EXECUTIVE SUMMARY

ES.1 INTRODUCTION

This Draft Integrated Feasibility Report (IFR) presents a summary of the ongoing planning process for the East San Pedro Bay (ESPB) Ecosystem Restoration Feasibility Study (Study). This IFR also fulfills both federal National Environmental Policy Act (NEPA) and state California Environmental Quality Act (CEQA) environmental documentation requirements as the combined Environmental Impact Statement (EIS) and Environmental Impact Report (EIR). The City of Long Beach, California (City) requested Federal partnership from the U.S. Army Corps of Engineers Los Angeles District (USACE or Corps) to address aquatic ecosystem restoration opportunities within ESPB.

The Study is being conducted and prepared as an interim response to Senate Committee on Public Works Resolution, approved 25 June 1969, reading in part:

> *"Resolved by the Committee on Public Works of the United States Senate, that the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby requested to review the report of the Chief of Engineers on the Los Angeles and San Gabriel Rivers and Ballona Creek, California, published as House Document Numbered 838, Seventy-sixth Congress, and other pertinent reports, with a view to determining whether any modifications contained herein are advisable at the present time, in the resources in the Los Angeles County Drainage Area."*

The Energy and Water Development and Related Agencies Appropriations Act for Fiscal Year 2010, Pub. L. 111-085, provided funds for the Long Beach Breakwater Reconnaissance Study, as specifically listed on the table on page 41 of Conference Report No. 111-278 to accompany H.R. 3183 dated September 30, 2009.

ES.2 STUDY AREA AND PROPOSED PROJECT AREA

The Study Area encompasses the entire San Pedro Bay, whereas the Proposed Project Area is focused on the eastern portion of San Pedro Bay, referred to as East San Pedro Bay. The Study area is part of a larger area known as the Southern California Bight (SCB), a coastal region from Point Conception west of Santa Barbara to the Mexico border. The Proposed Project Area is located offshore from the city of Long Beach, California. This 18 square mile area (11,465 acres) includes the Long Beach shoreline, the Los Angeles River estuary, the Middle Breakwater, the Long Beach Breakwater and Alamitos Bay Jetties.

ES.3 PROJECT PURPOSE AND NEED

The following **Study Problems** have been identified for this Study:

1. ***Loss of historic coastal wetlands and sensitive marine habitat areas with associated nursery, reproductive, and other ecological functions; and***
2. ***Reduced abundance and biodiversity of marine populations as a result of habitat loss.***

This Study's purpose addresses the Corps' aquatic ecosystem restoration mission with the stated goal to:

> ***Restore and improve aquatic ecosystem structure and function for increased habitat biodiversity and ecosystem value of the SBC within the Proposed Project Area of ESPB.***

