depth of 6 feet and freshwater marsh would be excavated to an average depth of approximately 3 feet. It is anticipated approximately 400,000 cubic yards of excavation would be required for freshwater emergent wetland, while no excavation or fill would be required for seasonal wetland.

Valley/Foothill Riparian (Forested and Scrub-Shrub)

At Mitigation Site B1, forested and scrub-shrub wetlands would be created adjacent to newly created open water and freshwater emergent wetland habitat. These riparian areas would be raised an average of 1 to 2 feet to create suitable elevations to support plantings. Grading would be achieved by placing approximately 240,000 cubic yards of fill generated from excavating open water

and emergent wetlands. At Mitigation Site B2, no excavation or fill would be required for riparian wetland enhancements and creation.

Riparian planting areas at Mitigation Sites B1 and B2 would be disked and planted with native materials. Vegetative materials (e.g., cuttings, seed, plugs, container plants) would be transported on the site using trailers pulled by pickup trucks and all-terrain vehicles. A temporary irrigation system would be installed to support plant establishment. The riparian areas would be managed during a 3- to 5-year establishment period, during which small farm tractors and all-terrain vehicles would be used to mow and apply herbicides.

Depression (Lake/Pond)

An open water feature (depression) would be created in the southwest portion of Mitigation Site B1 to provide aquatic habitat and support wetland and riparian habitats. This open water feature would be excavated to an average of 6 feet below grade, requiring approximately 100,000 cubic yards of excavation. It is assumed that excavated material would be used to support adjacent riparian and grassland habitats. Large land-based earthmoving equipment like bulldozers, excavators, loaders, dump trucks, water trucks, scrapers, and compactors would move earth around the sites to meet finish grades. Trucks and other vehicles would transport construction workers and equipment to the site. Other lakes and ponds that currently exist on the island and the mature riparian habitats surrounding them would be avoided.

Native Grasslands

Native grassland habitats would be created along the western and northern edge of the site grading limits at Mitigation Site B1. It is assumed that approximately 260,000 cubic yards of material generated from on-site excavation would be placed to raise native grassland areas 1 to 3 feet to suitable elevations. Native grasslands could also be restored at Mitigation Site B3 on existing ground and/or spoil from excavation of wetlands and open water features at Site B1. Native grassland areas would be disked using a large farm tractor to prepare the soil for seeding. Native grassland habitats would be drill seeded with a blend of native grasses and forbs that mimic interior and or coastal grasslands, including plant species that would provide foraging habitat for bumble bees. The seed drill would be pulled using a medium-sized farm tractor.

Construction Equipment

Table 3F-8 provides the estimated total days that various construction equipment would be operated to complete the work. The estimated number of “equipment days” assumes that excavation of open water and freshwater wetlands and fill placement for riparian and grassland habitats is performed as one coordinated operation. It is anticipated that most construction, including excavation and grading, would occur during the summer months (May–September). Construction activities would be coordinated with ongoing agricultural activities.

Table 3F-8. Estimated Construction Equipment Use—Bouldin Island

Equipment	Total Working Days ^a	Average Days/Year (over 2 years)
Excavators	98	49
Off-road trucks	98	49
Scrapers large	287	144

Equipment	Total Working Days ^a	Average Days/Year (over 2 years)
Rubber tired loaders	98	49
Track-mounted bulldozer	483	242
Tractors/backhoes	37	19
Sheepsfoot compactor	287	144
Water truck	770	385

^a Total working days is independent of the number of equipment in each category. To calculate the number of working days for a single equipment unit, divide the total working days by the number of equipment units (i.e., 10 excavator working days can represent 10 excavators working 1 day each or 1 excavator working 10 days). Construction equipment quantities would be determined by the construction contractor.

Construction Schedule

The mitigation sites would be built over a period of several years, with construction beginning once relevant permits and approvals have been acquired for the project. Construction would likely occur over a period of 2 to 4 years given the scale of the three mitigation sites on Bouldin Island. Each site would be protected in perpetuity under a conservation easement.

Water Quality

As discussed in Section 3F.4.1.3.3, *Site Design and Development*, freshwater emergent wetland and depressions on Bouldin Island (Mitigation Site B1) have potential to create conditions favorable for methylmercury formation. However, these emergent wetlands would not be hydrodynamically connected to Delta channels except during winter when high flood conditions could result in discharge, which would be monitored for mercury and discharged to a detention basin, if necessary. CHABs form in the summer months and thus do not have potential to be discharged into Delta waters. However, there is potential for CHABs to form within the newly created emergent wetlands where terrestrial species such as giant garter snake, least Bell's vireo, and yellow-billed cuckoo occur. While CHAB formation is not expected, monitoring would be performed, and any identified concerns would be adaptively managed. Valley/foothill riparian habitats are not associated with these water quality stressors. As such, these other types of new habitats would not affect methylmercury, selenium, or CHAB formation within Delta waterways, relative to existing conditions. For nontidal sites, methylmercury and CHABs would be monitored and adaptively managed to meet specific performance criteria as part of the site-specific maintenance and management plans described in Section 3F.6, *Maintenance and Management*, and Section 3F.7, *Performance Standards and Monitoring*.

3F.4.1.4 DWR I-5 Ponds

Site Objectives

DWR owns three rectangular former borrow pits near West Woodbridge Road and SR 12, known as I-5 Ponds 6, 7, and 8 (Figure 3F-1). They are in the White Slough Wildlife Area and within 2 miles of Woodbridge Ecological Reserve. The three ponds, totaling approximately 345 acres, were excavated between 1974 and 1978 to provide fill for freeway construction. Currently, all three ponds are managed under an interagency agreement with CDFW as Class C wildlife areas that are open to the public for hunting and fishing. The borrow pits are fed by groundwater and by periodic overland

flow from precipitation, irrigation runoff, and high canal flows, creating three perennial ponds characterized by deep open water, steep vegetated banks, and relatively flat adjacent uplands.

The proposed design at these sites would reconfigure the three ponds to develop compensatory habitat to mitigate project impacts on giant garter snake and other species. The creation of additional perennial wetland habitat in this area is consistent with the recovery goals identified in the *Revised Draft Recovery Plan for the Giant Garter Snake* (U.S. Fish and Wildlife Service 2017a:I-2–I-4). The proposed mitigation design would incorporate all habitat requirements for giant garter snake, including the following.

- Adequate water during the giant garter snake active season (approximately May 1 to October 1) to provide habitat for prey.
- Emergent, herbaceous wetland vegetation for escape, cover and foraging habitat during the active season.
- Sloped grassy banks, habitat rock and openings in waterside vegetation for basking sites and hibernation burrows.
- Higher-elevation uplands for cover and refuge from flood waters during the giant garter snake dormant season (winter).
- Critical north-south habitat linkages for known giant garter snake populations in San Joaquin County.

Site Selection Criteria and Baseline Conditions

Site Selection Criteria

Site selection is consistent with siting and design criteria from the Final EIR (Attachment 3F.1). The creation of additional perennial wetland habitat in this area is consistent with recovery goals (U.S. Fish and Wildlife Service 2017a:II-1). The I-5 ponds are well suited for giant garter snake habitat due to their location within the White Slough Management Unit of the Delta Basin Recovery Unit (U.S. Fish and Wildlife Service 2017a:II-10–II-11), which is known to support the Caldoni Marsh/White Slough giant garter snake population. Between the mid-1970s and mid-1990s, giant garter snakes were observed in the White Slough region with observations near Pond 7 and between Ponds 6 and 7. In 2009 and 2010, the area was surveyed again and giant garter snake were found to be isolated to an area west of Pond 9, also known as Caldoni Marsh (Hansen 2011). In 2019, two female giant garter snakes were captured in the Shin Kee wetland adjacent to Pond 9 (Fouts et al. 2020). The presence of known populations just south of the sites and their proximity to Woodbridge Ecological Reserve less than 2 miles to the north, as well as the direct hydrologic connection each site has to these areas through White Slough and Hog Slough, respectively, suggests that recolonization of the ponds could occur without intervention. Creating and enhancing wetland habitat in this area would promote population viability and genetic connectivity between isolated populations associated with Hog Slough and White Slough in the Delta (Wood et al. 2015), which is consistent with USFWS recovery strategy goals (U.S. Fish and Wildlife Service 2017a:III-1).

Property Location and Description

Pond 6

Pond 6 lies north of West Woodbridge Road, approximately 1.65 miles west of I-5. The north edge of the site includes Hog Slough and its earthen levee, with an on-site water delivery ditch extending

from a tide gate in the slough around the north and east edges of the property. To the east is the CDFW Woodbridge Ecological Reserve. To the west are agricultural fields in grape vines and row crops. Pond 6's current site uses are as a Class C wildlife area open to the public for hunting and fishing, managed by CDFW. The main access point is from the southeastern corner off of West Woodbridge Road.

Pond 6 is long and relatively narrow, is approximately 5,000 feet long, 50 feet wide, and 20 feet deep. It is located along the western edge of the site. The site generally slopes from the perimeter toward the pond. Past soil excavation activities have created many depressions, artificial drains, grade breaks and impediments to overland flow. Perimeter ditches and existing water conveyance systems surround the site on all sides, leaving the site isolated from surface flows except during exceptionally high-water events. The site has a relatively high groundwater table depth.

Ponds 7 and 8

Ponds 7 and 8 lie directly south of West Cotta Road approximately 1 mile west of I-5, bounded by a high-line irrigation delivery canal to the west and row crops to the east. The access point for both ponds is off West Cotta Road in the north via a gravel parking area. Pond 7 sits in the northern half of the site, while Pond 8 occupies the narrow southern portion of the site. Pond 7 is approximately 3,000 feet long by 300 feet wide and roughly 20 feet deep. Pond 8 is approximately 3,500 feet long, 400 feet wide, and 18 feet deep. Currently, the site is maintained by CDFW as a Class C wildlife area open to the public for hunting and fishing.

Pond 7 runs from northwest to south with a bend of approximately 30 degrees in the middle of the pond along the old canal alignment. Slopes on the site generally fall away from a perimeter berm around the edge of the pond. This berm is relatively steeply sloped on the water side, with a level or gently sloping grade away from the top of the berm on the west side of the pond. Site topography is relatively flat east of the pond's perimeter berm. Perimeter ditches, levees, and existing water conveyance systems surround the site on all sides, leaving the site isolated from surface flows except during exceptionally high-water events. Depressions along the toe of the levee on the western side of the site indicate possible borrow areas that may be up to 2 feet lower than surrounding grade. Several old water delivery and drainage structures also exist on the site. One feature contains parts of an old concrete-lined highline, while another deep drainage ditch bisects the parcel north to south and divides Pond 7 in the north from Pond 8 in the south. This ditch drains irrigation water from adjacent agricultural fields.

Pond 8 has a rim of high ground around the pond that generally slopes away from the pond toward the edge of the site in the west. Unlike Pond 7, Pond 8 has a gentle slope from the top of the berm to the water's edge. There are depressional areas adjacent to the levee on the west side, and a high, flat bench on the east side near the neighboring agricultural fields.

Soils

Pond 6

Pond 6 soils are dominated by Guard clay loam and Dello soil series (Natural Resources Conservation Service 2018). Guard clay loam is an alluvial soil with some clay content characteristic to basin rims and floors. The series may exhibit inclusions of coarser soil series or textures like sands and silts but usually has slow permeability and is poorly drained (Natural Resources Conservation Service 2018). Dello soils typically consist of sands or sandy loams sometimes

overlying clay lenses. Upper horizons tend toward high permeability and would not support wetland hydrology unless underlying clay lenses were present and intact. Soils on-site would have historically supported seasonal and semi-permanent marsh.

Ponds 7 and 8

Ponds 7 and 8 soils are dominated by Guard clay loam soil series, which is described for Pond 6. Soils on the site would have historically supported seasonal and semi-permanent marsh. Ponds 7 and 8 have a relatively high groundwater table depth.

