

# Bradmoor Island, Arnold Slough, and Blacklock Restoration Projects (combined)

Delta Plan Certification Consistency

**SECTION 2- COVERED ACTION PROFILE**

**2-BRADMOOR-ARNOLD\_FINAL\_PD\_2020.03.10**

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Bradmoor Island and Arnold Slough Restoration Project

Delta Plan Certification Consistency

Section 2- Covered Action Profile

# TABLE OF CONTENTS

Section	Page
<b>Project Description.....</b>	<b>1</b>
2.1 Introduction .....	1
2.2 Project Location .....	2
2.3 Project Site Background .....	2
2.4 Project Goals and Objectives .....	7
2.4.1 Project Goals.....	7
2.4.2 Project Objectives.....	7
2.5 Proposed Project.....	8
2.6 General Construction Methods and Activities .....	15
2.6.1 Demolition and Debris Removal.....	16
2.6.2 Beach Seine Monitoring Ramp Construction .....	16
2.6.3 New Fencing .....	17
2.6.4 Staging Areas and Stockpile.....	21
2.6.5 Well Removal.....	21
2.6.6 Internal Site Modification.....	21
2.6.7 Culvert Removal .....	21
2.6.8 Breaching of Interior Levees.....	21
2.6.9 Filling of Borrow Ditches.....	21
2.6.10 Removal of Water Control Structures and Bulkheads.....	22
2.6.11 Levee Grading at Arnold and Exterior Levee Breaching .....	26

Delta Plan Certification Consistency

SECTION 2- COVERED ACTION PROFILE

2-BRADMOOR-ARNOLD\_FINAL\_PD\_2020.03.10

---

2.6.12	Exterior Levee Breaching .....	28
2.6.13	Sign Installation for Kayak Trails.....	28
2.6.14	Stockpile Stabilization.....	31
2.6.15	Vegetation Management.....	31
2.7	Construction Schedule, Equipment, and Labor Force.....	31
2.8	Post-Construction Conditions .....	33
2.9	Adaptive Management .....	34
2.10	Environmental Commitments and Mitigation Measures .....	35
2.11	Permits, Approvals, and Regulatory Requirements.....	35
2.12	References .....	44

**Appendices**

- Appendix A List of the Environmental Commitments and Best Management Practices
- Appendix B Invasive Vegetation Management Plan

**Figures**

- Figure 2-1. Vicinity Map ..... 5
- Figure 2-2. Project Area and Elevations ..... 7
- Figure 2-3. Preliminary Restoration Site Plan for Bradmoor ..... 9
- Figure 2-4. Preliminary Restoration Site Plan for Arnold ..... 12
- Figure 2-5. Beach Seine Monitoring Ramp Layout ..... 19
- Figure 2-6. Beach Seine Monitoring Ramp Typical Cross Section ..... 20
- Figure 2-7. Typical Water Control Structures and Timber Breakwater ..... 25
- Figure 2-8. Typical Levee Grading Sections ..... 27
- Figure 2-9. Kayak Trail Route from Belden’s Landing to Bradmoor and Arnold ..... 30

**Tables**

- Figure 2-1. Vicinity Map ..... 5
- Figure 2-2. Project Area and Elevations ..... 7
- Figure 2-3. Preliminary Restoration Site Plan for Bradmoor ..... 9
- Figure 2-4. Preliminary Restoration Site Plan for Arnold ..... 12
- Table 2-1. Proposed Construction Timeline for Bradmoor and Arnold ..... 15
- Figure 2-5. Beach Seine Monitoring Ramp Layout ..... 19

[Delta Plan Certification Consistency](#)

SECTION 2- COVERED ACTION PROFILE

2-BRADMOOR-ARNOLD\_FINAL\_PD\_2020.03.10

---

Figure 2-6.	Beach Seine Monitoring Ramp Typical Cross Section .....	20
Table 2-2.	Ditch Filling and Ditch Blocks for Restoration on Bradmoor and at Arnold .....	22
Figure 2-7.	Typical Water Control Structures and Timber Breakwater .....	25
Figure 2-8.	Typical Levee Grading Sections.....	27
Table 2-3.	Levee Grading for Arnold Restoration .....	28
Table 2-4.	Exterior Levee Breaches for Bradmoor and Arnold Restoration .....	28
Figure 2-9.	Kayak Trail Route from Belden’s Landing to Bradmoor and Arnold .....	30
Table 2-5.	Work Windows .....	31
Table 2-6.	Construction Durations, Equipment, and Labor Force .....	32
Table 2-7a.	Bradmoor Island Existing Habitat, Restoration Outcome, and Net Conversion by Existing Habitat Type.....	36
Table 2-7b.	Bradmoor Island Total Estimated Habitat Areas Pre- and Post-Restoration and Gain/Loss of Habitat Area by Type .....	36
Table 2-8a.	Arnold Slough Existing Habitat, Restoration Outcome, and Net Conversion by Existing Habitat Type .....	38
Table 2-8b.	Arnold Slough Total Estimated Habitat Areas Pre- and Post-Restoration and Gain/Loss of Habitat Area by Type .....	38
Table 2-9a.	Blacklock Restoration Outcome by Existing Habitat and Net Conversion of Existing Habitat Type.....	40
Table 2-9b.	Blacklock Total Estimated Habitat Areas Pre- and Post-Restoration and Gain/Loss of Habitat Area by Type .....	40
Table 2-10a.	Project Summary Restoration Outcome by Existing Habitat and Net Conversion of Existing Habitat Type.....	41
Table 2-10b.	Project Summary Total Estimated Habitat Areas Pre- and Post-Restoration and Gain/Loss of Habitat Area by Type .....	42
Table 2-11.	Regulatory Agencies and Approvals .....	43

# ACRONYMS AND ABBREVIATIONS

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µg/m <sup>3</sup>	micrograms per cubic meter
Arnold	Arnold Slough
BiOp	Biological Opinion
Blacklock	Blacklock restoration project
BMP	best management practice
Bradmoor	Bradmoor Island
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CIWQS	California Integrated Water Quality System
DWR	California Department of Water Resources
EB	exterior breach
EIR	environmental impact report
EIS	environmental impact statement
ESA	Endangered Species Act
IB	interior breach
IVMP	Invasive Vegetation Management Plan
LiDAR	light detection and ranging
MHHW	mean higher high water
NAVD88	North American Vertical Datum of 1988
NMFS	National Marine Fisheries Service

[Delta Plan Certification Consistency](#)

SECTION 2- COVERED ACTION PROFILE

2-BRADMOOR-ARNOLD\_FINAL\_PD\_2020.03.10

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RWQCB	Regional Water Quality Control Board
SRCD	Suisun Resource Conservation District
SMP	Suisun Marsh Plan
USFWS	U.S. Fish and Wildlife Service
WCS	water control structure

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Delta Plan Certification Consistency

SECTION 2- COVERED ACTION PROFILE

2-BRADMOOR-ARNOLD\_FINAL\_PD\_2020.03.10

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# Project Description

## 2.1 Introduction

The California Department of Water Resources (DWR) is planning tidal restoration at Bradmoor Island (Bradmoor) and Arnold Slough (Arnold) and remnant water quality structure removal at Blacklock. At project completion, the restoration sites will provide approximately 855.09 acres of tidal waters and salt marsh habitat. This tidal restoration on Bradmoor and Arnold is intended to meet the obligations to improve habitat conditions for special-status fish species, set forth by:

- ▶ Reasonable and Prudent Alternative 4 in U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BiOp) No. 81420-2008-F-1481-5 (USFWS 2008) and (USFWS 2020) No. 08FBTD00- 2019-F-0164,
- ▶ Action 1.6.1 in the National Marine Fisheries Service (NMFS) BiOp for the long-term Central Valley Project and State Water Project Operations Criteria and Plan (NMFS 2009), and (NMFS 2019)
- ▶ Condition 7.1 in Longfin Smelt Incidental Take Permit No. 2081-2009-001-03 for State Water Project operations (CDFW 2009), and 2020 CDFW ITP Permit number 2081-2019-066-00

DWR also is proposing to conduct adaptive management actions at the Blacklock restoration site (Blacklock) such as the removal of a remnant water quality control structure for access to the DWR properties. Together, the proposed actions on Bradmoor, at Arnold, and at the Blacklock restoration site are referred to as the Proposed Project.

DWR initiated the Blacklock restoration project (Blacklock), restoring tidal inundation to an approximately 70-acre managed wetland site, to meet one of the requirements of the Suisun Marsh Preservation Agreement. The agreement was signed in 1987 (Reclamation et al. 1987), and subsequently was revised in 2005 and 2015 by DWR, the U.S. Bureau of Reclamation (Reclamation), the California Department of Fish and Game (now California Department of Fish and Wildlife [CDFW]), and the Suisun Resource Conservation District (SRCD). The agreement includes mitigation requirements for restoration of tidal wetlands, and acquisition, management, and maintenance of conservation lands to meet habitat goals for the salt marsh harvest mouse (*Reithrodontomys raviventris halicoetes*). Restoration of the Blacklock site was completed in 2007, and the 10 years of required monitoring were completed in 2017.

The Suisun Marsh Habitat Management, Preservation, and Restoration Plan, referred to as the Suisun Marsh Plan (SMP), was finalized in 2011 by the Suisun Marsh Principal Agencies, a group of agencies with primary responsibility for Suisun Marsh management. The Suisun Marsh Principal Agencies are USFWS, Reclamation, DWR, CDFW, NMFS, SRCD, and the Delta Stewardship Council. The SMP is intended to guide near-term and future actions related to restoring tidal wetlands and managed wetland activities. USFWS and Reclamation served as joint lead agencies under the National Environmental Policy Act and signed a Record of Decision for the SMP in April 2014. CDFW served as lead agency under the California Environmental Quality Act (CEQA). A final environmental impact statement/environmental impact report (EIS/EIR) was completed for the SMP, and the EIR was certified on December 22, 2011 (State Clearinghouse No. 2003112039).

DWR served as a responsible agency under CEQA for the SMP EIS/EIR. Thus, DWR will rely on the SMP EIS/EIR when acting on the aspects of the SMP (i.e., the original project under CEQA) that require DWR's approval, which includes

tidal restoration. DWR completed an addendum to the SMP EIS/EIR to comply with CEQA and Section 15164 of the State CEQA Guidelines, covering the Proposed Project and the environmental effects of the tidal restoration activities that were evaluated in the SMP EIS/EIR and further identified in the addendum, along with associated mitigation measures. The SMP was approved prior to the development of the Delta Plan as a programmatic EIR/EIS and is relied on for the analysis and resulting mitigation measures included in the CEQA addendum for the Proposed Project incorporated in this Consistency Determination.