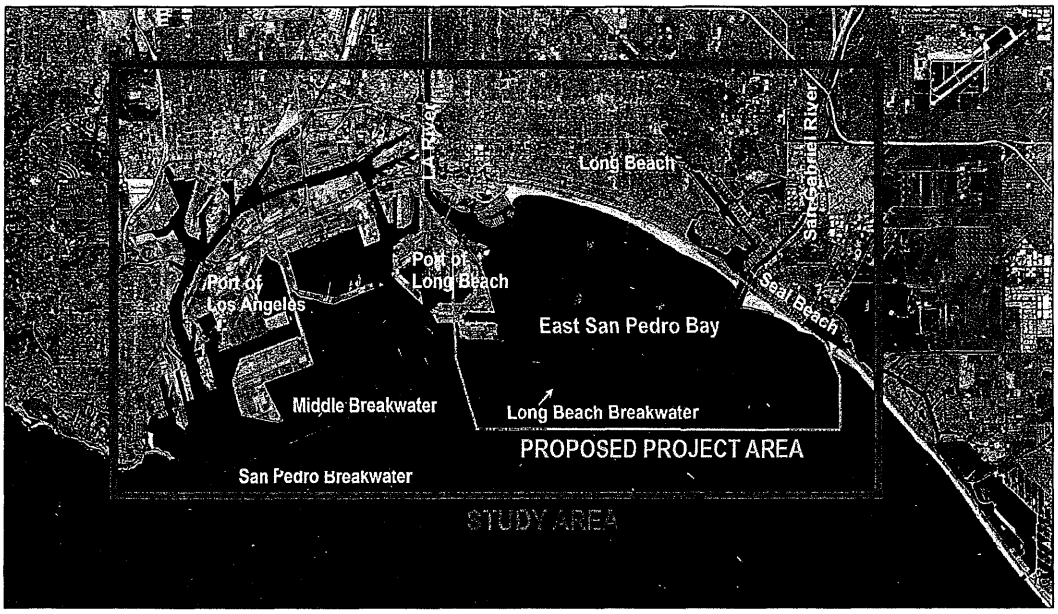

Figure ES-1: Study Area (San Pedro Bay)

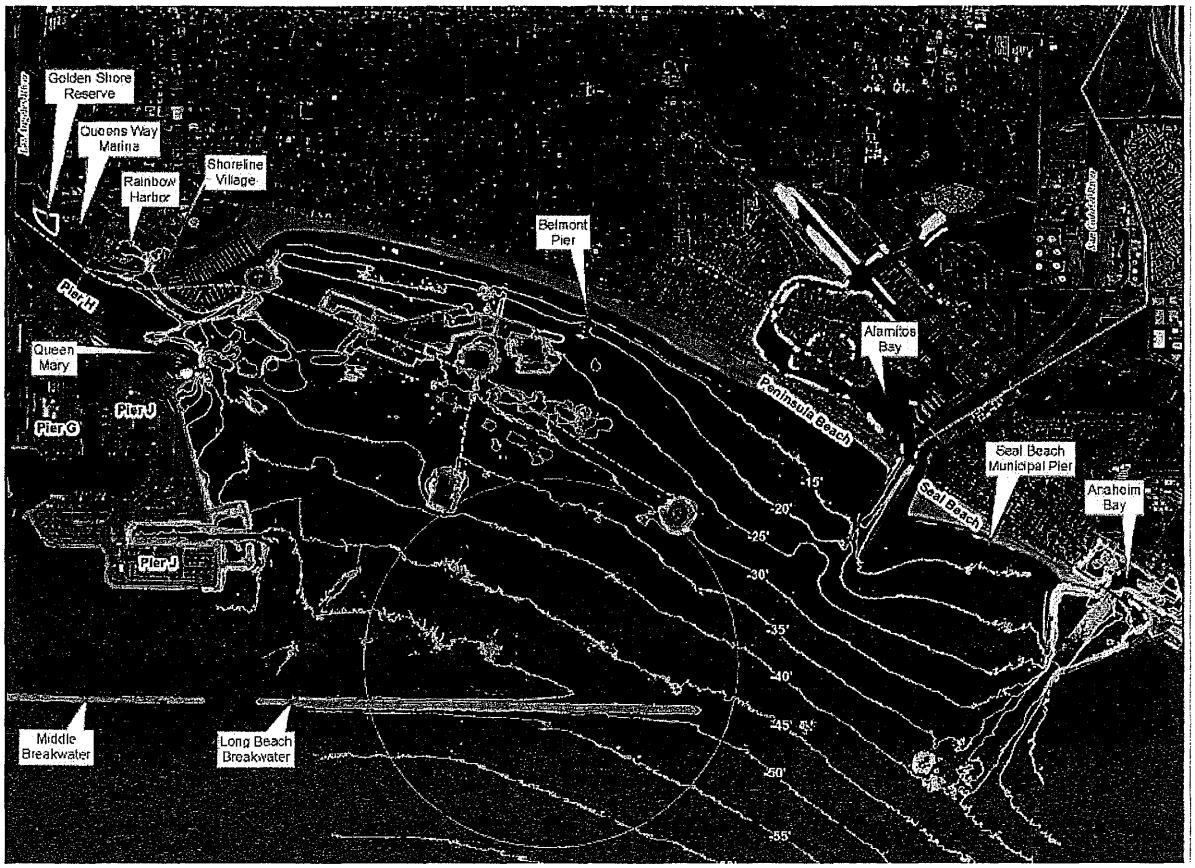

Figure ES-2: Proposed Project Area Map

The specific planning objective is to:

Restore and support the sustained functioning of imperiled aquatic habitats such as kelp, rocky reef, coastal wetlands, and other types historically present in San Pedro Bay of sufficient quality and quantity to support diverse resident and migratory species within ESPB during the period of analysis (50 years)

The specific sub-objectives related to the overall Study objective are as follows:

a. Increase the extent (total area) of complex aquatic habitats within the Proposed Project Area.
b. Increase the diversity and spatial heterogeneity of complex aquatic habitat types within the Proposed Project Area.
c. Increase the overall connectivity of complex aquatic habitat types within the Proposed Project Area by restoring habitat areas in a way to facilitate the movement of species between habitat nodes to support and enhance existing food webs.

