INTRODUCTION TO THE ADAPTING TO RISING TIDES EXISTING CONDITIONS AND STRESSORS REPORT

The Adapting to Rising Tides (ART) project evaluated the current condition of shoreline and community assets, and the stressors affecting them, because understanding existing conditions and stressors can inform an understanding of individual asset resilience (or lack thereof) to projected climate impacts, including sea level rise and storm events. Stressors can also provide information on current and future trends and how those trends may affect resilience. The existing conditions and stressors were analyzed and summarized for each asset category included in the ART project assessment. This analysis served as a foundation for the ART vulnerability and risk assessment, which examined asset exposure to five potential climate impacts, sensitivity of assets to these impacts, and the ability of assets to accommodate or adjust to these impacts with little financial or structural intervention.

The following Existing Conditions and Stressors report chapter includes:

- a definition of the asset category;
- a synthesis of information about current conditions and stressors; and
- discussion of these conditions through the lenses of sustainability organized by society and equity, environment, economy and governance.

The complete ART Existing Conditions and Stressors Report is available at the ART Portfolio website.

STRUCTURAL AND NATURAL SHORELINES

I. Definition

The ART project has a diverse shoreline composed of a variety of structural and natural areas. In general, structural shoreline protection assets in the project area are built features that have been constructed and maintained for specific purposes such as flood or erosion control. Natural shoreline areas are either fully tidal or managed wetlands, former salt ponds, storage/treatment ponds, or non-wetland beaches. These areas are generally managed, maintained, or enhanced to preserve or restore key ecosystem functions, species, and habitats.

The shoreline in the northern portion of the project area is generally composed of structural assets interspersed with a few natural areas. This portion of the project area is fairly urbanized, with development extending to the edge of the Bay. For example, the Port of Oakland, the Oakland Airport, East Bay Municipal Utility District's main treatment plant, and the toll plaza for the San Francisco Bay Bridge are all located along the shoreline of the northern portion of the project area.

The shoreline in the southern portion of the project area is less urbanized, with development generally located inland of Bay edge natural areas. The natural areas on the shoreline are composed of natural, restored, and managed wetlands of varying tidal regimes, with one notable non-wetland beach area. In many locations along the shoreline, natural areas are co-located with structural shoreline protection assets. For example, non-engineered berms on the Bay (outboard) side of wetlands help to reduce the exposure to wind and wave erosion, while levees on the inland (inboard) side help to reduce flooding of adjacent developed areas.

II. Locations and Physical Features

Five categories of shoreline were mapped onto the project area (Adapting to Rising Tides Transportation Vulnerability and Risk Assessment Pilot Project Technical Report, Chapter 2). These categories and the subcategories within them were developed in order to characterize the diverse and varied shoreline of the project area in a simplified manner. The categories were developed to best reflect the primary function of the shoreline, including the potential to protect inland areas from inundation due to sea level rise and storm events (see Table 1). Detailed descriptions of the shoreline categories follow below and are shown in Figure 1.

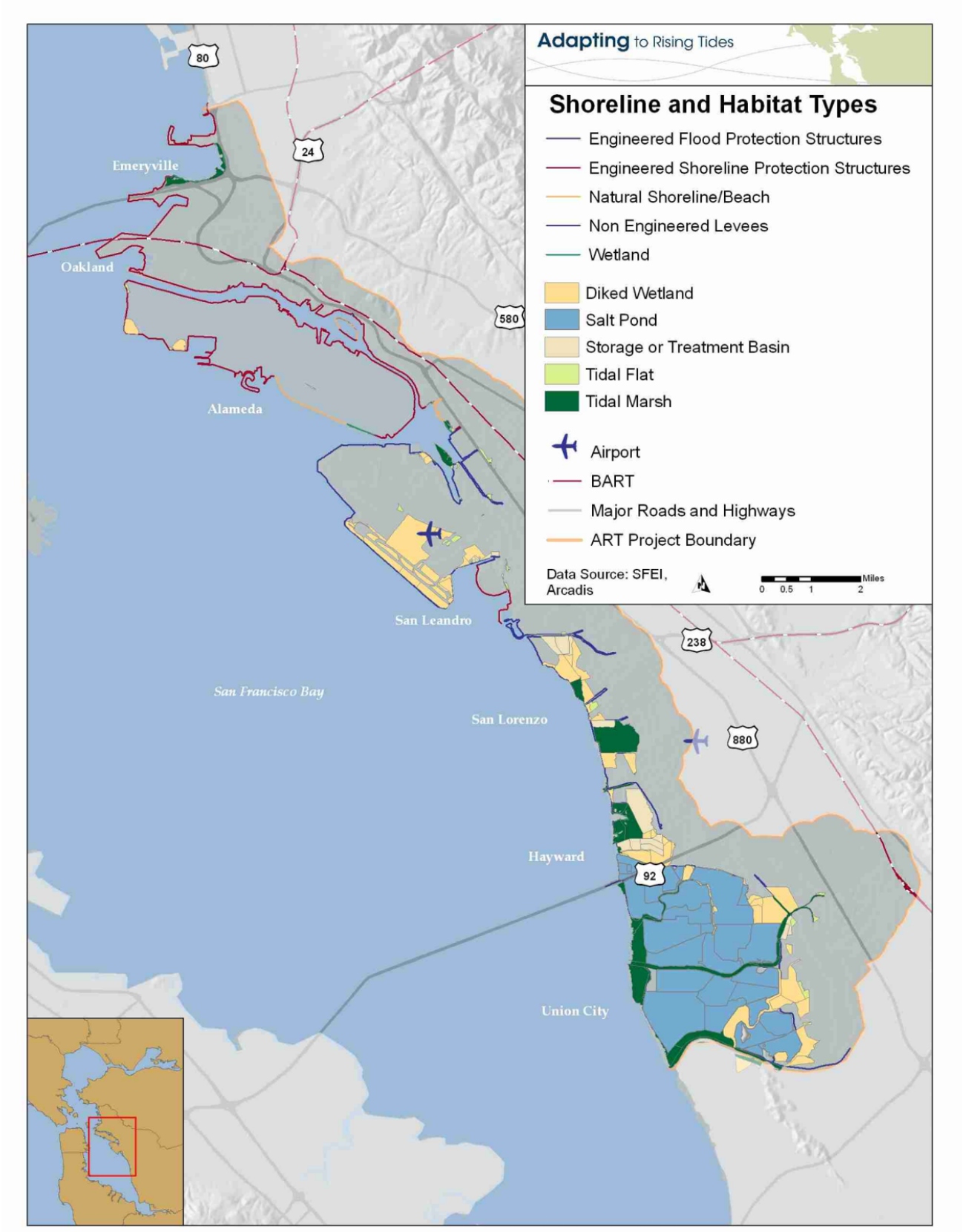
Table 1. Summary of Shoreline Categories

