APPENDIX A

Habitat Maintenance and Monitoring Plan

H. T. HARVEY & ASSOCIATES

Ecological Consultants

Guadalupe Channel Erosion Control Project
Habitat Maintenance and Monitoring Plan

Project #2440-02

Prepared for:

City of Brisbane, California

Prime consultant:
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April 24, 2019

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Section 1.0 Introduction

This habitat maintenance and monitoring plan (MMP) was prepared by H. T. Harvey & Associates in accordance with current guidelines from the U.S. Army Corps of Engineers (USACE) South Pacific Division (USACE 2015) and supports the following City of Brisbane (City) permit applications for the Guadalupe Channel Erosion Control Project (Project).

- Regional Water Quality Control Board (RWQCB) Clean Water Act Section 401 Certification
- U.S. Army Corps of Engineers (USACE) Clean Water Act Section 404 Nationwide Permit
- San Francisco Bay Conservation and Development Commission (BCDC) New Project Permit
- California Department of Fish and Wildlife (CDFW) Service Streambed Alteration Agreement
- U.S. Fish and Wildlife Service (USFWS) Federal Endangered Species Act Section 7 Consultation

This introduction identifies the responsible parties for Clean Water Act permitting, summarizes the project, its impacts, and the proposed habitat creation being planned as part of the project. This MMP then provides details how habitats under of the jurisdiction of the RWQCB, USACE, BCDC, and CDFW will be created, maintained, and monitored, along with standards for success and the required course of action if the project's habitat creation goals are not achieved.

1.1 Responsible Parties

1.1.1 Applicant/Permittee

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1.2 Project Habitat Impacts and Creation Overview

The Project is located along Guadalupe Channel in the City of Brisbane, San Mateo County, California. The purpose of the project is to stabilize and prevent erosion in approximately 400 linear feet of the Guadalupe Channel located between Tunnel Avenue and the intersection of Bayshore Boulevard and Valley Drive (Figure 1). In the existing condition, the Guadalupe Channel banks are incised and large, decadent non-native tree limbs overhang the channel bank. The project will grade back the incised channel banks and install erosion control features to protect the Guadalupe Channel from the possibility of large, woody, non-native vegetation falling into the channel, obstructing flow, and exposing the existing earthen channel slopes to further erosion (H. T. Harvey & Associates 2018). A secondary goal of the project is to improve the function of the jurisdictional habitats in the proejct area for wildlife and water quality.

Project work will result in permanent impacts to tidal aquatic habitat (i.e., other waters) and northern coastal salt marsh habitat (i.e., wetlands) within the jurisdiction of USACE, RWQCB, CDFW, and BCDC. The project will also permanatly imapact riparian habitats under the jurisdiction of RWQCB and CDFW; specifically, ruderal California annual grassland located below the top of bank and non-native ornamental woodland riparian trees.

The City proposes to create jurisdictional habitats on-site concurrently with the project's grading and erosion control work. Specifically, the City proposes to increase the acreage of tidal aquatic, northern coastal salt marsh (salt marsh), and tidal marsh-upland transition zone (transition zone) habitats located below the top of bank in the project area. The city will also establish native riparian trees and shrubs below and above the top of bank along Guadalupe Channel in the project area to replace the portion of non-native trees that will be removed from within the jurisdictional ornamental woodland (riparian) habitat. The salt marsh, transition zone, and oak woodland habitats will be revegetated using a combination of seeding and planting in the fall and winter immediately following completion of earthwork. All project work is expected to occur during the period of June 15 to October 15, 2020 with the exception of native container plant installation which will occur after the onset of the rainy season.

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Figure 1. Project Vicinity
Guadalupe Channel Erosion Control Project
Maintenance and Monitoring Plan (2440-02)
April 2019

Section 2.0 Jurisdictional Habitat Impact Areas

This section describes and quantifies the project's impacts on habitats under the jurisdiction of USACE, RWQCB, BCDC, and CDFW. Project impacts and the proposed habitat creation activities are summarized in Table 1. The locations of impacted habitats are shown on Figure 2. The minimum proposed area of habitat creation is shown in Table 1. The proposed replacement ratios for tree and shrub impacts are provided in Table 2. The project impacts and proposed habitat creation activities are discussed further in sections 2 and 3, respectively.

2.1 Project Impacts

2.1.1 Project Description

The project will grade the Guadalupe Channel bed and banks, install geoweb for erosion control below the top and bank, then backfill the geoweb and revegetate the project area. Construction will begin with vegetation clearing and grubbing within the impact areas shown on Figure 2. A small steel sheet pile retaining wall on the northern bank of the Guadalupe Channel will also be removed. Next, the Guadalupe channel slopes, which have been incised to near vertical in some locations, will be graded to a 2:1 slope ratio (i.e., 2 feet in horizontal distance for every 1 foot in vertical distance) except for the northern slope immediately east of the culvert outfall where the sheet pile retaining wall is removed. There, a benched geoweb retaining wall (geoweb retaining wall) with a 1:1 slope ratio will be installed (Figure 3). During grading, most of the channel slopes will be cut back, but some fill will also be required to create topographically smooth channel banks, which is necessary for geoweb installation (Figure 4).

In conjunction with the grading work, sediment will be excavated from the bottom of Guadalupe Channel to prepare the channel subgrade for geoweb installation. Sediment will also be excavated from a concrete-lined box culvert beneath Bayshore Boulevard, and from an upstream concrete collection basin (Figure 2). Water flows within the Guadalupe Channel will be temporarily diverted using a coffer dam to allow access to Guadalupe Channel, the culvert, and the sediment collection basin.

A geoweb will then be placed on the 2:1 channel slopes of the Guadalupe Channel starting at the top of bank[1] and across the channel bottom subgrade. The geoweb is a 6 inch deep plastic reinforcing web with approximately 9 inch by 9 inch openings filled with soil or rock that will blanket the ground surface to prevent erosion, while allowing water infiltration and vegetation growth. On the channel banks above mean high water[2] (MHW), the geoweb will be backfilled with excavated and salvaged on-site soil to allow tidal marsh and upland vegetation to establish and root into the channel slopes. Rock will be used to fill the geoweb on the channel slopes below MHW down to the toe of slope in the channel to prevent erosion and earthen scour. The geoweb

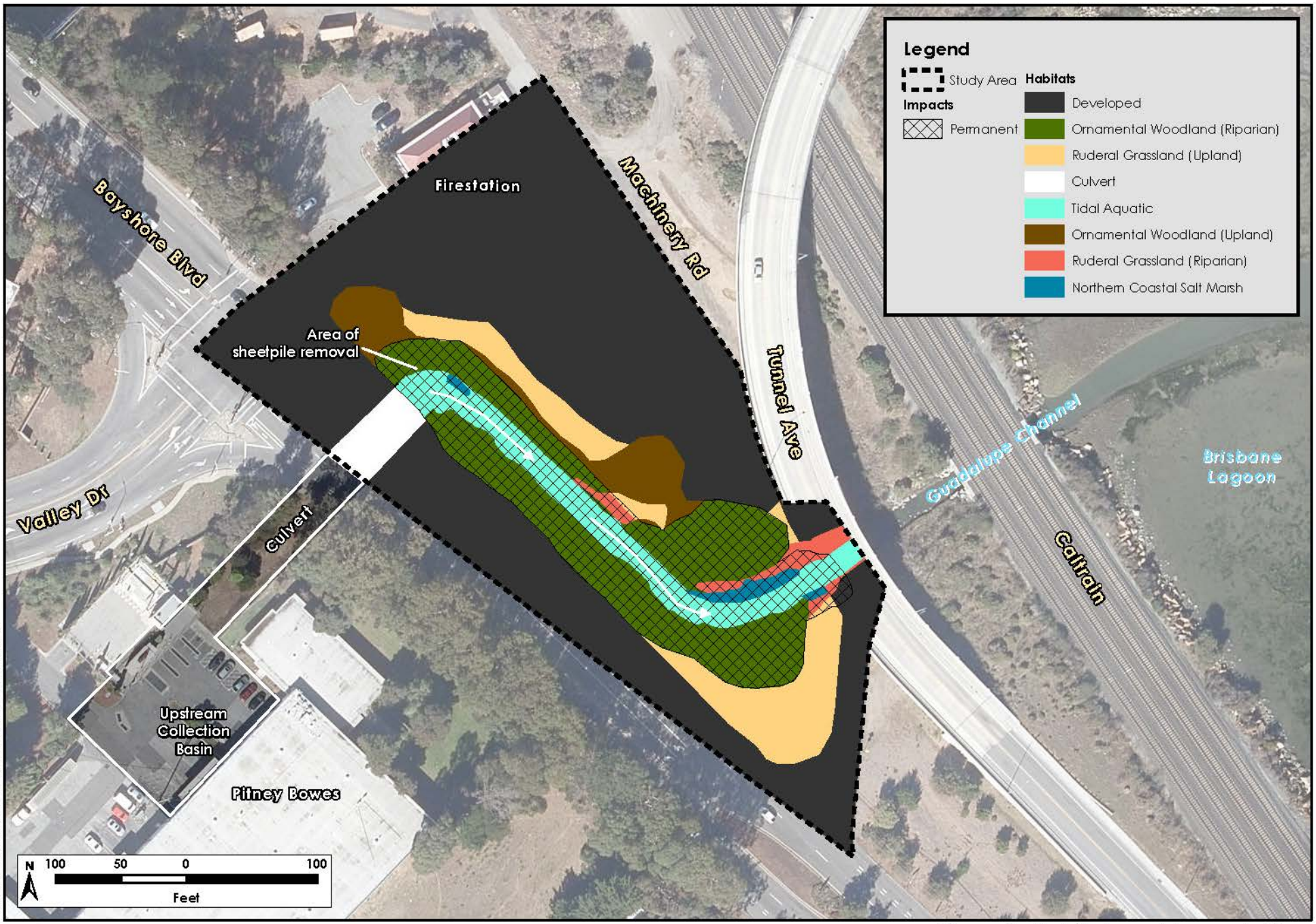
[1] Top of bank is situated at approximately 10.7 feet NAVD88
[2] Mean High Water (MHW) is situated at approximately 5.2 feet NAVD88 in the project area.