The planning constraints and considerations for the Study include:

- Constraint 1: Avoid negative impacts to U.S. Navy's operations including activities in support of national security and other missions.
- Constraint 2: Do not significantly reduce operational capacity for the ports, THUMS oil extraction islands or other existing maritime operations.
- Constraint 3: Do not allow for infilling any of the energy island borrow pits located within the ESPB boundary.
- Consideration 1: Minimize impacts to known major utilities or navigation channels and anchorages.
- Consideration 2: Avoid increases in shoreline erosion, wave related damages, and coastal flooding to existing residences, public infrastructure, marinas, existing jetties, other structures, and recreational beaches.
- Consideration 3: Minimize impact to flood risk management operations on the Los Angeles River.
- Consideration 4: Minimize vulnerability of coastal areas to accelerating sea level rise.

ES.4 PLAN FORMULATION PROCESS

Through a robust stakeholder input process, 200+ measures were collected, compiled and screened to address identified problems and opportunities. Various habitat restoration measures and breakwater modifications were screened based on specific evaluation criteria from the Federal Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (1983) (P&G), including: effectiveness, efficiency and acceptability metrics. The following measures proceeded forward with technical analysis and within alternatives.

Habitat measures:

- Kelp Beds
- Rocky Reef (intertidal and open water zones)
- Eelgrass
- Coastal Wetland
- Oyster Reef
- Sandy Island

Breakwater modifications:

- Lower entire breakwater to -30' MLLW
- Remove eastern 1/3 down to -30' MLLW
- Remove western 1/3 down to -30' MLLW
- Two 1,000' notches in eastern side
- Two 1,000' notches in western side
- Single 1,000'notch in the western side
- Single 1,000' notch in the center

Technical modeling and analysis efforts supported the evaluation of the measures and alternatives including:

- Coastal and hydrodynamic modeling
- Habitat evaluation modeling
- Cost estimating
- Cost Effectiveness/Incremental Cost Analysis (cost-benefit)

Analysis results show that the breakwater modifications resulted in providing no habitat value for the types of habitat being proposed for restoration. However, because breakwater plans remain a high priority measure to the City, they were carried forward in the Preliminary Array of Alternatives. These six plans include the No Action Plan, and five action alternatives. All five action alternatives included habitat restoration measures in varying combination of scales and locations. The two breakwater plans include restoration features equivalent to Alternative 2.

<u>Preliminary Array of Alternatives</u>

- Alternative 1: No Action Plan
- Alternative 2: "Kelp Restoration Plan" -
- Alternative 4A: "Reef Restoration Plan" -
- Alternative 8: "Scarce Habitat Restoration Plan"
- Alternative BW1: "Breakwater Western Notching Plan"
- Alternative BW2: "Breakwater Eastern Removal Plan"

The six plans were evaluated based on completeness, effectiveness, efficiency, and acceptability metrics. The five action alternatives are complete and effective in addressing the planning objectives of ecosystem restoration. However, in terms of efficiency, the two breakwater plans were inefficient in terms of costs per acre of restoration. For example, the western notching alternative BW1 had an average annual cost/average annual habitat unit value of over 10 times Alternative 2. Overall, the breakwater plans had low acceptability due to significant navigational impacts and violation of constraints.

Navigational impacts from breakwater modifications were evaluated against the planning constraints. Stakeholders characterized impacts based on wave modeling results showing locations, increase in occurrence and height of wave impacts. Impacts to the U.S. Navy, port ship pilots, THUMS oil islands, Carnival Cruise Line, and other maritime stakeholders including recreational activities were evaluated. Due to impacts to national security, ports operations and safety, only the three restoration focused plans were carried forward in the Final Array of Alternatives.