Category		Subcategory	Primary Function	Potential to Inhibit Flooding
1	Engineered flood protection structures	Levees	Protect inland areas from flooding and inundation	High
		Flood walls		
2	Engineered shoreline protection Structures	Bulkheads	Harden the shoreline to reduce erosion and prevent land loss	Moderate-high, not primary function
		Revetments		
3	Non-engineered berms		Protect marshes and ponds from wave erosion, provide flood protection to inland developments, and maintain hydraulic separation between the Bay and protected/managed areas	Moderate
4	Wetlands	Diked wetlands	Dissipate wave energy and provide ecological habitat value	Moderate-low
		Tidal marsh		
		Salt ponds		
		Storage or treatment basins		
5	Natural non-wetland shorelines	Beaches	Some wave energy dissipation	Low

The shoreline categories were mapped onto the project area using various sources of information including data from the San Francisco Estuary Institute's Bay Area Aquatic Resource Inventory (BAARI) and EcoAtlas, the NOAA Environmental Sensitivity Index, the FEMA San Francisco Bay Flood Study, locations and elevations of shoreline structures developed by Alameda County Flood Control, and best professional judgment. In locations with more than one type of shoreline category, e.g., a combination of levee and revetment, the shoreline category with the highest potential to protect against inundation or flooding was reflected on the map.

Arrowhead Marsh in Oakland supports Clapper Rail. Source: www.prbo.org.

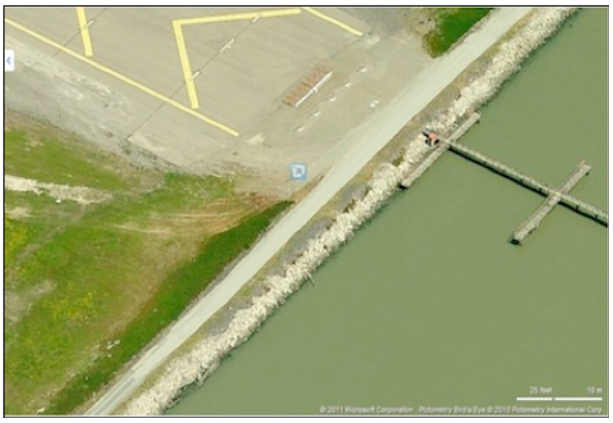
Figure 1. Map of Shoreline and Habitat Types in the ART Project Area



Category 1. Engineered Flood Protection Structures

Levee

Engineered levees are a common type of river and coastal structure that generally provide protection from a 100-year extreme water level that may be accompanied by large, powerful waves. They are designed to meet specific criteria with respect to freeboard (the distance between the levee crest and the 100-year extreme water level with wave run-up), embankment protection, embankment and foundation stability, and settling.



Aerial view of an engineered levee at Oakland Airport. The roadway is located along the levee crest, and the outboard slope (or embankment) of the levee is armored with a riprap revetment that protects the levee from wave-induced erosion.

The protective value of levees depends on the amount of freeboard provided, which may be reduced as sea level rises. Levee embankments can be susceptible to wave erosion, and frequent or infrequent overtopping can result in erosion along the levee crest and the backside of the levee, thus weakening it and increasing the potential for failure.

Most engineered levees are regularly maintained by the agencies responsible for them, and they can be upgraded by increasing the height of the levee crest or the amount of protection on the embankment. Levee upgrades generally result in an increase in the overall footprint of the structure and may not be feasible in all locations. Levees can be combined with other means of flood protection, such as flood walls constructed along the levee crest.

Flood Wall

A flood wall is a vertical barrier designed to protect inland areas from flooding. Flood walls are design to meet freeboard and overall stability criteria similar to that for engineered levees. Similar to levees, flood walls require ongoing maintenance and their flood protection value depends on the amount of available freeboard and the structural stability light of settling and wave erosion.

Flood wall at Eden Shores located landward of the Eden Landing Ecological Reserve in Hayward. Outboard of the flood wall is a non-engineered berm with a road on the crest.

