

Bradmoor Island and Arnold Slough Restoration Project

Delta Plan Certification of Consistency

GP1- MITIGATION MEASURES, BEST AVAILABLE SCIENCE, AND ADAPTIVE MANAGEMENT

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Introduction

California Department of Water Resources (DWR) is planning tidal restoration at Bradmoor Island (Bradmoor) and Arnold Slough (Arnold). At project completion, the restoration sites will provide approximately 855.09 acres of tidal waters and salt marsh habitat. DWR also is proposing to conduct adaptive management actions at the Blacklock restoration site (Blacklock). Together, the proposed actions on Bradmoor, Arnold, and the Blacklock restoration site are referred to as the Proposed Project.

DWR initiated the Blacklock restoration project, 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 originally signed in 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 for 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 adaptive management action on Blacklock is removal of a remnant water control structure. This will reduce the risk that the structure will become a navigational hazard if it further deteriorates. Removal of the structure is included as part of the Proposed Project because the restoration activities at Arnold will remove land-based access to Blacklock.

The Fish Restoration Program Agreement (FRPA) between DWR and CDFW was signed by both agencies on October 18, 2010. The FRPA implements the fish habitat restoration requirements of the Biological Opinions in the Delta, Suisun Marsh, and Yolo Bypass (USFWS 2008; and 2013: NMFS 2008). The FRPA is also intended to address the habitat requirements of the CDFW Longfin Smelt Incidental Take Permit (CDFW 2009). The Fish Restoration Program is focused on restoring 8,000 acres of tidal habitat in the Delta and Suisun Marsh to benefit Delta Smelt and 800 acres of low salinity habitat to benefit Longfin Smelt. These actions will also provide benefits for Winter-run and Spring-run Chinook Salmon, Steelhead, Green Sturgeon, and other native species.

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 the U.S. Fish and Wildlife Service (USFWS), Reclamation, DWR, CDFW, NMFS, SRCD, and the Delta Stewardship Council (DSC). 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 (FEIS/EIR) was completed for the SMP, and the final EIR was certified on December 22, 2011 (State Clearinghouse No. 2003112039).

DWR served as a responsible agency under CEQA for the SMP FEIS/EIR. Thus, DWR relies on the SMP FEIS/EIR when acting on the aspects of the SMP (i.e., the original project under CEQA) that require DWR's approval, which include tidal restoration. DWR prepared an addendum to the SMP FEIS/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. The CEQA Addendum to the SMP FEIS/EIR is provided as Addendum to the Suisun Marsh Plan Final Environmental Impact Statement/Environmental Impact Report (CEQA Addendum).

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 Long-Term Operation of the Central Valley Project and State Water Project BiOps (2008) and the Longfin Smelt Incidental Take Permit (2009), and carried forward in the 2019 Biological Opinions 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.

Project Goals

- **Goal 1:** Restoration will benefit listed fish species that have the potential to occur on Bradmoor and Arnold and in surrounding waterways.
- **Goal 2:** Restoration 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 on Arnold and in surrounding areas.

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 site 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.

Purpose of Document

As described above, DWR has prepared an addendum (CEQA Addendum) to the SMP EIS/EIR to comply with CEQA and State CEQA Guidelines Section 15164, covering the Proposed Project and the environmental effects of the tidal restoration activities evaluated in the SMP EIS/EIR. This is consistent with the goals of the SMP: to allow new restoration projects to rely on the SMP's universally accepted environmental documents, thereby virtually eliminating a duplication of efforts in trying to acquire new state-required environmental impact reports.

The Delta Stewardship Council was one of the Principal Agencies for the SMP and is also tasked with furthering the state's coequal goals for the Delta through development of a Delta Plan (CA Water Code §§ 85300[a], 85302[a]). State and local agencies proposing covered actions that occur in whole or in part in the Delta or Suisun Marsh must file written certifications of consistency with the applicable Delta Plan policies before initiating implementation of such actions (CA Water Code § 85225; CA Code Regs., Title 23 § 5002). The Proposed Project is considered a covered action under the Delta Plan.

A Certification of Consistency has been submitted electronically for this Proposed Project, via the Delta Stewardship Council's website on-line form. The purpose of this document is to provide detailed findings in support of this

Certification of Consistency, specifically with regulatory policy GP1 which includes adequate coverage of mitigation measures, documentation of use of Best Available Science, an Adaptive Management Plan, and financial assurances.