ES.4.1 Final Array of Alternatives

Ecosystem restoration is one of the primary missions of the Corps' Civil Works program. All plans considered for implementation are required by Corps policy to be evaluated on how well they contribute to the national objective of National Ecosystem Restoration (NER). Contributions to NER, NER outputs, are increases in the net quantity and/or quality of desired ecosystem resources. The following plans were carried forward into the Final Array of Alternatives for full evaluation and comparison. All action alternatives include environmental commitments, as detailed in Chapter 4.

ALTERNATIVE 1: No Action Alternative

Under the No Action Alternative, existing kelp and hard bottom habitat within ESPB would likely continue to be limited to features associated with the breakwater and other artificial hard substrates. Eelgrass beds located along a narrow band of shallow water offshore of Cherry Beach would not likely increase significantly in acreage under the No Action Alternative, but may increase in density of the existing beds. Other existing habitats, such as native and non-native oysters, coastal saltmarsh, and soft bottom habitat would not substantially change. However, in light of the persistent threat from the effects of climate change, climate change-induced alteration to rainfall patterns, and sea level rise over time, is expected that the existing habitats within the project area will become increasingly vulnerable and less resilient to the effects of these stressors (e.g., exacerbated loss of existing habitat, decreased viability of existing increased chances of wetland/habitat type conversion, submergence of transitional habitats). Eelgrass beds located offshore of Cherry Beach could migrate shoreward with sea level change, offsetting the effects of increased water depths predicted for this area.

ALTERNATIVE 2 (Best Buy Plan 2): Kelp Restoration Plan

Alternative 2 is the least-cost best buy action plan and minimally meets the planning objectives. This plan introduces three habitat types including extensive kelp beds, nearshore rocky reef and eelgrass, creating a horseshoe shaped benefit area in the bay. Total restoration area covers 162 acres. The nearshore rocky reef and eelgrass are co-located and also referred to as shoals or shoal complexes. The most prevalent feature in Alternative 2 are kelp beds in the breakwater and open water zones. Kelp beds provides high habitat output at a relatively low cost. Construction methods and materials required for Alternative 2, which provide the basis for cost estimates and environmental impacts analysis are provided in Chapter 4. It is anticipated to take approximately 30 months to construct Alternative 2.

Alternative 2 Kelp Beds Siting and Design Considerations

121 acres of giant kelp beds are restored in the breakwater and open water zones. 60+ acres in twelve, roughly five acre patches would be placed at irregular intervals along the seaward side of the existing breakwater. The kelp beds would be placed along the breakwater, expanding existing kelp forests on the submerged breakwater rock. The undulating edge would break up the linear configuration of existing breakwater rock, creating an "edge effect." This change would increase ecological complexity and value of kelp habitat. Another 60+ acres of kelp habitat in twelves, roughly five acres patches would be restored in the open water, off of the eastern end of the breakwater. This location allows kelp to take advantage of beneficial and nutrient rich cold water currents that giant kelp need to thrive. A recreational boating passageway is shown with the split configuration, which is subject to change.

Each kelp reef will be roughly circular in shape, spanning approximately 500' in diameter, with approximately 20% total bottom coverage of substrate with only one layer of stone thickness.

Alternative 2 Nearshore Rocky Reef Siting and Design Considerations

Under Alternative 2, five nearshore rocky reef shoals totaling 16 acres would be placed in shallow ~15' MLLW waters. Multiple factors influence nearshore reef site selection. With the locations shown in Figure 4-13, the nearshore rocky reef take advantage of shallower depths, availability of light, and greater movement of water and nutrients. The purpose of these reefs, aside from directly providing intertidal zone rocky reef habitat benefits, is to reduce the velocity of the surrounding fluid in order to provide suitable eelgrass habitat conditions. The submerged structures will cause some of the incident waves to break, producing a re-distribution of sediments allowing for the calm shallow condition eelgrass needs to thrive. They also provide a localized level of protection to the shoreline from storm surges and erosive wave action. Reef locations were chosen in part based on the absence of existing eelgrass combined with factors noted previously.