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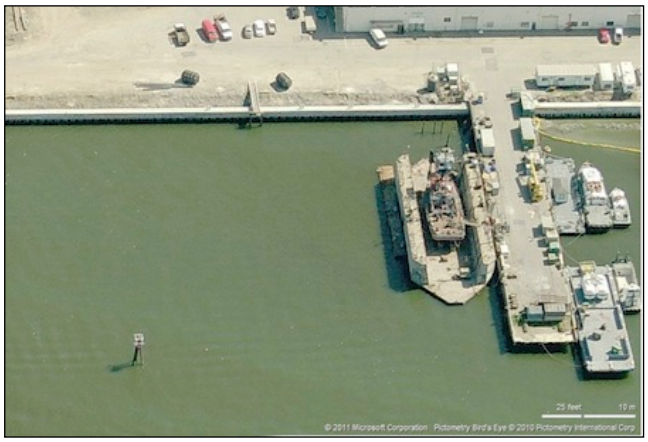
Category 2. Engineered Shoreline Protection Structure

The primary purpose of engineered shoreline protection structures is to harden the shoreline and reduce land erosion and land loss. Shoreline protection structures may provide some amount of flood protection, but unlike engineered flood protection structures they are not designed to protect inland areas from specific storm events and conditions. In the project area, bulkheads and revetments are the most common types of engineered shoreline protection.



Bulkhead at the Port of Oakland Inner Harbor Turning Basin.

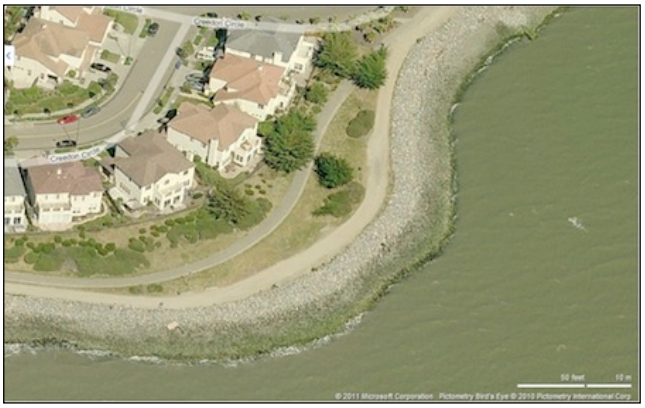
Bulkhead

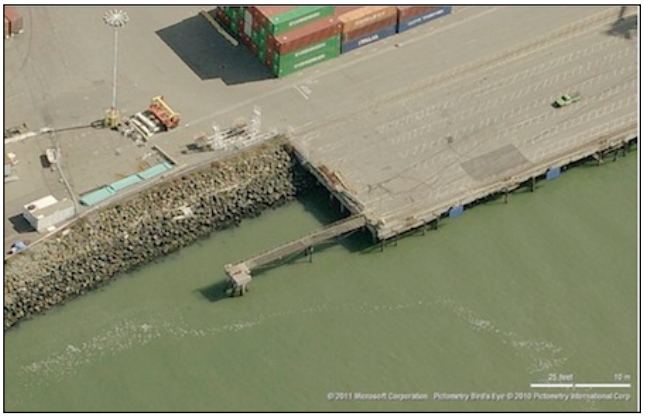
A bulkhead is a vertical retaining structure that primarily serves to reduce land loss, and secondarily protects inland areas from wave damage. Bulkheads can be cantilevered over the water surface or unanchored shoreline (gravity) structures. They will be susceptible to overtopping as sea level rises and wind wave conditions change.

Revetment

Revetments harden the shoreline, protecting it from waves and strong currents that could cause erosion and land loss. In the project area, revetments are commonly found either alone or in combination with other shoreline types such as engineered levees, non-engineered berms, and wetlands.

Revetments are generally constructed using three components: a stable armor layer of erosion resistant material (such as concrete or riprap), a filter cloth underlayer, and toe of slope protection. However, the presence of shoreline riprap does not always indicate there is a revetment. For example riprap can also be used to protect the side slopes of non-engineered berms. In these cases, riprap has generally been placed in an ad hoc manner to address erosion, and not necessarily in accordance with specific design standards to ensure it will withstand waves and strong currents.





Revetment at Shoreline Park in Alameda (above) and at the Port of Oakland (below).

Revetments are primarily designed to protect the shoreline, but they are susceptible to damage from strong currents and wave conditions that occur beyond the "design" event. For example, the size of riprap used is based on existing wave and current condition. As sea level rises, wave heights and velocities may increase, exposing the revetments to conditions beyond those for which the armor layer was designed. Additionally, increased overtopping could result in a loss of foundation material and undercutting of the toe, potentially causing the entire revetment to become unstable.

Riprap revetments protecting a non-engineered berm in Hayward (above), and the wastewater treatment plant in San Leandro (below).

Revetments generally require ongoing maintenance. They can be upgraded over time by placing additional armoring sized for increasing wave conditions, the revetment height can be increased, and additional toe protection can be added.

Category 3. Non-Engineered Berm

Non-engineered berms are similar to engineered levees in appearance; however, they have not been designed or constructed to meet specific criteria as described above. The most common non-engineered berms in the project area are salt pond berms. These structures are essentially excavated bay mud that has been piled and/or stacked into a mound. The characteristics of salt pond berms around the Bay vary greatly. Along the Bay front, berms tend to be larger because they protect inland areas from waves. Many berms contain maintenance roadways along the crest, and riprap protection on the wave-exposed sections (often consisting of concrete construction debris).