Covered Action Summary

Project Location

The project area is in the northeastern corner of Suisun Marsh (2. Bradmoor Arnold_Final_PD: 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 (2. Bradmoor Arnold_Final_PD: 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.

Project Description

A full description of the Proposed Project location, historic and current land uses, and existing conditions is provided in the Bradmoor Arnold CEQA Addendum to the *Suisun Marsh Habitat Management, Preservation, and Restoration Plan Environmental Impact Statement/Environmental Impact Report* (SMP EIS/EIR).

The Proposed Project would restore tidal hydrology to approximately 476 acres on Bradmoor and approximately 140 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 (2. Bradmoor Arnold_Final_PD: 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 5.85 acres of wetlands. DWR is executing an agreement with 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 0.95 acre 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 (2. Bradmoor Arnold_Final_PD: Figure 2-2).

Restoration of Bradmoor (2. Bradmoor Arnold_Final_PD: 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 (2. Bradmoor Arnold_Final_PD: Figure 2-4).

Consistency with Delta Plan GP 1

Mitigation Measures

This section provides detailed findings of consistency with regulatory policy GP 1 / 23 CCR Section 5002: (b)(2) Mitigation Measures.

Delta Plan Policy G P1 requires that covered actions that are not exempt from CEQA include “all applicable feasible mitigation measures adopted and incorporated into the Delta Plan as amended April 26, 2018, or substitute mitigation measures that the agency that files the certification of consistency finds are equally or more effective. The Project was subject to CEQA review and an Addendum was completed.

The proposed project would incorporate the appropriate environmental commitments (or equivalent measures) and mitigation measures, as identified in the SMP EIS/EIR (Section 2.5, Environmental Commitments and Mitigation Measures) and the CEQA Addendum (Appendix A, *Bradmoor Island and Arnold Slough Restoration Projects Environmental Commitments*). These Project-specific mitigation measures have been included as supporting documents for this Certification of Consistency.

Mitigation measures in the Delta Plan’s program EIR were reviewed to determine whether they are applicable to the Proposed Project.

The review of Delta Plan mitigation measures determined that the measures either have already been incorporated into the Proposed Project (as environmental commitments or mitigation measures, and as described under relevant Delta Plan policies below, where applicable) or are not applicable to the Proposed Project, for the following reasons:

- ▶ They are not specific to the geography of Suisun Marsh. For example, the project site is not within a designated mineral resource extraction area. Therefore, Mitigation Measure 13-1, which, in part, calls for future land use changes within designated mineral resource extraction areas to recognize mineral resource extraction as a compatible use, and Mitigation Measure 13-2, related to maintaining access to active mineral resource extraction sites, would not apply (Delta Stewardship Council 2018).
- ▶ They are not specific to restoration projects. For example, Delta Plan Mitigation Measure 11-7 applies to levee construction projects and projects entailing surface impoundments and fill embankments; and Delta Plan Mitigation Measure 11-8 applies specifically to the construction of on-site wastewater treatment systems (Delta Stewardship Council 2018).
- ▶ Many of the impacts of the Proposed Project and the SMP on resources would be less than significant and thus do not require mitigation (e.g., aesthetics, geology, hydrology, public health and environmental hazards, recreation, water supply and management).

- ▶ Site-specific SMP environmental commitments and/or mitigation measures have already been incorporated into the Proposed Project for various resources, as applicable (see Appendix A of the CEQA Addendum, *Bradmoor Island and Arnold Slough Restoration Projects Environmental Commitments*). These measures would be equally effective at avoiding and/or reducing impacts on the resources identified throughout this addendum as similar measures identified in the Delta Plan’s program EIR.

A comprehensive table that ‘crosswalks’ all mitigation measures included in the Delta Plan EIR MMRP with the Project’s specific environmental commitments and/or mitigation measures, to demonstrate consistency with these Delta Plan measures, is included as a supporting document for this Certification of Consistency (GP1_Mitigation_Consistency).

Additional measures may be imposed during the course of obtaining State and federal permits; those measures would be appended to the CEQA Addendum (FINAL_Bradmoor_Arnold CEQA Addendum) as permits are obtained.

Best Available Science

This section provides detailed findings of consistency with regulatory policy GP 1 / 23 CCR Section 5002: (b)(3) Best Available Science.