All rocky reef habitats are composed of rock outcrops (e.g. granite, basalt or other metamorphic conglomerate) of varying relief or height and configuration of stone large enough so as not to be normally moved by waves and currents. Each reef footprint is conceptually designed as a rectangle with crest limits roughly 1,000' long by 175' wide, running parallel to the shoreline in about -20' MLLW depth of water. The reef by Belmont Pier is smaller.

Reef crest elevations, or submerged depths below MLLW elevation, will vary from -3 to -10 feet MLLW. The stone pile height (or reef relief) would be roughly 2' to 17' in vertical height above the seabed. This shallow intertidal zone reef receives more light than deeper giant kelp reef and allows for other kelp and algae species to thrive. This aquatic plant variety increases coastal biodiversity within the bay. The design for these submerged reefs involves constructing sufficient voids for provision of refuges for smaller juvenile and adult fish and invertebrates. This placement also provides the conditions needed (calm, shallow waters) for eelgrass establishment. The multifunctional reefs could reduce shoreline erosion rates and provide incidental coastal storm damage protection.

Alternative 2 Eelgrass Beds Siting and Design Considerations

25 acres of eelgrass habitat would be established at five locations in the nearshore zone, co-located with the nearshore rocky reefs described above. These beds would provide connectivity to existing eelgrass beds west of Belmont Pier, effectively doubling span of eelgrass habitat in the bay. The presence of the 16 acres of nearshore rocky shoals would provide the calm, shallow conditions eelgrass requires by stabilizing the bathymetry of the nearshore environment. Beach compatible sediment would also be placed leeward of the rocky shoal to optimize ideal conditions and depth for eelgrass growth. See Chapter 4 for construction details.

Alternative 2 Monitoring/Adaptive Management and Operations, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R) Considerations

Immediately following completion of construction, monitoring and adaptive management activities will take place for a period of 5-10 years, to ensure success of the ecosystem restoration project. See Appendix F: Monitoring and Adaptive Management Plan (MAMP) for more details. The City will be responsible for OMRR&R following completion of construction. Habitat specific MAMP and OMRR&R are identified below.

Under the MAMP, kelp reefs will be monitored quarterly through imagery to capture seasonal maximums as well as variability during the year that may be due to project activities, disturbances, and/or seasonal variation. A reference reef will also be imaged and measured during each monitoring period. No OMRR&R is expected for kelp beds. Under the MAMP, the nearshore rocky reef will be monitored to provide estimates of total coverage. As a monitoring option, biological communities and

reef production would be qualitatively monitored and underwater diver surveys of the kelp reef will be used to assess condition and inform corrective actions. For nearshore rocky reef, some OMRR&R is required to maintain the design condition. Under the MAMP, the eelgrass beds will be monitored annually during the peak growing period for eelgrass, which is typically March through October for southern California. A reference population of established eelgrass within the nearshore zone of the study area will also be imaged and measured during each monitoring period. Adaptive management results will indicate if more than one reference site in an alternative location will be needed. No OMRR&R for eelgrass beds is expected.

ALTERNATIVE 4A (Cost Effective Plan 4A): Reef Restoration Plan

Alternative 4A introduces a productive new habitat type of rocky reef placed along Island Chaffee (oil island). This open water placement augments existing rocky reef habitat at the oil island. The central location provides "stepping stones" between proposed shoals and kelp beds, augmenting habitat connectivity between zones. The resultant benefit area is larger than Alternative 2, roughly forming a triangular configuration, with over 200 acres in restoration features. Construction methods and materials required for Alternative 2, which provide the basis for cost estimates and environmental impacts analysis are provided in Chapter 4. It is anticipated to take approximately 37 months to construct Alternative 4A.

Alternative 4A Open Water Rocky Reef Siting and Design Considerations

Open water rocky reef, similar to nearshore rocky reef introduced in Alternative 2, provides high habitat value due to the ability to support of a wide variety of aquatic species, and have vertical as well as horizontal habitat benefits. Placing open water rocky reef patches near Island Chaffee augments existing rocky reef habitat on the existing oil island infrastructure. Co-locating two rocky reef patches adjacent to each other promotes synergies between the patches, augmenting habitat value. Soft-bottom spaces in between patches of rock add edge effect complexity, creating more biodiversity opportunities. The relatively short distances between reef patches increase exchanges and expands distribution of species, enhancing biodiversity.