## 2.2 Project Location

The project area is in the northeastern corner of Suisun Marsh (Figure 2-1) and Region 3 of the SMP. Bradmoor is bordered on the north and east by Denverton Slough, to the west by Nurse Slough, and to the south by Little Honker Bay. Arnold is southeast of Bradmoor and south of Little Honker Bay, and bordered to the west by Blacklock and Arnold (Figure 2-2). The southwestern border of Arnold includes remnant levee and tidal wetland bordering Blacklock, and the eastern border transitions into uplands. Elevations across the restoration sites range from approximately -5 feet to 110 feet North American Vertical Datum of 1988 (NAVD88). A private residence is immediately north of the Arnold property. Other surrounding properties currently are used for cattle grazing and waterfowl hunting. The restoration sites are accessed by two gravel roads, located at the intersection of Shiloh Road and Little Honker Bay Road.

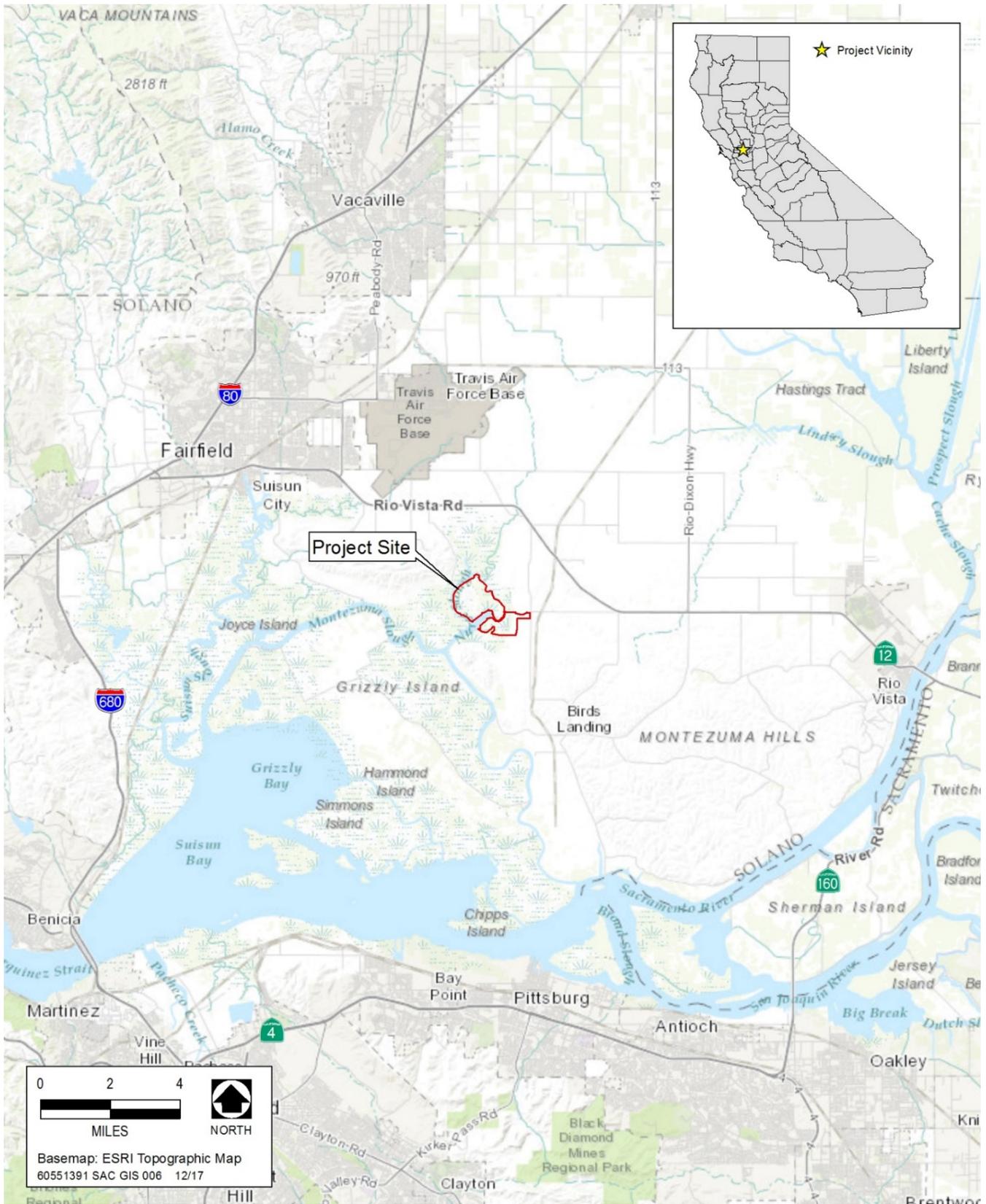
## 2.3 Project Site Background

Bradmoor is composed of approximately 144 acres of uplands, 469 acres of managed wetlands, and 141 acres of tidal wetlands and open tidal waters. The island is divided into three separate properties, historically managed as individual duck clubs: Wildwing Duck Club, Flying D Club, and Overlook Club. A building complex associated with the Flying D Club, consisting of two wood-framed buildings, a modular home, and a shed with a partially enclosed carport, is on the southwestern slope of the uplands segment of Bradmoor. One large building and a small dock and boat launching facility associated with the Wildwing Duck Club are on the southwestern side of Bradmoor. The managed wetlands have infrastructure associated with waterfowl hunting and water management. Bradmoor has six water control structures (WCSs) and associated bulkheads, and 10 culverts. A cattle fence and gate are in the uplands.

Arnold has approximately 105 acres of uplands or developed areas, 138 acres of managed wetlands, and 20 acres of tidal wetlands and open tidal waters. The site historically was part of the larger Blacklock Ranch, which traditionally has been used for cattle grazing and waterfowl hunting. Existing infrastructure on the property includes an old boat ramp and dock, a dilapidated shack, a windmill, an aboveground water tank and water trough, a pumping structure and pipe, one WCS and bulkhead, one culvert, cattle gates, and fencing.

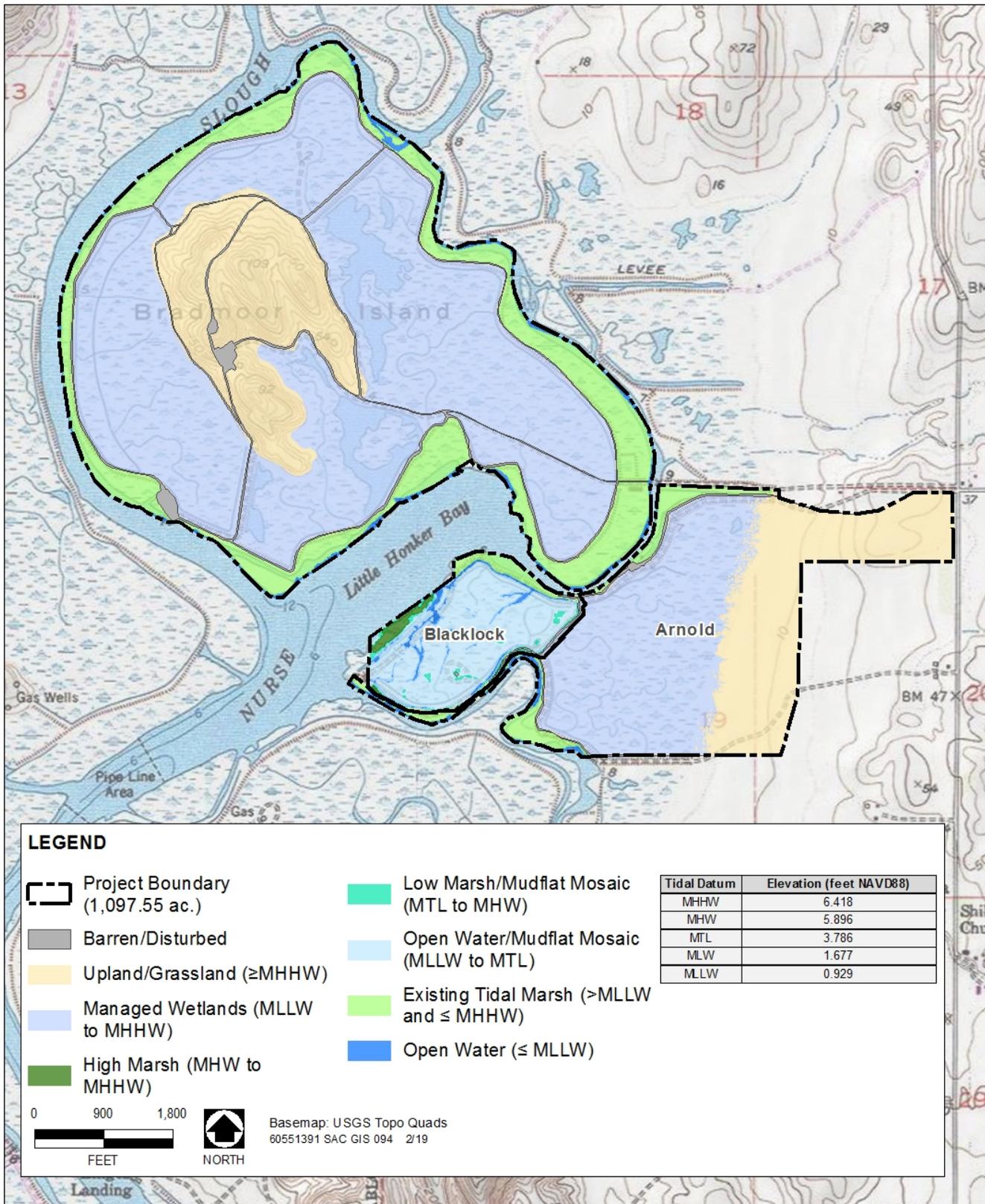
DWR is implementing an interim management plan for Bradmoor and Arnold to manage them before restoration. Management actions that are part of the interim management include maintenance of the levees and WCSs, water management (flooding, draining, and circulation), mosquito abatement through the Solano County Mosquito Abatement District, mowing and spraying of invasive vegetation, and mowing and grading of access roads as needed.

Grazing has occurred on the upland portions of Arnold and the adjacent Blacklock Ranch since the 1860s. The uplands are dominated by annual grasses, such as medusahead (*Taeniatherum caput-medusae*), Italian rye grass (*Festuca perennis*), and bromes (*Bromus* spp.). Grazing continues on Arnold through an agreement with the adjacent property owner of the Blacklock Ranch parcel. The combined 240-acre Arnold/Blacklock Ranch pasture has about 40 cows (up to 80 with calves) year-round, but the site currently lacks infrastructure to limit them to the uplands. The cattle's water source used to be a trough filled by a windmill-powered well at Arnold, but now the well is defunct and the current water source is an unnamed stream on Blacklock Ranch.



Source: Data compiled by AECOM in 2020

**Figure 2-1. Vicinity Map**



Source: Data compiled by AECOM in 2020

## Figure 2-2. Project Area and Elevations

Blacklock is an approximately 70-acre tidal wetland restoration project that was completed in 2007 after two exterior levee breaches in 2006, one of which was unintentional. The site was historically part of the larger Blacklock Ranch. An old WCS remains on the remnant levee that connects to Arnold. The WCS is no longer in use and would not be accessible after restoration takes place at Arnold, and therefore would be removed as part of the Proposed Project while access still is available.