Existing Land Cover

Pond 6

The Pond 6 site includes a historic irrigated pasture, an intermediate bench around the pond that contains riparian vegetation and depressional wetlands, and a long linear pond surrounded by a high berm with nearly vertical banks. In some places, the high berm has “blown out” and seasonal high groundwater from the pond inundates shallow depressions fringing the pond. Existing land cover at Pond 6 is displayed in Figure 3F-8, and approximate acreages of existing land cover are summarized in Table 3F-9.

Vegetation at the Pond 6 site includes common nonnative annual grasses and forbs in uplands to hydrophytes in marsh areas. Mature willows and Fremont cottonwood have established naturally in low-elevation depressions near the pond. Tule patches occur in some lower areas around the pond. Higher terrace vegetation includes upland herbaceous plants (e.g., filaree [*Erodium* spp.], hemlock [*Conium maculatum*], and thistle [*Cirsium* spp.]), as well as some species that are more indicative of wetland soil conditions (e.g., salt grass [*Distichlis* spp.] and rushes). Woody plants in the higher terrace include Himalayan blackberry and quail bush (*Atriplex lentiformis*).

Table 3F-9. Pond 6 Baseline Land Cover

Land Cover	Acres
Agricultural	0.55
Agricultural ditch	3.41
Developed	2.47
Grassland	130.73
Nontidal freshwater emergent wetland	3.11
Nontidal freshwater aquatic (depression, lake/pond, natural channel)	4.02
Tidal freshwater emergent wetland	0.02
Tidal perennial aquatic (tidal channel)	0.80
Valley/foothill riparian (forested and scrub-shrub) ^a	36.36
Total	181.47

^a Valley/foothill riparian vegetation community includes potentially jurisdictional wetlands (forested and scrub-shrub) and other riparian vegetation.



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Ponds 7 and 8

Ponds 7 and 8 are both rimmed with tules. The Pond 7 area includes an existing wetland/riparian marsh complex in the northeast along West Cotta Road. An upland area spans the west side of both ponds. Additional upland is immediately north and south of Pond 7. Existing land cover at Ponds 7 and 8 is displayed in Figure 3F-9, and approximate acreages of habitat types are summarized in Table 3F-10.

Table 3F-10. Ponds 7 and 8 Baseline Land Cover

Land Cover	Acres
Agricultural ditch	2.25
Grassland	90.00
Nontidal freshwater emergent wetland	0.41
Nontidal perennial aquatic (depression, lake/pond, natural channel)	60.57
Seasonal wetland	0.24
Valley/foothill riparian (forested and scrub-shrub) ^a	7.78
Total	161.25

^a Valley/foothill riparian vegetation community includes potentially jurisdictional wetlands (forested and scrub-shrub) and other riparian vegetation.

Vegetation at the Pond 7 site ranges from annual grasses and forbs in the uplands to hydrophytes in marsh areas. Mature valley oaks, willows, and cottonwoods have naturally recruited along relict agricultural features in the uplands, in the riparian forest at the northwest corner of the site area, and along the toe of the levee on the west side of the pond. A narrow thicket of tule circles the entire perimeter of the pond with only small breaks in cover where fishermen have trampled vegetation to access the water. Higher terrace vegetation includes upland herbaceous plants like filaree, hemlock, and thistle, as well as salt grass and rushes. Woody plants in the higher terrace generally consist of coyote brush (*Baccharis* spp.), sandbar willow, and quail bush.

Vegetation at the Pond 8 site ranges from annual grasses and forbs in the uplands to hydrophytes in wetland areas. A narrow band of tule circles the perimeter of the pond with occasional small breaks in cover along the pond's edge. Mature oaks, willows, and cottonwoods have naturally recruited in low-elevation depressions along the toe of the levee to the west of the pond. Higher terrace vegetation includes upland herbaceous plants like filaree, hemlock, and thistle, as well as salt grass and rushes. Woody plants in the higher terrace consist of coyote brush, sandbar willow, and quail bush.

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2 **Figure 3F-9. DWR I-5 Ponds, Ponds 7 and 8 Existing Land Cover**

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Potential Waters of the United States and State

An aquatic resources delineation was conducted using aerial imagery interpretation for the study area, which encompassed the I-5 ponds (Chapter 13, Section 13.1.4, *Wetlands and Other Waters of the United States*). Potentially jurisdictional wetlands and other waters are summarized in Table 3F-11 for Pond 6 and in Table 3F-12 for Ponds 7 and 8.

Table 3F-11. Pond 6, Baseline Potentially Jurisdictional Wetlands and Other Waters

Aquatic Resource	Acres
Wetlands	
Nontidal freshwater emergent wetland	3.10
Forested and scrub-shrub wetland	31.49
Other Waters	
Agricultural ditch	3.41
Depression (lake/pond)	4.00
Tidal channel	0.80
Total	42.80

Sources: California Department of Water Resources and GEI Consultants 2020; California Department of Water Resources 2020, 2021.

Table 3F-12. Ponds 7 and 8, Baseline Potentially Jurisdictional Wetlands and Other Waters

Land Cover Type	Acres
Wetlands	
Nontidal freshwater emergent wetland	0.41
Forested and scrub-shrub wetland	0.40
Seasonal wetland	0.24
Other Waters	
Agricultural ditch	2.25
Depression (lake/pond)	59.83
Total	63.13

Sources: California Department of Water Resources and GEI Consultants 2020; California Department of Water Resources 2020, 2021.

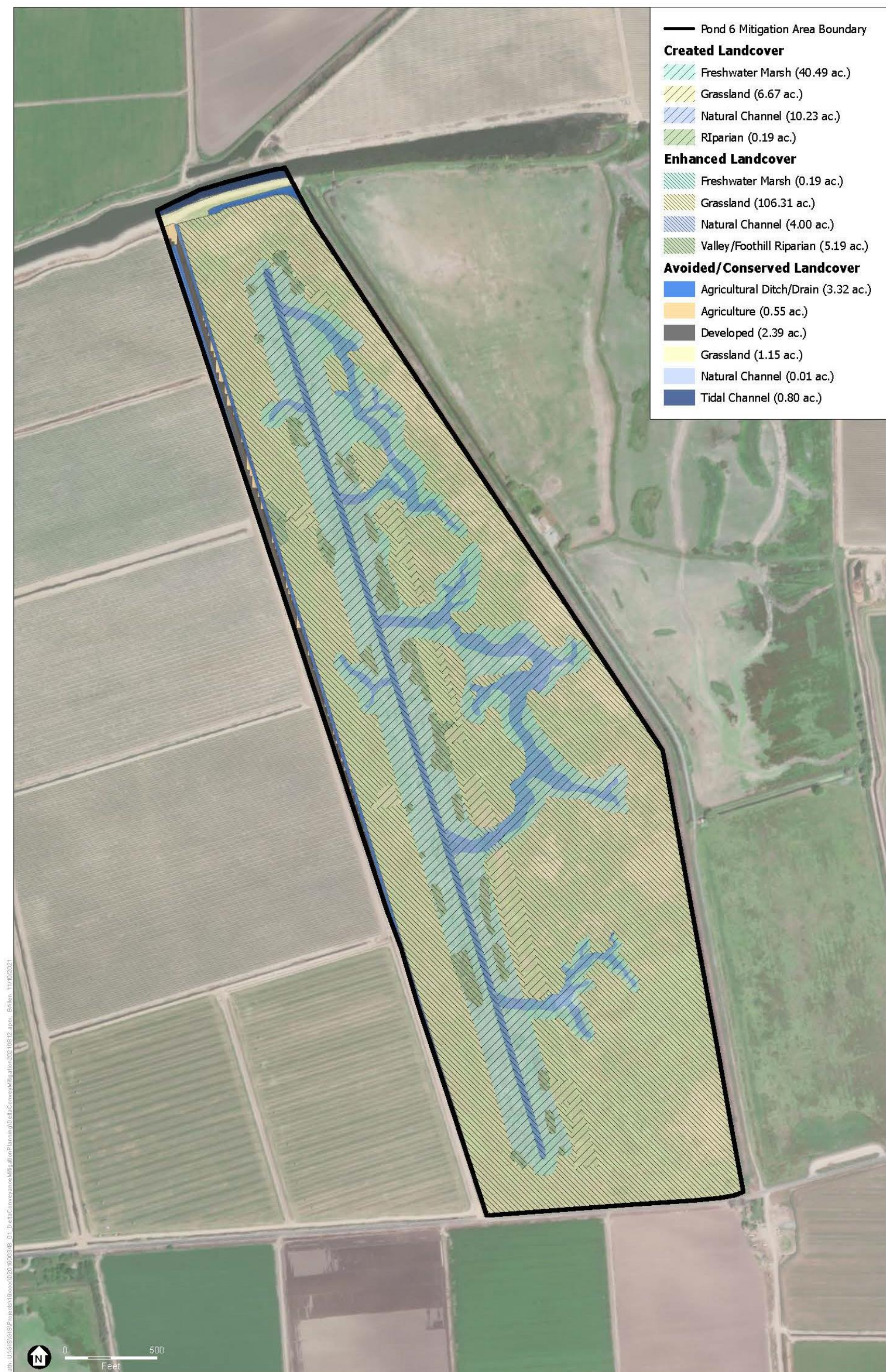
Site Design and Development

The sites would be graded to create a gradient of complex freshwater marsh habitats at varying elevations across the site, including the following.

- Maximizing “hemi-marsh,” consisting of a mix of open water/submerged vegetation and emergent vegetation.
- Creating basking shelves that are near open water, and preferably south and east facing.
- Creating a mix of open water (6–8 feet maximum depth) interspersed with emergent vegetation benches (approximately 3 feet deep), of varying width (average of 60–80 feet wide).

1 Conceptual restoration plans for Pond 6 and Ponds 7 and 8 are shown on Figures 3F-10 and 3F-11,
2 respectively. A schematic cross-section of the Pond 7 conceptual plan is shown in Figure 3F-12. Site-
3 specific grading by pond is described further below in sections *Pond 6 Design* and *Ponds 7 and 8*
4 *Design*.

5 The goal is to create a mosaic of high-quality, low-maintenance freshwater emergent wetland, open
6 water, and associated natural habitats for giant garter snake. In addition, existing riparian habitat
7 would be preserved to the extent feasible. If any existing riparian habitat is affected by construction,
8 it would be replaced with newly created riparian habitat.



SOURCE: Esri, 2018; DWR, 2021; ESA, 2021

Delta Conveyance Mitigation Planning

Note: A text description of this figure is provided in Chapter 39, *Description of Figures*.