Maintenance of non-engineered berms can be reactive, e.g., when erosion or failures are observed, or proactive, e.g., on a regular cycle based on the wave exposure and the amount of settling that is occurring. Non-engineered berms are not designed to provide flood protection; however, they do help maintain the expansive network of salt ponds and former salt ponds that serve as ad hoc flood protection by providing a substantial buffer between the Bay and inland developed areas.

Maintenance of a non-engineered berm at the Eden Landing Ecological Reserve in Hayward by the Mallard.

Non-engineered berms are susceptible to changes

in sea level, wind and wave condition. While the berms can continue to be maintained over time, historically the bay floor directly adjacent to the berm has been excavated and placed on top of the berm. Many of these adjacent borrow pits are already very deep, and this source of material could be exhausted over time, requiring the import of suitable material. Due to the non-engineered nature of these structures, there may also be a maximum height to which the berms can be built and maintained.

Category 4. Wetlands

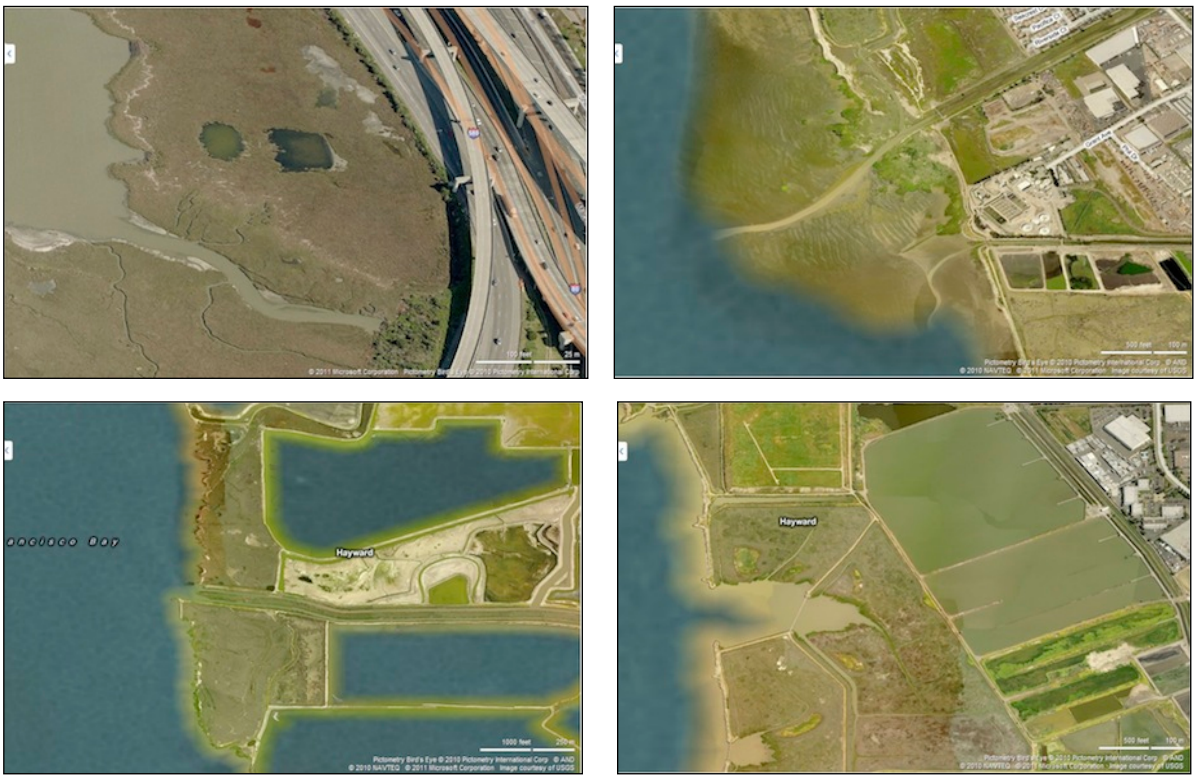
There are several different types of wetlands in the project area, with the majority located in the southern portion of the project areas where the shoreline is less urbanized. Natural and managed wetland resources located in the project area have been classified into four categories based on the Bayland Ecosystem Habitat Goals and using the San Francisco Estuary Institute's Bay Area Aquatic Resource Inventory (BAARI) and EcoAtlas data (see Table 2).

Wetlands in the northern portion of the project area that have a natural marsh edge exposed to the Bay include Arrowhead Marsh in Oakland and the Emeryville Crescent just to the north of the Oakland-Bay Bridge.

In the mid-portion of the study area, at the confluence of San Lorenzo Creek and the Bay, is a complex of wetlands that transition from shallow sub-tidal, to tidal flats, to fringing marsh, to managed marsh up to the inland margin.

In the southern portion of the project area, along the Hayward shoreline in particular, is a complex mosaic of tidal marshes and tidal flats, managed marshes and ponds. The outboard regions of these managed wetlands are generally protected against waves by non-engineered berms; the exception is Whales Tail marsh in the Eden Landing Ecological Reserve, just south of the San Mateo Bridge.