The design and adaptive management plan are based on best available science, as demonstrated by the following elements incorporated into planning:

- Well-stated objectives, as stated above in “Project Objectives” and hypotheses, as described in the AMMP
- Conceptual models of tidal wetland functions, habitat requirements and distribution of sensitive fish and wildlife species
- Background studies of historic and reference habitats in the Suisun Marsh and Delta
- Site-specific hydrodynamic modeling of various design alternatives, and water quality assessment
- Best professional judgment of experts

The planning and implementation, adaptive management and monitoring of the Proposed Project utilize the Best Available Science. DWR is committed to use input from experts and management to continually review and adapt to meet the restoration goals and objectives.

The Bradmoor Island/Arnold Slough Tidal Habitat Restoration Adaptive Management and Monitoring Plan has been attached as a supporting document (AMMP_BradArnold)

Objectives and Hypotheses

Objectives and Hypotheses were developed using the Best Available Science by performing literature reviews, utilizing conceptual models, and collaborating with experts and managers.

Increase available Delta Smelt and Longfin Smelt habitat, including enhancement of primary and secondary productivity:

- Benthic invertebrates also play an important role in productivity in the project area (Schroeter et al. 2006).
- Pelagic invertebrates are an important part of productivity in Suisun Marsh, and several species of caridean shrimp, mysids, rotifers, and calanoid copepods, and several species of amphipods (*Corophium* spp.) are common (Hennessy 2009; O’Rear and Moyle 2010).

Enhance the quality of habitats to support more special-status and native wildlife.

- Managed wetland activities have been proposed through the North American Waterfowl Conservation Act and the San Francisco Bay Joint Venture. Associated activities are expected to improve management capabilities and habitat functions and values.

To the greatest extent practical, take advantage of the natural features of the site 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.

- 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.

Conceptual Models

Basis of Design

The Project's restoration planning and design has been based on an understanding of target fish species, Delta habitats, food webs, and tidal marsh evolution. This includes life history and habitat requirements of delta smelt, Chinook salmon, and longfin smelt, as well as ecological functions of tidal emergent wetlands and managed wetlands. Information from the Suisun Marsh Plan Conceptual Models was used to capture current understanding of how the ecosystem works and how species may respond to restoration (Raabe et al., 2010; Siegel et al., 2010). This understanding informed the design of sustainable habitat features that would increase rearing habitat for salmonids and food web productivity for delta smelt and longfin smelt, while minimizing potential negative effects on other species.

Technical Advisory Groups

The Proposed Project was also informed by the Blacklock Monitoring Plan (DWR 2006) and preliminary results. Additional focused studies were conducted for the Proposed Project to acquire more information and refine the design. These studies included hydrodynamic modeling of various design alternatives (RMA 2012), a wetland delineation (AECOM 2018), a cultural technical report (AECOM 2018), and a biological assessment (AECOM 2018). Alternatives were selected based on a combination of hydrodynamic and particle tracking modeling. Velocity, residence time, and potential for export were considered.

Further design refinement occurred through repeated collaboration with multiple agencies, entities, and scientists. The Suisun Marsh Adaptive Management Advisory Team (AMAT) is an advisory team comprised of technical staff from the Bay Conservation and Development Commission (BCDC), California Department of Fish and Wildlife (CDFW), Department of Water Resources (DWR), Suisun Resource Conservation District (SRCD), Reclamation, US Fish and Wildlife Service (USFWS), and the Delta Stewardship Council (DSC), and Delta Science Program (DSP) with invitations to other entities to participate as appropriate. The project proponents have used the AMAT and their knowledge of the Suisun Marsh for project development, design, and support, and as a forum to coordinate and cooperate for the benefit of the overall restoration goals identified in the SMP. The AMAT met May 29, 2018 for a project review and discussion.

The FAST is a review team comprised of technical level representatives from each Fishery Agency (USFWS, NOAA Fisheries, CDFW) and Reclamation that work with proponent water agencies to review and assist in planning habitat restoration projects and provide guidance to water agencies on expected benefits of proposed habitat projects in meeting restoration objectives. FAST participants are CDFW (Jim Starr), USFWS (Andy Raabe), NMFS (Doug Hampton), and USBR (Armin Halston). The FAST team has not formally convened on this project but has regular updates at quarterly coordination meetings. DWR submitted the pre-prospectus prior to purchasing property to confirm that the properties were suitable for restoration credit by FAST.

A technical review panel was convened on November 16, 2017 and included staff from USFWS, UC Davis, the FAST team, and others.