Figure 3F-10. DWR I-5 Ponds, Pond 6 Conceptual Design



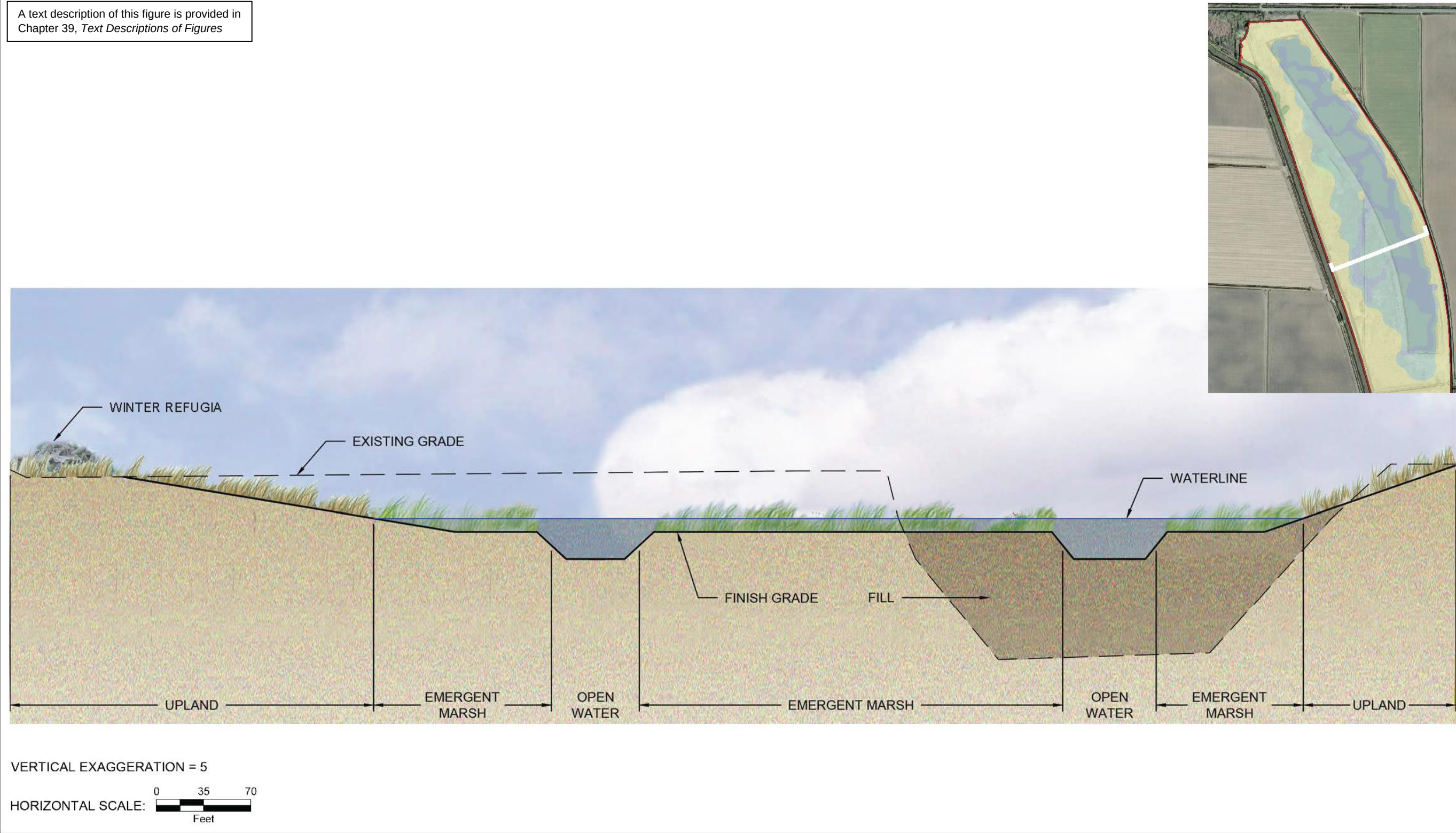
SOURCE: Esri, 2018; DWR, 2021; ESA, 2021

Delta Conveyance Mitigation Planning

Note: A text description of this figure is provided in Chapter 39, *Description of Figures*.

Figure 3F-11. DWR I-5 Ponds, Pond 7 and 8 Conceptual Design

A text description of this figure is provided in Chapter 39, *Text Descriptions of Figures*



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2 **Figure 3F-12. DWR I-5 Ponds, Pond 7 Conceptual Section**

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Pond 6 Design

Select upland areas would be excavated at Pond 6 to lower elevations to access the groundwater table and be recolonized by native wetland vegetation (e.g., tule, rushes) similar to that which currently exists near the pond's edge. Existing wetlands and riparian vegetation along the existing pond edge would be preserved to the extent possible.

Large open water areas would also be excavated (to approximately 6 feet elevation below existing grade or lower) to provide aquatic habitat for giant garter snake prey. Hemi-marsh and smaller open water channels would be excavated to create foraging and refugia habitat for giant garter snake. In addition, the remnant pasture on the west of the pond would be lowered to match the elevation of existing wetlands around the pond. Some excavated material would be placed on-site to grade uplands in a manner that improves habitat conditions for giant garter snake. Excess excavated material would be transported and placed on Ponds 7 and 8, as described in the next section.

Pond 6 proposed land cover (created and enhanced) and the change from existing conditions are summarized in Table 3F-13. Restoration would result in a net gain of freshwater marsh and open water (pond or depression), and a loss of riparian and grassland. Habitat loss would be mitigated by restoration at Bouldin Island of riparian wetland (Mitigation Sites B1 and B2) and grassland (Mitigation Site B3) (Table 3F-7).

1 **Table 3F-13. Comparison of I-5 Pond 6 Existing Land Cover with Total Habitat Created and Enhanced with Full Implementation (acres)**

Existing Land Cover Class	Acres	Habitat Created or Enhanced (acres)												Total Post-Project Habitat
		Agricultural	Agricultural Ditch	Developed	Grassland	Nontidal Freshwater Emergent Wetland	Nontidal Perennial Aquatic	Seasonal Wetland	Tidal Freshwater Emergent Wetland	Tidal Perennial Aquatic	Valley/ Foothill Riparian	Subtotal Habitat Loss	Subtotal Habitat Gain	
Agricultural	0.55	0.55	0	0	0	0	0	0	0	0	0	0	0	0.55
Agricultural Ditch	3.42	0	3.32	0	0.08	0.02	0	0	0	0	0	-0.10	0	3.32
Developed	2.48	0	0	2.39	0.09	0	0	0	0	0	0	-0.09	0	2.39
Grassland	130.75	0	0	0	107.46	14.76	8.34	0	0	0	0.19	-23.29	6.68	114.14
Nontidal Freshwater Emergent Wetland	3.11	0	0	0	2.73	0.19	0.19	0	0	0	0	-2.92	40.49	40.68
Nontidal Perennial Aquatic (depression, lake/pond, natural channel)	4.02	0	0	0	0	0.01	4.01	0	0	0	0	-0.01	10.22	14.23
Other Seasonal Wetlands	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
Tidal Freshwater Emergent Wetland	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
Tidal Perennial Aquatic (tidal channel)	0.80	0	0	0	0	0	0	0	0	0.80	0	0	0	0.80
Valley/ Foothill Riparian	36.36	0	0	0	3.78	25.70	1.69	0	0	0	5.19	-31.17	0.19	5.38
Total	181.49	0.55	3.32	2.39	114.14	40.68	14.23	0.00	0.00	0.80	5.38			181.49

2

Pond 7 and 8 Design

Pond 7 would be graded to create a large side channel to the west of the pond that would be fed by groundwater. Large open water areas would also be excavated (to approximately 6 feet elevation below existing grade or lower) to improve giant garter snake dispersal and foraging on the site. Hemi-marsh and smaller open water channels would also be excavated to create habitat for young snakes and aquatic prey species and provide refugia for giant garter snake. An expanded tule bench with occasional berms and open water fingers would be created around the edge of the pond to increase habitat complexity and increase multispecies benefits. Portions of the uplands would be excavated several feet to provide fill material for raising the bottom elevation of the existing ponds to a depth better suited for giant garter snake. Other portions of the site's uplands would be graded into mounds to provide high-elevation refugia from seasonal flooding.

Given that Pond 8 takes up most of its site, portions of the pond would be filled or raised to create a marsh complex that better supports a range of giant garter snake habitats. Open water expanses would be maintained to enhance water quality via wind mixing and to increase tule edge habitat. Hemi-marsh areas and upland islands would also be included to create a full set of giant garter snake habitats.

Ponds 7 and 8 proposed land cover (created and enhanced) and the change from existing conditions are summarized in Table 3F-14. Restoration would result in a net gain of freshwater marsh and grassland, and a loss of open water (depression) and riparian. Habitat creation at Bouldin Island would fully mitigate losses of riparian wetland (Mitigation Sites B1 and B2) and open water (Mitigation Site B1) (Table 3F-7).

1 **Table 3F-14. Comparison of I-5 Ponds 7 and 8 Existing Land Cover with Total Habitat Created and Enhanced with Full Implementation (acres)**

Existing Land Cover Class	Acres	Habitat Created or Enhanced (acres)												Total Post-Project Habitat
		Agricultural	Agricultural Ditch	Developed	Grassland	Nontidal Freshwater Emergent Wetland	Nontidal Perennial Aquatic	Seasonal Wetland	Tidal Freshwater Emergent Wetland	Tidal Perennial Aquatic	Valley/ Foothill Riparian	Subtotal Habitat Loss	Subtotal Habitat Gain	
Agricultural	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
Agricultural Ditch	2.25	0	1.96	0	0.29	0	0	0	0	0	0	-0.29	0	1.96
Developed	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
Grassland	90.00	0	0	0	59.94	25.51	4.13	0	0	0	0.42	-30.06	7.84	67.78
Nontidal Freshwater Emergent Wetland	0.41	0	0	0	0	0.29	0	0	0	0	0.12	-0.12	58.71	59.00
Nontidal Perennial Aquatic (depression, lake/pond, natural channel)	60.57	0	0	0	3.46	31.26	25.84	0	0	0	0.01	-34.73	4.71	30.55
Other Seasonal Wetlands	0.24	0	0	0	0.24	0	0	0	0	0	0	-0.24	0	0
Tidal Freshwater Emergent Wetland	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
Tidal Perennial Aquatic (tidal channel)	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
Valley/ Foothill Riparian	7.78	0	0	0	3.85	1.94	0.58	0	0	0	1.41	-6.37	0.55	1.96
Total	161.25	0.00	1.96	0.00	67.78	59.00	30.55	0.00	0.00	0.00	1.96			161.25

2

Construction Methods and Equipment

The following outlines the general sequence of anticipated construction activities for the three pond sites.

- **Weed Control**—Herbicide application and mowing would begin several seasons before site grading commences to remove several crops of nonnative annual grass weed seed from the soil's seed bank.
- **Wildlife Protection**—Before commencement of ground-disturbing activities, suitable wildlife avoidance and minimization measures (e.g., pond dewatering, exclusion fencing) would be implemented to protect any giant garter snake or other protected wildlife. See Chapter 13 for additional measures to protect wildlife during construction.
- **Site Preparation**—An on-site staging area would be established that would include a construction trailer, staging of any delivered materials, and an equipment refueling area. On-site utilities would be protected or relocated as needed.
- **Earthmoving**—Existing vegetation would be removed (grubbed) prior to grading. Large equipment would move material from uplands into the existing ponds to create higher-quality giant garter snake aquatic habitat in the footprint of existing ponds and uplands. Soils may be temporarily stored on-site in stockpiles. In addition, some fill would be placed to repair the existing perimeter berm that protects neighboring farms.
- **Planting and Seeding**—All disturbed areas would be revegetated with native plants. Plants and seeds would be sourced locally to the greatest extent possible. Temporary irrigation equipment would be installed for select plantings for the first 3 to 5 years of plant establishment.
- **Access Improvements**—Improvements would be needed for access during construction, as well as for future site access. A new gravel-surfaced access road would be created on the west boundary of the Ponds 7 and 8 site and would include a vehicular crossing at the agricultural drainage ditch separating Ponds 7 and 8. A boat ramp may be installed for future water access for maintenance. Finally, cattle exclusion fencing would be installed as needed if future land uses of the site include grazing. Site access could also be improved for limited public access for recreation (such as fishing) within designated areas outside of suitable habitat if resource agency approves of such uses.
- **Optional Water Control Structures**—Improvements such as temporary pumps, piping, or both may be installed to connect the expanded ponds with existing drainage ditches or Hog Slough to support target habitats and provide flexibility in future water management for maintenance.
- **Culvert Improvement**—The existing culvert under SR 12 would be replaced with a larger bridge or arch culvert so that giant garter snakes have a mud-substrate-bottomed link to provide connectivity between Pond 8 and adjacent giant garter snake habitat south of SR 12

Earthmoving and targeted active revegetation are the primary construction activities. The most significant construction activity would be earthmoving, including excavating uplands to create new wetlands and expanded open water, and fill placement to improve upland habitat conditions for giant garter snake and partially fill Ponds 7 and 8. Assuming approximately 10% losses between cut and fill, grading would entail up to approximately 1.2 million cubic yards of on-site cut and on-site fill. Approximately 0.4 million cubic yards of excess material generated on the Pond 6 site would be transported and used as fill at Ponds 7 and 8.