in the channel bottom will be backfilled with salvaged on-site soil. Then, an additional 1.1 foot deep layer of salvaged on-site soil will be placed above the geoweb on the channel bottom to establish an earthen channel bottom.

Following soil excavation and salvage, channel grading and geoweb application, the channel side slopes and riparian impact area above the top of bank will be revegetated with native plants, as described in Section 3.

Table 1. Jurisdictional Habitat Impacts and Proposed Habitat Creation

Permitting Agency	Habitat Type Impacted	Project Impacts	Proposed Minimum Habitat Creation to Impact Ratio	Proposed Minimum Habitat Creation Area
USACE and BCDC	Northern coastal salt marsh	Permanent loss of 0.02 acres (via channel grading)	2:1	Creation of at least 0.04 acres of northern coastal salt marsh on graded channel banks above mean high water (MHW)
	Tidal Aquatic	Permanent loss of 0.18 acres (via channel grading and installation of rock slope protection on banks below high tide line (HTL))	1.1:1	Creation of 0.19 acres of tidal aquatic habitat below HTL
RWQCB and CDFW	Northern coastal salt marsh	Permanent loss of 0.02 acres (via channel slope grading)	2:1	Creation of at least 0.04 acres of northern coastal salt marsh on graded channel banks above MHW
	Tidal Aquatic	Permanent loss of 0.18 acres (via channel grading and installation of rock slope protection on banks below HTL)	1.1:1	Creation of 0.19 acres of tidal aquatic habitat below HTL
	Riparian Ornamental Woodland	Removal of 74 primarily non-native riparian trees and shrubs located above and below the top of bank	See Table 2	Establishment of at least 69 native riparian trees and shrubs located above and below the top of bank
	Riparian California Annual Grassland	Permanent loss of 0.03 acres below top of bank (via channel slope grading)	2:1	Creation of at least 0.06 acres of salt marsh-upland transition zone habitat below top of bank on graded channel banks



N:\Projects\2440-02\Reports\MMP\Fig 2 Habitats and Impacts Map.mxd

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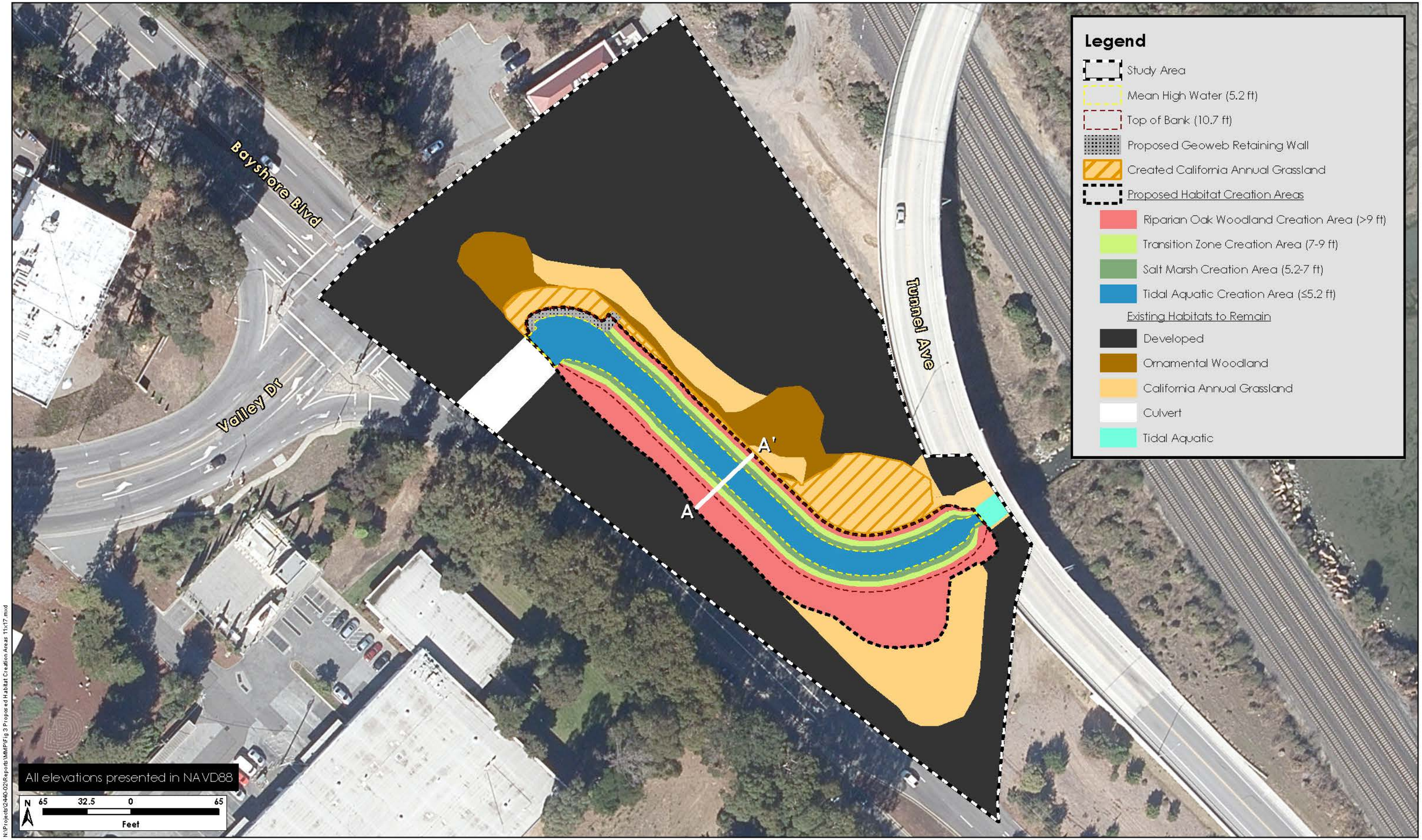
Figure 2. Habitats and Impacts Map

Guadalupe Channel Erosion Control Project Maintenance and Monitoring Plan (2440-02)
April 2019



N:\Projects\2440-02\Reports\MMP\Fig 3 Proposed Habitat Creation Areas 11x17.mxd

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Figure 3. Proposed Habitat Creation Areas
Guadalupe Channel Erosion Control Project Maintenance and Monitoring Plan (2440-02)
April 2019

A

A'