Adjacent landowners were also contacted. Landowners raised concerns about safety, public access, privacy, mosquitos, and a lowered property value including impacts to cattle grazing. DWR took public concerns into account during the design.

Special Studies

The control of *Phragmites australis* at the Project has been a very high priority for DWR since acquiring the properties. Project managers have been working to control *P. australis* during the dry periods in the managed wetlands by mowing and spraying all patches identified during the summer months, where possible. This has led to a major decrease of percent cover of *P. australis* at the Proposed Project locations. Additionally, DWR and UC Davis have two special studies in-progress located at Blacklock and Bradmoor respectively. The goal for the Blacklock *P. australis* control study is to determine the most effective and least environmentally impactful *P. australis* control method to inform site-wide invasive species removal and to benefit native species that rely on wetland habitat. Treatments include imazapyr alone and in combination with glyphosate, as well as mowing in combination with each herbicide application. Studies testing herbicide efficacy for *P. australis* indicate that glyphosate and imazapyr are most effective. The Bradmoor revegetation study is evaluating the planting success of three native emergent vegetation species (*Schoenoplectus acutus*, *S. americanus*, and *Typha latifolia*) and stages (seeds, rhizome, and adult) and determining which native species used has the most competitive advantage against *P. australis*.

Adaptive Management

This section provides detailed findings of consistency with regulatory policy GP 1 / 23 CCR Section 5002: (b)(4) Adaptive Management.

The Proposed Project will be implemented within an adaptive management framework that is guided by an Adaptive Management and Monitoring Plan, consistent with the Delta Plan Appendix 1B framework and the SMP (Appendix E, Adaptive Management and Monitoring Plan, of the SMP EIS/EIR).

Purpose of the AMMP

The Sacramento-San Joaquin Delta ecosystem is extremely dynamic on multiple temporal and spatial scales. In the absence of rigorous monitoring, fluctuations in natural populations of native and non-native flora and fauna, as well as variations in the physical environment related to climate and anthropogenic influences, are likely to complicate the assessment of tidal wetland restoration actions.

The AMMP establishes objectives, priorities, and tasks to manage, monitor, maintain, and report on the habitats and species at the Project site. The monitoring component of this Plan identifies the metrics of functional outcomes from Project construction and operation that will be measured to evaluate progress toward desired or hypothesized outcomes, and to inform corrective measures if criteria are not met. It also provides a strategy for managing the project to maximize benefits to listed species. The AMMP incorporates elements of the *Interagency Ecological Program Governance Framework* (IEP TWM PWT 2017a) and comprises three major components:

- ▶ **Compliance monitoring:** Determining whether restoration actions, including compliance with construction-related permitting requirements, have been completed as planned.
- ▶ **Routine effectiveness monitoring:** Evaluating hypotheses related to the premise that tidal wetland restoration would benefit listed fish species in accordance with project objectives.
- ▶ **Potential special studies:** Effectiveness monitoring that is too intensive in terms of time, expertise, and resources for regular implementation, but that would provide detailed information on the mechanisms responsible for wetland physical and ecological processes.

Compliance and Effectiveness Monitoring

The goal of the Proposed Project is to partially fulfill the 8,000-acre tidal restoration obligation established by the Fish Restoration Program Agreement in satisfaction of the BiOps (USFWS 2008; NMFS 2009) and incidental take permit (2009), and carried forward in the 2019 Biological Opinions and 2020 Incidental Take Permit for long-term operation of the State Water Project. Postconstruction monitoring would be implemented to verify the restoration (acres restored, as-built topography and elevations, and hydrology).

In addition, the conservation and mitigation measures in the permits obtained for project construction impose specific monitoring requirements as conditions of compliance. These monitoring elements focus on permitting requirements and mitigation measures listed in the SMP; Sections 401, 402, and 404 of the Clean Water Act; Section 7 of the Endangered Species Act (ESA); and the Suisun Marsh development permit (San Francisco Bay Conservation and Development Commission).

Compliance and effectiveness monitoring would be conducted to meet the requirements of the 2008 Delta Smelt BiOp (USFWS 2008), 2009 Salmonids BiOps (NMFS 2009), and 2009 Longfin Smelt ITP (CDFG 2009). The monitoring data would be used to identify the need for actions necessary for the adaptive management and maintenance of the site and to learn whether the stated objectives of the project are being met. Effectiveness monitoring would occur within the Proposed Action footprint, adjacent channels, and at the reference site, Blacklock Tidal Habitat Restoration (Figure 2-11). Table 2-6 describes the monitoring metrics, schedule, and proposed locations.