Large land-based earthmoving equipment like bulldozers, excavators, loaders, dump trucks, water trucks, scrapers, and compactors would move earth around and between the sites to meet finish grades. Excess Pond 6 material would be transported to Ponds 7 and 8 using highway-rated haul trucks. Large delivery trucks and dump trucks would bring construction materials to the sites. Trucks and other vehicles would transport construction workers and equipment to the sites.

The estimated total days that various construction equipment would be operated to complete the work is summarized in Table 3F-15. The average number of days per year is based on an assumed 3-year construction period.

Table 3F-15. Estimated Construction Equipment Use—DWR Ponds 6, 7 and 8

Equipment	Total Working Days ^a	Average Days/Year (over 3 years)
Excavators	1,190	397
Off-road trucks	1,763	588
Rubber tired loaders	1,224	408
Highway-rated trucks	1,854	618
Track-mounted bulldozer	2,414	805
Water truck	1,224	408
Tractors/backhoes	10	3

^a Total working days is independent of the number of equipment in each category. To calculate the number of working days for a single equipment unit, divide the total working days by the number of equipment units (i.e., 10 excavator working days can represent 10 excavators working 1 day each or 1 excavator working 10 days). Construction equipment quantities would be determined by the construction contractor.

Construction Schedule

The mitigation sites would be built over a period of several years, with construction beginning once relevant permits and approvals have been acquired for the project. Each parcel would require approximately one construction season for initial establishment; however, the timing could overlap so various parcels would undergo restoration simultaneously.

Construction would likely occur over a period of 2 to 4 years. Pond 6 would most likely be built first due to the abundance of upland habitat that could be created. Construction would likely occur on the Pond 7 site before the Pond 8 site given the site access constraints for Pond 8. Initial ground-disturbance activities would be conducted during the giant garter snake active season (May 1 to October 1) to minimize potential impacts on giant garter snake. Like the Bouldin Island sites, the I-5 pond sites would be protected in perpetuity under a conservation easement.

Water Quality

Risk of elevated methylmercury at the I-5 ponds is low because the ponds were not historically connected to Delta waters and are currently not tidally connected; therefore, it is unlikely that any mercury was deposited in soils. Risk of CHABs at the I-5 ponds is also low because the ponds are not tidally connected; water for the wetlands would come from ambient sources that would not contain Microcystis. Because these water quality concerns are not present at the I-5 ponds, monitoring is not needed at these locations.

3F.4.2 Mitigation Credits and Site Protection Instruments

The second approach for this CMP is to obtain credits from approved mitigation/conservation banks or to develop site protection instruments to meet mitigation needs for certain natural community types, including some types of wetlands and other waters, and for species. There are a number of approved and pending mitigation/conservation banks with service areas that overlap the proposed alternative footprints. For example, the Elsie Gridley Mitigation Bank with existing and pending alkaline wetland and vernal pool credits, along with vernal pool fairy shrimp (*Branchinecta lynchi*) and vernal pool tadpole shrimp (*Lepidurus packardii*) credits (Lee pers. comm.). Additionally, the pending Doolan Canyon Conservation Bank is in the process of getting California tiger salamander, as well as California red-legged frog, credits approved (Moss pers. comm.).

Although currently there are no mitigation/conservation banks approved or in development for Crotch bumble bee, it is possible that by the time of project implementation one may be available.

3F.4.2.1 Mitigation Credits from Approved Banks

The final amount of mitigation credits to be secured for aquatic resources and species habitats will be determined during the permitting phase of the project as on-the-ground land cover surveys and presence/absence surveys will inform more precise impact calculations and likely reduce the final mitigation burden. In some instances, reduced impact calculations may not result in changes to restoration design and implementation. However, as described in Section 3F.3, mitigation implementation will stay ahead of the cumulative, permanent suitable habitat loss by 10%.

Wetlands and Other Waters

Impacts on the following wetlands/waters may be mitigated through use of an approved mitigation bank.

- Alkaline wetland
- Vernal pool
- Tidal emergent wetland
- Tidal channel

Alkaline wetlands occur on alkaline soils with ponded or saturated soil conditions for prolonged periods during the growing season. The vegetation of alkaline wetlands is composed of plant species adapted to wetland conditions and high alkalinity levels. These wetlands are rare in the study area (the statutory Delta and a few areas southwest around Bethany Reservoir), occurring primarily around Clifton Court Forebay and southern Solano County. Vernal pools are seasonal wetlands that form in shallow depressions underlain by hardpan or a dense clay subsurface layer. These depressions fill with rainwater and surface runoff; the subsurface layers restrict infiltration into the subsoil and the depressions remain inundated throughout the winter and sometimes as late as early summer. Vernal pools are found in areas of level or gently undulating topography in the lowlands of California, especially in the grasslands of the Central Valley. Both of these wetland types require site-specific soil and hydrology factors to create. For these reasons, purchase of wetland creation credits at an approved mitigation bank whose service area includes the project may be the preferred option for compensating impacts on these resources.

Impacts on tidal habitats and fisheries may also be compensated through wetland creation credits or species conservation credits at approved banks. Another option is to compensate for these impacts through the Tidal Habitat Mitigation Framework, as described in Section 3F.4.3, *Tidal Habitat Mitigation Framework*.

Targeted Species

Agency-approved mitigation banks may be used to meet compensatory mitigation requirements for the following species that have habitat needs in excess of the habitat created at the identified mitigation sites or require habitat types that would not occur at those mitigation sites.

- California tiger salamander—aquatic and upland habitat
- California red-legged frog—aquatic and upland habitat
- Vernal pool fairy shrimp and vernal pool tadpole shrimp—vernal pool habitat
- Crotch bumble bee—foraging, nesting, and overwintering habitat

3F.4.2.2 Site Protection Instruments

Another approach to provide on- or off-site mitigation is to use real estate protection instruments and other site protection instruments to ensure the long-term protection of a mitigation site (Wood and Martin 2016:4–10). Examples include conservation easements, deed restrictions, transfer of title, or other documents such as Conservation Land Use Agreements. The site protection instrument would describe site ownership, management (e.g., vegetation or pest control, crop type requirements, water provisions for wildlife), and enforcement of any use restrictions (e.g., insecticide and pesticide restrictions). This approach would be useful to protect habitat functions provided by certain lands for targeted species, such as the following.

- Greater sandhill crane—foraging habitat, roosting habitat (e.g., flooded post-harvest rice or corn fields, pasture, rangeland)
- Swainson's hawk—foraging habitat (e.g., pasture, alfalfa, rangeland)
- Tricolored blackbird—nesting (e.g., active breeding sites) and foraging habitat (e.g., alfalfa, pasture, livestock feed lots)
- Crotch bumble bee—foraging, nesting, and overwintering habitat (e.g., grassland and rangeland)

During identification of properties in support of site protection instruments, DWR will coordinate with the implementing entities for the adopted habitat conservation plans, natural community conservation plans, and other regional conservation plans that overlap with the study area identified in Chapter 13, before decisions are made on acquiring site protection instruments within their respective plan areas. The goal of this coordination is to ensure that DWR's acquisitions to meet mitigation needs do not result in conflicts with these plans and their ability to achieve their biological goals and objectives.

3F.4.3 Tidal Habitat Mitigation Framework

3F.4.3.1 Programmatic Approach

The construction and operations of water conveyance facilities would potentially affect tidal perennial aquatic habitat (e.g., permanent and temporary loss of habitat due to construction) and alter hydrodynamics (e.g., reduce Sacramento River flows downstream of the north Delta intakes) (Chapter 12, Section 12.3.3.2, *Impacts of the Project Alternatives on Fish and Aquatic Resources*).

In summary, approximately 18 to 60 acres of tidal perennial habitat and approximately 1,700 to 4,900 linear feet of channel margin habitat would be required as compensatory mitigation for construction impacts under all alternatives. Approximately 1,600 to 2,800 linear feet of channel margin habitat for salmonids, up to approximately 3,500 acres of tidal habitat for salmonids, approximately 1,100 to 1,400 acres of tidal habitat for delta smelt, and approximately 110 to 140 acres of tidal habitat for longfin smelt would be required as compensatory mitigation for operations impacts under all alternatives. Coordination is ongoing with the regulatory agencies to refine and finalize the tidal habitat mitigation requirements.

This section describes the general approach to identify and construct mitigation sites for channel margin and tidal wetland habitats. It includes a description of the factors considered for site selection as well as the design concepts that may be applied once a site is selected and acquired. Once developed, it is anticipated these mitigation sites will provide suitable habitat for affected fish and aquatic species, including salmonids, delta smelt, and longfin smelt. Creation of tidal wetlands in the north Delta could influence hydrodynamics in ways that may beneficially affect routing and survival conditions for outmigrating anadromous salmonids by decreasing the fraction of Sacramento River flow (and fish) that enters Georgiana Slough (Perry et al. 2018; California Department of Water Resources 2023).

Opportunities for habitat restoration in the Delta are constrained by the elevation of land, which determines the potential to reestablish land-water connections that sustain wetland and floodplain habitat (Delta Stewardship Council 2020a:4–12). Much of the Delta has subsided too deeply to restore its original ecological functions. Farming practices on subsided islands that expose peat soils to oxidation contribute to ongoing subsidence. However, some practices can also reverse subsidence, by creating or promoting accumulation of new soil layers. Examples include managed wetlands, placement of fill, and levee breaching to reestablish hydrological connections (Delta Stewardship Council 2020b:Q2-3). Managed wetlands that are designed to promote subsidence reversal and carbon sequestration would be appropriate for lands at these elevations (Delta Stewardship Council 2020b:Q2-5). For example, restoration of freshwater wetlands on Bouldin Island would contribute to halting or reversing subsidence on the island and is therefore an important element proposed in this CMP.

For tidal habitats, wetland restoration is not appropriate at elevations that are too far below the intertidal range (i.e., below mean lower low water). The Tidal Habitat Mitigation Framework therefore focuses first on the suitable restoration areas identified in the *Delta Plan*, such as the tidally influenced regions of Cache Slough and lower Yolo Bypass. However, it is uncertain that all tidal wetland habitat needs can be feasibly met in this region. In addition, while the proposed approach considers existing elevations, it also considers other benefits beyond wetland habitat structure, such as hydrodynamic effects of tidal mitigation (subtidal, intertidal, and transition habitats) on fish migration and survival through the Delta. Therefore, other locations and project

types have been considered based on the best available science, as well as feasibility criteria. This includes the beneficial reuse of tunnel material to raise elevations if available nearby (with consideration of other impacts from moving material).

Similarly, enhancing and creating channel margin habitat along the lower Sacramento River mainstem from Freeport to Rio Vista may be challenging due to elevations or levee status (i.e., federal project levees), which could constrain opportunities for levee setbacks and waterside modifications. Other options will be considered to provide the functions of the impacted channel margin habitat, such as enhancing channel margin habitat on distributary sloughs (e.g., Sutter Slough, Steamboat Slough) and enhancing and creating additional foraging and refugia habitat in tidal wetlands and seasonally inundated floodplains (Takata et al. 2017).

3F.4.3.2 Targeted Habitats

Channel Margin

The construction of flood protection levees throughout the Delta has led to a reduction in the range of shoreline habitats by eliminating the shallow, slow-velocity river margins, overhanging riparian vegetation, and future woody debris sources (Chapter 13). Channel margin habitat occupies the transition zone between open water and upland terrestrial vegetation (e.g., grasslands, woodlands) along the shorelines of rivers and sloughs. This includes tidal freshwater marsh, riparian habitats, and associated shallow water. These habitats are needed for foraging and as refugia for juvenile fish and salmonids to escape fast currents, deep water, and predators (Bureau of Reclamation 2008:5-17; National Marine Fisheries Service 2009:78).