Bayshore Blvd

Riparian Oak Woodland Creation Area

Transition Zone Creation Area

Salt Marsh Creation Area

Tidal Aquatic Habitat Creation Area

Salt Marsh Creation Area

Transition Zone Creation Area

Riparian Oak Woodland Creation Area

Existing Ornamental Woodland

Approx 10.8 Ft NAVD88

9.0 Ft NAVD88

HTL

7.0 Ft NAVD88

MHW

5.2 Ft NAVD88

2H:1V

2H:1V

1.8 Ft NAVD88

Water

Rock Fill (1.5-2.0" Diameter)

Geoweb

Salvaged Soil Backfill

Existing Site Soil

NOT TO SCALE

Existing Grade

Proposed Restoration Grade

Notes:

1. For plan view, refer to Figure 3.

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Figure 4. Habitat Creation Areas-Cross Section

Guadalupe Channel Erosion Control Project Maintenance and Monitoring Plan (2440-02)

April 2019

Table 2. Proposed Tree and Shrub Replacement Ratios

Size of Removed Tree (inches diameter at 2 feet above ground surface)	Native Tree (replacement to loss)	Non-native Tree (replacement to loss)	Non-native Invasive Tree (replacement to loss)
< 6	1:1 (2:1 for oaks)	0.5:1	0
6 - 11	2:1 (4:1 for oaks)	1:1	0.5:1
12 - 17	3:1 (6:1 for oaks)	2:1	0.5:1
> 17	5:1 (10:1 for oaks)	2:1	0.5:1

2.1.2 Permanent Impacts

2.1.2.1 Tidal Aquatic Habitat

Tidal aquatic habitat is located below MHW along Guadalupe Channel. Permanent impacts will occur on tidal aquatic habitat through channel grading and installation of the geoweb (Table 1). After geoweb installation, 1.5-2 inch diameter rock will be installed in the geoweb and geoweb retaining wall cells below MHW. Salvaged soils from the project area will be placed over the geoweb in the channel invert so the channel bottom remains earthen. By decreasing the slope of the channel banks, grading will expand the area of tidal aquatic habitat (Table 1). Aquatic habitat conditions within the channel will return to pre-project or better condition shortly after tidal flows resume. Additionally, water quality within the tidal aquatic habitat will be improved through reduced erosion owing to the reduction in bank slope, the geoweb and rock slope protection, and active revegetation of dense cover above MHW.

2.1.2.2 Northern Coastal Salt Marsh

Salt marsh habitat will be impacted through vegetation removal, grading, and geoweb placement (Table 1; Figure 2). However, because the banks will be laid back to a 2:1 slope rather than the near vertical existing slope and because tidal marsh will be able to establish within the geoweb cells, the project will restore a greater area of salt marsh following channel grading, as described in Section 3.

2.1.2.3 Riparian California Annual Grassland

Ruderal California annual grassland located below the top of bank will be impacted through vegetation removal, grading, and geoweb placement (Table 1). This area will be restored as a transition zone habitat and planted with native forbs, grasses, and sub-shrubs, as described in Section 3.

2.1.2.4 Ornamental Woodland Riparian

Approximately 0.64 acres of riparian ornamental woodland, including canopy that overhangs the area beyond top of bank, will be impacted through vegetation removal, grading, and geoweb placement (H. T. Harvey & Associates 2018). The riparian ornamental woodland is dominated by non-native and invasive, non-native trees. Table 3 lists the species, number, and size class of trees that will be removed by the project.

2.2 Temporary Impacts

Aside from dewatering of the Guadalupe Channel, no temporary impacts to jurisdictional habitats are anticipated. All impacts are considered permanent, as described in the section above.

Table 3. Trees to be Removed and Replaced by the Project

Common Name	Species Name	Size Class	Number of Trees Removed	Invasive, Non-native, or Native	Replacement Ratio (number replacement trees: number impacted trees)	Native Tree and/or Shrub Replacement Requirement
Lollipop tree	*Myoporum laetum*	<6 inches	1	Moderate invasive	0:1	0
Lollipop tree	*Myoporum laetum*	> 6 inches	28	Moderate invasive	0.5:1	14
Blue gum	*Eucalyptus globulus*	< 6 inches	2	Non-native	0.5:1	1
Blue gum	*Eucalyptus globulus*	6 – 11 inches	2	Non-native	1:1	2
Blue gum	*Eucalyptus globulus*	> 11 inches	9	Non-native	2:1	18
California buckeye	*Aesculus californicus*	6 – 11 inches	3	Native	2:1	6
Ornamental conifer		12 – 17 inches	1	Non-native	2:1	2
Blackwood acacia	*Acacia melanoxylon*	< 6 inches	5	Invasive	0:1	0
Blackwood acacia	*Acacia melanoxylon*	> 6 inches	12	Invasive	0.5:1	6
Privet	*Ligustrum sp.*	6 – 11 inches	2	Non-native	1:1	2
Mexican fan palm	*Washingtonia robusta*	> 18 inches	1	Non-native	2:1	2
Coast live oak	*Quercus agrifolia*	6 – 11 inches	1	Native	4:1	4
Coast live oak	*Quercus agrifolia*	12 – 17 inches	1	Native	6:1	6
Toyon	*Heteromeles arbutifolia*	12 – 17 inches	1	Native	3:1	3
Cotoneaster	*Cotoneaster sp.*	< 6 inches	5	Non-native	0.5:1	3
		Totals	**74**			**69**

2.3 Existing Conditions in Impact Areas

2.3.1 Hydrology and Topography

The Guadalupe Channel is an eastward-flowing tidally-influenced stream located within the Guadalupe Valley Watershed. The Guadalupe Channel is fed by runoff from San Bruno Mountain (H. T. Harvey & Associates 2018). Guadalupe Channel is tidally connected to San Francisco Bay via Brisbane Lagoon. Tides at the project site are muted relative to San Francisco Bay because the tidal flushing of Brisbane Lagoon is muted via culverts passing under Highway 101 between Brisbane Lagoon and San Francisco Bay. On October 4, 2018, an H. T. Harvey & Associates restoration ecologist measured the elevation of tidal marsh vegetation at the project site and estimated that MHW at the project site is approximately 5.2 feet NAVD88. Soil is sufficiently wetted upslope via tides and freshwater input to allow tidal marsh to extend to approximately 7.0 feet NAVD88 in Guadalupe Channel, which is the approximate elevation of the high tide line observed of October 4, 2018 (Figure 4).

The project area has relatively flat topography immediately adjacent to Guadalupe Channel. Elevations in the project area range from approximately 2 feet NAVD88 in the channel bottom to about 11 feet NAVD88 at the top of bank. Between Bayshore Boulevard and Machinery Road bridge, the Guadalupe Channel banks are steep and unreinforced except for sheet piles that form the left bank along the bend at the north end of the project area, just east of Bayshore Boulevard.

2.3.2 Soils

Soils on the site were analyzed via County soil survey maps. The soils in the project area are mapped as Urban land-Orthents, reclaimed complex, 0 to 2 percent slopes. Urban land and orthents soils are defined as well drained mixed alluvium that are nonsaline and consist mostly of urban land soil composition. The typical soil prolife is variable texture soil from 0-3 feet below ground surface and silty clay from 3-5 feet below ground surface (Natural Resources Conservation Service Web Soil Survey 2019). A cursory soils investigation by an H. T. Harvey & Associates restoration ecologist on October 4, 2018 found that the soil in the riparian area is compacted in the upper 2 feet.

2.3.3 Vegetation

The salt marsh in the study area is limited to the slopes of Guadalupe Channel, between MHW and the high tide line, where wetting of the root zone occurs on a regular basis via tidal action. The horizontal width of this zone is narrow, ranging from approximately 4-8 feet wide in the higher quality habitat near Machinery Way, and transitioning to small discontinuous patches upstream along the eastern bank (Figure 2). This habitat is dominated by pickleweed, with lesser but still significant amounts of alkali heath (*Frankenia salina*) and invasive Russian thistle (*Salsola soda*). No vegetation is present in the Guadalupe Channel below MHW.