### 2.4 Project Goals and Objectives

The Proposed Project would partially fulfill obligations to improve habitat conditions for special-status fish species, as set forth in the Operations Criteria and Plan BiOp (2008) and the Longfin Smelt Incidental Take Permit (2009) and carried forward in the 2019 Biological Opinions for long-term operation of the State Water Project and Central Valley Project and the 2020 Incidental Take Permit for long-term operation of the State Water Project. In addition, Bradmoor and Arnold are identified as priority restoration projects under the Delta Plan and California EcoRestore Program. Project-specific goals and objectives were developed to guide restoration planning, so that the process would be directed toward specific restoration outcomes. These goals and objectives are listed in order from highest priority to lowest.

#### 2.4.1 Project Goals

- ▶ Goal 1: The restoration project will benefit listed fish species that have the potential to occur on Bradmoor and Arnold and in surrounding waterways.
- ▶ Goal 2: The restoration project will benefit special-status wildlife species that have the potential to occur on Bradmoor and Arnold.
- ▶ Goal 3: The restoration sites will be self-sustaining over time and incorporate design features that anticipate the potential effects of climate change where feasible.
- ▶ Goal 4: The restoration project will be designed to facilitate monitoring of the habitats at Arnold and in surrounding areas.

#### 2.4.2 Project Objectives

- ▶ Increase available Delta Smelt and Longfin Smelt habitat, including enhancement of primary and secondary productivity.
- ▶ Enhance the quality of habitats to support more special-status and native wildlife.
- ▶ To the greatest extent practical, take advantage of the natural features of the project restoration sites to promote habitat resiliency to changes in future Suisun Marsh conditions.
- ▶ Avoid promoting conditions, such as noxious weed infestations, that are in conflict with the above project objectives.

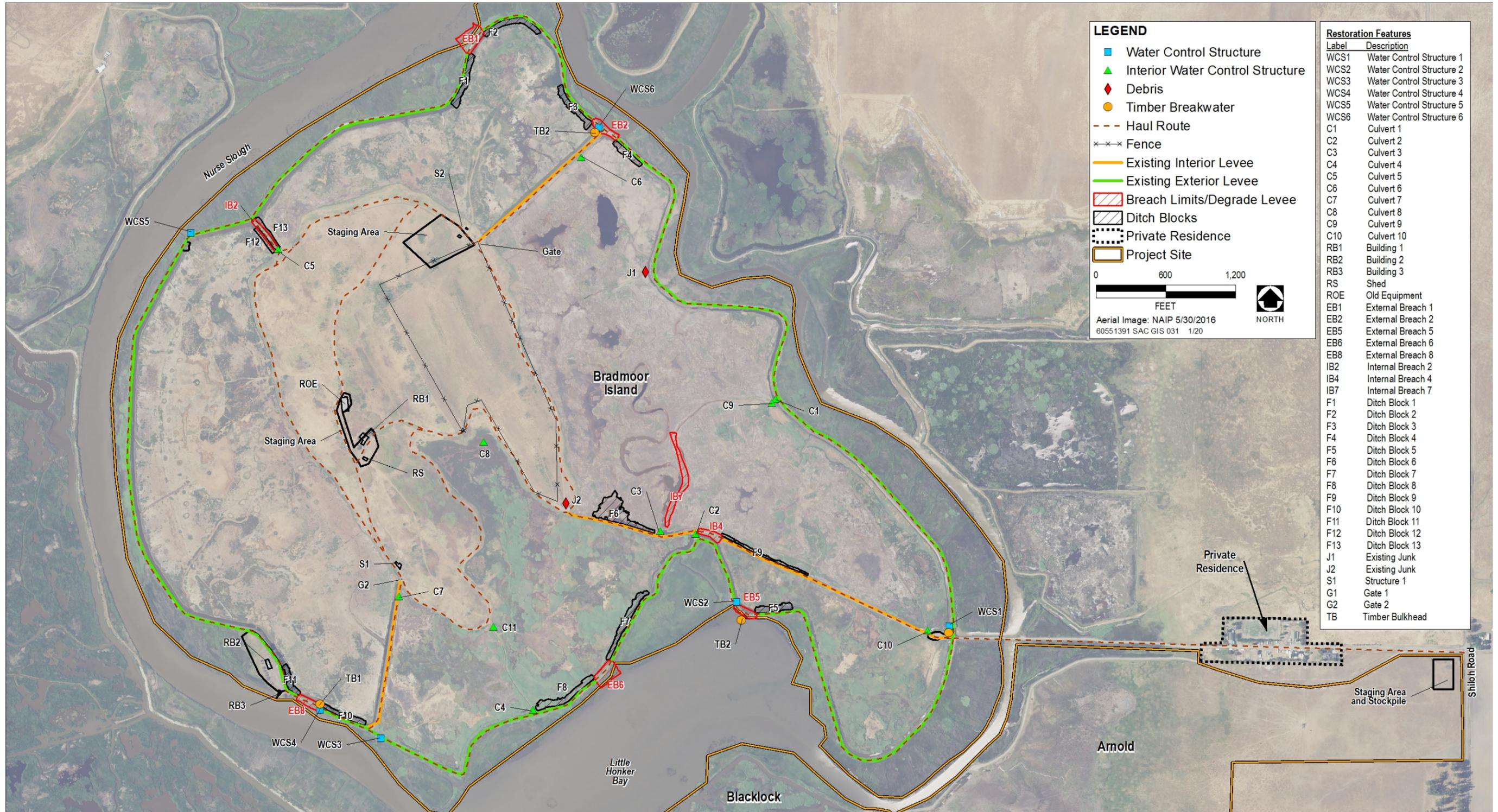
## 2.5 Proposed Project

The Proposed Project would restore tidal hydrology to approximately 476 acres on Bradmoor and approximately 141 acres at Arnold by breaching levees in strategic locations, grading down sections of the levees, and filling ditches near the breach locations to the elevation of the adjacent marsh plain to create ditch blocks (Figure 2-3 and Figure 2-4). The restored tidal wetlands are expected to provide on-site and regional habitat benefits to native fish and wildlife. The Proposed Project would result in creation (net gain) of approximately 9.07 acres of new waters and wetlands. DWR is executing an agreement with the Regional Water Quality Control Board (RWQCB) to complete 4.9 acres of mitigation for impacts from the Tule Red Project, as required in the Board Order for that project (California Integrated Water Quality System [CIWQS] ID 818757). DWR intends to reserve the remaining 4.17 acres surplus creation of jurisdictional waters as mitigation for other DWR projects, pending requirements by resource agencies and associated agreements. The Proposed Project would convert privately owned land to new navigable waters accessible by the public. The Proposed Project would allow approximately 610 acres of new water-based public access for personal watercraft and would provide recreation opportunities, such as wildlife viewing, nature study, photography, hunting, and boat fishing. Any debris and infrastructure remaining on Bradmoor and Arnold, including WCSs and modular buildings, would be removed and disposed of before restoration. Grazing infrastructure (fencing and gates) on Bradmoor would be removed and grazing would be discontinued, while grazing infrastructure at Arnold would be enhanced to allow grazing to continue as part of long-term management. In addition, an old WCS on Blacklock would be removed. The total project area encompasses approximately 1,098 acres (Figure 2-2).

Restoration of Bradmoor (Figure 2-3) would consist of removing six WCSs (three of which are in breach locations and would be removed during breaching and three that would be removed and backfilled), creating seven breaches of varying length—five on the exterior levee (exterior breach [EB] 1, EB2, EB5, EB6, and EB8) and two on interior levees (interior breach [IB] 2 and IB4); and grading down a berm (IB7). At each breach (interior and exterior), fill would be placed in ditches adjacent to the existing levees, so that the ditch elevations would match the elevations of the adjacent marsh plain to create 13 ditch blocks (F1–F13). Remnants of a tidal slough through the lowest part of the island would be reconnected to Little Honker Bay through the proposed breach configuration.

Restoration of Arnold (Figure 2-4) would consist of removing two WCSs (one at Arnold and a remnant one on Blacklock), creating three breaches on the exterior levee (B1–B3), grading down sections of the exterior levee (G1–G4), and filling in ditches near the breaches to create four ditch blocks (F1–F4). As part of the restoration, a beach seine monitoring ramp would be installed to facilitate effectiveness monitoring of the interior of Arnold (Figure 2-4).

The Proposed Project would incorporate the appropriate environmental commitments (or equivalent measures) and mitigation measures identified in Section 2.5, “Environmental Commitments and Mitigation Measures,” of the SMP EIS/EIR and provided in Appendix A of this document.

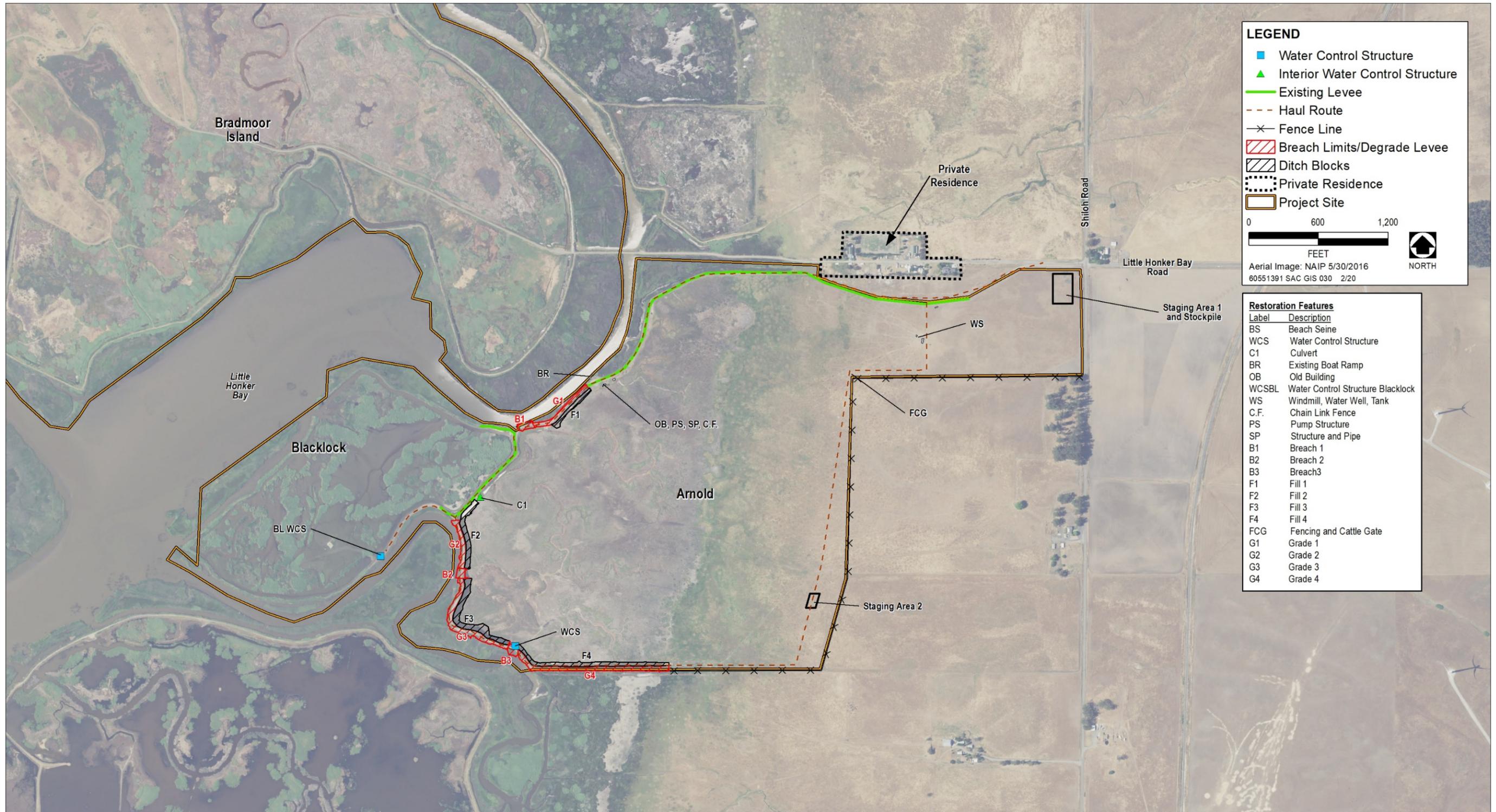


Source: Data compiled by AECOM in 2020

**Figure 2-3. Preliminary Restoration Site Plan for Bradmoor**



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Source: Data compiled by AECOM in 2020