Tidal Perennial Aquatic

The tidal perennial aquatic natural community is defined as deep-water aquatic (more than 10 feet deep from mean lower low tide) and shallow aquatic (less than or equal to 10 feet deep from mean lower low tide) zones of estuarine bays, river channels, and sloughs (Chapter 13). Under existing conditions, tidal perennial aquatic in the Delta is mainly freshwater habitat, with brackish and saline conditions occurring in the western Delta at times of high tides and low flows into the western Delta. The Yolo Bypass is fresh water.

Tidal channels may have floating aquatic vegetation and submerged aquatic vegetation. Floating aquatic vegetation extends over the open water surface, either as free-floating plants or as colonies extending from plants rooted in banks. Most floating aquatic vegetation in the Delta consists of highly invasive nonnative plants such as water hyacinth, which commonly occurs in dense floating mats that can create anoxic conditions or smother marsh vegetation with decomposing masses of debris.

Submerged aquatic plants are fully submerged and often have root systems reduced to minimal anchorage structures. Many native species, including pondweeds and stoneworts, are valuable food plants for waterfowl and nursery habitat for aquatic invertebrates and fish. In the Delta, nonnative invasive submerged aquatic species such as Brazilian waterweed (*Egeria densa*) and alligatorweed (*Alternanthera philoxeroides*) dominate and replace native species in naturally open water slough beds. These plants create suitable cover and shelter for predatory nonnative fish in tidal slough beds.

Wildlife species associated with tidal aquatic habitats vary with water depth and other habitat features. Deeper open water areas without vegetation provide foraging habitat for wildlife such as terns, gulls, osprey, diving ducks (e.g., ring-necked duck [*Aythya collaris*] and canvasback [*Aythya valisineria*]), and river otters (*Lontra canadensis*), which feed primarily on fish, crayfish, and other aquatic organisms. Shallower water with submerged or floating aquatic vegetation provides foraging habitat for reptiles, such as western pond turtle, and dabbling ducks, such as American widgeon (*Mareca americana*) and northern pintail (*Anas acuta*), which feed on a variety of invertebrates and plant material. Special-status wildlife species include giant garter snake and western pond turtle.

Tidal channels serve as migration corridors for Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*), as well as migration, spawning, and rearing habitat for delta smelt and longfin smelt. Restored tidal habitat areas would have positive effects on delta smelt (Sommer and Mejia 2013) and longfin smelt (Lewis et al. 2020) through greater habitat extent (e.g., as shown for Liberty Island in the north Delta; Sommer and Mejia 2013) and greater food availability on-site or in nearby areas (Hammock et al. 2019).

Tidal Emergent Wetlands

The tidal freshwater emergent wetland natural community is typically a transitional community between tidal perennial aquatic and valley/foothill riparian or terrestrial upland communities across a range of hydrologic and soil conditions (Chapter 13). In the study area, the tidal freshwater emergent wetland community often occurs at the shallow, slow-moving or stagnant edges of freshwater waterways or ponds in the intertidal zone and is subject to frequent long-duration flooding. Tidal freshwater emergent wetland vegetation naturally occurs along a hydrologic gradient in the transition zone between open water and riparian vegetation or upland terrestrial vegetation such as grasslands or woodlands. In the study area, there are often abrupt transitions to agricultural cover, managed wetlands, and boundaries formed by levees and other artificial landforms.

Wildlife species composition in sparsely vegetated areas in low-elevation tidal freshwater emergent wetland is similar to the composition described above under tidal perennial aquatic natural community. Other wildlife species that could utilize these low-elevation tidal freshwater emergent wetlands include western pond turtle, wading birds (egrets and herons), waterfowl (ducks, geese, and swans), shorebirds (e.g., rails, plovers, sandpipers), and perching birds. Common nesting birds include red-winged blackbird (*Agelaius phoeniceus*), marsh wren (*Cistothorus palustris*), common yellowthroat (*Geothlypis trichas*), and black-crowned night heron (*Nycticorax nycticorax*). American beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*) forage on marsh plants and use them for cover and den material. Several special-status plant and wildlife species occur in the tidal freshwater emergent wetland natural community, including side-flowering skullcap (*Scutellaria lateriflora*) and giant garter snake.

Restored tidal habitat areas would have the potential for positive effects on juvenile salmonids, for example by providing foraging habitat along marsh edges (Brown 2003) or a greater extent of inundated vegetated habitat for occupancy (Hellmair et al. 2018).

3F.4.3.3 Channel Margin Habitat Mitigation Approach

Purpose

Channel margin enhancements would seek to improve rearing and outmigration habitat for juvenile salmonids along migration corridors that has been degraded by construction of flood protection levees. Channel margin restoration would be expected to increase rearing habitat; improve conditions along migration corridors by providing increased habitat complexity, overhead and in-water cover, and prey resources for covered fish species; and improve connectivity between patches of existing, higher-value channel margin habitat. Creation of this habitat would also have the potential to increase resting habitat for migrating adult covered fish species, as well as increase spawning habitat for covered fish that spawn in area, including delta smelt and longfin smelt. There could be some rearing benefit for green sturgeon and white sturgeon (*Acipenser transmontanus*) from channel margin enhancement as well.

The focus would be to provide enhanced channel margin habitat along important juvenile salmonid migration routes; consequently, the measure would improve connectivity between patches of higher-value enhanced channel margins and primary channels. This is particularly necessary for reaches that currently have low habitat value for covered fishes and are heavily used by migrating and rearing fish—for example, the Sacramento River between Freeport and Georgiana Slough. Enhanced channel margin in the vicinity of the proposed north Delta intakes (upstream, between the intakes, and downstream) would provide resting spots and refuge for fish moving through this reach.

It is anticipated that channel margin habitat would be restored to mitigate construction impacts, depending on alternative. Channel margin restoration would 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 current practice by USACE and other flood management agencies when implementing levee improvements. Channel margin restoration associated with federal project levees would 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 United States Code § 408) and levee vegetation policy. Any restoration will be designed, constructed, and maintained to ensure no reduction in performance of the federal flood project.

Channel margin restoration would be achieved by site-specific projects. The following habitat suitability factors would be considered when evaluating sites for potential location and design of restored channel margins.

- Existing poor habitat quality and biological performance for listed species of fish combined with extensive occurrence of listed species of fish.
- Locations where migrating salmon and steelhead are likely to require rest during high flows.
- The length of channel margin that can be practicably restored and the distance between restored areas (there may be a tradeoff between restoring multiple shorter reaches that have less distance between them and enhancing relatively few longer reaches with greater distances between them).

- 1 • The potential for native riparian plantings to augment habitat for non-aquatic listed species
2 using riparian habitat, such as Swainson's hawk, least Bell's vireo, western yellow-billed cuckoo,
3 or tricolored blackbird, in proximity to known occurrences.
- 4 • The potential cross-sectional profile of enhanced channels (elevation of habitat, topographic
5 diversity, width, variability in edge and bench surfaces, depth, and slope).
- 6 • The potential amount and distribution of installed woody debris along restored channel
7 margins.
- 8 • The extent of shaded riverine aquatic overstory and understory vegetative cover needed to
9 provide future input of large woody debris.

10 As with tidal wetland restoration, siting, design, and performance criteria for channel margin
11 restoration would be developed. As necessary and reflecting permitting requirements, a
12 collaborative technical team that includes DWR and fishery agency representatives would be formed
13 to select the most biologically appropriate and cost-effective restoration sites, as well as review
14 designs, performance criteria, and management plans for the sites.

15 Site Selection Criteria

16 Approaches to creating channel margin habitat can vary and are dependent on location. Channel
17 margin enhancements would likely occur along migration corridors that also provide a certain level
18 of flood protection for adjacent properties. To maintain the current extent of in-water habitat and
19 level of flood protection, the existing levee would need to be reconstructed to be further set back
20 from the shoreline. Waterside and landside improvements would be implemented to create
21 enhanced channel margin habitat and provide continued flood protection.

22 The following criteria would be used to screen potential sites for channel margin habitat
23 enhancement.

- 24 • **Benefits to species**—Consider the geography and functions of targeted habitat features for
25 affected species, population segment, and life stages where appropriate. Projects that benefit
26 multiple species will be prioritized, to be cost-effective and efficient with restoration efforts.
- 27 • **Ownership**—Focus first on lands owned by DWR, other publicly owned lands, or land owned by
28 project partners.
- 29 • **Existing opportunities**—Look for opportunities to incorporate habitat restoration or creation
30 into project construction, such as channel margin habitat creation as part of levee improvements.
- 31 • **Engineering feasibility**—Consider geotechnical or other issues that might limit options, be cost-
32 prohibitive, or delay implementation.
- 33 • **Enhance habitat function**—Channel margin habitat projects should be focused in the
34 migration corridor for listed anadromous fishes in the Sacramento River (winter-run Chinook
35 salmon, spring-run Chinook salmon, Central Valley steelhead, and southern distinct population
36 segment of green sturgeon). For the purposes of this program, sites would be targeted within
37 the same general geography of the project, including the north Delta along the Sacramento River
38 mainstem, north Delta along Sacramento River tributaries (e.g., Steamboat, Sutter, and Elk
39 Sloughs), lower Yolo Bypass, and the Cache Slough Complex.
- 40 • **Velocity**—Sites that have a lower-velocity environment or where a lower-velocity environment
41 can be created are well suited to channel margin enhancement. However, sedimentation in this

depositional environment can bury instream woody material and plantings, so the potential for deposition of sediment must be taken into consideration. Another consideration is locations where migrating salmon and steelhead are likely to require rest during high flows.

- **Depth**—Sites where shallow-water habitats can be created. Avoid sites with steep banks, as it would likely be cost prohibitive because of the amount of necessary material and feasibility of placement.
- **Proximity**—Prioritize sites near each other or existing suitable habitat to create more continuous habitat. Another consideration is the length of channel margin that can be practicably restored and the distance between restored areas (there may be a tradeoff between restoring multiple shorter reaches that have less distance between them and enhancing relatively few longer reaches with greater distances between them).
- **Elevation**—Existing land surface/relationship connectivity to adjacent hydrologic stage range. Channel margin defined as zone within the waterline -5 feet to +10 feet.
- **Linear miles of channel margin**—Projects should seek to maximize the length of channel margin at a single site. Maximize cost effectiveness and ecological function by selecting few sites with longer channel margin. Linear miles of enhancement will be measured along one side of a given channel segment (e.g., if both sides of a channel were enhanced for a length of 1 mile, this would account for a total of 2 miles of channel margin enhancement).
- **Human disturbance**—Avoid areas with heavy recreational uses.
- **Multispecies benefit**—The potential for native riparian plantings to augment habitat for non-aquatic listed species using riparian habitat, such as Swainson's hawk, least Bell's vireo, western yellow-billed cuckoo, tricolored blackbird, or riparian brush rabbit (*Sylvilagus bachmani riparius*), in proximity to known occurrences.

Design Criteria and Concepts

The following criteria were considered in the development of concept designs for channel margin habitat.

- **Bank slope**—Gentle bank slopes of 10:1 provide shallow-water habitat that creates areas of refuge from predators and high-velocity flows and feeding and rearing opportunities. Additionally, it is more difficult to maintain soil on steep slopes.
- **Benches**—Rock benches are relatively flat areas within the levee slope that create a buffer against toe scour and shear stress, provide a space for planting riparian vegetation, and create a platform for aquatic habitat features. They also create shallow-water habitat for juvenile fish rearing and refugia.
- **Instream woody material**—Provides habitat complexity and high-quality cover and velocity refugia for juvenile Chinook salmon.
- **Bank substrate and emergent vegetation**—Vegetation can provide bank stabilization as well as habitat complexity, refugia for fish, and shade. Riparian vegetation is planted on rock benches that are seasonally inundated.
- **Shade**—Riparian vegetation also contributes to instream woody material and overhanging shade.

1 Design criteria should also take into account geotechnical issues and feasibility, since many areas in
2 the Delta could have challenges with new loading on existing levees or construction of new setback
3 levees.