The ornamental woodland is most dense along the west side of Guadalupe Channel. The habitat is dominated by non-native ornamental species, including lollypop tree (*Myoporum laetum*), blue gum (*Eucalyptus globulus*), and

blackwood acacia (*Acacia melanoxylon*). The understory is sparse and is almost exclusively English ivy (*Hedera helix*). The California Invasive Plant County (Cal-IPC) ranks English ivy as being highly invasive. It ranks lollypop tree as moderately invasive, with blue gum and blackwood acacia given a limited rating. A small component of native tree and shrub species do occur in the ornamental forest (less than 1% of habitat area), and include coast live oak (*Quercus agrifolia*), toyon (*Heteromeles arbutifolia*), and California buckeye (*Aesculus californica*).

Ruderal (i.e., disturbed) California annual grassland habitat occurs along below the top of bank (Figure 2) and consists primarily of wild oat (*Avena fatua*), ripgut brome (*Bromus diandrus*), and hairy vetch (*Vicia villosa*). This habitat is substantially manipulated and in many areas is covered in a dense layer of mulch.

2.3.4 Wildlife

Guadalupe Channel does not provide high-quality habitat for any state or federally listed species, nor are any such species expected to use the channel frequently or in large numbers, if at all. Ostensibly suitable foraging habitat for the federally endangered Central California Coast steelhead (*Oncorhynchus mykiss*) and the California state endangered longfin smelt (*Spirinchus thaleichthys*) is present in the channel; however, neither species is expected to occur except as occasional, infrequent strays, and there is no spawning habitat for either species in the channel or upstream of the channel.

Generalist species such as the mallard (*Anas platyrhynchos*), great blue heron (*Ardea herodias*), California towhee (*Melozone crissalis*), black phoebe (*Sayornis nigricans*), and common raven (*Corvus corax*) may use the salt marsh habitat present along Guadalupe Channel. The California vole (*Microtus californicus*), often the most common small mammal species found in salt marshes in the region, may occur, and the western harvest mouse (*Reithrodontomys megalotis*) and deer mouse (*Peromyscus maniculatus*) may also be present. In addition, the belted kingfisher (*Megaceryle alcyon*) and generalist wading birds such as great blue herons, great egrets (*Ardea alba*), and snowy egrets (*Egretta thula*) may forage for fish and other prey in the Guadalupe Channel. Ducks, including the mallard, may also forage on aquatic invertebrates and aquatic plants in this habitat. Black phoebes forage along the banks of the channel; old, unoccupied phoebe nests were discovered during the reconnaissance survey on the Caltrain bridge just downstream of the study area, as well as just inside one of the Guadalupe Channel tunnels under Bayshore Boulevard. The Pacific treefrog (*Hyliola regilla*) and western toad (*Anaxyrus boreas*) may also occur in less brackish portions of the channel.

Few species of reptiles and amphibians occur in the California annual grassland below the top of bank due to its disturbed nature and low habitat heterogeneity. Nevertheless, reptiles such as the western fence lizard (*Sceloporus occidentalis*) and gopher snake (*Pituophis melanoleucus*) occur in this habitat type. Smaller amphibians such as the Pacific treefrog, which require freshwater marshes to breed in, are expected to occur in the study area and could use this habitat. Small mammals expected to be present include the native western harvest mouse and nonnative house mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), and black rat (*Rattus rattus*). Small burrowing mammals, such as the Botta's pocket gopher (*Thomomys bottae*) and California ground squirrel

(*Spermophilus beecheyi*), may also be present, and larger mammals, such as the striped skunk (*Mephitis mephitis*), Virginia opossum (*Didelphis virginiana*), and raccoon (*Procyon lotor*) are likely to occur here.

The riparian woodland provides foraging habitat for chestnut-backed chickadees (*Poecile rufescens*), hooded orioles (*Icterus cucullatus*), and yellow-rumped warblers (*Setophaga coronata*), and foraging and nesting habitat for Anna's hummingbirds (*Calypte anna*). The low structural diversity of the woodland within the study area (i.e., the absence of dense understory and sub-canopy vegetation) and the paucity of native vegetation limits the likelihood that it might be used by riparian-obligate species. Nevertheless, a number of more ubiquitous wildlife species inhabit this woodland, including mammals such as the raccoon and striped skunk. Raptors, such as red-tailed hawks (*Buteo jamaicensis*) and red-shouldered hawks (*Buteo lineatus*), may nest in these ornamental woodlands.

Section 3.0 Wetland and Riparian Habitat Creation Approach

3.1 Overview of Proposed Habitat Creation for Project Impacts

The package of habitat creation activities described in this MMP was developed to compensate for permanent impacts to jurisdictional habitats resulting from the project as summarized in Table 1.

3.1.1 Permanent Impacts

The project will permanently convert the earthen side slopes in Guadalupe Channel below MHW (aquatic habitat) to rock lined channel aquatic habitat. The Guadalupe Channel invert (channel bottom) below the toe of slope will remain earthen, while the toe of slope below MHW will consist of rock. The city proposes to mitigate this permanent impact through on-site tidal aquatic habitat creation by enlarging and re-grading the impacted channel. The project will increase the area of aquatic habitat in the channel (Table 1) by laying back channel banks. It will also reduce potential for continued erosion by installing geoweb on the channel banks, filling the geoweb with rock below MHW, and revegetating the channel side slopes above MHW. The project will substantially improve the quality and native diversity of vegetated habitat upslope of the channel, which will improve the quality of the habitat for wildlife.

Grading will impact small areas of salt marsh and California annual grassland below the top of slope (Table 1). To offset this loss, the city will restore a greater area of salt marsh and transition zone than was impacted. The restored salt marsh will have increased plant species diversity and will be more stable than the current habitat, which is tenuously established on the steep, incised channel banks. Above the tidal marsh, the transition zone will have increase native species diversity and provide greater foraging opportunities for wildlife than the existing California annual grassland. The city proposes to monitor the tidal marsh, transition zone and aquatic habitat for a period of 5 years to document its establishment.

The project will also result in the permanent loss of non-native ornamental woodland riparian habitat. The city proposes to mitigate for this loss concurrently with project impacts through on-site creation of riparian oak woodland habitat located above and below the top of bank in the project area. The city proposes to replace the non-native canopy with native riparian shrubs and trees based on the ratios in Table 2 and provide monitoring for 10 years after installation to demonstrate that the habitat establishes sufficient canopy cover.

3.2 Basis of Design

The following section explains the goals, location, and rationale for the types of the proposed habitat creation.

3.2.1 Habitat Creation Goals

The goal of the habitat creation package is to establish a combination of the following habitat types:

- Tidal aquatic habitat with an earthen channel bottom and stable channel banks
- Salt marsh habitat dominated by native salt marsh vegetation
- Transition zone habitat dominated by non-invasive grasses, forbs and subshrubs
- Riparian oak woodland habitat dominated by native trees and shrubs

These created habitats will be self-sustainable without human intervention following attainment of the success criteria set forth in Section 6 below. The locations of the proposed habitat creation areas are provided in Figures 3 and 4. The proposed mosaic of habitats will greatly increase the abundance and diversity of native plant species in the project area and enhance foraging habitat for native wildlife. The stabilized channel banks will improve water quality by reducing sediment inputs.

3.2.2 Tidal Aquatic Habitat Creation Area

The goal of the tidal aquatic habitat creation area (Figures 3 and 4) is to provide improved water quality within the Guadalupe Channel through bank stabilization, by reduction of bank slope, and establishment of native riparian vegetation above MHW. To achieve these goals, the geoweb on the channel side slopes below MHW will be backfilled with small rock to stabilize the soil along the channel banks and prevent erosion and sedimentation into the channel. The channel invert will remain earthen. Conditions within the channel will return to pre-project or better condition shortly after reintroduction of tidal action.

3.2.3 Salt Marsh Creation Area

Salt marsh will be established from MHW up to the high tide line where the geoweb is backfilled with salvaged soil and regular tidal inundation occurs (Figures 3 and 4). The goal in the salt marsh creation area is to rapidly establish moderately dense cover of native tidal marsh plant species common in San Francisco Bay. The created salt marsh will provide a more contiguous and wider band of habitat along the channel than the existing condition. In addition, the created marsh will be bordered upslope by a vegetated transition zone which is currently devoid of transition zone habitat. This will substantially improve the ecological function of the salt marsh in the project area by virtue of expanding the extent of salt marsh, by improving upslope vegetation cover and hence stream bank stability and water quality, and will provide greater wildlife habitat value.