**Figure 2-4. Preliminary Restoration Site Plan for Arnold**

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## 2.6 General Construction Methods and Activities

Project construction would be implemented between July 1, 2021 and December 31, 2022. Table 2-1 shows the anticipated construction schedule for Bradmoor and Arnold. All construction and demolition methods and activities would employ best management practices (BMPs), described in Section 2.9, “Environmental Commitments and Mitigation Measures.”

**Table 2-1. Proposed Construction Timeline for Bradmoor and Arnold**

Timing	Bradmoor	Arnold
2021–Site preparation and construction	<ul style="list-style-type: none"> <li>• Drain and pump interior berm and culvert removal locations.</li> <li>• Remove structures and any debris from both sites.</li> <li>• Construct IB7 and IB2.</li> <li>• Manage <i>Phragmites australis</i> (mow and spray).</li> <li>• Remove culverts C5, C8, and C11.</li> <li>• Construct associated ditch blocks F12, F13, F6, and a portion of F9.</li> </ul>	<ul style="list-style-type: none"> <li>• Drain and pump interior berm and culvert removal locations.</li> <li>• Remove culvert C1.</li> <li>• Deconstruct the water well.</li> <li>• Remove the boat dock and pile, old building, and any debris.</li> <li>• Construct cattle fencing and gate.</li> <li>• Construct the monitoring ramp.</li> <li>• Manage <i>Phragmites australis</i> (mow and spray).</li> </ul>
2021–In-water work	<ul style="list-style-type: none"> <li>• Remove and backfill three WCSs.</li> </ul>	<ul style="list-style-type: none"> <li>• Remove any remaining infrastructure (e.g., culverts)</li> <li>• Grade levees, place ditch blocks, and complete breaches</li> </ul>
2022	<ul style="list-style-type: none"> <li>• Drain and pump interior berm and culvert removal locations.</li> <li>• Remove any remaining infrastructure and complete all remaining restoration features (IB4, all exterior breaches, and ditch filling).</li> </ul>	Conduct monitoring and adaptive management.
	Clean up the site, stabilize the stockpile, and demobilize.	

Notes:

IB = interior breach; WCS = water control structure

All work would be done in accordance with work windows identified in Section 2.7, “Construction Schedule, Equipment, and Labor Force.”

Before tidal restoration, the interior restoration areas would be drained and pumped dry, consistent with annual duck club operations, to facilitate site modifications (e.g., culvert removal, interior breaches), and debris from decades of

the property's operation as managed wetlands would be removed. These activities would occur on land while the site is dry and would be contained in areas already disturbed by ongoing managed wetland maintenance.

Interior work would include culvert removal and construction of interior breaches, and may start as early as July 1. In-water work would involve removing WCSs, breaching and grading exterior levees, and filling ditches. In-water work would be performed between August 1 and November 30, with the exception of WCS removal and backfilling.

To maintain access to levee breaching sites at Arnold, in-water activities would start at the southeastern most portion at G4 and F4 (shown in Figure 2-4), and grading and breaching would proceed in sequence from southeast to northwest. The remnant WCS at Blacklock also would be removed before B1 and G1 are constructed (e.g., while access to the WCS still is available). Similarly, breaching work on Bradmoor would begin on the western side at EB8 (shown in Figure 2-3), with equipment moving east toward EB5 and EB6, before concluding at EB1. Breaching and WCS removal would be performed from 3 hours before to 3 hours after low tide to minimize any impacts on fish and water quality.

To successfully target project goals and objectives, DWR would continue vegetation management, in accordance with the proposed Invasive Vegetation Management Plan (IVMP) provided in Appendix B, the monitoring and adaptive management plan as described in the SMP, and the environmental commitments for the Proposed Project provided in Appendix A. New colonization by undesirable plants is expected to be ongoing, following restoration activities. The project area would be monitored for undesirable invasive vegetation for 5 years after tidal restoration is completed as part of the Proposed Project. If invasive vegetation is found at the restoration sites, it would be assessed and appropriate management actions would be taken to help control it, consistent with the IVMP, incorporating relevant BMPs.

### 2.6.1 Demolition and Debris Removal

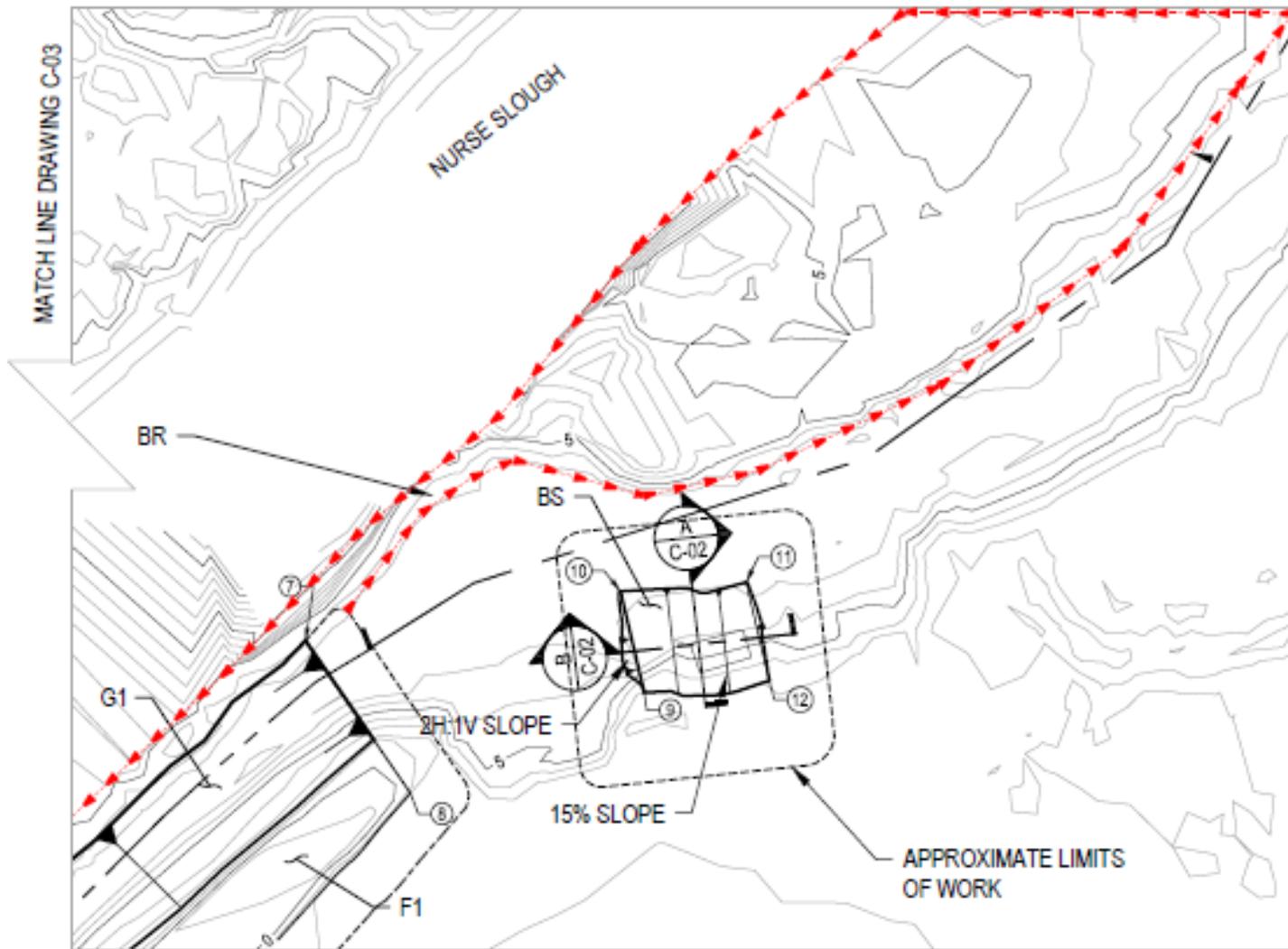
DWR would remove and properly dispose of approximately 2,830 cubic yards of debris that occupies just over a half acre in the project area, including abandoned equipment, water control systems, and other structures that could negatively affect the restoration sites on Bradmoor and at Arnold (Figure 2-3 and Figure 2-4). Buildings, remnant fencing, and structures would be dismantled on-site as feasible, removed, and transported to appropriately licensed waste facilities by haul truck. Estimates indicate that this would require approximately 38 one-way haul trips.

### 2.6.2 Beach Seine Monitoring Ramp Construction

An approximately 33- by 50-foot ramp with a 15 percent grade would be cut into the slope of the existing interior levee, to allow biological monitoring after restoration (Figure 2-5 and Figure 2-6). Approximately 60 cubic yards of levee material would be removed with a bulldozer or loader and graded. Geotextile fabric would be placed to discourage the growth of emergent vegetation on the ramp, and 4 inches of 0.75-inch-diameter aggregate base (40 cubic yards) would be placed on the ramp surface.