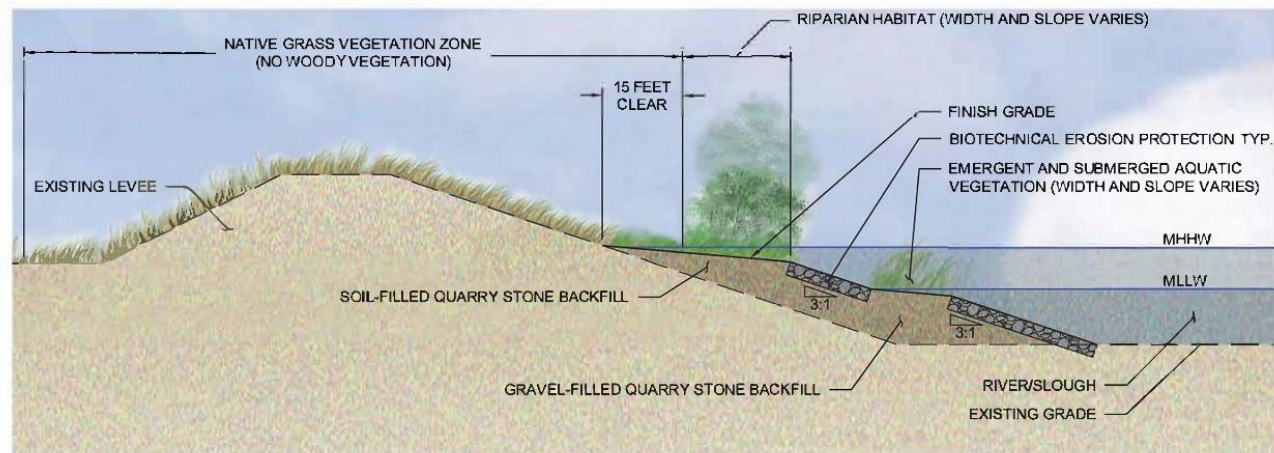
4 Enhancement would generally entail replacing armored or otherwise altered channel banks with
5 more natural shoreline habitats that provide shallow, slow-velocity river margins, overhanging
6 riparian vegetation, and future woody debris sources. Approaches to creating channel margin
7 habitat enhancement can vary and are dependent on location. Channel margin enhancements would
8 likely occur along migration corridors that also provide a certain level of flood protection for
9 adjacent properties. To maintain the current extent of in-water habitat and level of flood protection,
10 the existing levee would need to be reconstructed to be set back from the shoreline. Waterside and
11 landside improvements would create enhanced channel margin habitat and provide continued flood
12 protection.

13 Waterside improvements would entail degrading the existing levee to create gently sloping banks
14 that gradually transition from tule marsh to riparian vegetation on the face of the new setback levee.
15 While enhanced habitat would primarily be provided by native vegetation, ballasted large wood may
16 be incorporated into the channel bank in some locations for enhanced complexity and refugia. While
17 the heavily vegetated bank would provide some wave attenuation value, erosion protection may still
18 be required along the waterside of the setback levee. Bio-technical bank treatments, which combine
19 cobble and other erosion resistant materials with willows and other plantings, would be employed
20 as much as possible. Following all grading, the site would be revegetated, likely through a
21 combination of active and passive methods. Riparian and upland areas would be actively seeded,
22 planted, and temporarily irrigated during the initial establishment period. Intertidal wetland areas
23 would be revegetated through a combination of active planting and passive natural recruitment.

24 Landside improvements would include the construction of a new setback levee behind and
25 connected to the existing levee. The actual extent of earthmoving required for levee construction
26 would vary significantly by site depending on the degree of land subsidence and the level of flood
27 protection needed. It is generally anticipated that imported fill would be needed to construct some
28 or all of the new setback levee. Material generated by degrading the existing levee would be reused
29 in the new levee construction as much as feasible based on timing, soil suitability, and other factors.

30 Figure 3F-13 provides a conceptual design for channel margin habitat creation with no setback levee
31 while Figure 3F-14 depicts a design for sites needing a setback levee.

A text description of this figure is provided in Chapter 39, *Text Descriptions of Figures*



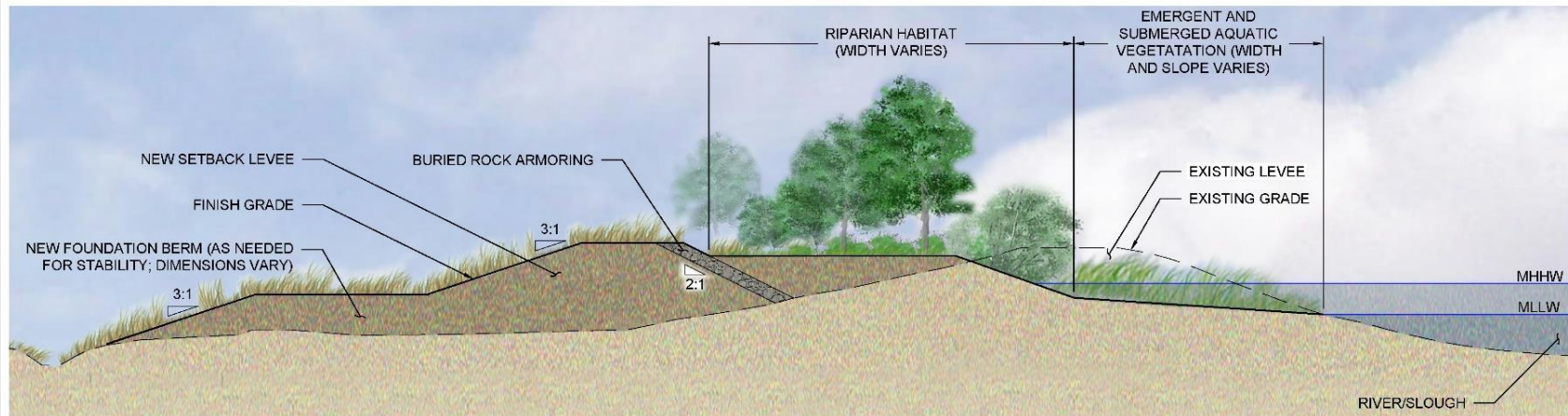
SECTION

VERTICAL EXAGGERATION = 1

HORIZONTAL SCALE: 0 10 20
Feet

Figure 3F-13. Channel Margin No Setback Levee

A text description of this figure is provided in Chapter 39, *Text Descriptions of Figures*



SECTION

VERTICAL EXAGGERATION = 1

HORIZONTAL SCALE: 0 10 20
Feet

Figure 3F-14. Channel Margin Setback Levee

Channel margin enhancement construction is expected to be performed in the following manner.

- Use of large, mechanized equipment (typically, a trackhoe) to remove riprap from channel margins.
- Use of grading equipment such as trackhoes and bulldozers to 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.
- Use of construction equipment such as trackhoes, bulldozers, and cranes to install large woody material (e.g., tree trunks, stumps) into constructed low benches or into existing riprapped levees to provide physical complexity.

3F.4.3.4 Tidal Wetland Habitat Mitigation Approach

Purpose

The construction and operations of water conveyance facilities would potentially affect tidal perennial aquatic habitat (e.g., permanent and temporary loss of habitat due to construction) and alter hydrodynamics (e.g., reduced Sacramento River flows downstream of the north Delta intakes). Restoration of tidal wetlands is one approach to mitigate for these impacts. Tidal perennial aquatic and tidal freshwater emergent wetland habitats in the Delta play a critical role for native fish, including providing improved foraging opportunities and refuge from predators. The restoration of tidal wetlands containing dendritic channels and shallow subtidal areas is intended to mitigate impacts by providing habitat to support survival and growth (including food production) of one or more life stages of delta smelt, longfin smelt, and Chinook salmon (Sherman et al. 2017:29–30, 276–277, 316–321). Depending on the location and size, tidal wetland creation in the north Delta may also have a beneficial effect on flow reversals in Georgiana Slough (Perry et al. 2018), which would benefit migrating Chinook salmon juveniles.

Site Selection Criteria and Tools

Tidal wetland habitat mitigation would generally be achieved at suitable locations by reconnecting former wetland areas to adjacent tidal sloughs and rivers. 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 (2020:7–12) and Sommer and Mejia (2013).

- **Benefits to species**—Consider the geography and functions of targeted habitat features for affected species, population segment, and life stages where appropriate. Projects that benefit multiple species will be prioritized, to be cost-effective and efficient with restoration efforts.
- **Ownership**—Focus first on lands owned by DWR, other publicly owned lands, or land owned by project partners.
- **Mineral Rights**—Preferably, the mineral rights would be intact with the land title. In the instance where the mineral rights are severed, a remoteness opinion would be provided documenting the minimal risk of future surface disturbance for mineral purposes.
- **Geography**—Prioritize sites within the North Delta Habitat Arc, especially those areas within the lower Yolo Bypass and Cache Slough Complex. These areas would provide greater benefits for target fish species.

- 1 • **Elevation**—Prioritize existing land surfaces that have high hydrologic connectivity to adjacent
2 lands within the tidal stage range, consistent with *Delta Plan* policy ER P2 *Restore Habitats at*
3 *Appropriate Elevations* (23 California Code of Regulations § 5006).
- 4 • **Lateral extent/surface area**—The potential lateral extent of land surface connectivity to the
5 tidal range is important to maximize the surface area of created wetland habitat.
- 6 • **Sea level rise accommodation**—Similar to lateral extent, sites that offer sufficient interior land
7 area that could accommodate landward retreat in face of sea level rise should be prioritized.
- 8 • **Water quality**—Siting would consider factors such as local hydraulics, source water, drainages,
9 and location of nearby drinking water supply intakes. Harmful algal blooms of cyanobacteria
10 (CHABs) have not been problematic in the Cache Slough region because water quality conditions
11 in the North Delta Habitat Arc (Cache Slough to Suisun Marsh) are generally not conducive to
12 *Microcystis* growth and aggregation (Environmental Science Associate 2022). The risk for
13 increased selenium bioaccumulation would be minimized by locating new tidal habitat in the
14 north Delta, away from selenium sources from the San Joaquin Valley. The risk of dissolved
15 organic carbon in drainage water from oxidizing peat soils (Fleck et al. 2007) would be
16 minimized because sites with suitable intertidal elevations would have more mineral-based
17 soils due to geography (Cache Slough and lower Yolo Bypass areas) or design (e.g., build up
18 elevations with RTM or dredge spoil).
- 19 • **Feasibility**—Consider factors such as type of levee (federal project or non-federal, existing
20 condition and easements), other regulatory permitting, land ownership, geotechnical feasibility,
21 implementation readiness, easements, and infrastructure.

22 **Design Criteria and Considerations**

23 The following criteria were considered in the development of concept designs for tidal wetland
24 habitat.

- 25 • **Tidal marsh landmasses**—Tidal marsh elevations should allow exchange between adjacent
26 tidal marsh areas and channel habitats during high tides. Marsh plains should generally slope
27 toward the channel for effective draining.
- 28 • **Intertidal channels**—Channel network with dendritic channels ranging in size. Channels
29 should be sinuous and branching, similar to natural channel networks. Channels should be
30 largest (deepest and widest) where they enter the marsh and smallest at their terminus inside
31 the marsh.
- 32 • **Large patch size**—Where feasible, designs should favor the creation of larger patches that can
33 be more sustainable. Large marsh patches (around 250 acres) can support well-developed
34 channel systems and a range of physical and ecological features.
- 35 • **Minimize distance to nearest marsh “neighbor”**—This allows greater habitat connectivity
36 and cumulative benefits.
- 37 • **Increase core habitat**—Core areas provide productivity to edge habitats, are less accessible to
38 many predators, buffered from human disturbance.
- 39 • **Water quality**—Designs should consider hydrologic regime (sites that experience frequent
40 wetting/drying may foster greater methylation of mercury) and channel morphology
41 (backwater areas with low velocities and high residence time can create conditions that foster

harmful algal blooms and bioaccumulation of selenium) to minimize potential effects related to methylmercury generation, selenium bioaccumulation and CHABs.

