CHAPTER 2
Project Description

2.1 Introduction

2.1.1 Project Location

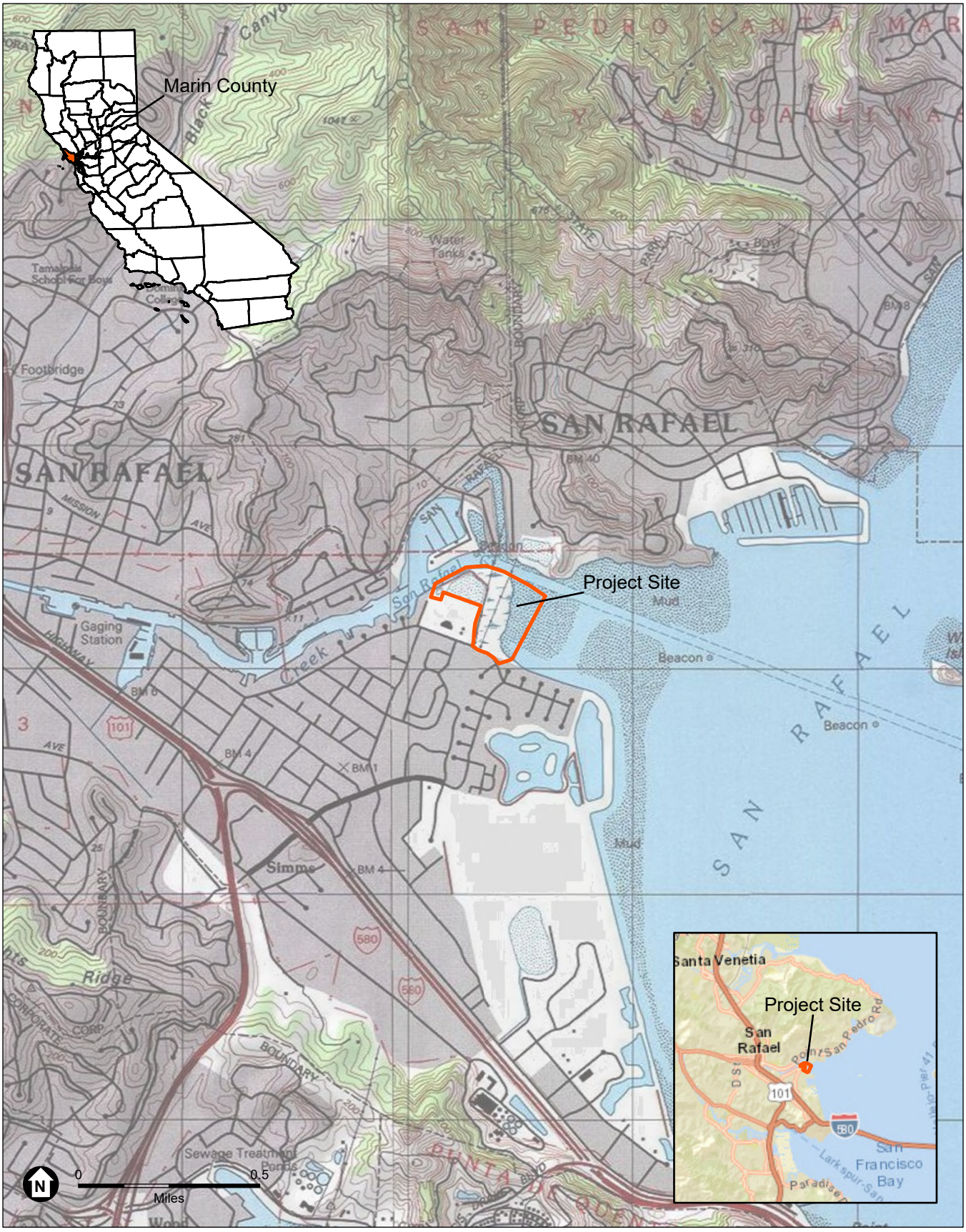
The Tiscornia Marsh Habitat Restoration and Sea Level Rise Adaptation Project (Proposed Project) would restore former tidal marshlands and improve a shoreline levee on a 28-acre site at the confluence of San Rafael Creek and San Rafael Bay (**Figure 2-1**). The Project site is along the north boundary of the Canal neighborhood in central San Rafael, at Assessor's Parcel Numbers (APNs) 009-142-01, 009-032-06, 009-032-08, and 009-032-09.

Tiscornia Marsh is bounded on the west by the Albert J. Boro Community Center and Pickleweed Park. To the north is the mouth of San Rafael Creek, which transitions into San Rafael Bay (Bay).[1] The location of former Schoen Park (removed by the City of San Rafael in 2019) lies south of the Tiscornia Marsh shoreline levee, on the southeastern portion of the Project site, bordered by Spinnaker Point Drive (**Figure 2-2**). The shoreline levee that traverses the Project site, which is used as a recreational trail, is part of the shoreline flood protection system for the southeastern shoreline of the creek. The existing shoreline levee encloses Albert J. Boro Community Center and Pickleweed Park and then extends east along the Bay shoreline, past the Spinnaker and Baypoint developments and the Canalways property, and then onto the Richmond-San Rafael Bridge area. The west end of the existing shoreline levee ends on the west side of Pickleweed Park, adjacent to private residences, transitioning to lower ground elevations and an inconsistent flood protection system on private property along the south bank of the creek.

2.1.2 Project Background

The Project site includes the 21-acre Tiscornia Marsh property and approximately 500 feet of shoreline levee/trail owned by Marin Audubon Society (MAS), as well as currently diked salt marsh within Pickleweed Park, approximately 1,800 feet of shoreline levee/trail, and a portion of former Schoen Park (now a vacant lot) owned by the City of San Rafael (City). Proposed Project activities would reconstruct the highly eroded Tiscornia Marsh, reconnect the diked marsh in Pickleweed Park to tidal inundation, and fortify the local shoreline against sea level rise.

[1] San Rafael Creek between Highway 101 and San Rafael Bay is often referred to locally as the San Rafael Canal; however, the formal name of San Rafael Creek is used throughout this EIR.