Wetlands are sensitive to sea level rise, storms, and wave conditions. Historically, wetlands have kept pace with rising sea levels, either through the accumulation of inorganic and organic material (horizontal accretion) or by migrating inland (upland transgression). However, as sea level rise accelerates in response to global climate change, wetlands may not have sufficient sediment supply or vegetative productivity to keep pace. If this is the case, and there is little or no access to upland areas for inland migration, tidal wetlands may be inundated and eventually converted to open water.



Wetlands in Emeryville with a natural marsh edge exposed to the Bay (above, left), tidal flat-marsh complex at the confluence of San Lorenzo Creek and the Bay in San Leandro (above, right), Whales Tail marsh at the Eden Landing Ecological Reserve in Hayward (below, left), and managed protected tidal marsh and ponds with an extensive non-engineered berm network in Hayward (below, right).

Table 2. Wetland Categories and Subcategories Used in the ART Project

Wetland Category*,**	Subcategory
Diked wetland—historic tidal marsh that has been isolated from tidal influence by a dike or levee	*Managed marsh*—diked wetland habitat managed for wildlife, primarily waterfowl
	Diked marsh—not actively managed for wildlife, generally seasonal wetlands
Tidal marsh—a vegetated wetland that is subject to tidal action	*High tidal marsh*—occurs between MHHW and the highest margin of the marsh
	Mid-tidal marsh—occurs between MHW and MHHW
	Low tidal marsh—occurs between the lowest margin of the marsh and MHW
	Muted tidal marsh—receives less than full tidal flow due to a physical impediment
Salt pond—large, persistent hypersaline ponds that are intermittently flooded with Bay water	
Storage or treatment basin—diked, perennial shallow or deepwater pond constructed to store or treat runoff, sewage, or industrial discharges	

* Bay Area Aquatic Resource Inventory (BAARI)
** Baylands Ecosystem Habitat Goals

Category 5. Natural Non-Wetland Shorelines

Natural non-wetland shorelines are found in the project area in one notable location, the stretch of shoreline known as Robert Crown Memorial State Beach in Alameda. The beach, which is 2.5 miles long and backed by sand dunes, was constructed on the margin of Bay fill placed to expand Alameda island, and is maintained by nourishment with imported sand and through the use of engineered sand-retaining structures.

Robert Crown Memorial State Beach in Alameda. The erosion-prone shoreline is maintained through nourishment; steep dunes currently protect a local road and bicycle trail (right).

The shoreline beach and dunes provide some protection to the inland area from large waves; however both are already experiencing erosion and require ongoing maintenance and capital improvements. As sea level rises and wave intensity increases, natural shorelines such as the nourished beach in the project area will be extremely susceptible due to increased wave energy and currents, potentially requiring additional maintenance measures or perhaps hardening.

III. Ownership and Management

Structural Shorelines

Structural shorelines, including engineered flood protection, engineered shoreline protection, and non-engineered berms, are owned and maintained by various public and private entities. In the northern portion of the project area, the majority of the publicly owned structural shoreline is owned and maintained by the Port of Oakland (airport and seaport), ACFCWCD, and California Department of Transportation. In the southern portion of the project area the majority of the publicly owned structural protection is owned and maintained by DFG, ACFCWCD, EBRPD, and HARD.

Natural Shorelines

Natural shorelines, including tidal marsh, diked wetlands, former salt ponds, storage/treatment basins, and beaches are mostly owned and maintained by public entities including EBRPD, HARD, DFG, the Port of Oakland, and the City of Hayward (see Figure 2). Below is a list of significant

natural areas found in the project area identified by the entity that either owns or maintains the shoreline.

California Department of Fish and Game (DFG)
Eden Landing Ecological Reserve (ELER)

DFG is actively managing approximately 6,400 acres of former salt ponds at ELER. Efforts are underway to restore the former salt ponds to a mixture of tidal marsh and managed pond habitat. The effort at ELER is part of the South Bay Salt Ponds Restoration Project, which is returning thousands of acres of diked salt ponds throughout the South Bay to tidal action in order to restore essential wetland habitat, provide flood protection, and provide wildlife-oriented public access and recreation.

City of San Leandro, State Lands Commission and Citation Homes
Robert's Landing

Robert's Landing is an area of approximately 475 acres, a portion of which is owned by the City of San Leandro and the State Lands Commission (272 acres) and a portion by Citation Homes (206 acres). Restoration activities at Robert's Landing include the conversion of 172 acres of wetland to muted tidal marsh (Shoreline Marsh Enhancement Project, City of San Leandro and State Lands Commission), restoration of the 95-acre "citation marsh" to a muted tidal regime, a 16-acre compensatory mitigation upland wetland creation area, and an 18-acre upland habitat refugia enhancement for the endangered salt marsh harvest mouse (Citation Homes).

EBRPD—Eastshore State Park
Emeryville Crescent

The Emeryville Crescent is a distinctive and highly visible complex of tide marsh and mudflats. The horseshoe-shaped Crescent is adjacent to I-80, extending from the Bay Bridge Toll Plaza to the Powell Street Interchange and Emeryville Peninsula. The tidal wetlands were enhanced as part of the mitigation required for improvements to I-80. The area supports clapper rails and black rails; has a relatively natural plant community, potentially including two rare or endangered plant species (the soft bird's-beak and Point Reyes bird's-beak); provides habitat to an abundance and diversity of shorebirds; and supports eelgrass beds just north of the Toll Plaza.