3.2.4 Transition Zone Creation Area

For the purpose of this report, the term "transition zone" refers to the vegetation zone of transition from tidal salt marsh to upland riparian vegetation. The transition zone will be established from the high tide line up to the riparian oak woodland creation area (two vertical feet). The goal for the transition zone creation area is to establish a dense transition zone dominated by salt tolerant native rhizomatous grasses, forbs, and subshrubs. Non-native salt tolerant grasses and forbs are expected to persist as well. This habitat will create a vegetated buffer and high tide refuge for wildlife species that utilize the marsh, increase plant diversity, and increase foraging opportunities for wildlife, including for insect pollinators, relative to the existing condition.

3.2.5 Riparian Oak Woodland Creation Area

The impacted non-native canopy will be replaced with a native riparian tree and shrub canopy using at the replacement quantity per Table 3. The riparian planting area will begin approximately 2 feet above the high tide line to avoid placing plantings in areas that may be occasionally inundated with saline tidal water during winter high stream flow events (Figures 3 and 4). Inflexible shrubs and trees planted below the top of bank would increase the potential for debris snags and flooding in the channel. Therefore, flexible, native woody shrubs will be established below the top of bank to provide a contiguous canopy with trees and shrubs above the top of bank. Above the top of bank, a mixture of native trees and shrubs will be planted. Native grasses and forbs will be seeded in the understory of the riparian oak woodland creation area, but non-native annual grassland is expected to persist in the understory in the long term. The goal for the riparian habitat is to, over time, provide a diverse, native, multistoried tree and shrub canopy. Achievement of this goal will substantially improve the ecological function of the riparian area and provide greater wildlife habitat value in synergy with the improvements to stream bank stability and water quality. While some temporal riparian habitat loss will occur in the time period between the impact of grading activities and the maturation of created riparian oak woodland habitat, the increase in ecological function of the system provided by the creation will offset the effects of the temporal impacts.

3.3 Projected Conditions in the Habitat Creation Areas

3.3.1 Topography and Hydrology

The slope of the Guadalupe channel will be converted from incised, steep banks, to a 2:1 slope, as shown in Figure 4. The created salt marsh will be sustained by regular tidal events and occasional high flow channel events. Overall, hydrology in the salt marsh and aquatic habitats will be comparable to the pre-construction condition. Transition zone vegetation will be sustained by incidental precipitation and occasional high flood flow events. Following cessation of irrigation, incidental precipitation and possibly occasional periods of elevated winter groundwater will provide the soil moisture needed to sustain the riparian oak woodland habitat.

3.3.2 Soils

The habitat creation areas will be constructed with onsite soil material, with the exception of the tidal channel from MHW to the toe of slope, which will be small rock. In upland areas where the grading plan requires fill, soil will be derived from on-site soil excavated from above the high tide line. In the created channel, soil placed in the invert will be derived either from existing wetland surface soil located below MHW, or will meet the RWQCB's standards for placement in wetlands (RWQCB 2000). After channel grading and prior to placement of the geoweb, soil on the channel side slopes above MHW will be decompacted to a depth of 1 foot and, if necessary, amended to achieve minimum horticultural requirements for percent organic matter, pH and calcium to magnesium ratio. Similarly, soils above the top of bank will be decompacted to a depth of 1.5 feet and, if necessary, amended to achieve minimum horticultural requirements.

3.3.3 Wildlife

Wildlife species using the project area are expected to benefit from the creation of the northern coastal salt marsh, tidal aquatic habitat, riparian oak woodland, and a transition zone between the northern coastal salt marsh and the riparian oak woodland.

The project will replace the existing approximately 0.02 acres of northern coastal salt marsh habitat with approximately 0.07 ac of northern coastal salt marsh habitat that will be of higher quality than the existing habitat. The created salt marsh, although still small, will provide a more contiguous band of habitat along the channel than currently exists, and will be bordered upslope by a native dominated ecotone (transition zone) where currently none is present. This will substantially improve the ecological function of the salt marsh in the project area by virtue of expanding the extent of salt marsh, by improving upslope vegetation cover and hence stream bank stability and water quality, and will provide greater wildlife habitat value. While no special status wildlife species are expected to use the existing or created salt marsh habitat, more common wildlife species known to occur in the adjacent habitats are expected to benefit from the creation of this habitat; these include the black phoebe, mallard, snowy egret, great egret, and great blue heron..

The creation of the tidal aquatic habitat in the channel itself is expected to benefit common wildlife species that may currently use the channel. Bank stabilization, reduction in soil erosion and sedimentation, and improved water quality are expected to greatly improve the quality of the tidal aquatic habitat. Fish species that may occur in the channel will likely benefit from the improved habitat quality present in the channel following creation. Other species expected to benefit from channel creation include birds such as the black phoebe, which is known to forage along the channel and to nest in the project area, as well as the great egret, snowy egret, great blue heron, mallard, and belted kingfisher. Amphibians such as the Pacific treefrog and western toad are also expected to benefit from the less brackish portions of the created channel.

Conversion of the existing riparian woodland into an riparian oak woodland is also expected to benefit wildlife. Cedar wawxwings and American robins, among other wildlife, will benefit from the establishment of blue elderberry (*Sambucus nigra*), California blackberry (*Rubus ursinus*), thimbleberry (*Rubus parviflorus*), and toyon. Coast live oaks provide food, in the form of acorns for species such as California scrub-jays (*Aphelocoma californica*), and cover and foraging habitat for other wildlife, such as chestnut-backed chickadee, western screech-owl (*Megascops kennicottii*), Townsend's warbler (*Setophaga townsendii*), yellow-rumped warbler (*Setophaga coronata*), northern flicker (*Colpates auratus*), and bushtit (*Psaltriparus minimus*). Western fence lizards will also likely benefit from the creation of additional foraging habitat. The value of this woodland is expected to increase as it matures, and becomesa structurally diverse native woodland that can provide higher quality habitat for native wildlife than currently exists in the non-native dominated riparian woodland.

Finally, the transition zone that will be created between the northern coastal salt marsh and the riparian oak woodland will also provide habitat for common wildlife species that are expected to occur in the created northern coastal salt marsh and the adjacent oak wooland.

Section 4.0 Habitat Creation Work Plan

This section describes the proposed habitat creation work plan required to achieve the target habitat conditions described in Section 3.

4.1 Topsoil Handling Plan

The project's grading plan calls for channel banks and areas above the top of bank to be both excavated and filled to reach the desired grade. In addition, horticulturally suitable soil will be needed to fill the upper 6 inches of the geoweb cells on the channel side slopes above MHW. Fill soil will be generated onsite from grading work. To ensure that the topsoils constructed in tidal marsh, transition zone, and riparian oak woodland creation areas are horticulturally suitable for planting, a topsoil handling plan will be prepared, approved by a qualified soils restoration ecologist and integrated into the project's earthwork construction requirements.

The topsoil handling plan will be prepared to match horticulturally suitable areas of excavated soils to areas needing topsoil fill and to recommend amendments, if needed. The topsoil handling plan will be based upon topsoil sampling and testing results and will exclude material that has excess gravel, rock or substantial horticultural suitibliy issues. The topsoil handling plan will also determine whether amendments for organic matter, pH, or calcium to magnesium ratio in the upper 1.5 feet are necessary to sustain the habitat creation plantings. Soil treatments, including screening topsoil to reduce gravel/rock content, and horticultural amendments for the project's native plant palette will be specified. The upper 1.5 feet of onsite soil (i.e., topsoil) will be sampled and tested prior to grading to inform preparation of the topsoil handling plan. The goal of the topsoil plan will be to achieve the horticultural soil properties in Table 4 in the upper 1.5 feet of the habitat creation areas above MHW.