SOURCE: USGS, Esri

Tiscornia Marsh Habitat Restoration and Sea Level Rise Adaptation Project

Figure 2-1
Regional Setting

ESA

SOURCE: Aerial Imagery: Esri

Tiscornia Marsh Habitat Restoration and Sea Level Rise Adaptation Project

Figure 2-2
Project Location Existing Conditions

ESA

The low-lying Canal neighborhood adjacent to Tiscornia Marsh is currently at risk to coastal flooding, as is a significant extent of central San Rafael that occupies what was once tidal marshlands and open bay. The area is currently in the Federal Emergency Management Agency (FEMA) 100-year floodplain[2] and will be increasingly susceptible to flood hazards as sea level rises, as described in Marin County's recent Marin Bay Waterfront Adaptation Vulnerability Evaluation (BayWAVE; BVB Consulting 2017). Much of the Canal neighborhood lies below high tide elevations, requiring pump stations to remove stormwater and shoreline levees to protect against coastal flooding. The reach of San Rafael Creek shoreline upstream of the Project site is vulnerable to flooding, as many buildings have encroached on the shoreline edge and there is no formal flood protection system.

The roughly 2,300 feet of shoreline levee on the Project site is an un-accredited earthen berm, which varies in height and does not meet the FEMA freeboard requirements, with much of its length below the required elevation of the 100-year base flood elevation (BFE)[3] plus 3 feet of freeboard. A segment of the levee on the southern end of the Project site, near the former Schoen Park, is even lower, below the 100-year BFE level. Portions of the shoreline levee segment on the Tiscornia Marsh and Pickleweed Park properties are therefore at risk of overtopping during an extreme coastal flood event, resulting in flooding of low-lying portions of the adjacent Canal neighborhood.

In addition, the tidal marshlands have experienced considerable erosion over the past 30 years, retreating as much as 200 feet, with approximately 3 acres lost. This erosion has resulted in a significant loss of habitat for the endangered Ridgway's rail and salt marsh harvest mouse, migratory shorebirds, and other important marsh wildlife. The habitat impacts of the marsh loss are exacerbated by the current lack of a functional wetland-upland transition along the marsh's landward boundary, which currently transitions abruptly to the steep levee embankment.

Both of these conditions are expected to worsen in the coming decades as sea level rises. Sea level rise of about 8 inches has already occurred in the last century, and several feet or more of sea level rise is projected by the end of this century. By elevating Bay water levels, sea level rise will increase the frequency and severity of flooding along the City's shoreline.

2.1.3 Goals and Objectives

The goal of the Proposed Project is to enhance the ecological function of the Tiscornia Marsh property and increase flood protection for the Canal neighborhood, while maintaining the community value of the Albert J. Boro Community Center and Pickleweed Park.

[2] A 100-year flood is a flood event with a magnitude that has a 1 in 100 chance (1 percent probability) of occurring in any given year. The 100-year floodplain therefore encompasses lands with a 1 percent annual chance of such flooding.

[3] The 100-year base flood elevation is defined by FEMA as the computed elevation to which the 100-year flood, or 1 percent annual chance flood, is anticipated to rise.

Specific Project objectives originating from this overarching goal include:

- Restore tidal marsh on the Project site to improve ecological function and habitat quantity, quality, and connectivity (including upland transition zones) for native marsh species and marsh-upland transition species, including special status species.
- Protect Project site marshlands from future marsh edge erosion.
- Increase the level of flood protection for the Canal neighborhood and other nearby communities of central San Rafael.
- Create sustainable benefits that consider future environmental changes such as sea level rise and sedimentation.
- Maintain and improve public access to passive recreational and outdoor education opportunities (e.g., hiking, jogging, bird watching).

2.1.4 Anticipated Approvals and Permits

The anticipated regulatory permits and consultations that would be needed for the Project are identified in **Table 2-1** below. These potential permitting requirements are preliminary and may change during pre-application coordination with the regulatory agencies or as the Project design develops.

TABLE 2-1
ANTICIPATED REGULATORY REQUIREMENTS

Agency	Governing Regulation	Potential Requirement
Federal		
U.S. Army Corps of Engineers	Clean Water Act Section 404, Rivers and Harbors Act Section 10	Nationwide Permit Pre-Construction Notification or Individual Permit
U.S. Fish and Wildlife Service	Endangered Species Act (ESA), Fish & Wildlife Coordination Act (FWCA), Migratory Bird Treaty Act (MBTA)	Federal ESA Section 7 Consultation
National Marine Fisheries Service	Endangered Species Act and Magnuson-Stevens Fishery Conservation and Management Act	Federal ESA Section 7 and Magnuson-Stevens Fishery Conservation and Management Act Consultation
State Historic Preservation Office (SHPO)	Section 106 of the National Historic Preservation Act	Federal undertaking (i.e., permit or funding)
State		
California Department of Fish and Wildlife	Fish and Game Code Section 1602	Lake and Streambed Alteration Agreement
California Department of Fish and Wildlife	California Endangered Species Act (CESA), Fish and Game Code Section 2081	CESA Incidental Take Permit
State Water Resources Control Board	National Pollutant Discharge Elimination System (NPDES)	Storm Water Pollution Prevention Plan for Construction Activities
San Francisco Bay Regional Water Quality Control Board	Clean Water Act Section 401; Porter-Cologne Water Quality Act	Water Quality Certification/Waste Discharge Requirements
State Lands Commission		Lease or lease amendment

TABLE 2-1 (CONT.)
ANTICIPATED REGULATORY REQUIREMENTS

Agency	Governing Regulation	Potential Requirement
Local/Regional		
Bay Conservation and Development Commission (BCDC)	McAteer-Petris Act	Administrative Permit
City of San Rafael		Use Permit, Environmental and Design Review Permit, Tidelands Permit, Encroachment Permit, Grading Permit

2.2 Project Description

The Proposed Project would restore Tiscornia Marsh to its 1950s-era extent by beneficially reusing dredged material from local sources. A coarse beach (man-made beach constructed of course-grained materials like gravel and cobbles) would be constructed along the bayside edge of the restored marsh to resist future erosion. Tidal action would also be restored to the City-owned diked marsh at the north end of Pickleweed Park. Altogether, the Project would reconstruct approximately 4 acres of eroded tidal marsh, preserve and protect the approximately 8 remaining acres of Tiscornia Marsh, and restore approximately 5 acres of diked marsh by reconnecting it to tidal inundation. The Project would also construct a new approximately 600-foot levee on the south side of the existing diked marsh and improve approximately 1,100 feet of existing shoreline levee to achieve greater flood protection, public access, and habitat benefits. Major Project elements are shown in **Figure 2-3** and summarized below.[4]

2.2.1 Coarse Beach Construction

A coarse beach would be constructed beyond the edge of Tiscornia Marsh to provide transitional habitat and nature-based erosion protection. The coarse beach feature would be approximately 50 to 60 feet wide, extending from the marsh's bayside mudflat to an approximate elevation of 9 feet above sea level. The relatively narrow beach is not intended for recreational use, and therefore has no direct land access (the beach would be separated from the southern shoreline by a small tidal channel). The planned crest elevation is designed to protect the area behind the beach from high tides, wave runup, and erosion during an average year's storm events. The crest of the beach would be planted with high marsh vegetation and would transition gradually to newly created tidal marsh on the landward side.