EBRPD—Martin Luther King Regional Shoreline
Arrowhead Marsh / Damon Slough

The Martin Luther King Jr. Regional Shoreline is located in the Oakland Estuary at the southern end of San Leandro Bay. The Shoreline sits at the mouths of five major creek systems and has natural and restored wetlands including Damon Slough, Arrowhead Marsh, and Doolittle Pond Wildlife Sanctuary. Arrowhead Marsh is thought to have formed in the late 1860s when sediment was released during the Lake Chabot Reservoir construction and the logging of the San Antonio Forest. In 1998, tidal flow was restored to 71 acres of tidal and seasonal wetlands at Arrowhead Marsh that had been filled in the mid-1980s. The effort resulted in the recolonization of native plants and the return of many species of birds. Thousands of migrating birds have returned to the marsh to rest and feed during the winter. Other species such as avocets, terns, egrets, and the endangered California clapper rail and burrowing owl live at the marsh year round. Restoration of the 9-acre Damon Slough in 2002

enhanced seasonal wetland and shallow pond habitat, improving the area for seasonal foraging and as a refuge for migrating waterfowl and shorebirds.

EBRPD—Robert M. Crown Memorial State Beach

Located along the southwestern shoreline of Alameda Island, Crown Beach is a nearly 2-mile-long artificial public beach. The berm between the beach and Shoreline Drive is a gently sloping sandy habitat that supports native and introduced plants. The beach is located near Crab Cove, a marine reserve where all plant and animal life is protected, and Elsie Roemer Bird Sanctuary, which provides habitat for aquatic, bird, and mammal species. Additionally, just offshore of the beach is a perennial eelgrass bed, a sensitive resource that provides nursery habitat for a variety of juvenile fish and a food source for aquatic birds. The beach has had significant sand loss over the years due to ordinary erosion and damage from severe storms. A major, multi-phased beach restoration project was completed in 1988, and there is a proposed plan to bring in more than 82,000 cubic yards of sand and extend the existing groin that separates the beach from the Elsie Roemer Bird Sanctuary.

EBRPD—Hayward Regional Shoreline

Oro Loma Marsh

Oro Loma Marsh is a 364-acre former diked, degraded marsh that was restored to tidal action in 1997. It is now a complex of tidal marsh, seasonal wetlands, and transitional uplands managed for California clapper rails and salt marsh harvest mice, and to control non-native *Spartina alterniflora* in tidal areas. There are several islands and numerous refugial mounds that provide areas for wildlife nesting and refuge. There are extensive tidal flats outboard of the Bayshore levees that protect the marsh. The levees are from historic salt pond activities and are not built to flood control standards, but they are part of the Bay Trail and the outboard levee has armored slopes that are maintained annually. Also in the marsh is a utility corridor that runs through the middle of the property, and access roads to service numerous utilities that cross the marsh including overhead PG&E transmission lines, underground distribution lines, the East Bay Dischargers Authority 60-inch pipeline, and the abandoned 6-inch Shell Oil Jet Fuel pipeline.

Cogswell Marsh

Cogswell Marsh is a 250-acre site that was restored to full tidal action in 1980. The marsh includes numerous islands for wildlife nesting, is managed for California clapper rails and salt marsh harvest mice, including predator management, and to control non-native *Spartina alterniflora* in tidal areas. Extensive tidal flats outboard of the Bayshore levees protect the marsh. The levees are from historic salt pond activities and are not built to flood control standards, but they are part of the Bay Trail and the outboard levee has armored slopes that are maintained annually.

Hayward Marsh

Hayward Marsh consists of 145 acres of fresh water and brackish ponds that were constructed in 1985. There are five ponds in total, three fresh and two brackish. Fresh water is supplied to the ponds by Union Sanitary District (secondary treated effluent), and the overall system is highly managed as required by a NPDES permit from the Regional Water Quality Control Board. There are a total of 15 islands in the marsh that are managed for waterfowl, shorebirds, and terns, and the marsh is fenced to protect nesting habitat. One of the islands is specifically

managed for California least terns and Western snowy plovers, including predator management activities. The Bayshore levees that protect the marsh are from historic salt pond activities and are not built to flood control standards, but they are part of the Bay Trail and the outboard levee has armored slopes that are maintained annually.

Salt Marsh Harvest Mouse Preserve

The preserve is a 27-acre site that provides critical habitat to the salt marsh harvest mouse. It was enhanced in 1985 and again in 1997 to improve water management. The site includes a muted tidal marsh system controlled by tide gates and culverts, seasonal wetlands, and some transitional uplands. It is hydrologically connected to City of Hayward seasonal wetlands property to the east, which EBRPD is in the process of acquiring. The levees, which were enhanced in 1985, are from historic salt pond activities and are not built to flood control standards.