Table 4. Target Soil Horticultural Properties in the Upper 1.5 Feet of the Salt Marsh, Transition Zone, and Riparian Oak Woodland Habitat Creation Areas

Constituent	Test Method	Minimum	Maximum
Clay (0-0.002 mm)	USDA round hole sieves and hydrometer procedure	10%	55%
Slit (0.002-0.05 mm)	USDA round hole sieves and hydrometer procedure	10%	80%
Sand (0.05-2.0 mm)	USDA round hole sieves and hydrometer procedure	10%	70%
Gravel (2-12mm)	USDA round hole sieves and hydrometer procedure	0%	10%
Rock (up to 1 inch diameter)	USDA round hole sieves and hydrometer procedure	0%	10%
Organic matter (by weight of soil)	Dichromate reduction using Walkley Black method	2%	5%
Electrical conductivity[1]	Saturation extract method using Wheatstone Bridge method	0	3.0 dS/m @ 25 degrees
pH	Soil paste method and pH meter	6.5	8.0

Constituent	Test Method	Minimum	Maximum
Calcium to magnesium ratio	1N sodium chloride extract and measure via atomic absorption	3:1	NA
Sodium adsorption ratio	Calculate from soil extract values for calcium, magnesium, and sodium	0	15
Boron	Saturation extract method using ICP	NA	<2 ppm

[1] In the salt marsh, electrical conductivity, boron and percent clay may exceed these limits with review and approval from the monitoring restoration ecologist.

The soil handling plan will also determine the soil handling approach so that channel invert soil is derived from below the high tide line. If the soil in the channel invert must be derived from on-site upland soil, it will be tested for chemical contaminants to ensure it meets the RWQCB contaminant screening criteria for wetland surface material to protect aquatic life in RWQCB 2000.

4.2 Tidal Aquatic Habitat Creation Area

4.2.1 Target Habitat

The target habitat in the tidal aquatic habitat creation area is a stable tidal channel with an earthen channel bottom and slopes that are resistant to erosion.

4.2.2 Channel Design

The geoweb in the tidal channel from MHW to the toe of slope will be backfilled with rock 1.5-2 inches in diameter. Below the toe of slope the geoweb in the channel invert will be backfilled with soil. An additional 1.1 feet of of soil will be placed over the backfilled geoweb in the channel bottom. After fill placement, the elevation of the channel bottom will be 1.8 feet NAVD88.

4.3 Salt Marsh Creation Area

4.3.1 Target Habitat

The target habitat in the salt marsh creation area is dense perennial pickleweed (*Salicornia pacifica*) interspersed with a diverse range of common native salt marsh plants that thrive between MHW and the high tide line in the tidal marsh around Brisbane Lagoon and the San Francisco Bay.

4.3.2 Soil Preparation

The Guadalupe Channel side slopes above MHW will be decompacted to a depth of 12 inches prior to geoweb installation. The upper 12 inches of soil below the geoweb will be amended if needed to improve horticultural soil conditions as described in section 4.1. Following goeweb placement, the geoweb cells (6 inches deep) will be backfilled with horticulturally suitable soil that has a similar texture as the upper 12 inches below the geoweb.

4.3.3 Planting

Following soil preparation and backfill of the geoweb, the salt marsh creation area will be established by densely planting tidal marsh container plants into the soil-filled geoweb cells. Plants will be installed across a two foot vertical range from MHW to the approximate high tide line (Figure 4). Planted species will include the common marsh plants listed in Table 5. The goal of the planting spacing in Table 5 is to install 1 plant in each geoweb cell.

Table 5. Salt Marsh Creation Area Planting Palette

Scientific Name	Common Name	Percent Composition	Planting Spacing	Container Size[1]
Distichlis spicata	saltgrass	10	9 inches	TB2
Frankenia salina	alkali heath	10	9 inches	TB2
Grindelia stricta	marsh gumplant	10	9 inches	D40
Jaumea carnosa	marsh jaumea	5	9 inches	TB2
Limonium californicum	marsh rosemary	5	9 inches	TB2
Salicornia pacifia	perennial pickleweed	60	9 inches	D16

[1] For explanation of container sizes see The Watershed Nursery: https://www.watershednursery.com/nursery/container-explanation/

4.4 Transition Zone Creation Area

4.4.1 Target Habitat

The target habitat in the transition zone creation area is dense native and non-native grass, forb and sub-shrub cover to form a vegetated buffer between the salt marsh and the riparian oak woodland habitats.

4.4.2 Soil Preparation

The transition zone creation area will be prepared as described for the salt marsh creation area.

4.4.3 Planting and Seeding

The transition zone creation area will be established using a combination of seeding and planting. In the two vertical feet above the salt marsh, the salt-tolerant forbs, grasses, and subshrubs in Table 6 will be planted in each geoweb cell. To create conditions for strong competition with non-native upland weeds, the transition zone will be seeded using the seed mix in Table 7.

Table 6. Transition Zone Creation Area Planting Palette

Scientific Name	Common Name	Percent Composition	Planting Spacing	Container Size[1]
Ambrosia psilostachya	western ragweed	10	9 inches	D16
Baccharis glutinosa	marsh baccharis	10	9 inches	D16
Distichlis spicata	saltgrass	20	9 inches	D16

Scientific Name	Common Name	Percent Composition	Planting Spacing	Container Size[1]
Elymus triticoides	creeping wildrye	20	9 inches	SC
Euthamia occidentalis	goldenrod	10	9 inches	D16
Grindelia stricta	marsh gumplant	20	9 inches	D40
Symphyotrichum chilense	Pacific aster	10	9 inches	D16

[1] For explanation of container sizes see The Watershed Nursery: https://www.watershednursery.com/nursery/container-explanation/

Table 7. Transition Zone and Riparian Oak Woodland Creation Area Seed Mix

Botanical Name	Common Name
Achillea millefolium	Yarrow
Ambrosia psilostachya	Western ragweed
Artemisia douglasiana	Mugwort
Baccharis glutinosa	Marsh baccharis
Bromus carinatus	California brome
Elymus glaucus	Blue wildrye
Elymus triticoides	Creeping wildrye
Euthamia occidentalis	Western goldenrod
Festuca microstachys	Small fescue
Festuca rubra var. *molate*	Red molate fescue
Grindelia stricta	Marsh gumplant
Hordeum brachyantherum var. *salt*	Meadow barley
Lupinus bicolor	Miniature lupine
Stipa pulchra	Purple needlegrass

4.5 Riparian Oak Woodland Creation Area

4.5.1 Target Habitat

The target habitat in the riparian oak woodland creation area is a dense, multistory canopy of native trees and shrubs with a native and non-native herbaceous vegetation understory. To reduce the risk of flooding and to prevent large woody debris from entering the channel in future years, a planting palette of flexible shrubs will be used below the top of bank. A mixture of trees and shrubs will be established above the top of bank.

4.5.2 Soil Preparation

The riparian oak woodland riparian area below the top of bank will be prepared as described for the salt marsh and transition zone creation areas. Above the top of bank (where no geogrid will be installed), the riparian oak woodland creation area will be decompacted to a depth of 18 inches. The upper 12 inches of the soil profile above the top of bank will then be amended if needed to improve soil fertility as described in section 4.1.

4.5.3 Planting

The riparian oak woodland creation area will be established using a combination of seeding and planting. In the two vertical feet below the top of bank, the flexible shrubs in Table 8 will be planted into soil filled geoweb cells. All species in Table 8 will be planted above the top of bank (Figures 3 and 4). After container plant installation, the native grasses and forbs in Table 7 will be seeded. As the proposed creation area is in a urban area with little expected deer herbivory, the plantings will be installed without herbivore protection cages.

Table 8. Riparian Oak Woodland Creation Area Planting Palette

Scientific Name	Common Name	Percent Composition	Planting Spacing	Flexible Shrub?
Aesculus californica	buckeye	10%	12 feet	No
Fremontadendron californicum	flannel bush	5%	12 feet	No
Heteromeles arbutifolia	toyon	10%	12 feet	No
Quercus agrifolia	coast live oak	30%	16 feet	No
Rosa californica	California rose	10%	6 feet	Yes
Rubus parviflorus	thimbleberry	5%	6 feet	Yes
Rubus ursinus	California blackberry	10%	6 feet	Yes
Sambucus nigra	Blue elderberry	10%	12 feet	No
Symphocarpus albus	snowberry	10%	6 feet	Yes

4.6 Native Plant and Seed Progagule Sourcing

Native plant propagules for revegetation likely have higher survival and growth rates when sourced from populations that occur in similar soil and climatic conditions to that at the revegetation site. Therefore, this project's propagules for container plants and seeding will be derived from local populations as described below.