[4] The Project Description for this EIR, including overall description of Project elements, construction approach and phasing, and operations and maintenance approach is summarized from the draft Preliminary Design Report prepared by environmental engineers supporting MAS in the development planning of the Project (ESA 2021). The Preliminary Design Report was supplemented by the environmental engineers during preparation of the EIR. Should the EIR be certified, and the EIR approved, the Project Design would be further advanced and some project elements may be refined. However, it is expected that the overall Project would be consistent with the description herein.

SOURCE: Aerial Imagery: Esri

Tiscornia Marsh Habitat Restoration and Sea Level Rise Adaptation Project

Figure 2-3
Proposed Project Elements

ESA

This coarse-grained feature would emulate naturally occurring beaches in San Francisco Bay, consisting predominantly of gravel, with larger cobbles (e.g., 4- to 9-inch diameter) used for the beach subgrade. Coarser beach materials such as gravels and cobbles would be more durable against storm events and less likely to drift laterally into San Rafael Creek.

The coarse beach would provide multiple benefits, including increasing the stability of eroding shorelines; creating aquatic, transitional, and/or wetland habitats; and providing a platform for ecosystem adaptation to sea level rise. Over time, the coarse beach is expected to persist as sea level rises, responding by adjusting its profile landward and upward.

A series of retention groins, constructed of wood and/or rock, would be incorporated into the beach to restrict longshore drift and retain sufficient sand and gravel in the beach profile. In addition, a flexible (i.e. made of granular, porous material instead of concrete) jetty structure constructed of suitably sized cobble would be built at the north end of the new marsh and beach to reduce erosion and prevent the movement of beach sediment into the creek. Where feasible, features may be incorporated in the lower, subtidal portion of the jetty structure to enhance its potential as aquatic habitat.

2.2.2 Eroded Tidal Marsh Reconstruction

The existing mudflat bayside of Tiscornia Marsh would be filled to recreate approximately 4 acres of tidal marsh. The marsh would be created by placing locally obtained dredged sediments compatible with the existing marsh, along with soils excavated on site for other Project elements, into the mudflat. Imported sediments would be dredged mechanically, transported to the site via barge, and mechanically unloaded and placed in the existing mudflat.

Prior to dredged fill placement, a coarse containment berm (that would later be further built out as the coarse beach) would be constructed along the water's edge of the new marsh area, the crest of which would be high enough to contain dredged material and isolate the work area from open waters. Other Project features (i.e., the existing shoreline levee) and protection measures (e.g., coir logs) would contain the south and west sides of the fill placement area, respectively. Placed material would slowly consolidate because of draining and drying.

Following fill placement, a tidal channel would be excavated along the existing marsh edge to connect to the existing marsh channel system that drains to the creek. To the extent feasible, the new channel would expose and/or recreate the overhanging vegetation at the marsh edge to provide suitable foraging conditions for Ridgway's rail.

2.2.3 Diked Marsh Restoration

The diked marsh bordering Pickleweed Park is at mid-marsh elevation and dominated by pickleweed, but it is isolated from the tidal action of the Bay by the shoreline levee. Tidal action would be restored by lowering and breaching the shoreline levee and excavating a tidal channel network of one to three branching channels, connecting the diked marsh to the Bay through the breached levee. Portions of the levee around the diked marsh would be lowered and revegetated to create disconnected high marsh and upland transitional habitat, disconnected by the breached

areas from consistent land access to deter terrestrial predators (e.g., house cats). Two non-native palm trees would be removed for this work. Up to 150 linear feet of riprap armoring along the banks of the creek (as seen in Figure 2-3) would also be removed.

For this reintroduction of tidal inundation to occur, a new levee would be constructed on the south side of the diked marsh, adjacent to the existing soccer field (shown on Figure 2-5), before the outboard (bay-adjacent) levee is breached (see Section 2.2.4, *Shoreline Levee Improvements*, for further discussion). There is a small City-owned pond west of the diked marsh (shown on Figure 2-2) that is disconnected from adjacent habitats and has limited ecological value. This triangular pit is fenced off and has no known drainage inlet or outlet. A portion of the pit would be partially filled to connect the west end of the new levee to the existing shoreline (see Section 2.2.4, *Shoreline Levee Improvements*).

2.2.4 Shoreline Levee Improvements

The Project's shoreline levees were designed in accordance with U.S. Army Corps of Engineers guidance (USACE 2000), including a seismic deformation analysis as recommended by guidance developed for the California Department of Water Resources (DWR; URS 2015). Levee improvements were designed to approximately 13 feet above sea level, providing 3 feet of freeboard above FEMA's current 100-year BFE for the Project area of 10 feet (FEMA 2021). This would require raising the existing levees 1-4 feet, depending on their current height (e.g., the existing levee on the west side of the Project site would be raised by 4 feet, while the levee on the east side of the soccer field would only be raised by 1 foot). This design elevation considers an approximate 50-year timeline for the Project, and anticipated sea level rise to roughly 2070 under a medium–high risk aversion scenario as defined by the state's sea level rise planning guidance. The medium–high risk aversion scenario equates to a one in 200 chance that sea level rise would meet or exceed the probability projections of 2.4 to 2.6 feet for 2060 or 3.1 to 3.5 feet by 2070 (California Natural Resources Agency and California Ocean Protection Council 2018). The levee crests were designed to a width of approximately 12 feet, allowing space for future raising to address actual sea level rise by 2070.

The shoreline levee/trail around the diked marsh would be lowered and breached to restore tidal inundation (see Section 2.2.3, *Diked Marsh Restoration*) and would be replaced with a new levee along the north side of the soccer field, approximately 200 to 400 feet behind the location of the existing perimeter levee. The new levee would be approximately 12 feet wide at the crest, and the total levee footprint would be approximately 70 feet wide, including the ecotone slope (see Section 2.2.5, *Ecotone Slope Development*). There are currently two design options for tying the west end of the new levee into the shoreline (both represented in Figure 2-3). The west tie-off option would partly depend on the City's future plans for the existing stormwater line that runs north-south along the west side of the Project site and outfalls into San Rafael Creek. Either of the alignments described below could accommodate the City's future plans to potentially install a trash capture device at the end of the existing storm drain to comply with new law.[5] The decision

[5] The State Water Resources Control Board enacted the Trash Amendments in December, 2015 as part of the Trash Implementation Program, requiring all trash larger than 5 millimeters be captured prior to discharge into water bodies. The Trash Amendments apply to all Phase I and II permittees under the National Pollutant Discharge

of which design option to implement would be made in coordination with the City, as the plan to install the trash capture device is further developed.