### 2.6.3 New Fencing

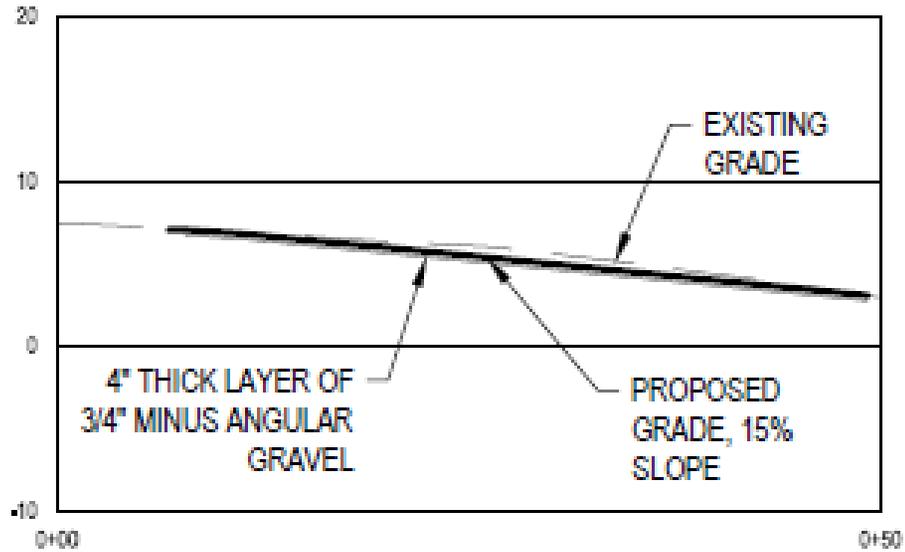
DWR plans to continue the current grazing regime on Arnold after installing new fencing and a gate along the property boundary. The fencing would divide the Blacklock Ranch from Arnold. Cattle would be allowed to continue accessing the Arnold upland pasture, under a lease agreement to provide habitat benefits. The new fencing would allow control of cattle movement on and off the property if needed for adaptive management. The barbed-wire fencing would be approximately 4 feet tall, would extend for 1,200 linear feet, and would have wooden posts set 2 to 6 feet deep, with a maximum of 16 feet between posts. The cattle gate would be 16 feet wide and would be supported by H braces and steel posts at each end. An auger or post hole digger would be used to install the fence posts.



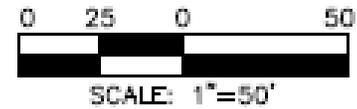
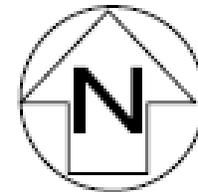
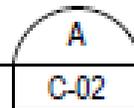
**LAYOUT PLAN**  
 SCALE: 1" = 50'

**Figure 2-5. Beach Seine Monitoring Ramp Layout**

F



**BS TYPICAL SECTION**  
SCALE 1" = 10'



Source: Data compiled by AECOM in 2020

**Figure 2-6. Beach Seine Monitoring Ramp Typical Cross Section**

#### 2.6.4 Staging Areas and Stockpile

Temporary staging areas (Figure 2-3 and Figure 2-4) would be used in upland areas for temporary storage of materials and equipment. Existing roads on already disturbed upland habitat would be used for transport. Staging areas would have stabilized entrances and exits, and would be located at least 100 feet from wetlands and water bodies to the maximum extent possible. Appropriate BMPs for erosion control would be implemented, including use of straw wattles and reseeding. A stockpile site would be co-located with one of the staging areas at Arnold (Figure 2-4).

#### 2.6.5 Well Removal

All features associated with the well, including the windmill, water tanks, and pumps, would be demolished and removed. The contractor would pull or overdrill the well casing to the full depth of installation, and then would insert a tremie pipe to the bottom of the hole and grout the entire hole, from the bottom up. Groundwater displaced by the grout could be dispersed on the adjacent ground. Water contaminated with grout would be collected and disposed of appropriately at a licensed facility. Destruction of water wells would be performed in accordance with Solano County regulations and following the recommendations of a qualified geotechnical engineer and/or a certified C-57 driller.

#### 2.6.6 Internal Site Modification

To avoid unnecessary in-water work, any modifications would be done before breaching and grading down of the exterior levees. Making modifications inside the properties would allow better tidal connections to historic remnant channels and previously divided portions of the property.

#### 2.6.7 Culvert Removal

Bradmoor and Arnold have culverts and crossings in the ditches to allow easy access to the marsh plain from the levees. Bradmoor has 11 culverts and ditch crossings, and Arnold has one culvert and ditch crossing (Figure 2-3 and Figure 2-4). All culverts would be excavated and left open, except where a ditch block would be installed.

#### 2.6.8 Breaching of Interior Levees

Three interior levees would be breached to facilitate internal water circulation on Bradmoor. IB2 would be 350 feet long with a volume of 2,020 cubic yards removed, IB7 would be 863 feet long with 870 cubic yards removed, and IB4 would be 206 feet long with 1,100 cubic yards removed. Material from these breaches would be stockpiled for use elsewhere on-site or deposited directly into adjacent ditch-filling locations.

#### 2.6.9 Filling of Borrow Ditches

Borrow ditches next to exterior and interior levees promote water circulation in managed ponds, and historically the ditches were used as a source of material for levee construction and repair. To minimize creation of backwaters that could provide habitat for nonnative fish and invasive aquatic plants, portions of these interior borrow ditches would be brought up to the elevation of the existing marsh plain. Borrow ditches would be filled with materials obtained from on-site restoration features (IBs, EBs, and levee grading). Table 2-2 summarizes the estimated areas of ditch filling and ditch block creation. Figure 2-3 and Figure 2-4 show the locations of these features.

**Table 2-2. Ditch Filling and Ditch Blocks for Restoration on Bradmoor and at Arnold**

Borrow Ditch/Ditch Block	Area (square feet)	Fill Volume (cubic yards)
<b>Bradmoor</b>		
F1	23,900	3,750
F2	26,000	4,570
F3	22,000	2,900
F4	14,500	2,110
F5	17,200	3,450
F6	56,600	4,930
F7	31,600	3,660
F8	29,800	2,040
F9	16,200	2,310
F10	15,700	1,530
F11	14,100	460
F12	7,100	920
F13	9,800	2,020
<b>Arnold</b>		
F1	15,300	1,530
F2	27,800	3,010
F3	44,400	6,870
F4	44,500	5,830

Source: Data compiled by AECOM in 2020

### 2.6.10 Removal of Water Control Structures and Bulkheads

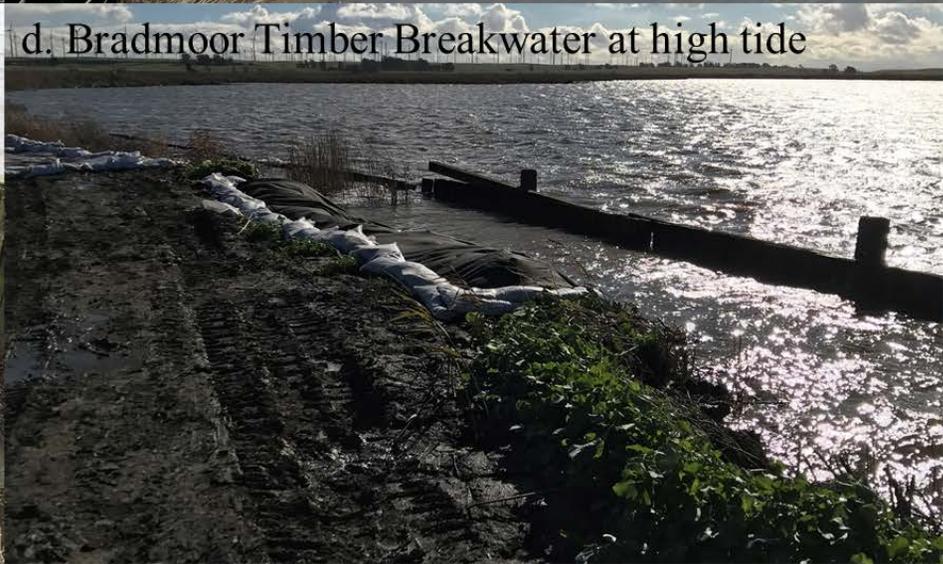
WCSs would be removed from the levees using an excavator. WCS parts include culverts, flashboard risers, flap/screw gates, bulkheads, and a wheel used to control water movement (Figure 2-7). Some WCSs would be removed as part of a breach (e.g., EB2, EB6, and EB8 on Bradmoor, and the Blacklock WCS) and others would be removed and backfilled in locations without planned breaches. The maximum depth of excavation would be -4 feet NAVD88, as the WCS depths would vary from -2 to -3.6 feet NAVD88.

Bradmoor has six WCSs. Three would be removed and backfilled, and the others would be removed as part of a breach. Removal of the WCSs to be backfilled would occur in 2022 to allow the material to dry before breaching the following year.

Temporary levee overbuilding on Bradmoor on the interior side may be required for removal of WCSs that are not at breach locations (WCS 1, 3, and 5). Material would be placed in the ditch, using an excavator to widen the levee for stability. Half of the culvert pipe would be removed at a time, starting on the interior side. The pipe would be severed while excavating it to remove the first half and would be backfilled; then the other half on the exterior side of the levee would be removed and backfilled with imported rock and covered with the fill that was removed from the

excavation. Before breaching the exterior levees, the levee would be brought back to the original dimensions during 2022. At WCS 5, a temporary turnaround would be installed to facilitate removal (Figure 2-3).

On Bradmoor, one bulkhead (identified as “timber breakwater”) is not associated with a WCS (Figure 2-3 and Figure 2-7 [c and d]). This structure would be removed as part of construction of EB5. At Arnold, a single WCS and associated bulkhead would be removed, and the breach would be left open (Figure 2-7 [a and b]). Bulkheads are made of treated lumber and are anchored by wooden piles, pushed in to refusal. Lengths range from 10 to 100



Source: Data compiled by AECOM in 2020

**Figure 2-7. Typical Water Control Structures and Timber Breakwater**

feet. Figure 2-7 shows typical bulkheads on Bradmoor and at Arnold. To avoid creating navigation hazards, bulkheads would be removed by pulling piles or snapping them off 3 feet below the mudline. All additional wooden debris created by demolition of bulkheads would be removed and hauled off-site for disposal at an appropriately licensed facility.

The design of the Blacklock restoration project originally included removing the southern WCS along Arnold. However, this action did not occur during restoration construction and the WCS remains in place. Before grading levee elevations down and breaching exterior levees at Arnold, the remaining WCS at Blacklock would be excavated and left open as a breach.