Siting, design, and performance criteria for tidal perennial habitat restoration would be developed based on assessments of topography, local hydrodynamic conditions, and sediment transport. As necessary and reflecting permitting requirements, a collaborative technical team including DWR and fishery agency representatives would 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.

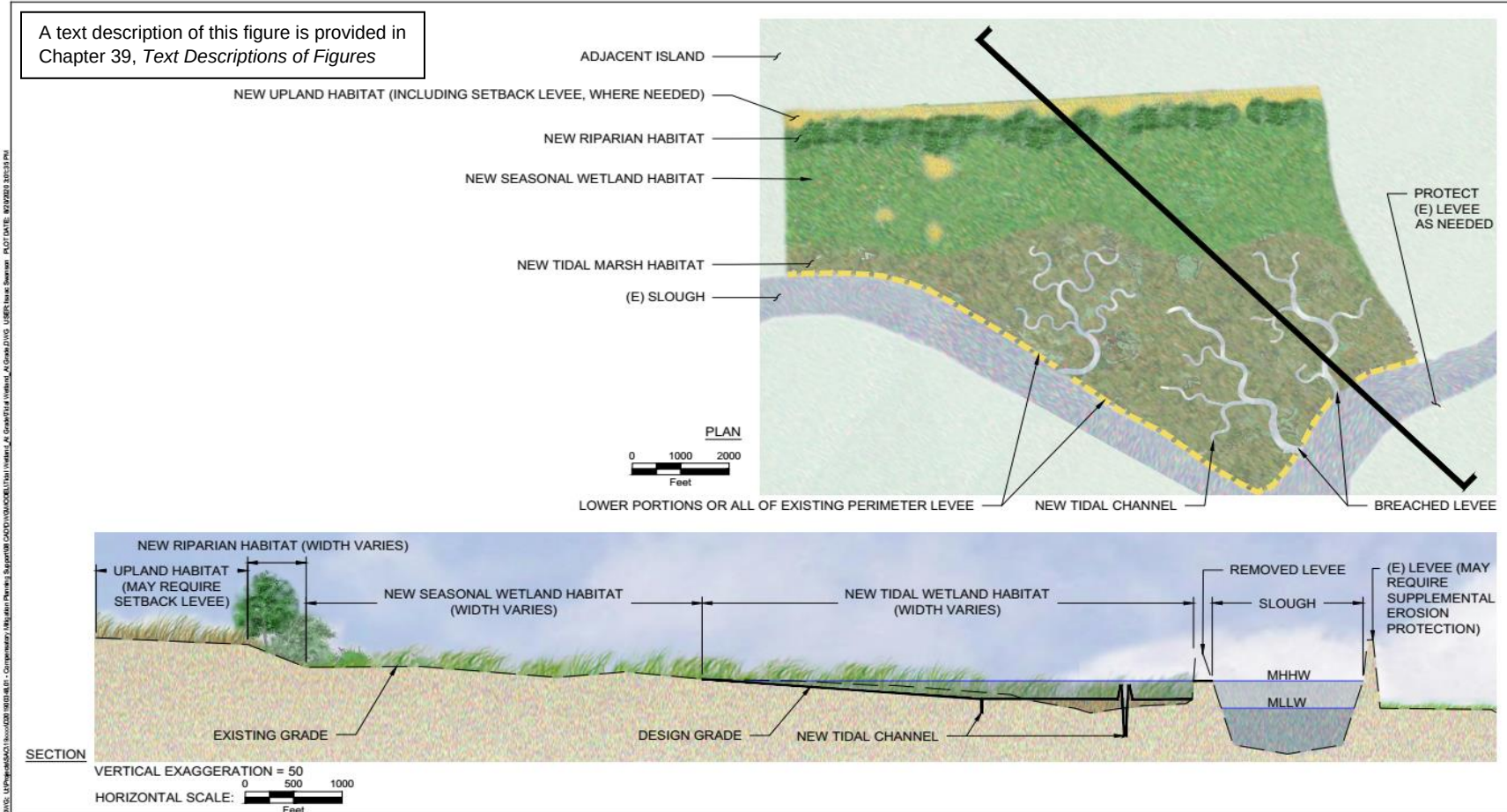
Tidal wetland habitat mitigation would be achieved at suitable locations by reconnecting former wetland areas to adjacent tidal sloughs and rivers. Restoration would primarily occur through breaching or setback of levees to restore tidal fluctuation to land parcels currently isolated behind those levees. Where practicable and appropriate, some areas would be raised to elevations that would support tidal marsh vegetation following levee breaching. Figure 3F-15 provides a conceptual design for tidal wetland creation at unsubsidized sites while Figure 3F-16 depicts a design for subsidized sites.

Typical actions required to create suitable tidal marsh habitat at these sites include grading, planting, and infrastructure modifications. Earthwork often includes breaching an existing levee or berm to reintroduce tidal action to the site. Other grading may be performed prior to breaching to create wetland features that enhance habitat function, including tidal channels, tidal pannes and tidal ponds. In addition, for certain sites, more significant earthmoving may be required to raise subsidized areas to intertidal elevations or to reinforce surrounding levees. Depending on the project location, it also may be necessary to construct an entirely new flood control levee along portions of the project perimeter to protect adjacent properties. Where feasible, transitional riparian and other habitat may be graded between the marsh plain and high elevation areas. The actual extent of earthmoving required can vary significantly depending on the existing topography of the site.

Following earthwork and grading, the site would be revegetated, likely through a combination of active and passive methods. Any riparian or upland areas would be actively seeded, planted, and temporarily irrigated during the initial establishment period. 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. Following reintroduction of tidal exchange, tidal marsh vegetation is expected to establish and maintain itself naturally at suitable elevations relative to the tidal range.

Various infrastructure modifications, such as protection, removal, or relocation of existing utilities, pumping systems, and other water management structures, would occur as needed. Typically work would be sequenced so that grading and infrastructure improvements occur first, followed by planting and finally breaching of the existing levee to reintroduce tidal action.

Levee breaching would require removing levee materials from within and adjacent to tidal and other aquatic habitats. Levee breaching would entail in-water work using construction equipment such as bulldozers, backhoes, and barges; any in-water work would be performed during an in-water work window to be approved by CDFW, the National Marine Fisheries Service (NMFS), and USFWS. Removed levee materials would be placed on the remaining levee sections, placed within the restoration area, or hauled to a disposal area previously approved by CDFW, NMFS, and USFWS.



1
2 **Figure 3F-15. Tidal Wetland Unsubsidized Conceptual Section**

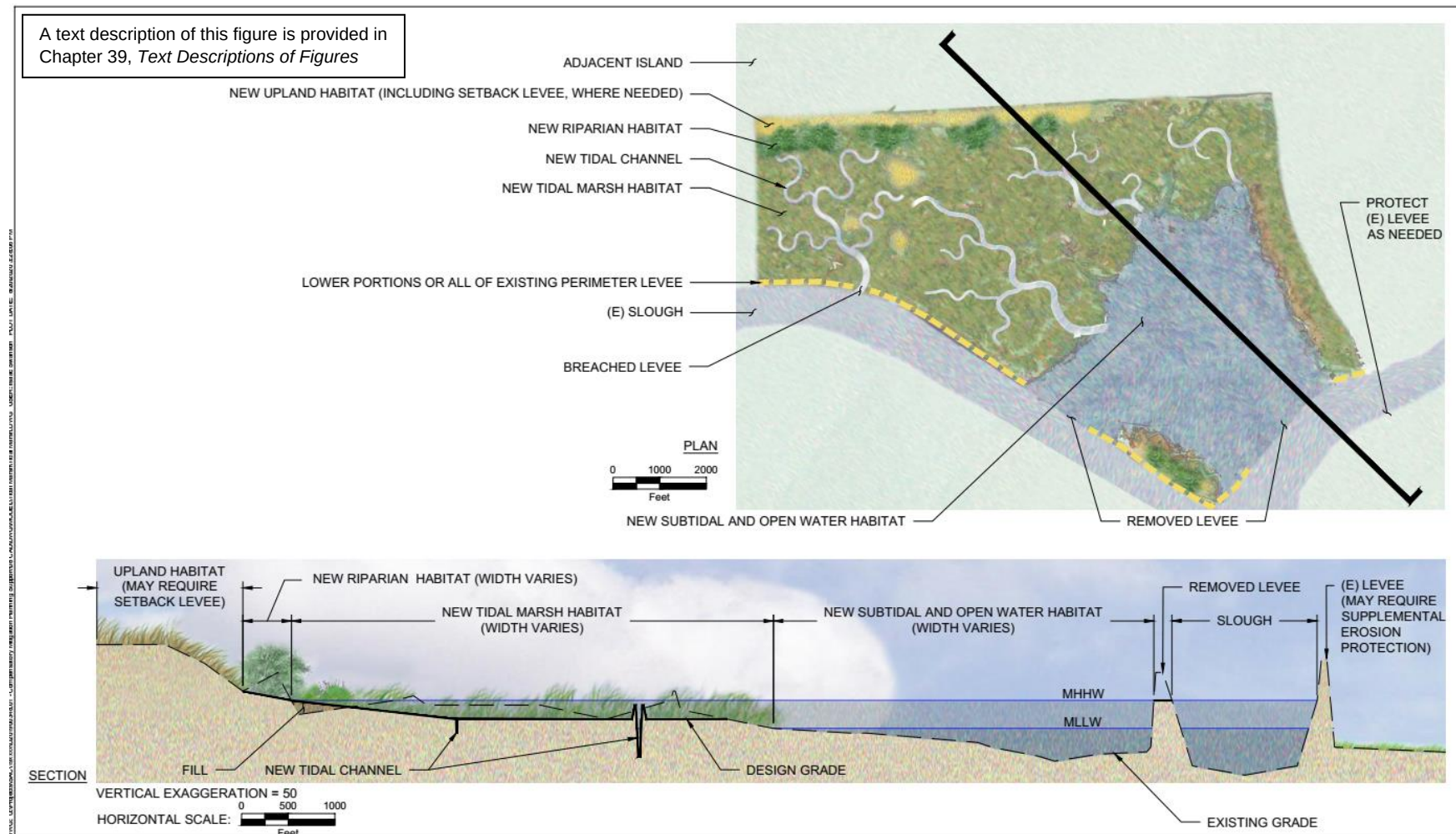


Figure 3F-16. Tidal Wetland Subsidied Conceptual Section

Water Quality Management

Compensatory mitigation could affect water quality in the Delta, namely levels of bioaccumulation of methylmercury and selenium, levels of dissolved organic carbon, and harmful algal blooms of cyanobacteria (CHABs) such as *Microcystis* (Chapter 9, Section 9.3.3.2, *Impacts of the Project Alternatives on Water Quality*). The creation of tidal wetland habitats, which would be hydrodynamically connected to Delta channels, could create conditions conducive to methylation of mercury, promote uptake and bioaccumulation of methylmercury and selenium in fish and aquatic-dependent birds within and adjacent to new tidal habitats, and create areas where water residence time and water temperatures could be sufficiently high to support CHABs where such blooms do not currently exist. Tidal wetland habitats would be sited in the Cache Slough region, where water quality conditions are generally not conducive for *Microcystis*. More information regarding water quality considerations can be found in Chapters 9 and 13.