Under the first option (west levee tie-off option 1), the new levee would connect to the existing trail on the west side of the diked marsh and soccer field and follow it to the existing shoreline levee. The trail and approximately 250 feet of shoreline levee west of the trail would be raised by approximately 4 feet to match the design elevation of the new levee. Under the second option (west levee tie-off option 2), the new levee would extend approximately 150 feet directly west to the northwest corner of the site, and would be partly set back from the shoreline, cutting off the existing subsurface stormwater line (as seen on Figure 2-2) where it intersects with the levee. This would require that a small stormwater outlet channel be excavated to the north of the new levee through the tidal marsh and into the creek. For either option the pond would be partially filled, and the remaining area would be graded and planted to function as wetlands (freshwater wetland under west levee tie-off option 1, and tidal wetland under west levee tie-off option 2).

The remainder of the existing levee (approximately 1,100 feet on the west and south sides of the existing Tiscornia Marsh) would be raised and/or widened in place (requiring a setback) to provide habitat benefits and uniform flood protection meeting regional standards. The existing levee between Pickleweed Park and the west side of Tiscornia Marsh would be raised 1 to 2 feet, creating a more defined approximately 12-foot-wide crest, but no grading is proposed in or adjacent to the marsh in this segment. The levee along the south end of Tiscornia Marsh would be set back landward, partially onto City property, to accommodate levee raising and the proposed ecotone slope (see Section 2.2.5, *Ecotone Slope Development* below). The levee crest would be approximately 12 feet wide and the total levee footprint, accounting for the ecotone slope, would be approximately 80 feet wide. The toe of the ecotone would be at the edge of the existing marsh, which is closer to the levee at the west end, and farther away at the east end. Therefore, the amount of encroachment onto adjacent City property would vary from 20 to 30 feet, west to east. This activity for setback levee improvements would require the removal of five existing trees, including three pines, one small (10-inch) oak, and a cluster of non-native acacias.

Construction of the new and setback levees would include excavation of sandy foundation soils, which would be backfilled with imported, less permeable levee material. All improved levee segments would also include asphalt-paved trails at the levee crest once completed, to provide a uniform surface for public access (whereas the existing trail segments are unpaved).

2.2.5 Ecotone Slope Development

The new and setback levee segments described above would include a gradually sloped ecotone transition to the outboard marsh. This ecotone transition would provide both ecological and flood benefits (including high tide refugia for native marsh wildlife and shoreline erosion protection through wave-dampening), and would allow for marsh landward transgression under future sea level rise.

Elimination System (NPDES) municipal separate storm sewer systems (MS4) permits, including the City of San Rafael. Permittees must be in full compliance by December, 2030.

An ecotone slope would be constructed along the raised, setback levee along the south end of Tiscornia Marsh, as well as the new levee between the soccer field and the diked marsh. The ecotone slope on the south end of Tiscornia Marsh would be located where feasible between existing and/or restored marsh and the shoreline levee. Each segment would be approximately 500 linear feet, for a total length of 1,000 feet. The ecotone would be sloped at 10:1 (horizontal: vertical) and would be approximately 30 feet wide, totaling roughly 0.7 acre.

The ecotone slopes would be planted with native vegetation adapted to historic ecotones, intermixing high marsh and upland species adapted to infrequent flooding and salinity. Planted vegetation would include grasses, shrubs, and herbs that serve as essential cover for wildlife species, including small marsh mammals, and secretive marsh birds, protecting them from predation. To be effective as high tide refugia, the plants must be tall enough to extend roughly 1 foot above the highest tide elevations in winter. The ecotone slopes would be temporarily irrigated during the initial plant establishment period (2 to 3 years).

2.3 Project Construction

2.3.1 Construction Schedule, Hours, and Workforce

The planned construction schedule is summarized in **Table 2-2** below. Project construction activities would occur from approximately 8:00 a.m. to 5:00 p.m., Monday through Friday. The daily construction work force would vary depending on the construction activity; however, it is expected that the maximum daily workforce would be 19 workers.

TABLE 2-2
CONSTRUCTION SCHEDULE OVERVIEW

	Phase 1 (Year 1)				Phase 2 (Year 2 or 3)				Phase 3 (Year 3 or 4*)			
Construction Activity	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Site Preparation, Access, and Staging												
Coarse Beach Construction												
Shoreline Levee and Ecotone Improvements												
Eroded Tidal Marsh Reconstruction									drying *			
Diked Marsh Restoration												
Trail surfacing												

NOTES:

* Drying/consolidation of imported dredged material would take 6 to 18 months (shown as 6 months above). The timing of Phase 3 (Year 3 or 4) would depend on actual time needed for adequate drying, conditioning, and consolidation.

2.3.2 Construction Phasing

Construction of the Proposed Project would occur in three phases, over at least 3 years, beginning in 2023.[6] Most activities would occur during months of July through December, with the factors considered in the proposed work sequence including:

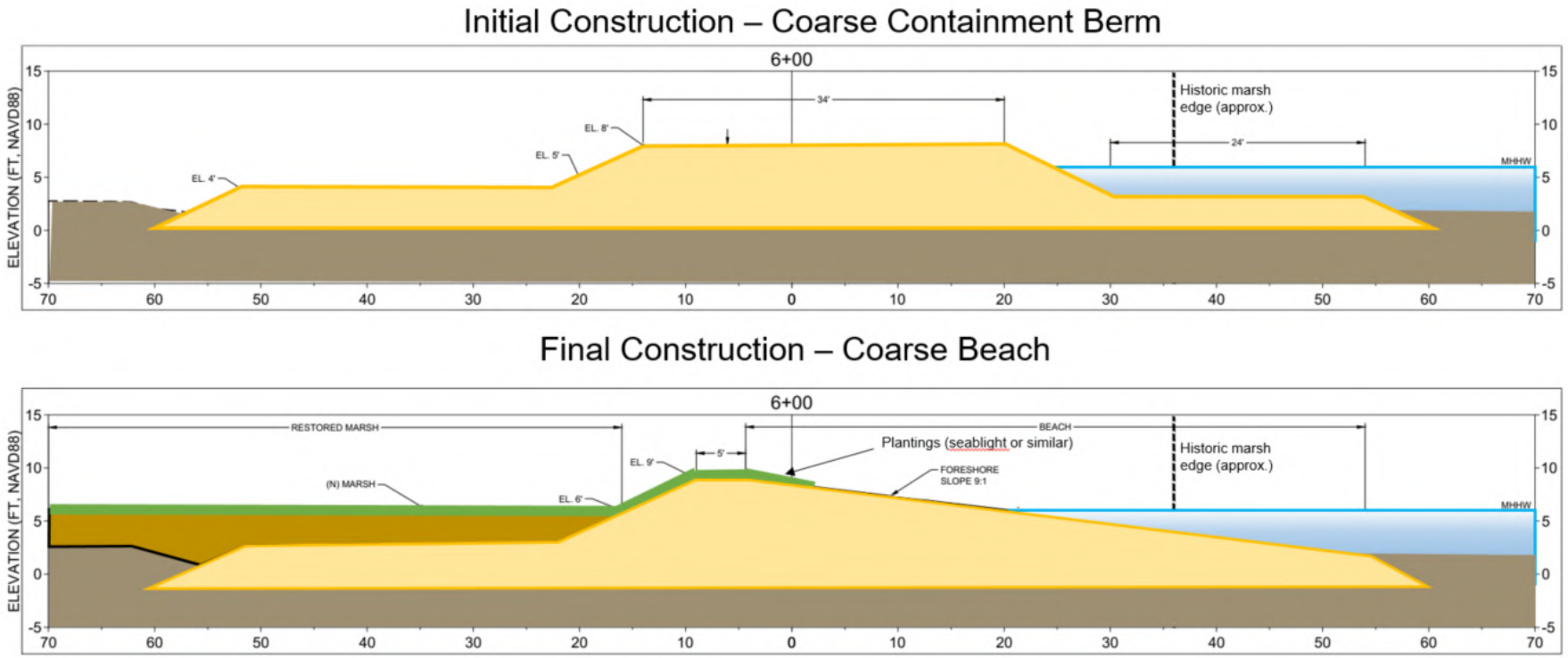
- Required sequencing of in-water work in order to protect water quality, primarily requiring constructing containment of the work area prior to dredged material placement.
- Reuse of excavated material as on-site fill as much as possible, to avoid trucking material off site.
- Expected timing of receiving dredged sediment from a navigational dredging project to use as marsh material.

Phase 1 (planned for summer and fall of 2023) would include site preparation (e.g., staging area development, vegetation clearing, temporary road improvements, and installation of the temporary in-water crane platform). Phase 1 would also include initial construction of the coarse beach (i.e., a coarse containment berm that would later be built up to create the coarse beach; see **Figure 2-4**) to serve as temporary containment of dredged fill material.

Phase 2 (planned for 2024 or later, depending on the availability of dredged sediment as explained below) would include construction of the new levee behind the diked marsh and improvement of the existing shoreline levee. Material generated from excavating the levee foundation would be placed on site to help reconstruct the eroded tidal marsh, but additional material (i.e., dredge sediment) would also be required to build out the new marsh. Dredged material would be placed between the existing marsh and the new containment berm. The exact timing of dredged material placement would be closely coordinated with planned dredging of source material in order to avoid storing the dredged material on site; therefore, Phase 2 may be postponed by 1 year or more until dredged material is known to be available and the Project site is prepared for fill placement. After dredged material is placed, it would be dried and conditioned over 6 to 18 months until it is consolidated.

Phase 3 would occur once the dredged material is dried and consolidated, most likely in fall of 2025 (or later if additional drying is needed or if the availability of source material for the marsh is delayed). This final phase would include building up and final shaping of the coarse beach and tidally connecting the new marsh to the Bay. Phase 3 would also include restoring the diked marsh by excavating a new tidal channel connection and lowering and breaching the existing shoreline perimeter levee around the diked marsh. Excavated material would be used to raise areas of localized settlement on the new levee crest (built in Phase 2) or within the newly created marsh. In this phase, the levee crest trails on the new and improved levee segments would be surfaced.

6 It is noted that, should regulatory permits be received by spring 2022, Project construction could begin in summer and fall 2022.



SOURCE: ESA and Hultgren-Tillis

Tiscornia Marsh Habitat Restoration and Sea Level Rise Adaptation Project

Figure 2-4
Beach Construction Phases

ESA

A summary of general construction activities by phase and year is outlined below:

Phase 1 – 2023:

- Site preparation including staging area development, installation of erosion and sediment control measures, and selective vegetation clearing and tree removal.
- Over-water installation of a crane platform on San Rafael Creek.
- Construction of a temporary access road across Tiscornia Marsh and placement of a temporary culvert underneath the temporary access road at existing channel crossings.
- Construction of the coarse containment berm (i.e., initial construction of the coarse beach, see Figure 2-4) to serve as a land-based access route and as containment of the placed dredged material.

Phase 2 – 2024 (or 2025):

- Completion of levee improvements, including foundation excavation, fill import and placement for levee raising and/or widening and ecotone slope development, and new levee construction.
- Placement of excavated material from the levee subgrade into eroded tidal marsh area (using land-based equipment).
- Water-based import and unloading of dredged material from the crane platform into the eroded marsh area.
- Mechanical placement, drying, and conditioning of dredged material to recreate the tidal marsh.
- Seeding, planting, temporary irrigation, and erosion and sediment control installation on the ecotone slopes at the new levee and setback levee.

Phase 3 – 2025 (or 2026-27):

- Removal of the temporary culvert and other dewatering equipment installed in Phase 1.
- Placement and shaping of material on top of the containment berm to complete construction of the coarse beach, and planting the crest (Figure 2-4).
- Excavation of tidal channels within the reconstructed/restored portion of Tiscornia Marsh, connecting to the existing channel, following consolidation of dredged material.
- Restoration of diked marsh, including tidal channel excavation and lowering/breaching the shoreline perimeter levee to restore tidal action to the diked marsh.
- Placement of final lift on new levee and improved levee segments and surfacing with asphalt pavement.

Phasing of Trail Closures

The existing trails along the levee and the perimeter of Pickleweed Park would need to be closed to public access at certain times during construction. The trail would be closed approximately 3 months each year of construction, most likely between September and November. During this

time, users of the San Francisco Bay Trail (Bay Trail) east of the site may need to access Pickleweed Park by crossing to the sidewalk on the south side of Spinnaker Point Drive. The trail surface would consist of compacted gravel until it is paved during the final year of construction.