### 2.6.11 Levee Grading at Arnold and Exterior Levee Breaching

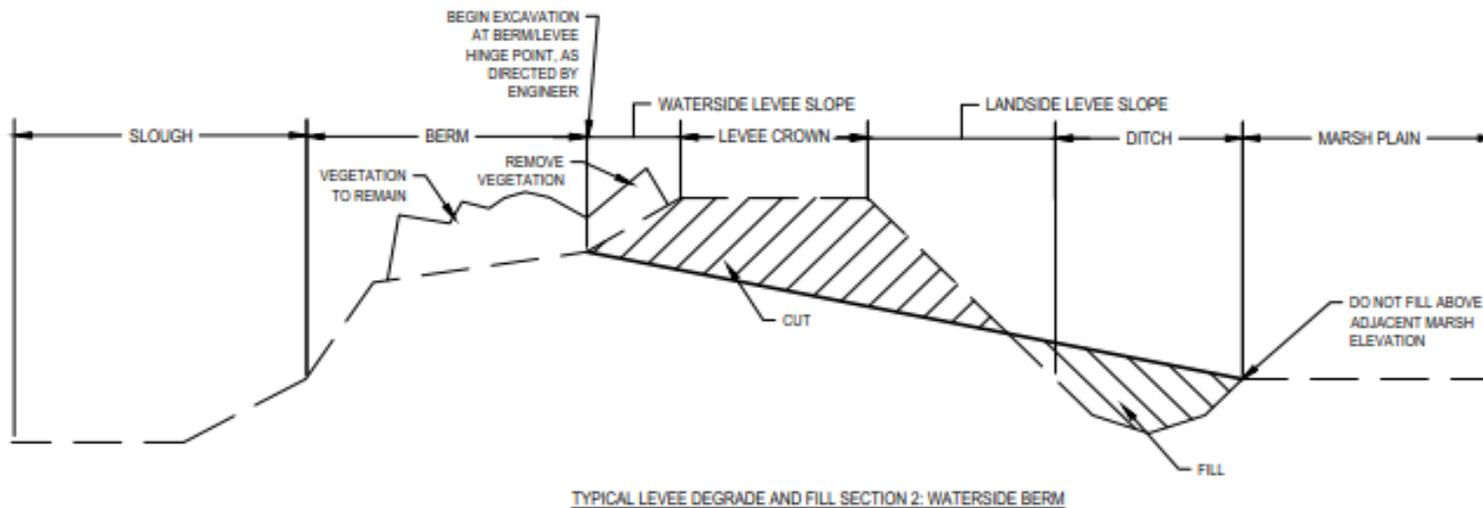
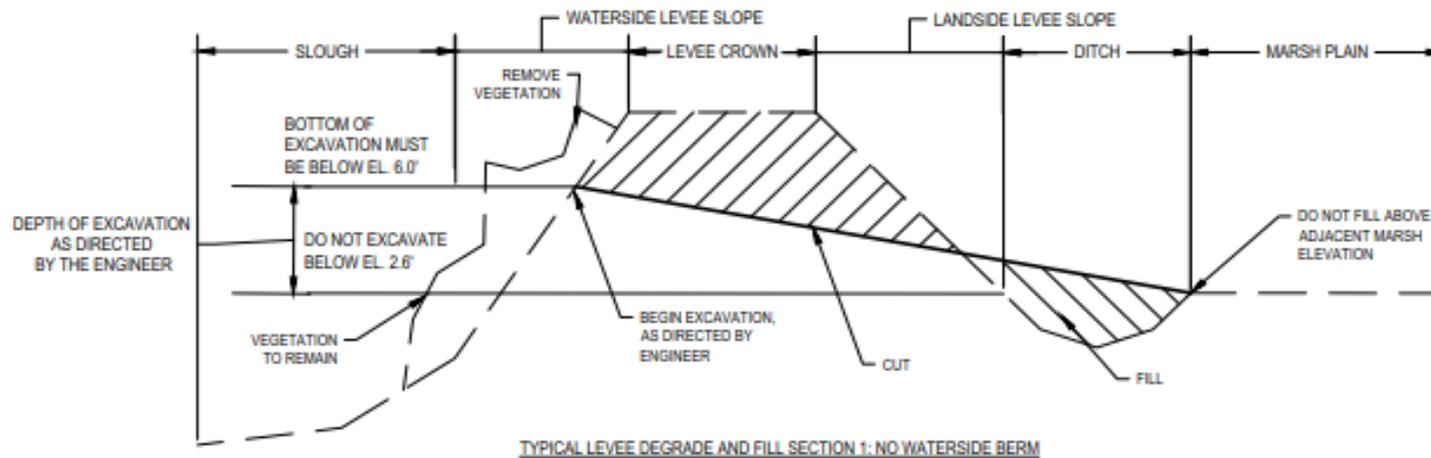
Levees would be graded and exterior levees breached after removal of the WCSs. Both levee grading and exterior levee breaching would occur at Arnold, while only exterior breaching would occur on Bradmoor. Material from the levee breaching and grading would be used to finish filling ditches to create ditch blocks nearby (Table 2-2).

Temporary turnarounds would be required to access exterior features for construction. Temporary ramps would be on top of ditch blocks, within the footprint of the ditch block. To minimize impacts, the ramps would be created in areas where ditch filling or ditch block creation are located. Following exterior breaches, the access ramps would be regraded to design elevation.

To maintain access to levee breaching sites at Arnold, in-water activities would start at the southeastern most portion (by G4), and grading and breaching would proceed in sequence from southeast to northwest. Similarly, breaching work on Bradmoor would begin on the western side at EB8, with equipment moving east toward EB5 and EB6 before concluding at EB1. Exterior breaching would be performed from 3 hours before to 3 hours after low tide to minimize any impacts on fish and water quality.

Levee grading at Arnold would be done using an excavator, and levee material would be pushed into the adjacent borrow ditch to bring it to the elevation of the marsh plain, and then would be compacted. Excess fill would be placed on top of the ditch fill at a continuous slope to a maximum elevation of 6 feet NAVD88 (below mean higher high water [MHHW]). This method is believed to help expedite tidal restoration and allow more water exchange within the restoration site while providing high marsh habitat for sea level rise accommodation and wildlife habitat.

The top elevations and slopes of the graded-down levees would be determined at the discretion of the engineer in the field and would be based on the elevation of the tidal berm and the marsh plain. The maximum elevation of these levees would be 6 feet NAVD88, and the minimum would be the elevation of the adjacent marsh plain. The width of the graded-down levees would vary from 25 to 50 feet. Tidal berms on the slough side of the levee would not be disturbed and would help the engineer to determine appropriate elevations. Figure 2-8 shows examples of levee grading designs, based on the elevation and slope of the levee and adjacent tidal berm. Figure 2-4 shows the locations at Arnold where levees would be graded, and Table 2-3 lists these locations.



Source: Data compiled by AECOM in 2020

**Figure 2-8. Typical Levee Grading Sections**

**Table 2-3. Levee Grading for Arnold Restoration**

Levee Section	Length (feet)	Area (square feet)	Volume Cut (cubic yards)
G1	640	24,900	2,170
G2	440	18,400	2,270
G3	970	35,400	3,660
G4	1,370	35,600	6,790

Source: Data compiled by AECOM in 2020

### 2.6.12 Exterior Levee Breaching

Exterior levee breaches would be trapezoidal and created with an excavator. Material from the breaches would be transported to nearby ditch block locations to be placed and compacted. Bradmoor would have five exterior breaches, and Arnold would have three. Table 2-4 lists the approximate dimensions, Figure 2-4 and Figure 2-5 show the locations of the exterior levee breaches.

**Table 2-4. Exterior Levee Breaches for Bradmoor and Arnold Restoration**

Levee Section	Length (feet)	Bottom Elevation (feet NAVD88)	Area (square feet)	Volume Cut (cubic yards)
<b>Bradmoor</b>				
EB1	210	0	30,100	7,630
EB2	130	-1	15,100	4,630
EB5	210	0	10,500	3,040
EB6	200	0	26,500	8,030
EB8	230	0	13,500	3,900
<b>Arnold</b>				
B1	120	-1	7,600	2,250
B2	70	-1	3,300	1,080
B3	80	-1	5,800	1,680

Note: EB = exterior breach; NAVD88 = North American Vertical Datum of 1988

Source: Data compiled by AECOM in 2020

Any fill remaining after the creation of ditch blocks would be placed at the designated stockpile location at Arnold (Figure 2-4).

### 2.6.13 Sign Installation for Kayak Trails

New kayak routes to Bradmoor, Arnold and Blacklock would allow access via kayak or other small watercraft for wildlife viewing, fishing, and other recreational activities without risking damage to sensitive resources. Interpretive and “No trespassing” signs would be installed on Bradmoor, and at Arnold and Blacklock to inform the public about

the restoration project and to limit disturbance at restoration sites. Three interpretive signs would be installed near EB5 on Bradmoor, near B1 at Arnold, and near the existing breaches at Blacklock. Two “No trespassing” signs would be installed, north of EB8 on Bradmoor and northeast of B1 at Arnold. Figure 2-9 shows the locations where the signs would be installed and the kayak trail route.



Source: Data compiled by DWR 2020

**Figure 2-9. Kayak Trail Route from Beldon's Landing to Bradmoor and Arnold**

### 2.6.14 Stockpile Stabilization

After completion of restoration activities, any excess material from excavation or grading would be placed at the designated stockpile area at Arnold (Figure 2-4). The excess material is expected to total approximately 3,050 cubic yards. Fill stockpiled at Arnold would be no more than 3 feet high. The stockpile site then would be seeded, mulched, and stabilized in accordance with applicable BMPs to minimize the potential for erosion. The stockpile then would be available to be beneficially re-used for levee maintenance elsewhere in Suisun Marsh, consistent with the SMP.

### 2.6.15 Vegetation Management

New colonization by undesirable plant species is expected to be ongoing during and immediately following restoration construction. The project area would be monitored for undesirable invasive vegetation during tidal restoration activities and for 5 years after these activities are completed as part of the Proposed Project. When invasive vegetation is found at the restoration sites, DWR would assess the invasive species and appropriate management actions would be taken in an attempt to control it, consistent with the IVMP (Appendix B) and incorporating relevant BMPs (Appendix A).

## 2.7 Construction Schedule, Equipment, and Labor Force

Project construction activities would begin no earlier than July 1, 2021, following site dewatering, and would be completed by December 31, 2022. In-water work, including levee breaching, would occur between August 1 and November 30 to minimize impacts on listed fish species. Table 2-5 summarizes the work window for each work activity.

**Table 2-5. Work Windows**

Year	Work Activity	Work Window
2021	Remove structures and any debris from both sites.	N/A
	Construct IB7 and IB2 and fill adjacent ditches.	N/A
	Construct cattle fencing and gate.	N/A
	Construct the monitoring ramp at Arnold.	N/A
	Remove and backfill three WCSs on Bradmoor.	August 1–November 30
	Remove the Blacklock WCS.	August 1–November 30
	Grade levees, fill ditches, and complete breaches at Arnold.	August 1–November 30
2022	Construct all exterior breaches on Bradmoor and construct remaining ditch fill.	August 1–November 30
	Clean up site, stabilize stockpile, and demobilize	N/A
2022–2027	Assess the property for invasive vegetation for 5 years post-construction and manage as needed following the IVMP.	N/A

Notes:

IB = interior breach; IVMP = Invasive Vegetation Management Plan ; N/A = not applicable; WCS = water control structure

Implementing the Proposed Project would require various types of hand tools and heavy equipment, including rubber tire and tracked excavators, tracked mini-dumpers, bulldozers, rollers, loaders, drill rigs, pickup trucks, and other light-duty vehicles. Conditions in the field during construction may influence the type of equipment best suited for the work, which ultimately would be chosen by the construction contractor. Table 2-6 lists the construction equipment anticipated for restoration activities.