4.6.1 Container Plants

Container plants will be contract-grown by a native plant nursery from propagules collected from plant populations growing in San Mateo County. This will require establishment of a nursery contract at least 16 months prior to the target date for plant installation. For example, if plants are planned for installation in November-December 2020, then a nursery contract sould be established by July 2019. The native plant nursery selected for this contract will implement best management practices (BMPs) for to minimize *Phytophthora* spp., pathogens in container plants in accordance with *Guidelines to Minimize Phytophthora Pathogens in Restoration Nurseries* (Working Group for Phytophthoras in Native Habitats. 2016).

4.6.2 Seed

Seed for hydroseeding of the transition zone will be derived from plant populations growing in any of the San Francisco Bay Area Counties. If multiple sources of seed are commercially available for a given species, seed

sources will be preferentially selected from ecologically similar habitats as close to the revegetation site as possible.

4.7 Habitat Creation Construction Schedule

Habiat construction will take place in accordance with the following schedule (Table 9):

Table 9. Habitat Construction Schedule

Habiat Creation Area	Timing	Rationale
Guadalupe Channel grading and soil preparation in the habitat creation areas	Prior to October 15	Prior to the start of the rainy season
Seeding in the salt marsh, transition zone, and riparian oak woodland creation areas	August 15 to October 15	Within 2 months of the start of the rainy season
Container plant installation in the salt marsh, transition zone, and riparian oak woodland creation areas	December 15 – January 15	In the early part of the rainy season and after seed set.

4.8 Avoidance and Minimization Measures for Regulated Habitats and Special-Status Species during Construction

The proposed habitat creation areas will be established as a part of the project analyzed in the project's California Environmental Quality Act document and forthcoming regulatory agency permits. Therefore, the avoidance and minimization measures in the project's CEQA document and forthcoming permits will be implemented during construction of the habitat creation areas and no additional avoidance and minimization measures are needed.

4.9 Implementation Monitoring and Biological As-Built Report

A qualified restoration ecologist will monitor creation implementation to ensure that the site is installed as described in this plan. Observations will be summarized in a biological as-built report and submitted to the project permitting agencies within 90 days of completion of construction.

Section 5.0 Vegetation Maintenance Plan

5.1 Overview and Schedule

The salt marsh, transition zone, and riparian planting and seeding areas will require vegetatation maintenance for 5 years after installation to establish and become self-sustaining. Salt marsh and transition zone vegetation maintenance will include replanting of transition zone and salt marsh plants in year 1, irrigation of transition zone plantings during years 1 and 2, and weed control during the first 5 years. Riparian maintenance will include dead plant replacement, weed control, and irrigation for the first 5 years. Regular monitoring visits will be conducted per the Monitoring Plan (Section 7) by a restoration ecologist, in order to provide feedback to guide maintenance activities.

5.2 Dead Plant Replacement

During the first year, all dead tidal marsh and transition zone container plantings will be replaced. During the first 3 years, all dead riparian oak woodland tree and shrub plantings will be replaced. This will facilitate rapid establishment of the target vegetated habitats.

5.3 Weed Control

Invasive plant species are defined as species rated by the California Invasive Plant Council (Cal-IPC) as having a "high" ecological impact in the most current version of *California Invasive Plant Inventory* (Cal-IPC 2018). These species, and any other non-native species that the monitoring restoration ecologist deems a threat to attaining the habitat goals, will be controlled throughout the mitigaion site and kept below 5% cover during the 5-year maintenance period. Control methods will consist of manual removal by hand pulling, string trimming, and herbicide application, if necessary. If herbicides are used, the maintenance contractor will obtain and follow recommendations from a certified pest control advisor and use only herbicides that are registered for use near aquatic environments. Measures will be taken during all invasive plant control activities to protect preexisting, planted, and naturally recruited native plant species.

5.4 Irrigation

An irrigation system will be installed or hand watering will be used to provide regular irrigation to facilitate successful establishment of the riparian and transition zone plantings. If an irrigation system is installed, it will be regularly maintained during the 5-year maintenance period. Any component of the system not functioning properly will be subsequently repaired as part of regular site maintenance.

The riparian oak plantings will require irrigation during the first 3 years of the plant establishment period. The irrigation frequency should be gradually reduced during the 3 years to encourage plant acclimation to the site's natural moisture regime. In Year 1, the plantings in this area will be irrigated approximately 2 to 4 times/month

over the period March through October, with each irrigation session providing sufficient water (5 to 10 gallons/plant) to encourage vigorous root growth deep into the soil profile. The irrigation schedule in Year 2 will be based on the overall health and vigor of the plants, but should be substantially less (i.e., one to 2 times/month) compared to Year 1. Further reduction (zero to one time/month) in watering frequency should occur in Year 3. The irrigation schedule can be adjusted to reflect seasonal differences in weather patterns to ensure vigorous growth during the summer, especially during times of drought.

The transition zone enhancement area plantings will be irrigated for 2 years following installation. In Year 1, the plantings will be irrigated with enough regularity (approximately 2–4 times per month), from March through October, to keep the soil within the plant-rooting zone moist. The irrigation schedule in Year 2 will be based on the water requirements of the plants and is anticipated to be substantially less (approximately 1–2 times per month).

The irrigation schedule will be modified based on climatic conditions and plant performance to ensure vigorous plant growth during the summer months and/or times of drought, with input from the monitoring restoration ecologist.

5.5 Trash/Debris Removal

During the 5-year maintenance period, any trash in the habitat creation areas will be removed when maintenance activities are performed.

Section 6.0 Site Protection Instrument

The habitat creation areas will be constructed on land owned by the city. The city will preserve the habitat creation areas in perpetuity in accordance with the habitat goals set forth in this document unless permission is granted for a change in land use by the project permitting agencies.

Section 7.0 Monitoring Plan

7.1 Overview and Schedule

A restoration ecologist will conduct the monitoring and reporting. This monitoring plan defines the objective, measurable performance and final success criteria that will be used to determine if the habitat creation areas are on a trajectory toward establishing the habitat types and accomplishing the target habitat goals described above in section 3. This section also describes the monitoring methods to quantify the various metrics for comparison to the performance and final success criteria.

The tidal aquatic, salt marsh, and transition zone creation areas (Figure 3) will be monitored annually for 5 years. The riparian oak woodland creation area (Figure 3) will be monitored for 10 years; this area requires a longer monitoring period because the growth rate of the target vegetation is substantially slower than the salt marsh and transition zone. Monitoring in the habitat creation areas will take place toward the end of the growing season for the respective target habitats (July- September). The first annual monitoring event will occur during the first full growing season following site grading and plant installation.

7.2 Long-Term Habitat Goals and Habitat Success Criteria

Performance criteria apply in Years 1 – 4 for the tidal aquatic, salt marsh, and transition zone creation areas and through Year 9 for the riparian oak woodland creation area. They are interim targets that provide quantitative indicators of the trajectory of habitat establishment and inform maintenance measures prior to the final monitoring year. However, failure to meet performance criteria does not necessarily indicate failure of the habitat creation area and will not result in an extended monitoring period.

Achievement of the final success criteria is required in the final monitoring year to demonstrate that the site is on a trajectory towards achieving the project's long-term habitat goals. The final monitoring year for the tidal aquatic, salt marsh, and transition zone creation areas is Year 5. The final monitoring years for the riparian oak woodland creation area is Year 10. Failure to meet the final success criteria will require the permittee to consult with the permitting agencies to identify appropriate remedial or continued monitoring measures acceptable to the agencies.

7.2.1 Final Success Criteria

This section describes the final success criteria for the habitat creation areas.

7.2.1.1 Tidal Aquatic Creation Area

A primary goal of the project is to reduce ongoing sedimentation into Guadalupe Channel resulting from active channel bank erosion. Therefore, the tidal aquatic habitat creation area will meet the following final success criterion after 5 growing seasons:

- At least 0.19 acres of jurisdictionl wetland are established in the project area.
- No substantial active erosion that would adversely affect water quality, such as rills greater than 0.5 foot width and/or depth below the top of bank, or distortion of the geoweb by more that one foot from its installed location, or damage that breaks to integrity of more than two adjacent geoweb cells at a location where erosion is observed.