During Phase 1, the trail segment along the east side of the soccer field would likely be used as temporary construction access during initial construction of the coarse beach. The trail segments along the west and north sides of the soccer field would remain open as spur trails. During Phase 2, the trails would again be closed for approximately 3 months until levee improvements are complete. The trails would be reopened to the public while dredged material is being placed and consolidated. In Phase 3, the trails would again be temporarily closed for approximately 3 months to allow final levee grading and asphalt surfacing of the trail.

2.3.3 Construction Methods

Construction activities at the Project site would require a combination of barge access and land access. A crane platform, offloading locations, and a temporary access road along the constructed beach crest and through existing Tiscornia Marsh would be required. Construction staging areas and potential access routes and offloading areas for all phases of construction are shown on **Figure 2-5.**

Construction activities would be required for levee creation and improvements, marshplain restoration and creation, beach installation, and revegetation. Construction activities are described in detail below.

Site Preparation, Access, and Staging

Equipment Staging

Equipment staging areas would be located in upland areas outside of sensitive habitats. The empty lots adjacent to the Community Center and east of former Schoen Park would be used for materials staging and equipment fueling and maintenance (Figure 2-5). The need for, and specific location of, additional staging areas would be determined by the contractor at the time of construction based on field conditions. These areas would be clearly demarcated in the field, and erosion control structures (e.g., straw wattles, silt fences) would be installed around them in accordance with the Project Stormwater Pollution Prevention Plan (SWPPP) to prevent the transport of sediments and/or construction contaminants into surrounding areas. The staging areas would be used off and on throughout the 3- to 4-year construction period.

Temporary Crane Platform

A temporary crane platform would be installed along San Rafael Creek near the northeast corner of the Project site to unload materials and equipment brought in via barge. The platform would be a pile-supported steel and timber deck, approximately 30 square feet in size. The platform would be supported by 12 to 16 steel piles, approximately 18 inches in diameter and driven 60 to 70 feet deep using a vibratory hammer. The platform would remain in place for 1 to 3 years while the coarse beach and eroded marsh area are being constructed. Following construction, the platform would be completely removed and transported off site.

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SOURCE: ESA, 2020; Base - Google Earth, 2020

Tiscornia Marsh Habitat Restoration and Sea Level Rise Adaptation Project

Figure 2-5
Temporary Construction Access and Staging

ESA

Temporary Barge Offloading Locations

Material for construction of the coarse beach may be transported to the site partly via barge, as an alternative to trucking. Barges would employ standard safety measures, such as buoys, lighting, and signage. Two potential locations have been identified to allow land-based offloading of materials delivered by barge (in addition to the offloading described above at the crane platform), both of which are adjacent to the point shown on Figure 2-5. These locations were selected because there is no fringing marsh and they are already armored with riprap. Therefore, significant improvements at these locations are not anticipated. The use of multiple potential offloading location is intended help expedite the process of delivering material to the new marsh and coarse beach.

Temporary Access Roads

Dredged material for marsh reconstruction would be imported and placed from the waterside of Tiscornia Marsh as much as possible, to minimize impacts on neighbors and existing marsh habitat. However, land-based import and placement of construction materials would be needed for construction of levee improvements and portions of coarse beach construction.

Temporary access roads would be located along existing trails or other currently disturbed areas to the extent feasible. The existing looped trail around the diked marsh and soccer field would be used as an equipment access road during construction of the levee improvements and diked marsh restoration. This road would also be temporarily used for hauling when beach material is transported by barge and then offloaded with land-based equipment (e.g. off-road trucks). A temporary access road would also be constructed in the diked marsh, mainly within the footprint of the new tidal channel. This temporary road would be completely removed in conjunction with tidal channel excavation.

As described in Sections 2.2 and 2.3, the initial construction of the coarse beach would be a coarse containment berm to contain dredged material as it is placed for tidal marsh reconstruction. The coarse containment berm would also be sufficiently wide to allow one-way access for land-based equipment. A temporary access road would be constructed across Tiscornia Marsh (in an east-west direction) to allow looped construction access. The temporary road would be approximately 20 feet wide and would either be constructed of timber mats or temporary fill built up to a height of 3 feet. The road would be located at narrower portions of the marsh to reduce the area of disturbance and would include culverts over the existing tidal channel to maintain tidal flows to the south portion of the marsh. Any access roads and/or crane pads required on the existing mudflat would be constructed in stages in accordance with geotechnical recommendations to avoid soil failures (e.g., creating mud waves). All access road materials would be completely removed following construction.

Vegetation Removal

Removal of existing vegetation would be minimized. Existing pickleweed vegetation in the diked marsh would be removed within the footprint of the new levee ecotone, located on the south side of the existing diked marsh, and within the footpring of marsh channel excavation. Vegetation clearing would be performed in a manner protective of the salt marsh harvest mouse (e.g., using hand tools). Removed pickleweed would be salvaged and reused, as feasible. Removal of trees would occur in former Schoen Park as needed for the new levee and ecotone on the south side of the existing

Tiscornia Marsh, and selective removal of non-native palm trees would occur in the marsh. Any trees (including the root system) removed in the process of diked marsh restoration and levee improvement construction as described in Sections 2.2 and 2.3 would be chipped and spread on site as wood mulch. If any native trees need to be removed, they would be replaced on site.

Shoreline Levee Improvements and Ecotone Slope Development

Most of the work for levee improvements would be earthwork, performed using land-based earthmoving equipment, including excavators, loaders, bulldozers, and articulated trucks. Approximately 6,000 cubic yards of material would be created due to excavation of the foundation soils for levee improvements, which would then be backfilled with imported, less permeable soils. The excavated material would be placed in the eroded marsh area to begin reconstruction of the marsh.

Levee and Ecotone Fill Placement

Approximately 18,000 cubic yards of fill material would be imported from an upland source(s) up to 20 miles away and placed on site for levee improvements and ecotone slope construction. Fill material would be trucked to the site on City streets and unloaded within the Project site. Levee fill material would be spread in lifts and mechanically compacted using a sheepsfoot compactor or similar machine. The estimated fill volumes account for anticipated settlement, expected to vary from 1 to 3 feet.

The ecotone slopes would be planted by hand with container plants and plugs in coordination with organizations such as Students and Teachers Restoring a Watershed (STRAW) and Conservation Corps North Bay, volunteer programs who perform vegetation planting efforts (along with other services) . A temporary drip irrigation system would be installed if needed for planting establishment in the first 2 to 3 years but would be completely removed after the plants have established. Additional temporary erosion and sediment control measures, such as straw wattles, would be installed on the levee and ecotone slopes as needed and removed once construction was completed.