Hayward Area Recreation Division

Triangle Marsh

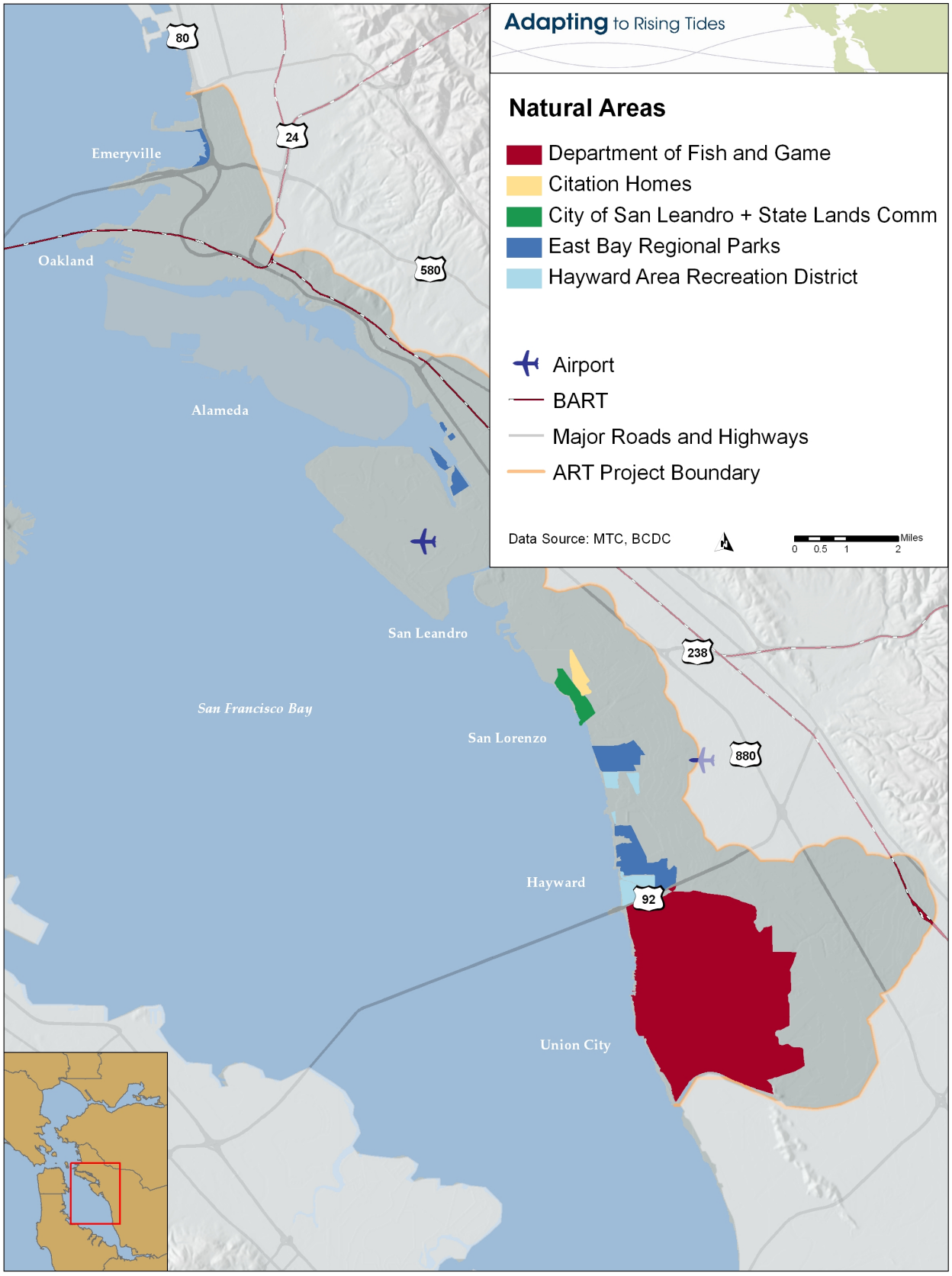
Triangle Marsh is an 8.7-acre site located at the west end of West Winton Avenue, on the north side of a former landfill. Prior to restoration it was partially isolated by levees, a road, and a flood control channel, and much of the marsh contained dead or dying pickleweed most likely due to restricted tidal flow. The site was enhanced to improve biological productivity, habitat diversity, and water quality, and to reduce mosquito breeding and prevent flooding at high tide. Site enhancements were targeted at improving habitat for the salt marsh harvest mice, salt marsh song sparrow, California clapper rail, black rail, and other shorebirds, waterfowl, herons, and egrets. Improvements to the tidal regime at the site and other features have resulted in more vigorous marsh vegetation and use of the site by shorebirds, waterfowl, fish, and macroinvertebrates.

Port of Oakland

Middle Harbor Shoreline Park

Middle Harbor Shoreline Park is located on the site of former salt marshes and shallow tidal wetlands. The Port of Oakland and the U.S. Army Corps of Engineers are working to restore shallow water habitat and provide habitat enhancement, including eelgrass planting in the 180-acre Middle Harbor Enhancement Area that is adjacent to the park. Numerous shorebirds, diving ducks, and sea birds can be seen just offshore of the park. Year-round residents include the Forster's tern, western gull, double-crested cormorant, and brown pelican; summer visitors include the Caspian tern, least tern, California gull, Canada goose, and snowy egret; and winter visitors include the common goldeneye, ruddy duck, bufflehead, scaup, western sandpiper, dunlin, surf scoter, Western grebe, Clark's grebe, and eared grebe.

Figure 2. Map of Natural Shoreline Areas in the ART Project Area



IV. Existing Stressors

Many structural and natural shoreline areas are currently exposed to stressors that can limit their capacity to respond to climate change, in particular to sea level rise. Existing stressors generally include:

- Lack of resources to conduct necessary maintenance, enhancements, and restorations
- Regulatory requirements that create barriers to improving, enhancing, or maintaining shorelines, both structural and natural
- Potentially inadequate sediment supply to maintain natural area accretion rates
- Limited or no access to upland areas for inland migration and historic sea level rise
- Invasive plant and animal species
- Erosion
- Subsidence

V. Equity

Many low-income communities are disproportionally located in low-lying areas that are currently protected from Bay flooding by either structural or natural shorelines. The maintenance and improvement of the protective nature of the shoreline will be critical to those living and working in these low-lying areas that are highly susceptible already to Bay flooding.