Table 2-1. Bradmoor Island and Arnold Slough Tidal Wetland Restoration Metrics and Monitoring Methods

Monitor Group	Metric	Method	Time of Year, Frequency	Sampling Intervals								Sites and samples	
				Pre-Breach	Post-Breach	Years after breach ¹							
						1	2	3	4	5	Yr 5-10		
Hydrologic Connections, Physical Processes, and Hydrology													
	Topography and bathymetry (e.g., channel morphology, pond depths)	Ground-based global positioning system (GPS) survey, or light detection and ranging (LiDAR) if available, aerial photos	Annual during summer	X	X						X	Once Every 5 years	Project area, up to 10 cross-sections including breaches, major channels, marsh plain
	Tidal Regime	Gauges or water level loggers	automatic measurements (may focus on spring-fall or tidal extremes)		X	X		X		X		D	2-5 sites (breaches, main channel, marsh plain)
Water Quality													
	Water quality (temperature, electrical conductivity, turbidity, pH, dissolved oxygen)	data sonde	Automatic measurements (may focus on spring-fall period)		X	X	X	X	X	X		D	1-5 site (temporary sondes at various locations)
		Discrete seasonal samples	Up to 9 monthly events; typical: 3 events (spring, summer, fall)	X	X	X	X	X	X	X		D	At sonde locations and concurrently with invertebrate sampling.
	Nutrients (NH ₄ -PO ₄)	Grab samples, standard methods	Up to 9 monthly events; typical: 3 events (spring, summer, fall)	X	X	X	X	X	X	X		D	Up to 21 sites (9 sites within Bradmoor, 6 sites in Arnold, 3 sites in Little Honker Bay (LHB), 3 sites in Blacklock.)
	Particulate organic matter (POM), dissolved organic matter (DOM)	Grab samples, standard methods or FDOM on sonde.	Up to 9 monthly events; typical: 3 events (spring, summer, fall)	X	X	X	X	X	X	X		D	Up to 21 sites (9 sites within Bradmoor, 6 sites in Arnold, 3 sites in LHB, 3 sites in Blacklock.)
Food Web Productivity													
	Chlorophyll a	Optical sensor (if available); Grab samples	Up to 9 monthly events; typical: 3 events (spring, summer, fall)	X	X	X	X	X	X	X		Reduced frequency	Up to 21 sites (9 sites within Bradmoor, 6 sites in Arnold, 3 sites in LHB, 3 sites in Blacklock.)
	Phytoplankton	Plankton grab samples lab sorting	Up to 9 monthly events; typical: 3 events (spring, summer, fall)	X	X	X	X	X	X	X			
	Zooplankton	Mesozooplankton and mysid	Up to 9 monthly	X	X	X	X	X	X	X			

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Monitor Group	Metric	Method	Time of Year, Frequency	Sampling Intervals								Sites and samples
				Pre-Breach	Post-Breach	Years after breach ¹					Yr 5-10	
						1	2	3	4	5		
		net trawls, lab sorting	events; typical: 3 events (spring, summer, fall)									
	Benthic macroinvertebrates	Benthic grab samples or sediment cores, lab sorting	Up to 2 events (spring and fall)	X	X	X		X	X	X	Reduced frequency	Up to 21 sites (9 sites within Bradmoor, 6 sites in Arnold, 3 sites in LHB, 3 sites in Blacklock.)
	Surface invertebrates	Neuston tow	Up to 2 events (spring and fall)	X	X	X		X	X	X		Up to 21 sites (9 sites within Bradmoor, 6 sites in Arnold, 3 sites in LHB, 3 sites in Blacklock.)
	Epibenthic/epiphytic macroinvertebrates	Sweep nets	Up to 2 events (spring and fall)	X	X	X		X	X	X		Up to 21 sites (9 sites within Bradmoor, 6 sites in Arnold, 3 sites in LHB, 3 sites in Blacklock.)
Wetlands and Vegetation												
	General habitat conditions	Photo points (qualitative record)	Annual during growing season (summer)	X		X	X	X	X	X	Every 5 years	Up to 10 points across site
	EPA recommended level II assessment (optional)	California Rapid Assessment Method (CRAM: http://www.cramwetlands.org/)	Once during growing season (summer)	X		X				X	D	Vegetated marsh plain
	Vegetation composition and cover	Surveys consistent with marsh-wide protocols. rake transect for submerged aquatic	Once during growing season (summer)	X		X		X		X	D	Plots across sites for terrestrial vegetation, channels for submerged aquatic vegetation.
	Invasive plants	Visual survey (aerial imagery and ground surveys)	Annual during early growing season	X	X	X		X		X	Every 5 years	Survey entire site. Annual checks to continue during qualitative site surveys.
Other Monitoring												
	<i>Chloropyron molle</i>	Presence/ absence, extent and density if possible.	Annual during growing season	X	X	X	X	X	X	X	Every year	Arnold Slough transition zones
	Salt Marsh Harvest Mouse	CDFW trapping protocols	Every 3-5 years	X			X			X	Every 5 years	Established grids on Arnold and Bradmoor
	Secretive marsh birds	Currently accepted marsh protocol	3 times during survey season, every other year	X	X		X		X		Every 5 years	Several points around Arnold and Bradmoor