Trail Surfacing

Approximately 2 to 3 years after initial construction, a final layer of fill would be placed on the crest of the new levee and improved levee segments to provide a uniform surface and address any short-term settlement. The levee crest would then be paved with asphalt concrete to provide a consistent trail surface. Further, the trail would be consistent with San Francisco Bay Trail Design Guidelines.[7] The trails would include seating areas and signage.

Diked Marsh Restoration

Restoration in the diked marsh would entail excavation of approximately 3,500 cubic yards for tidal channel construction and levee lowering. Excavated material would be reused on site as fill material for the eroded marsh area or for the final lift on the new levee and improved levee

[7] For more information regarding the San Francisco Bay trail Design Guidelines, see: https://baytrail.org/about-the-trail/building-the-trail/.

segments. Excavated material would be wet, but not to the degree that prohibits earth-handling or requires excessive processing. Any drying operations would be performed within the limits of fill placement.

The tidal channel would be excavated prior to lowering and breaching the perimeter levee, in isolation of tidal waters. The temporary access road through the diked marsh, as described above under *Temporary Access Roads*, would be further excavated to create a tidal channel, approximately 600 feet long and 20 feet wide. Channel excavation in the diked marsh would be performed using a long-reach excavator staged on the temporary access road.

The perimeter levee would be lowered and a single levee breach, 4 feet deep and 20 feet wide, would be excavated in the northeastern portion to connect the new tidal channel to Tiscornia Marsh. The levee breach would be accomplished by one or more excavators staged on the perimeter levee, starting at the proposed breach location, and working southward.

Following excavation, all temporary access mats and/or any temporary fill would be removed. Riprap removal along San Rafael Creek would be performed using equipment (e.g., long-reach excavators, dragline, etc.) staged on the perimeter levee trail. The lowered portions of the perimeter levee would be at marshplain elevation and are expected to revegetate through natural recruitment.

Coarse Beach Construction

The coarse beach would be constructed in stages to meet geotechnical requirements and to facilitate reconstruction of the historic footprint of Tiscornia Marsh. As discussed in Sections 2.2 and 2.3, the initial construction of the coarse beach would be a coarse containment berm that would be high enough to contain dredged material as it is placed for eroded tidal marsh reconstruction, isolate the work area from open water, and serve as a temporary access road for land-based equipment. After reconstruction of the eroded marsh area is finished, construction of the coarse beach would be completed by placing and shaping imported material on top of the previously constructed coarse containment berm to create a gently sloping beach. The raised crest would protect the area behind the beach from high tides, wave runup, and erosion during an average year's storm events. Proposed phased construction of the beach is shown in section view in Figure 2-4.

The beach along with its supporting retention groins and jetty structure would be constructed together within similar methods and phasing. Construction materials (approximately 26,000 cubic yards in total) would be transported to the site by truck, barge, or both. Beach material brought in by barge would be unloaded by crane or potentially by conveyor, either staged on the crane platform or the perimeter access road. The coarse containment berm and subsequent beach would then be constructed progressively from one or each end, with materials being placed from the northern crane platform, and/or from the southern shoreline using low-pressure land-based equipment (e.g., bulldozer, excavator, and/or track trucks) staged on the partially constructed berm as it is built.

Given the soft, saturated sediments to be used for tidal marsh reconstruction, synthetic geotextile fabric would be placed underneath the coarse containment berm/beach to stabilize the foundation and reduce sinking. Fill would be placed on either side of the coarse containment berm for

stability, to prevent the formation of mud waves. The stable fill material would be capped with marsh soils or reshaped to function as the beach as construction progresses. A soil filter would also be installed on the landward face of the containment berm crest to reduce its permeability during tidal marsh reconstruction. The filter would consist of 1- to 2-foot layers of progressively coarser material, placed over biodegradable filter fabric. Fine, clayey material on the face would reduce permeability of the coarse containment berm/beach core and reduce flow in both directions; during high tides, the soil filter would help reduce tidal seepage into the containment cell, and during low tides the soil filter would reduce turbidity releases to Bay waters. Prior to fill placement for the tidal marsh reconstruction, sediment curtains would also be installed along the perimeter of the exposed mudflat during low tide.

Following reconstruction of the tidal marsh, the final phase of beach installation would be performed, which includes import and placement of additional coarse fill material (i.e., gravel, cobbles), shaping the beach, and planting the crest with upland and marsh transition native plant species.

Eroded Tidal Marsh Reconstruction

Dredged Material Sources

There are three potential sources of dredged material, all of which are ongoing dredging operations that utilize either the Montezuma (located at the eastern edge of the Suisun Marsh) or Open Ocean (located in the Pacific Ocean, near the Golden Gate Bridge) dredge disposal site. The City is currently partnering with the USACE on dredging the navigation canal of San Rafael Creek. If the timing aligns, canal dredging would provide sufficient dredged material for the Proposed Project. The volumes of sediment from dredging marinas and private docks range from between 1,000 and 66,000 cubic yards. It is possible that one to three local dredging projects could provide suitable fill volume required for the Proposed Project, which would require approximately 25,000 cubic yards of imported material in addition to the 6,000 cubic yards of fill material created from on-site Project activities (i.e., levee foundation soils excavation). In addition, the Larkspur Ferry Terminal is dredged by the Golden Gate Bridge, Highway and Transportation District every 4 to 5 years. One dredge cycle for the ferry terminal generates more than enough material needed for Tiscornia Marsh restoration.

Dredged Material Containment

Protection measures such as coir logs would be installed along the landside (west) of Tiscornia Marsh to protect the existing marsh from incidental sediment deposition. The partially constructed beach (i.e., coarse containment berm) would contain dredged material on the waterside (east). The south end of the fill placement area would be contained by the new ecotone slope adjacent to the setback shoreline levee.

Dredged Material Placement

Dredged material would be transported by barge to the Project site and unloaded by crane, staged on the temporary crane platform. Unloaded material would be placed and spread using a crane and/or an amphibious excavator in the mudflat. A line may be rigged between the crane and a remote anchor, which would allow the crane bucket to be pulled a long distance (sometimes

referred to as skyline or Sauerman dredges). Any access roads and/or crane pads located in the mudflats would be constructed in stages to avoid soil failures (e.g., creating mud waves).

Overhead electrical transmission lines traverse the existing marsh, and one power tower owned by PG&E is located within the footprint of the new marsh. Dredged material would be placed in a manner that maintains safe distance from the overhead power lines. In addition, material would be carefully placed around the power tower footings in a protective manner that does not cause settlement or other damage.