To mitigate for these potential effects, tidal habitat siting, design, and maintenance would be guided by the design criteria stated above. DWR will implement site-specific monitoring and management plans (Mitigation Measure WQ-6: *Develop and Implement a Mercury Management and Monitoring Plan*) to minimize generation of methylmercury resulting from CMP activities that could potentially promote mobilization of methylmercury into the food chain within new tidal habitats. DWR will develop a Mercury Management and Monitoring Plan (MMMP) to guide tidal habitat siting, design, monitoring, and adaptive management. The MMMP will require evaluation of site-specific conditions and include implementation design elements that minimize conditions that would be conducive to the creation or increased availability of methylmercury in tidal habitats while still achieving most or all of the restoration benefits desired. The MMMP will also require preparation of site-specific mercury management plans that will address MMMP elements for sites selected for new tidal habitat, as appropriate, based on site-specific conditions.

3F.5 Assurances

3F.5.1 Financial Assurances

DWR commits to providing the funding for the initial establishment and long-term management of the mitigation sites to ensure that the mitigation sites continue to meet the established goals of the CMP and any subsequent management plans. This includes the initial 5-year establishment period for the mitigation sites and all activities associated with ongoing maintenance and long-term management. Prior to the initiation of project construction activities, DWR would acquire permits and approvals from CDFW, which would specify the mechanisms for financial assurances.

Payment of the costs of constructing and operating the mitigation sites is assured by DWR's long-term water supply contracts and applicable state law. DWR is a party to a long-term water supply contract with each of the SWP water contractors. These contracts are the foundation of the SWP's fiscal strength. DWR has not experienced payment delinquencies or defaults by the contractors that have had a materially adverse effect on the operation or maintenance of the SWP, or the ability of DWR to pay its obligations when due.

Construction and operation (i.e., associated management costs) of the proposed mitigation sites for the project are expected to be paid by DWR and charged to participating SWP water contractors.

DWR would issue revenue bonds to fund construction costs. As part of the Delta Conveyance Project, the long-term water supply would be amended to provide for the payment of construction and operation and maintenance costs, including all mitigation and monitoring costs incurred during and after construction.

All lands protected and restored for compensation of impacts from construction and operation of the project on aquatic resources and special-status species, as appropriate and consistent with the specific mitigation, would be protected and managed in perpetuity and with appropriate conservation easements. DWR, as project applicant, would ensure appropriate long-term funding for the compensatory mitigation and designation of the party or entity that will be responsible for long-term management of the mitigation sites.

3F.5.2 Site Protection Instrument

The mitigation sites on Bouldin Island and I-5 ponds would be owned and managed by the state or its designee. Long-term management plans would be developed as a part of each individual site. Conservation easements would be used to ensure long-term legal protection of these mitigation sites, with the conservation easements anticipated to be held by CDFW. Other methods of long-term legal protection could be used at other sites through deed restrictions, transfer of title, etc.

3F.6 Maintenance and Management

3F.6.1 Approach

This CMP provides the broad framework for the maintenance and management of mitigation sites. It is anticipated that more detailed, site-specific interim and long-term management plans would be prepared for each mitigation site as designs progress and, in the case of tidal and channel margin sites, additional mitigation sites are selected.

3F.6.2 Establishment Period Maintenance and Management

DWR would prepare an interim management plan for the establishment period for each site (generally the first 5 years following construction). This plan would address site establishment issues such as weed control and irrigation.

Weed control and vegetation maintenance would occur in all restoration areas for 5 years following restoration, as appropriate, based on performance standards described below. Approved herbicides, mowing, or grazing may be used to manage weeds, as appropriate.

Irrigation systems at mitigation sites would be maintained in working order for at least 1 year or until vegetation becomes established. Once the installed plants are established and irrigation is no longer needed, all temporary irrigation materials would be removed from the mitigation site.

3F.6.3 Long-Term Maintenance and Management

3F.6.3.1 General Approaches

DWR would prepare and implement a long-term management plan for each mitigation site at Bouldin Island and the I-5 ponds. These plans would address long-term maintenance needs at each site, including vegetation management, weed control, trash management, and facilities maintenance, as well as identify the qualified staff or third-party entities responsible for overseeing the maintenance and management. The plans would be working documents that are updated and revised as needed to incorporate new acquisitions suitable for coverage under the same management plan and to document changes in management approach that have been agreed to by all parties, consistent with their authority.

Basic elements of long-term site maintenance may include the following.

- General site maintenance
 - Site visits
 - Checks for trespassing
 - Removal of trash
 - Maintenance and replacement of signs, fences, and gates
- Vegetation management
 - Mapping of nonnative invasive plant species
 - Control of nonnative invasive plant species
 - Mowing
 - Controlled burns
 - Grazing
 - Disking
- Levee and channel maintenance
 - Levee inspection
 - Dredging of sediment
 - Monitoring of erosion
 - Road gravel replenishment
 - Grading
 - Rodent abatement and damage repair

Annual reports would be prepared for each mitigation project site. The annual reports would include a summary of work completed to date, milestones, current status, constraints, and relative accrued benefits of the project. The report would specify remedial actions or management responses, as described in Section 3F.6.4, *Adaptive Management*.

3F.6.3.2 Giant Garter Snake Management at I-5 Pond Sites

In addition to the general maintenance activities described above, the I-5 pond sites would be subject to management activities designed to achieve sustainability for giant garter snake habitat. Long-term management would require access to the sites to perform ongoing vegetation and water management. Sites may need to accommodate access of large equipment and boats into marsh areas to chop and disc vegetation, excavate sediment, and to repair berms and water control structures. Ongoing water management and the ability to selectively isolate, dewater, and rewater separate management units are essential to maintain giant garter snake habitat at the I-5 pond sites.

Giant garter snake mitigation areas usually discourage the establishment of large stands of woody vegetation to minimize shading as well as potential predation of giant garter snake by birds of prey. Grazing, mowing, controlled burns, and discing can be used to minimize the growth of woody vegetation and to reduce fire risk in uplands. Grazing would require installing an exclusion fence, gates, and watering troughs to keep grazing animals out of sensitive wetland habitat and open water areas. Other fencing to dissuade trespassing may also be incorporated.

3F.6.4 Adaptive Management

Adaptive management is a science-based, flexible approach to resource management decision making. The Delta Reform Act of 2009 identified adaptive management as the desired approach to reduce the ecological uncertainty associated with the management of the Delta system. An adaptive management and monitoring plan would be prepared for each mitigation site to ensure habitat creation goals are met, consistent with the *Delta Plan's* adaptive framework (Delta Stewardship Council 2013:Appendix 1B).

The Adaptive Management Program for the project would outline key uncertainties for tidal wetlands, channel margin, riparian, and floodplain restoration projects intended to benefit listed terrestrial and fish species. Effectiveness monitoring and research studies would be necessary to examine the ecological function of planned restoration.

For each of the mitigation project sites, a monitoring and adaptive management plan would be prepared, as described in Section 3F.7.2, *Monitoring*). These site-specific plans would track progress toward performance standards, to improve understanding of restoration effectiveness, and to trigger remedial actions as needed to adjust management to achieve mitigation goals.

3F.7 Performance Standards and Monitoring

3F.7.1 Performance Standards

As part of the development of the site-specific maintenance and management plans, performance standards would be established for each mitigation site to provide the basis for annual monitoring parameters and help determine the need for possible remedial actions after project implementation. Development of performance standards assumes an adaptive management approach. Failure to reach one or more of the performance standards does not necessarily imply failure of the mitigation project. Rather, all monitoring results obtained during annual monitoring would be evaluated and provide the basis for discussion with the resource agencies.

Performance standards would be provided for each habitat type described herein, consistent with current USACE uniform performance standards for compensatory mitigation monitoring (33 CFR Part 332). Monitoring categories and examples of potential metrics include the following.

- **Hydrologic**—Wetland hydrology, soil saturation, inundation, hydric soils, seepage
- **Vegetation**—Survivorship of installed or transplanted plants (e.g., elderberry shrub transplants), dominance of native vegetation representative of the target natural community, percent cover of invasive nonnative vegetation, species richness, recruitment of native plants
- **Physical**—Topography, channel geomorphology, bank stability

Performance standards are not included for special-status species directly since the objective of the project mitigation is to establish compensatory suitable habitat rather than to ensure occupancy. Therefore, the successful establishment of aquatic, wetland, and upland habitats based on the floristic, physical, and hydrologic components of the habitats would be used to evaluate the success of special-status species habitat compensatory mitigation. Species-specific habitat requirements, as outlined in the design parameters (Attachment 3F.1), would also be considered as performance criteria. Examples could include the following.

- **Giant garter snake**—Amount and configuration of open water, emergent vegetation, and upland refugia
- **Fisheries**—Amount of shaded riverine aquatic habitat, water quality (temperature, dissolved oxygen, turbidity)

Monitoring would also examine threats to habitat quality and wildlife health that could occur at mitigation sites. Examples of metrics could include the following.

- **Water quality**—concentrations of CHABs (which produce cyanotoxins) and methylmercury
- **Invasive species**—percent cover of native or non-native invasive plant species or presence of invasive wildlife species

See Attachment 3F.1 for more criteria for design and performance for mitigation sites.

3F.7.2 Monitoring

A monitoring and adaptive management plan would be prepared to guide post-construction monitoring and management during a 3- to 5-year establishment period. Compliance monitoring would be conducted to document in a GIS database the extent of natural communities and species habitats restored by measuring constructed outputs (e.g., acres restored, as-built topography and elevations, hydrology). Regulatory permits may also require specific monitoring actions. Effectiveness monitoring would be conducted to evaluate progress toward objectives and performance standards by measuring indicators of ecological status and function (“metrics”) (Section 3F.7.1, *Performance Standards*). Examples of key metrics would be the establishment of native and invasive nonnative plants in restored natural communities and survivorship of transplanted plants (e.g., elderberry shrub). Species-specific habitat features, such as upland refugia, or the production of toxins, such as methylmercury or cyanotoxins would be considered as well.

The initial monitoring period would last 5 years and would evaluate establishment success of aquatic resources and special-status species habitats at the mitigation sites. The year 5 performance standards in most cases would match those identified by USACE in the Uniform Performance

Standards for Compensatory Mitigation Monitoring (33 CFR Part 332). Performance standards for flora in years 1 through 4 are related to year 5 standards by assuming that each year following installation habitats should demonstrate an increase in cover of native hydrophytes, number of native recruits, species richness, and a decrease in percent cover of invasive nonnative species. Monitoring would be conducted annually.

Long-term monitoring would focus on conformance with the long-term management plan. The long-term management plan would identify remedial actions in the event that monitoring indicates performance standards may not be on track for success beyond the establishment period. Examples of remedial actions could include, but are not limited to, additional plantings, topographic recontouring, weed control, erosion control, and further monitoring to diagnose the source of the problem. Long-term monitoring of the sites would occur every 5 years.

Tidal wetlands monitoring would be performed at the scale of the individual restoration site using consistent sampling techniques developed by the Tidal Wetland Monitoring Project Work Team of the Interagency Ecological Program (IEP Tidal Wetlands Monitoring Project Work Team 2017).

Potential subsurface seepage of nuisance water would be monitored by implementing seepage monitoring studies. The studies would measure the level of shallow groundwater in the adjacent soils to evaluate the baseline conditions and continue to measure the level of groundwater for seepage. If seepage of nuisance water is detected through monitoring efforts, a seepage monitoring plan would be implemented, which would include seepage control measures such as installing subsurface agricultural drainage systems to avoid raising water levels into crop root zones.

The scale and sampling frequency (season and number of years) of required monitoring would dictate the source and extent of funding for postconstruction monitoring). The monitoring frequency of various metrics would likely be adjusted each year to account for changing environmental conditions (e.g., floods, drought) and current status of performance standards.

3F.7.3 Reporting

For the establishment period, an annual report would be prepared that includes a summary of management tasks conducted, general site conditions, and monitoring results, including status of resources and progress toward performance standards. The annual report would include descriptions of any management problems and recommendations regarding remedial actions to resolve or reduce (e.g., weed control, security, vegetation removal, erosion control, methylmercury or CHAB production).

In the long term, it is anticipated that monitoring and reporting may be downscaled to once every 5 years based on results and recommendations to ensure that the project continues to perform as expected.

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3F.8.2 Personal Communications

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