Notes:

1. Years after breach: X = Sampling proposed in this year, D = Discretionary sampling, contingent on available resources, partners, and project needs.

Adaptive Management Response

A range of activities could occur post-restoration. Some activities are potential management responses that could be triggered if monitoring data reach an intervention threshold that indicates a problem or unsatisfactory progress toward objectives. Others are maintenance activities that may be necessary for long-term management of the project area.

Future management responses are subject to approval of the USFWS, NMFS, and CDFW to determine if the activities are necessary towards meeting the objectives of the Proposed Action. If, through implementing any of the activities associated with the adaptive management, the Proposed Action effects differ from those analyzed herein in a manner or to an extent not previously considered, re-initiation is required.

Table 2-7 shows a draft summary of the three project objectives, the expected outcomes related to those objectives, the metrics by which progress towards meeting the objectives is measured, as well as triggers (or intervention thresholds) for undertaking a management response if goals are not being met or problems occur which require intervention.

Table 2-2. Potential Bradmoor/Arnold Management Responses to Deficiencies in Achieving Objectives

Objective	Expected outcome	Monitoring group	Metric	Target	Intervention threshold	Potential Management Response
Objective 1						
Increase available Delta Smelt and Longfin Smelt habitat, including enhancement of primary and secondary productivity.	The levee breach and levee degrade would increase tidal exchange, increasing habitat available to smelt, salmonids and other native fishes.	Physical & Hydrological	Topography, Tidal gauges, Photo-point pictures.	Channels formation evolves over time and connectivity to breaches remain, tidal stage in restoration site similar to slough stage.	Levee degrades and/or breach becomes blocked by debris, sediment, or by beaver dams in first 5 years. Blockage severely limits water exchange within the restoration site or with the habitat adjacent to it.	Clearing or re-excavation of the blocked area.
	The enhanced tidal exchange would increase primary and secondary productivity at the site and/or adjacent to it, increasing prey abundance for fishes.	Food web	Phytoplankton, Zooplankton, Surface invertebrates, Benthic macroinvertebrates.	Similar food web metrics inside the site and in adjacent sloughs.	N/A	N/A
Objective 2						
Enhance the quality of habitats to support more special status and native wildlife.	Tidal restoration would create suitable habitat for <i>C. molle</i> and the population will expand.	Other Monitoring	Population survey	<i>C. molle</i> population present	<i>C. molle</i> extent declines significantly over 5 years.	consult with USFWS and CDFW on potential actions
	Tidal restoration would create suitable habitat for rails.	Other Monitoring	Secretive marsh bird survey	No reduction in rail detection.	N/A	N/A
	Tidal restoration would not cause the SMHM population to decline.	Other Monitoring	SHMH survey	long-term availability in SMHM habitat	N/A	N/A
Objective 3						
To the greatest extent possible, take advantage of natural features of site to promote habitat resiliency for future Suisun Marsh conditions.	Sediment would accrete over time.	Physical & Hydrological	Topography, sedimentation	Elevations rise over time. No scour unless channel formation.	Elevation in different survey points over the years decreases.	N/A
Objective 4						
Avoid promoting conditions, such as invasive species infestations, that are in conflict with the above project objectives.	Invasive species composition and spread would be reduced as much as possible.	Vegetation	Aerial imagery, site visit	Invasive weeds cover less than 20% of the site.	<i>P. australis</i> invades previously <i>P. australis</i> free areas in the site. Invasive weed coverage increases 5% from vegetation composition in year 1 after restoration.	Physical removal, spraying, TBD