On-site conditioning of the dredged material would be important to shape the new marsh. Initially, low-ground pressure dozers and/or amphibious excavators would be used to place the dredged material throughout the new marsh. As material is dewatered, it would be further dried and conditioned using a low-ground pressure dozer pulling a disk.

Water Management

Water removal and management are key considerations for placed dredged material, which would have high water content. Water needs to be consistently drained and removed from the marsh placement area to allow drying and consolidation of sediments. Water would be removed using temporary flap-gated culvert(s) that gravity drain to the Bay during low tide, supplemented by pumps. The water removal system would be sized to handle seepage from dredged material dewatering, seepage through the containment cell, as well as periodic tidal overtopping during spring tides (from the marsh side). Any removed water would be treated for sediment removal in a settling basin or similar feature (located on the mudflat where marsh reconstruction would occur) prior to discharge to the Bay. Interior berms would be constructed to subdivide the marsh placement area into cells to facilitate material drying and treatment of removed water prior to discharge. It is anticipated that dredged fill placement and consolidation would occur over 1 to 2 years (with drying and conditioning occurring over 6 to 18 months).

Final Marsh Restoration and Tidal Connection

When the site is ready to reintroduce tidal action (i.e., once the fill material has properly consolidated after 6 to 18 months), a new tidal channel would be excavated to connect to the existing tidal marsh channel that drains toward San Rafael Creek. The channel would be approximately 20 feet wide and 1,000 feet long, running generally along the existing edge of the eroding marsh. Excavated material would be spread in thin layers on the surface of the newly created marsh. The newly restored tidal marsh is expected to revegetate with appropriate marsh vegetation through natural recruitment.

2.3.4 Construction Equipment

Major Project elements would be constructed using a combination of land-based and marine equipment. The anticipated types of equipment for each Project element, and the total number of days in operation (assuming an 8-hour work day), are presented in **Table 2-3**.

TABLE 2-3
CONSTRUCTION EQUIPMENT

Construction Activity	Phase	Equipment-Days												
		Excavators	Off-road Trucks	Rubber Tired Loaders	Track-mounted Bulldozer	Water Truck	Highway Trucks	Sheepsfoot Compactor	Barge-mounted Pile Driver /Crane	Tug and Barge	Dragline	Amphibious Excavator	Low Pressure Bulldozer	Low Pressure Track Truck
Site Preparation, Access, and Staging														
Temporary Crane Platform	1								5					
Temporary Access Roads	1		10	5	5	5		5						
Coarse Beach Construction														
Initial Beach Construction	1								77	23	77	77	77	155
Final Lift and Shaping	3								9	3	9	9	9	19
Levee Improvements														
Foundation Over Excavation & Placement	2	20	20	20		20						20	20	
Imported Fill Placement & Compaction	2				60	60	180	120						
Final Levee Lift	3													
Eroded Tidal Marsh Reconstruction														
Imported Dredged Material	2								87	26	87	87	173	
Drying, Shaping, and Channel Excavation	2											40	40	
Diked Marsh Restoration														
Lowering of Existing Levee	3	7	7		7	7		7						
Excavation of Tidal Channel	3	5	5			5						5	5	
Trail Improvements														
Trail Surfacing	3				2	2	2	2						
TOTAL		**32**	**42**	**25**	**74**	**99**	**182**	**134**	**178**	**52**	**173**	**238**	**324**	**174**

2.3.5 Earthwork Volumes

Most Project elements entail earthwork. **Table 2-4** below summarizes the approximate cut and fill volumes, as well as the destination for excavated material, and proposed sources of fill material. Excavated material would be reused as on-site fill as much as possible. While it is expected that levee foundation soils removed are sandy soils appropriate for reuse for the tidal marsh reconstruction; it is possible that some portion of the foundation soils would require export and disposal offsite, and additional imported soil would then be required for the tidal marsh reconstruction.

TABLE 2-4
ESTIMATED EARTHWORK VOLUMES

Project Element	Earthwork Item	Volume (cubic yards)	Material Destination/ Source
Excavation Items			
Diked Marsh Restoration	New tidal channel	1,500	Eroded marsh fill
Levee Improvements	Foundation soils removal	6,000	Eroded marsh fill
Diked Marsh Restoration	Levee lowering	2,000	Final lift of levee improvements or offsite disposal (if needed)
Diked Marsh Restoration	Rip Rap Removal	400	Beach foundation or offsite disposal/reuse
Fill Items			
Levee Improvements	Levee construction	18,000	Imported soil (via truck)
Coarse Beach Construction	Coarse beach material	26,000	Imported cobble and gravel (via truck and/or barge)
Eroded Tidal Marsh Reconstruction	Portion of marsh fill	6,000	Onsite excavated material
Eroded Tidal Marsh Reconstruction	Remainder of marsh	25,000	Imported dredge material (via barge)

2.4 Operations and Maintenance

Physical and biological monitoring would be conducted at the completion of Project construction and at 1, 3, 5, and 10 years post-construction. The restored wetland habitats would be largely self-maintaining after the initial period of vegetation establishment. Anticipated maintenance for the tidal marsh, ecotone slopes, and coarse beach during the 3- to 5-year establishment period would include manual removal of invasive plants, using mechanical means, and the temporary irrigation of ecotone slope plantings. While unlikely, use of localized herbicides would be employed, if highly invasive species become present at the site.

In addition, the levee segments and trails that were constructed or improved as part of the Project would be periodically inspected to identify maintenance needs. At a minimum, levees would be

inspected annually via pedestrian levee crest surveys to identify any localized settlement, rodent holes, or other conditions that could compromise the levee integrity.

Post-construction monitoring for the Project is anticipated to lead only to minor repair and maintenance activities, which may include the following:

- Manual hand removal of any obstructions that may be blocking tidal channels (e.g., sediment and/or debris), if needed.
- Periodic grading, fill placement, and trail resurfacing due to additional settlement/subsidence, or earthquake damage that occurs after initial construction period (anticipated to occur once, or possibly twice, in the first 10 years after construction).
- Grading and filling of any settlement cracks that occur along the new levee, particularly at the connection to the existing trail.
- Minor repair and/or bank protection of any erosion scarps that may threaten the levee.
- Additional manual vegetation management beyond the initial establishment period, including weed control and replanting to be done by hand, and/or extended temporary watering, as needed.

If monitoring identifies that an unanticipated type or intensity of activity is required to address repairs or adaptive management needs in addition to or more complex than those suggested above, such activity would be considered a future project. As mentioned in Section 2.2.4, Project shoreline levees were designed with consideration of sea level rise projections to roughly 2070. Any future levee raising to provide protection to 2070would be considered a future project.

2.5 References

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