7.2.1.2 Salt Marsh Creation Area

- At least 0.04 acres of jurisdictionl wetland are established in the project area.
- The salt marsh creation area will have an average percent cover of at least 60% provided by native wetland plants. Wetland plants consist of species rated as "obligate wetland", "facultative wetland", or "facultative" by the most recent USACE National Wetland Plant List.
- The salt marsh creation area will have an average percent cover of no more than 5% provided by invasive plant species. Invasive plant species are those rated with a "high" ecosystem impact by the California Invasive Plant Council.

7.2.1.3 Transition Zone Creation Area

- The transition zone creation area will have an average percent cover of at least 70% provided by non-invasive plant species.
- The transition zone creation area will have an average percent cover of no more than 5% provided by invasive plant species.

7.2.1.4 Riparian Oak Woodland Creation Area

- The riparian oak woodland creation area will have an average percent cover of at least 40% in Year 10 provided by native tree and shrub species.

7.2.2 Performance Criteria

This section describes the performance criteria for the habitat creation areas.

7.2.2.1 Tidal Aquatic Creation Area

- No substantial active erosion that would adversely affect water quality, such as rilling below the top of bank or channel bank scour beneath the geoweb.

7.2.2.2 Salt Marsh Creation Area

- The average percent cover of native wetland vegetation will exhibit an increasing trend on a trajectory toward meeting the final success criterion of 60% cover.

- The average percent cover of vegetation will be less than 5% provided by invasive plant species.

7.2.2.3 Transition Zone Creation Area

- The average percent cover of non-invasive vegetation will exhibit an increasing trend on a trajectory toward meeting the final success criterion of 70% cover.
- The average percent cover of vegetation will be less than 5% provided by invasive plant species.

7.2.2.4 Riparian Oak Woodland Creation Area

- The riparian oak woodland creation area will exhibit an increasing trend on a trajectory toward meeting the final success criterion of at least 40% cover in Year 10 provided by native tree and shrub species.

7.3 Monitoring Methods

Field surveys will be carried out annually in Years 1-5 to monitor the tidal aquatic, salt marsh, and transition zone creation areas. Field surveys will be carried out annually in Years 1-6, Year 8 and Year 10 in the riparian oak woodland creation area. The following sections describe the monitoring methods that will be used to determine whether the habitat creation areas are meeting the success criteria in section 7.2.

7.3.1 Tidal Aquatic Creation Area

The following monitoring methods will be used in the tidal aquatic creation area.

- A restoration ecologist will inspect the habitat creation area below the top of bank during a lower low tide. Any areas of substantial erosion (as defined above) on the channel banks will be noted on a site map and photographed for inclusion in the annual monitoring report.

7.3.2 Salt Marsh Creation Area

The following monitoring methods will be used in the salt marsh creation area.

- Foliar cover of vegetation within the salt marsh creation area will be sampled using the quadrat method (Bonham 1989) at random point locations. Locations will be sampled using a 1-meter quadrat. Percent cover of each plant species within each quadrat will be determined using a visual assessment of species and cover by a qualified biologist. Identification of plant species will follow Baldwin et al. (2012). The number of samples will be determined by the point at which additional samples do not substantially change the average non-invasive vegetation cover (Kershaw 1973). Initially, a minimum of 3.0% of the surface area of the salt marsh creation area will be sampled (6 quadrats) stratified acoss the two channel banks. The average percent cover of non-invasive, wetland vegetation will be calculated and compared to the performance and final success criteria. The average percent cover of invasive vegetation will be calculated separately and compared to the performance and final success criteria.

- **Wetland Delineation.** Beginning in Year 3, the aquatic and salt marsh habitat creation areas will be examined to determine if it meets the technical criteria for wetland vegetation, soils, and hydrology according to the USACE Wetland Delineation Manual (Environmental Training Laboratory 1987). It is expected that the site will develop sufficient wetland characteristics to be classified as jurisdictional Waters of the United States. Delineation of the site's jurisdictional Waters will continue annually until the final success criteria are met or contingency measures are accepted by the agencies.
- The above maintenance subsection calls for all dead plantings to be replaced in Year 1. Therefore, the number of geoweb cells lacking a living plant in the transition zone creation area will be counted. These findings will be used to inform replacement plant recommendations with the goal of installing a replacement plant in each empty geoweb cell in Year 1.

7.3.3 Transition Zone Creation Area

The following monitoring methods will be used in the transition zone creation area.

- Foliar cover of vegetation within the transition zone creation area will be sampled using the quadrat method as described above for the salt marsh creation area. Initially, a minimum of 3.0% of the surface area of the transition zone creation area will be sampled (8 quadrats) stratified acoss the two channel banks. The average percent cover of non-invasive vegetation will be calculated and compared to the performance and final success criteria. The average percent cover of invasive vegetation will be calculated separately and compared to the performance and final success criteria.
- The above maintenance subsection calls for all dead plantings to be replaced in Year 1. Therefore, the number of geoweb cells lacking a living plant in the transition zone creation area will be counted. These findings will be used to inform replacement plant recommendations with the goal of installing a replacement plant in each empty geoweb cell in Year 1.

7.3.4 Riparian Oak Woodland Creation Area

The following monitoring methods will be used in the riparian oak woodland creation area:

- Percent cover will be determined using the line-intercept method after Bonham (1989). Fixed-length, permanent transects will be established and marked with metal T-posts. Random, or stratified random, transect locations will be established in Year 1. The number of transects will be determined based on the variability of the site's vegetative cover, which itself will be determined by evaluating the average cover value obtained over increasing numbers of transects. The number of transects used will be the point where additional samples do not substantially change the average cover value obtained (Kershaw 1973). The average percent cover of native woody riparian species (by species and for all species combined) will be calculated among the fixed length transects. The results will be compared to the percent cover performance and final success criteria described above.

- The above maintenance subsection calls for all dead plantings to be replaced in Years 1, 2 and 3. Therefore, the percent survival of plantings will be measured in the riparian oak woodland creation area during monitoring Years 1, 2 and 3 via a total count of all live plants compared to the quantities installed. These findings will be used to inform replacement plant recommendations. Percent survival will be calculated by species as follows:

  Percent Survival of Species A = (number of individuals of species A alive during monitoring period / total number of species A alive at installation) * 100.

7.3.5 Site Maintenance

All habitat creation areas will be inspected for maintenance needs 3 times per year in Years 1–5 and annually in Years 6, 8, and 10 within the riparian oak woodland. Qualitative assessments of the site will be made during these site visits that will be used to inform maintenance recommendations. Assessment of the following factors will be made during maintenance monitoring site visits:

- Vegetation establishment with special attention paid to areas lacking vegetation
- Mortality/loss of installed plants
- Invasion of the habitat creation areas by invasive or non-native weeds
- Accumulation of trash or incidences of vandalism
- Erosion

7.3.6 Photodocumentation

Photographs will be taken from fixed photodocumentation points during each annual monitoring event. Photodocumentation points will be established during the first year of monitoring.

7.4 Reporting

An Annual Monitoring Report will be submitted to the permitting agencies by February 1 following each monitoring year. Monitoring Reports will present the findings of the annual field surveys relative to the performance standards in the monitoring plan described above. Monitoring Reports will include the following elements:

- Introduction
- Methods
- Results and Discussion: a summary of findings and, if necessary, a discussion of problems with achieving performance standards

- Management recommendations for corrective measures (if necessary)
- Photodocumentation

7.5 Completion of Monitoring

Monitoring will be conducted over a minimum of 5 years for the tidal aquatic, salt marsh, and transition zone creation areas. If the monitoring restoration ecologist determines that the habitat creation areas have met the final success criteria, the Year 5 report will document completion of the project for those areas. Monitoring will be conducted over a minimum of 10 years for the ripairian oak woodland creation area. If the monitoring restoration ecologist determines that the riparian oak woodland creation area has met the final success criteria, the Year 10 report will document completion of the project.

If remedial measures were implemented, as described in Section 8 below, and additional monitoring and reporting was required by the permitting agencies in order to meet the final success criteria, then the city will submit a letter to the permitting agencies with the final monitoring report requesting final "sign-off" on the project.

Section 8.0 Adaptive Management Plan

If assessment of annual performance criteria indicate that the site will not meet final success criteria or the final success criteria are not met, the City will prepare an analysis of the cause(s) of failure and propose remedial actions to the permitting agencies. The city will provide funding for the planning, implementation, and monitoring of any remedial actions determined to be necessary to meet the habitat creation goals and final success criteria.

Section 9.0 References

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