Monitoring Program Design

Effectiveness monitoring would track progress toward objectives by measuring indicators of ecological status and function (“metrics”) and comparing the measurements to expected or hypothesized outcomes. Sampling techniques (“methods”) would include conducting terrestrial surveys of vegetation, monitoring hydrology and water quality via instrumentation, sampling aquatic food web components, and sampling for fish presence, where permitted. Measurements of physical and biological components would be used to evaluate the evolution of habitat on the site, including tidal channel and marsh morphology, response of vegetation (including nonnative invasive plants) to the reconnected tidal influence, contributions of habitat components to the food web, and identification of occupied fish habitat. Where possible, existing data will be leveraged from long-term fish and zooplankton monitoring conducted by various IEP and academic programs. Monitoring activities are subject to adaptation. DWR would incorporate applicable environmental commitments and mitigation measures from the SMP EIS/EIR into the Proposed Action and has proposed additional BMPs that would be implemented to further protect sensitive resources. These environmental commitments are summarized in Chapter 2 of the SMP EIS/EIR. 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 (See Appendix A of the CEQA Addendum submitted in this package: A_EC_FINAL_2020.02.04).

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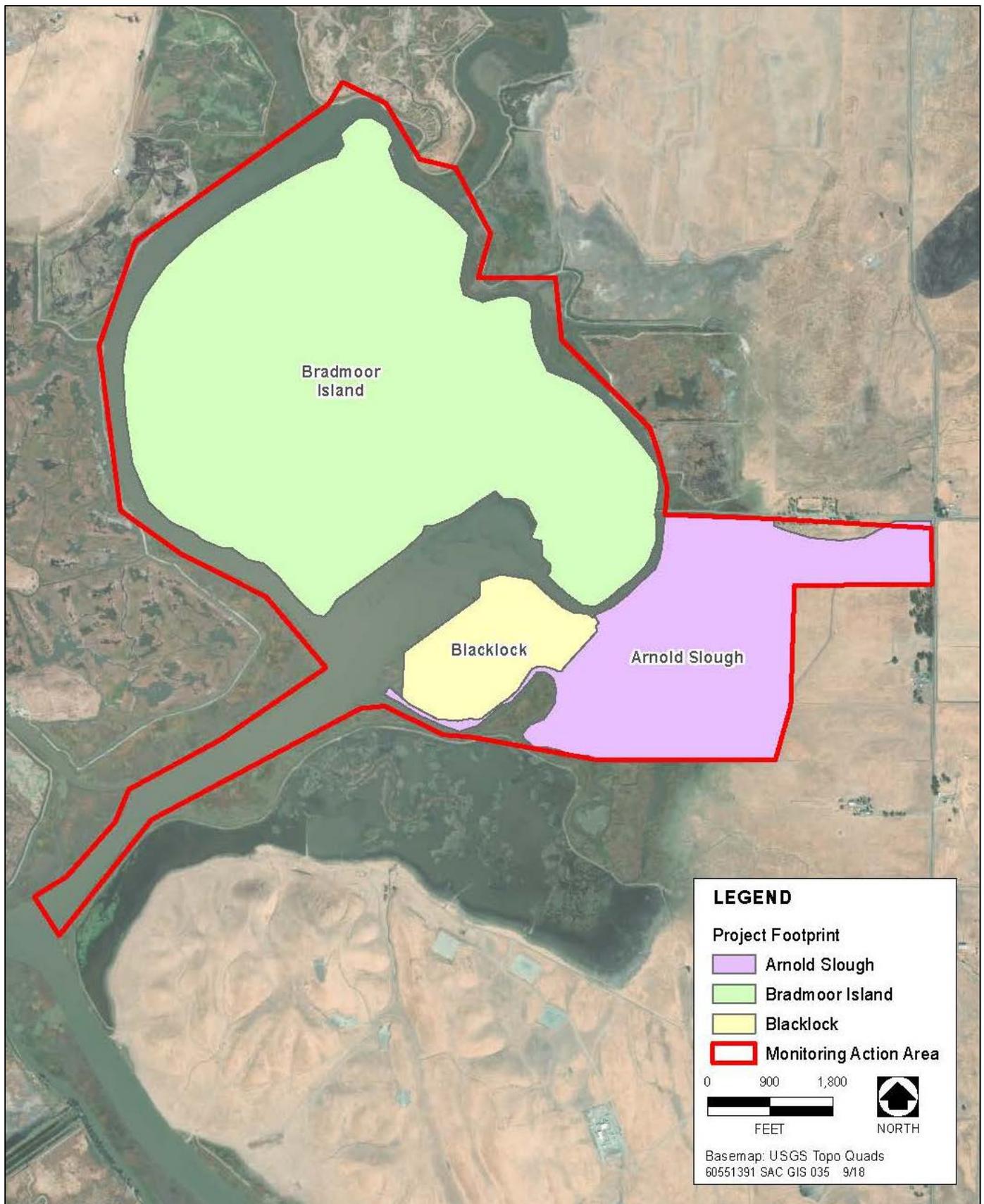