**Table 2-6. Construction Durations, Equipment, and Labor Force**

Site	Activity	Duration	Labor	Equipment
Arnold	Dewater site. Remove culvert C1, debris, buildings, equipment, fencing, and boat ramp.	July 1–December 31, 2021: 10–20 days	Average: 6 Maximum: 8	1–2: 426 rubber-tired backhoes 1–2: tracked mini-dumps 1: support pickups, 4 x 2-3/4 ton 1–5: trash pumps 1–5: portable generators
	Deconstruct water well.	July 1–December 31, 2021: 1–5 days	Average: 2 Maximum: 3	1: drill rig 1–2: support pickups, 4 x 2-3/4 ton
	Grade ditch crossing and monitoring platform.	July 1–December 31, 2021: 4–10 days	Average: 8 Maximum: 9	1: 325L excavator 1: tracked mini-dump 1: D-8N bulldozer 1: water truck 1: support pickup, 4 x 2-3/4 ton 1: transfer truck (gravel import) 1: smooth drum roller operator (same as bulldozer operator)
	Establish and stabilize stockpile/staging area 1.	July 1–December 31, 2021: 10–20 days	Average: 11 Maximum: 17	1–2: HL955 loaders 1–5: transfer trucks 1: support pickup, 4 x 2-3/4 ton 1–2: low-beds (for equipment mobilization)
	Grade B1, B2, B3, G1, G2, G3, G4, F1, F2, F3, F4, and WCS BL.	August 1– November 30, 2021: 30–60 days	Average: 10 Maximum: 14	1–2: 325L excavators 1–2: tracked mini-dumps 1–2: D-8N bulldozers 1: water truck 1–2: support pickups, 4 x 2-3/4 ton 1–3: trash pumps 1–3: portable generators
	Establish and stabilize stockpile/staging area 2.	July 1–December 31, 2022: 5–15 days	Average: 7 Maximum: 9	1–2: HL955 loaders 1: 815F sheepsfoot compactor operator 1: support pickup, 4 x 2-3/4 ton 1–3: low-beds (for equipment mobilization)
Bradmoor	Establish and stabilize stockpile/staging areas.	July 1–December 31, 2021: 10–20 days	Average: 11 Maximum: 17	1–2: HL955 loaders 1–5: transfer trucks 1: support pickup, 4 x 2-3/4 ton 1–2: low-beds (for equipment mobilization)
	Dewater site. Remove culverts, debris, buildings, equipment, and fencing.	July 1–December 31, 2021: 20–60 days	Average: 8 Maximum: 12	1–4: trash pumps 1–2: 426 rubber tire backhoe 1–2: tracked mini-dump 1–2: support pickup 4 x 2-3/4 ton 1–2: flatbed 2-ton truck 1–10: trash pumps 1–10: portable generators 1: portable trailer

**Table 2-6. Construction Durations, Equipment, and Labor Force**

Site	Activity	Duration	Labor	Equipment
	Grade IB2, IB7, F12, F13, F6, and part of F9.	July 1–December 31, 2021: 5–15 days	Average: 9 Maximum: 10	1–2: 325L excavator 1–2: tracked mini-dump 1–2: D-8N bulldozer 1: water truck 1–2: support pickup 4 x 2-3/4 ton
	Excavate WCSs 2, 4, and 6, and EB1, EB2, EB5, EB6, and EB8.	July 1– November 30, 2022: 40–80 days	Average: 14 Maximum: 20	2–3: 325L excavators 2–3: tracked mini-dumps 2–3: D-8N bulldozers 1: water truck 1–3: support pickups, 4 x 2-3/4 ton 1–3: trash pumps 1–3: portable generators 1: portable trailer

Notes: EB = exterior breach; IB = interior breach; WCS = water control structure

## 2.8 Post-Construction Conditions

Upon completion of the Proposed Project, the interior portions of the Bradmoor and Arnold restoration sites would be reconnected with tidal waters from the surrounding waterways, creating new tidal wetland habitat. The Proposed Project is expected to result in the creation (net gain) of approximately 5.85 acres of new waters and wetlands. DWR is executing an agreement with the RWQCB to complete 4.9 acres of mitigation for impacts from the Tule Red Project, as required in the Board Order for that project (California Integrated Water Quality System [CIWQS] ID 818757). DWR intends to reserve the remaining 4.17 acres surplus creation of jurisdictional waters as mitigation for other DWR projects, pending requirements by resource agencies and associated agreements. Tables 2-7a; 2-8a; 2-9a; and 2-10a summarize the type conversion within existing habitat types that would occur after restoration activities. Tables 2-7b; 2-8b; 2-9b; and 2-10b summarize the overall habitat areas estimated for pre- and post-restoration scenarios, and the net gain or loss of habitat type from existing conditions to restoration outcomes.

Habitat acreage and wetland-type conversions resulting from the Proposed Project were calculated based on a digital elevation model that was developed using topography surveys, DWR bathymetry, University of California at Davis topography surveys, and 2014 Solano County light detection and ranging (LiDAR) data. DWR determined that LiDAR data on the tidal berms were inaccurate because the data, due to vegetation interference, showed elevations 0.5 foot to 5 feet higher than survey points. DWR collected additional elevation points in various locations on the tidal berms on Bradmoor and at Arnold (Figure 2-10) and determined that although the LiDAR data showed the area as upland, all points were between 3 and 6.1 feet NAVD88. Based on the survey data and analysis, the tidal berms were classified as tidal wetland.

The Proposed Project ultimately would create approximately 616.91 acres of new tidal wetlands and would enhance approximately 238.18 acres of existing tidal wetlands. Together, these actions would result in a mosaic of approximately 855.09 acres of tidal wetlands and associated subtidal habitats in an area known to have a high diversity of native fish. Furthermore, the design of the Proposed Project would provide food web benefits to native and listed fish species on-site and in the region, and would therefore meet project goals

## 2.9 Adaptive Management

Adaptive Management is defined as an approach to better understand problems and reduce uncertainties of environmental and water management using a science-based approach (DSC, 2020). The proposed project uses the SMP EIS/EIR which included a plan outlining the need for and intent of monitoring and adaptive management, and general considerations for project proponents. As described in the adaptive management and monitoring plan, DWR would be responsible for monitoring as described in project planning documents. The approach for each restoration action would be determined by the specific lead agency and would be based on the SMP EIS/EIR, project-specific design components, any new information (including that obtained during implementation of the adaptive management and monitoring plan), and other factors. Adaptive management for the proposed project would include fish monitoring.

As described in the SMP EIS/EIR, the following listed and special-status native species occur in Suisun Marsh:

- ▶ Central Valley steelhead (*Oncorhynchus mykiss*)
- ▶ Sacramento River winter-run Chinook Salmon (*Oncorhynchus tshawytscha*)
- ▶ Central Valley spring-run Chinook Salmon (*O. tshawytscha*)
- ▶ Central Valley fall-/late fall–run Chinook Salmon (*O. tshawytscha*)
- ▶ Delta Smelt (*Hypomesus transpacificus*)
- ▶ Longfin Smelt (*Spirinchus thaleichthys*)
- ▶ Sacramento Splittail (*Pogonichthys macrolepidotus*)
- ▶ Green Sturgeon (*Acipenser medirostris*)

The SMP EIS/EIR includes information regarding the status, life history, distribution, and description of any designated critical habitat for these listed and special-status species. The information in the SMP EIS/EIR is current, except for the federal listing for Longfin Smelt, which now is considered to be a candidate for listing.

In addition, to successfully target project goals and objectives, DWR would continue vegetation management, in accordance with the proposed Invasive Vegetation Management Plan (IVMP) provided in Appendix B, the monitoring and adaptive management plan as described in the SMP, and the environmental commitments for the Proposed Project provided in Appendix A. New colonization by undesirable plants is expected to be ongoing, following restoration activities. The project area would be monitored for undesirable invasive vegetation for 5 years after tidal restoration is completed as part of the Proposed Project. If invasive vegetation is found at the restoration sites, it would be assessed and appropriate management actions would be taken to help control it, consistent with the IVMP, incorporating relevant BMPs.

## 2.10 Environmental Commitments and Mitigation Measures

DWR would incorporate applicable environmental commitments and mitigation measures from the SMP EIS/EIR into the Proposed Project, with the exception of CDFW and USFWS-approved Environmental Commitments and conservation measures for protection of salt marsh harvest mouse, as provided in Appendix A. These environmental commitments are also summarized in Chapter 2 of the SMP EIS/EIR, with the exception of the new measures. Mitigation measures from the SMP EIS/EIR also would be applied, as necessary, to minimize potential adverse effects, and are discussed further in the impact assessments.

## 2.11 Permits, Approvals, and Regulatory Requirements

As the lead agency, DWR has the principal responsibility for approving and carrying out the Proposed Project, and for ensuring that the requirements of CEQA and all other applicable regulations are met. Table 2-11 lists the agencies that also may have authority over portions of the Proposed Project.

**Table 2-7a. Bradmoor Island Existing Habitat, Restoration Outcome, and Net Conversion by Existing Habitat Type**

Habitat Classification	Existing (acres)	Post-Restoration Outcome (acres)								Net Conversion of Existing Habitat Type (acres)
		Open Water	Open Water/Mudflat Mosaic	Low Marsh/Mudflat Mosaic	High Marsh	Existing Tidal Marsh	Managed Wetland	Upland/Grassland	Barren/Disturbed	
Subtidal/Open Water	15.25	15.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Existing Tidal Marsh	125.74	1.08	0.00	0.00	0.00	124.66	0.00	0.00	0.00	1.08
Managed Wetland	468.82	55.13	407.19	5.44	1.06	0.00	0.00	0.00	0.00	468.82
Upland/Grassland	122.28	0.12	0.00	0.54	0.33	0.00	0.00	121.29	0.00	0.99
Barren/Disturbed	22.13	0.79	2.14	2.51	0.97	0.00	0.00	15.72	0.00	22.13
<b>Total</b>	<b>754.22</b>	<b>72.37</b>	<b>409.33</b>	<b>8.49</b>	<b>2.36</b>	<b>124.66</b>	<b>0</b>	<b>137.01</b>	<b>0</b>	<b>493.02</b>

Source: Compiled by AECOM in 2020

**Table 2-7b. Bradmoor Island Total Estimated Habitat Areas Pre- and Post-Restoration and Gain/Loss of Habitat Area by Type**

Habitat Classification	Existing (acres)	Post-Restoration Outcome (acres)	Gain/Loss in Project Area (acres)
Subtidal/Open Water	15.25	72.37	57.12
Open Water/Mudflat Mosaic	0.00	409.33	409.33
Low Marsh/Mudflat Mosaic	0.00	8.49	8.49
High Marsh	0.00	2.36	2.36
Existing Tidal Marsh	125.74	124.66	(1.08)
Managed Wetland	468.82	0.00	(468.82)
Upland/Grassland	122.28	137.01	14.73
Barren/Disturbed	22.13	0.00	(22.13)
<b>Total</b>	<b>754.22</b>	<b>754.22</b>	<b>0</b>

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Source: Compiled by AECOM in 2020