VI. Economy

Many of the natural shoreline areas in the project area have either been restored or are being restored/enhanced. The region as a whole has made a significant financial commitment to restoring natural areas around the Bay, and special consideration will be necessary for protecting the unique functions and values they provide (see Table 3).

VII. Governance

Shoreline areas, both structural and natural, are regulated by a variety of state, regional, and federal agencies. These include, but are not limited to:

- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- U. S. Environmental Protection Agency
- National Oceanic and Atmospheric Administration National Marine Fisheries Service
- Federal Emergency Management Agency
- California State Lands Commission
- California Department of Fish and Game
- San Francisco Bay Conservation and Development Commission
- San Francisco Bay Regional Water Quality Control Board
- Alameda County Flood Control and Water Conservation District

Table 3. Natural Area Restoration Projects, Completed and Ongoing, in ART Project Area

Owner/Operator	Location	Name	Acreage	Habitat	Activity	Compensatory Mitigation?
Port of Oakland	Middle Harbor Shoreline Park	Oakland Middle Harbor Restoration Project	4.94	Estuarine	Restored	No
City of San Leandro and State Lands Commission	Robert's Landing	San Leandro Shoreline Marshland Enhancement Project	171.9	Estuarine	Mixed	Yes
Citation Homes	Citation Homes, behind Robert's Landing	Citation Marsh	95.3	Estuarine	Mixed	Yes
East Bay Regional Parks	Eastshore State Park	Emeryville Crescent	50.3	Estuarine	Mixed	Yes
	Martin Luther King Regional Shoreline	Damon Slough Seasonal Wetland Mitigation	9.75	Estuarine	Mixed	Yes
	Martin Luther King Regional Shoreline	MLK New Marsh Restoration	70.6	Estuarine Depressional	Restored	Yes
	Hayward Regional Shoreline	Oro Loma Marsh Enhancement Project	315.29	Estuarine	Mixed	No
	Hayward Regional Shoreline	Cogswell Marsh	229.12	Estuarine	n/a	Yes
	Hayward Regional Shoreline	Hayward Marsh Fresh	85.9	Depressional	Mixed	No
Hayward Area Recreation	Hayward Regional Shoreline	Triangle Marsh at Hayward Shoreline	8.7	Estuarine Depressional	Restored	Yes
	Hayward Regional Shoreline	Hayward Shoreline Enhancement Project—Oliver Salt Ponds	134	Depressional	Restored	Yes
California Department of Fish and Game	Eden Landing Ecological Reserve	Whales Tail	254	Estuarine	Restored	No
	Eden Landing Ecological Reserve	Cargill Mitigation Marsh	49.16	Estuarine	Restored	Yes
	Eden Landing Ecological Reserve	Eden Landing Ecological Reserve Restoration (Baumberg Tract)	835	Estuarine Depressional	Mixed	Yes
	Eden Landing Ecological Reserve	South Bay Salt Ponds Restoration Project	6,300	Estuarine Depressional	Mixed	No
	Eden Landing Ecological Reserve	Ponds E8A, E9, E8X	630	Estuarine	Restored (11/2011)	Yes (partial)

Information in this table is from the California Wetlands Portal at http://www.californiawetlands.net/tracker and the California Department of Fish and Game, Region 3 (Bay Delta).

References

California Wetlands Portal. www.californiawetlands.net/tracker

Eastshore State Park General Plan, Prepared for: California Department of Parks and Recreation, East Bay Regional Park District, California State Coastal Conservancy. December 6, 2002. www.parks.ca.gov/pages/21299/files/resource-summary-06-2001.pdf.

Goals Project. A report of habitat recommendations prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. Monroe, M, Olofson PR, Collins JN, Grossinger RM, Haltiner J, Wilcox C. 1999. (www.sfei.org/sites/default/files/sfbaygoals031799.pdf).

San Francisco Estuary Institute's Bay Area Aquatic Resource Inventory (BAARI). www.sfei.org/BAARI.

San Francisco Estuary Institute's EcoAtlas. www.sfei.org/ecoatlas.

Climate Information Summary Report. Chapter 4 (draft). Adapting to Rising Tides Risk and Vulnerability Assessment Pilot Project. November 2011.

South Bay Salt Pond Restoration Project. www.southbayrestoration.org/index.html.

Eastshore Park Project Resource Summary. June 2001. http://www.parks.ca.gov/pages/21299/files/resource-summary-06-2001.pdf

Middle Harbor Shoreline Park. www.portofoakland.com/communit/serv_midd.asp

Restoration of Robert W. Crown Memorial State Beach Mitigated Negative Declaration. November 2009. http://www.ebparks.org/files/ebrpd_crown_beach_restoration_mitigated_negative_declaration11-16-2009c.pdf

Triangle Marsh Restoration. USACE Management Measures Digital Library. www.iwr.usace.army.mil/docs/MMDL/ECO/NonCorpsCaseStudies.asp?ID=27

Martin Luther King Jr. Regional Shoreline. http://www.savesfbay.org/mlk-regional-shoreline

Adapting to Rising Tides Transportation Vulnerability and Risk Assessment Pilot Project Technical Report. November 2011.