Figure 1-11. Monitoring Action Area

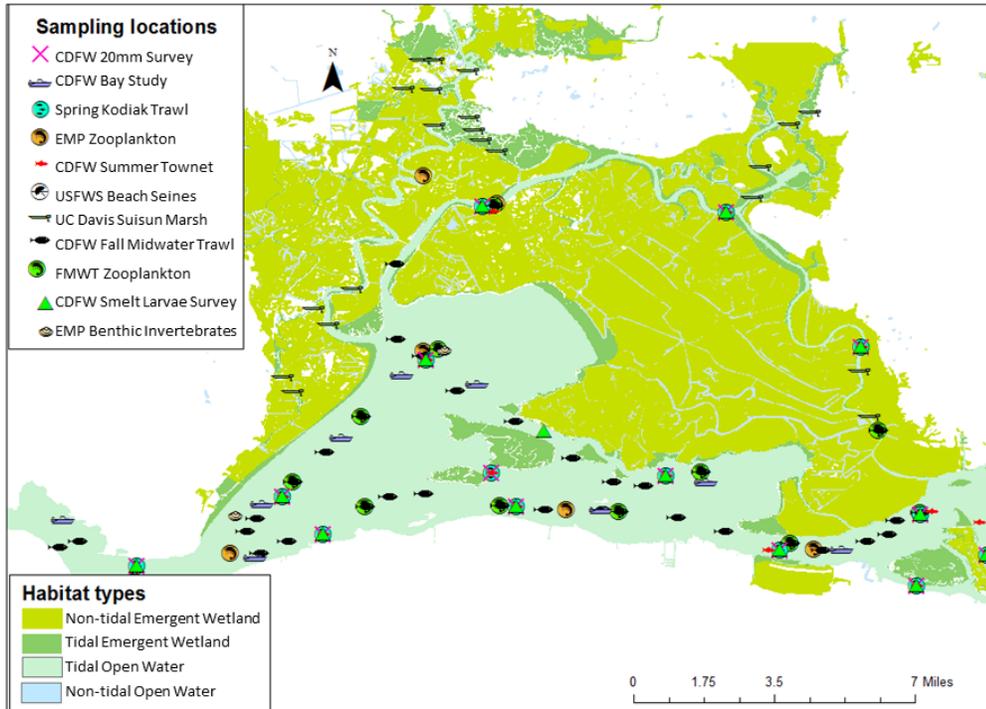


Figure 1-12. Existing Long-Term Interagency Ecological Program Monitoring Stations in the Region Surrounding the Restoration Site

Restoration Objectives: Intervention Thresholds and Responses

Major site modification is not anticipated to be needed. However, one purpose for the adaptive management and monitoring plan is to guide monitoring to identify concerns that could compromise the objectives of the Proposed Project, and to propose potential management responses or further focused monitoring efforts. Table 2-7 summarizes the Proposed Project's objectives, expected outcomes, the metrics for measuring progress toward the objectives, and thresholds for undertaking a management response if goals are not being met or problems require intervention. DWR would consult with the resource agencies before taking any major corrective measures. Should no corrective measures be feasible, the reasons for the lack of progress toward the objectives would be scientifically evaluated, and the lessons learned from this project would be used to improve future project

Financial Assurances and Resources to Implement Adaptive Management

The Project has access to adequate resources and delineated authority to implement the proposed adaptive management process. The Project is fully funded through State Water Project funds including 10 years of planned monitoring and long-term maintenance and management. DWR is committed to assuring the Fish Restoration Program is funded in perpetuity. This Project is not subject to appropriation to the State General Fund. In addition, DWR has a strong AA1 bond rating (Cregger 2018) and is in a good financial position to make any on-going payments.

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