**Table 2-8a. Arnold Slough Existing Habitat, Restoration Outcome, and Net Conversion by Existing Habitat Type**

Habitat Classification	Existing (acres)	Post-Restoration Outcome (acres)								Net Conversion of Existing Habitat Type (acres)
		Open Water	Open Water/Mudflat Mosaic	Low Marsh/Mudflat Mosaic	High Marsh	Existing Tidal Marsh	Managed Wetland	Upland/Grassland	Barren/Disturbed	
Subtidal/Open Water	4.54	4.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Existing Tidal Marsh	15.76	0.13	0.00	0.58	0.00	15.05	0.00	0.00	0.00	0.71
Managed Wetland	137.90	2.30	113.47	16.71	5.42	0.00	0.00	0.00	0.00	137.90
Upland/Grassland	102.15	0.04	0.00	0.63	0.00	0.00	0.00	101.48	0.00	0.67
Barren/Disturbed	3.13	0.12	0.00	0.87	0.00	0.00	0.00	0.78	1.36	1.77
<b>Total</b>	<b>263.48</b>	<b>7.13</b>	<b>113.47</b>	<b>18.79</b>	<b>5.42</b>	<b>15.05</b>	<b>0.00</b>	<b>102.26</b>	<b>1.36</b>	<b>141.05</b>

Source: Compiled by AECOM in 2020

**Table 2-8b. Arnold Slough Total Estimated Habitat Areas Pre- and Post-Restoration and Gain/Loss of Habitat Area by Type**

Habitat Classification	Existing (acres)	Post-Restoration Outcome (acres)	Gain/Loss in Project Area (acres)
Subtidal/Open Water	4.54	7.13	2.59
Open Water/Mudflat Mosaic	0.00	113.47	113.47
Low Marsh/Mudflat Mosaic	0.00	18.79	18.79
High Marsh	0.00	5.42	5.42
Existing Tidal Marsh	15.76	15.05	(0.71)
Managed Wetland	137.90	0.00	(137.90)
Upland/Grassland	102.15	102.26	0.11
Barren/Disturbed	3.13	1.36	(1.77)
<b>Total</b>	<b>263.48</b>	<b>263.48</b>	<b>(0.00)</b>

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Source: Compiled by AECOM in 2020

**Table 2-9a. Blacklock Restoration Outcome by Existing Habitat and Net Conversion of Existing Habitat Type**

Habitat Classification	Existing (acres)	Post-Restoration Outcome (acres)								Net Conversion of Existing Habitat Type (acres)
		Open Water	Open Water/Mudflat Mosaic	Low Marsh/Mudflat Mosaic	High Marsh	Existing Tidal Marsh	Managed Wetland	Upland/Grassland	Barren/Disturbed	
Subtidal/Open Water	6.33	6.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Open Water/Mudflat Mosaic	59.81	0.01	59.80	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Low Marsh/Mudflat Mosaic	3.09	0.01	0.00	3.08	0.00	0.00	0.00	0.00	0.00	0.01
High Marsh	2.46	0.00	0.00	0.00	2.46	0.00	0.00	0.00	0.00	0.00
Existing Tidal Marsh	5.20	0.00	0.00	0.00	0.00	5.20	0.00	0.00	0.00	0.00
Managed Wetland	1.12	0.46	0.00	0.66	0.00	0.00	0.00	0.00	0.00	1.12
Upland/Grassland	0.87	0.01	0.00	0.00	0.00	0.00	0.00	0.86	0.00	0.01
Barren/Disturbed	1.04	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.04	1.00
<b>Total</b>	<b>79.92</b>	<b>6.82</b>	<b>59.80</b>	<b>3.74</b>	<b>2.46</b>	<b>5.20</b>	<b>0.00</b>	<b>1.86</b>	<b>0.04</b>	<b>2.15</b>

Source: Compiled by AECOM in 2020

**Table 2-9b. Blacklock Total Estimated Habitat Areas Pre- and Post-Restoration and Gain/Loss of Habitat Area by Type**

Habitat Classification	Existing (acres)	Post-Restoration Outcome (acres)	Gain/Loss in Project Area (acres)
Subtidal/Open Water	6.33	6.82	0.49
Open Water/Mudflat Mosaic	59.81	59.80	(0.01)
Low Marsh/Mudflat Mosaic	3.09	3.74	0.65
High Marsh	2.46	2.46	0.00
Existing Tidal Marsh	5.20	5.20	0.00

Managed Wetland	1.12	0.00	(1.12)
Upland/Grassland	0.87	1.86	0.99
Barren/Disturbed	1.04	0.04	(1.00)
<b>Total</b>	79.92	79.92	(0.00)

Source: Compiled by AECOM in 2020

**Table 2-10a. Project Summary Restoration Outcome by Existing Habitat and Net Conversion of Existing Habitat Type**

Habitat Classification	Existing (acres)	Post-Restoration Outcome (acres)								Net Conversion of Existing Habitat Type (acres)
		Open Water	Open Water/Mudflat Mosaic	Low Marsh/Mudflat Mosaic	High Marsh	Existing Tidal Marsh	Managed Wetland	Upland/Grassland	Barren/Disturbed	
Subtidal/Open Water	26.12	26.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Open Water/Mudflat Mosaic	59.81	0.01	59.80	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Low Marsh/Mudflat Mosaic	3.09	0.01	0.00	3.08	0.00	0.00	0.00	0.00	0.00	0.01
High Marsh	2.46	0.00	0.00	0.00	2.46	0.00	0.00	0.00	0.00	0.00
Existing Tidal Marsh	146.70	1.21	0.00	0.58	0.00	144.91	0.00	0.00	0.00	1.79
Managed Wetland	607.84	57.89	520.66	22.81	6.48	0.00	0.00	0.00	0.00	607.84
Upland/Grassland	225.30	0.17	0.00	1.17	0.33	0.00	0.00	223.63	0.00	1.67
Barren/Disturbed	26.30	0.91	2.14	3.38	0.97	0.00	0.00	17.50	1.40	24.90
<b>Total</b>	1,097.62	86.32	582.6	31.02	10.24	144.91	0	241.13	1.4	636.22

Source: Compiled by AECOM in 2020

**Table 2-10b. Project Summary Total Estimated Habitat Areas Pre- and Post-Restoration and Gain/Loss of Habitat Area by Type**

Habitat Classification	Existing (acres)	Post-Restoration Outcome (acres)	Gain/Loss in Project Area (acres)
Subtidal/Open Water	26.12	86.32	60.20
Open Water/Mudflat Mosaic	59.81	582.60	522.79
Low Marsh/Mudflat Mosaic	3.09	31.02	27.93
High Marsh	2.46	10.24	7.78
Existing Tidal Marsh	146.70	144.91	(1.79)
Managed Wetland	607.84	0.00	(607.84)
Upland/Grassland	225.30	241.13	15.83
Barren/Disturbed	26.30	1.40	(24.90)
<b>Total</b>	<b>1,097.62</b>	<b>1,097.62</b>	<b>(0.00)</b>

Source: Compiled by AECOM in 2020

**Table 2-11. Regulatory Agencies and Approvals**

Agency	Approval/Permit
U.S. Army Corps of Engineers	Section 404 permit under the Clean Water Act and Section 10 of the Rivers and Harbors Act for activities within wetlands and waters of the United States (Nationwide Permit 27)
U.S. Coast Guard	Coordination with the U.S. Army Corps of Engineers on Section 10 of the Rivers and Harbors Act; aids to navigation
U.S. Fish and Wildlife Service	ESA Section 7 consultation; review of compliance by the Proposed Project with the existing programmatic BiOp for the SMP
National Marine Fisheries Service	ESA Section 7 consultation; review of compliance by the Proposed Project with the existing programmatic BiOp for the SMP
California Department of Fish and Wildlife	California Endangered Species Act compliance, California Fish and Game Code Section 2081 incidental take permit, Streambed Alteration Agreement, and California Fish and Game Code Section 1600 for activities in the Secondary Management Area
California State Lands Commission	Memorandum of Understanding
State Water Resources Control Board	NPDES Construction General Permit and Stormwater Pollution Prevention Plan approval under Section 402 of the Clean Water Act
San Francisco Bay Regional Water Quality Control Board	Water quality certification/waste discharge requirements to control pollutant discharges to water bodies under Clean Water Act Section 401 certification
State Historic Preservation Office	Consultation under Section 106 of the National Historic Preservation Act
San Francisco Bay Conservation and Development Commission	Suisun Marsh development permit
Delta Stewardship Council	Consultation regarding consistency determination for Delta Plan covered actions; consistency determined by DWR through self-certification

Notes: BiOp = biological opinion; DWR = California Department of Water Resources; ESA = Endangered Species Act; NPDES = National Pollutant Discharge Elimination System; SMP = Suisun Marsh Plan

Source: Compiled by AECOM in 2020

Source: Data compiled by AECOM in 2020

## 2.12 References

- California Department of Fish and Wildlife (CDFW). 2009. *Longfin Smelt Incidental Take Permit No. 2081-2009-001-03 for State Water Project Operations*.
- California Department of Fish and Wildlife (CDFW). 2020. Incidental Take Permit for Long-Term Operation of the State Water Project in the Sacramento-San Joaquin Delta. Permit number 2081-2019-066-00. Sacramento, California.
- Delta Stewardship Council (DSC). 2020. Adaptive Management information: accessed 8/26/2020 <https://deltacouncil.ca.gov/delta-science-program/adaptive-management>
- National Marine Fisheries Service (NMFS). 2009. *Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and the State Water Project*. Long Beach, CA.
- National Marine Fisheries Service (NMFS). 2019. Biological Opinion on Long-term Operation of the Central Valley Project and the State Water Project. West Coast Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce. Consultation tracking No. WCRO-2016-00069
- Suisun Marsh Principal Agencies (USFWS, Reclamation, DWR, CDFW, NMFS, the SRCD, and the Delta Stewardship Council). 2011. *Suisun Marsh Habitat Management, Preservation, and Restoration Plan*.
- U.S. Bureau of Reclamation (Reclamation), California Department of Water Resources, California Department of Fish and Game, and the Suisun Resource Conservation District. 1987 (March 2). *Suisun Marsh Preservation Agreement*.
- 2005 (June 20). *Revised Suisun Marsh Preservation Agreement*. Contract No. 4600000633.1. Available: <http://www.iep.ca.gov/suisun/smpa/index.html>.
- U.S. Bureau of Reclamation (Reclamation), U.S. Fish and Wildlife Service, and California Department of Fish and Game. 2011 (November). *Suisun Marsh Habitat Management, Preservation, and Restoration Plan, Final Environmental Impact Statement/Environmental Impact Report*. Sacramento, CA. Prepared with assistance from ICF International, Sacramento, CA.
- U.S. Fish and Wildlife Service (USFWS). 2008. Biological Opinion on the Coordinated Operation of the Central Valley Project and the State Water Project. Biological Opinion No. 81420-2008-F-1481-5.
- U.S. Fish and Wildlife Service (USFWS). 2019. Biological Opinion for the Reinitiation of Consultation on the Coordinated Operations of the Central Valley Project and State Water Project. Service File No. 08FBTD00-2019-F-0164.

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