Open water reefs are made up of individual rock groupings, roughly 100' in diameter, spaced apart within a circular area. This distribution will offer a variety of habitats for different species by providing alternating rocky reefs and sandy bottom in a concentrated area. The individual patches make up a single reef complex, covering about 15 acres. Each individual rock grouping varies in height between 3 feet to 12 feet above the seabed. This distribution will offer a variety of habitats for different species. Higher reefs will be placed furthest away from any marine navigation (commercial and recreational) as possible. The highest crest elevation will be set no more than -15 ft. MLLW. A medium stone weight of 10 tons will provide for sufficient stability.

Alternative 4A Remaining Features Siting and Design Considerations

Kelp Beds: Site selection and design considerations are the same as Alternative 2.

Nearshore Rocky Reef: Site selection and design considerations are the same as Alternative 2, plus one additional four-acre shoal (total of six), west of Belmont Pier. For the Recommended Plan prior to the release of the Final IFR, the team will also consider adjusted locations for this particular rocky reef shoal to reduce potential impacts to existing eelgrass beds west of Belmont Pier based on updated existing eelgrass information. An additional 40,000 tons of 1-6 ton armor and filter stone will be required as well as 14,000 tons of quarry run from the same sources as discussed in Alternative 2.

Eelgrass Beds: Site selection and design considerations are the same as Alternative 2, with the addition of a sixth eelgrass bed, made possible by the additional rocky reef shoal, totaling 30 acres of eelgrass restored. See note above for nearshore rocky reef placement.

Alternative 4A Monitoring/Adaptive Management and OMRR&R Considerations

Immediately following completion of construction, monitoring and adaptive management activities will take place for a period of 5-10 years, to ensure success of the ecosystem restoration project. See Appendix F: Monitoring and Adaptive Management Plan (MAMP) for more details. The City will be responsible for OMRR&R following completion of construction. Habitat specific MAMP and OMRR&R activities are outlined below.

Open Water Rocky Reefs: MAMP activities are the same as those described for the nearshore rocky reef in Alternative 2. No maintenance is projected to be required. Deeply submerged open water reefs will not experience any maintenance cost due to the large armor stone size required for sufficient large void spaces and stability.

Kelp Beds: MAMP and OMRR&R activities are the same as Alternative 2.

Nearshore Rocky Reef: MAMP and OMRR&R activities are the same as Alternative 2.

Eelgrass Beds: MAMP and OMRR&R activities are the same as Alternative 2.

ALTERNATIVE 8 (Best Buy Plan 8): Scarce Habitat Restoration Plan

Alternative 8 restores three scarce habitat types, a sandy island, coastal wetlands, and oyster beds, aquatic habitat types which have been largely lost or degraded within the SCB. These are in addition to kelp beds, open water rocky reef by Islands Chaffee and Freeman, intertidal zone rocky reef and eelgrass beds which places restoration features in all five opportunity zones. These distributed restoration measures effectively creates a benefit area that encompasses the entire project area. Restoration features cover 372 acres. Construction methods and materials required for Alternative 8, which provide the basis for cost estimates and environmental impacts analysis are provided in Chapter 4. Alternative 8 is anticipated to take approximately 53 months to complete construction of restoration features.

Alternative 8 Sandy Island Siting and Design Considerations

The proposed 24-acre sandy island provides much needed habitat for threatened and endangered shorebirds which are subject to disturbance from people and predators. Under Alternative 8, a 24-acre sandy island would be constructed in the nearshore zone. Relatively shallow waters <20' MLLW minimize construction material quantities and costs over locations out in deeper waters. The sandy island in this location off of Peninsula Beach may reduce shoreline erosion.

Alternative 8 Coastal Wetlands Siting and Design Considerations

Two coastal tidal salt marsh wetlands are added in Alternative 8, providing transitional habitat functions where freshwater Los Angeles River flows intermixes with saltwater from the bay. Adding 52 acres of this tidal salt marsh would greatly increase this rare habitat type in support of aquatic species, amphibians (land and water), shorebirds and other open water birds, and terrestrial species within the southern California bight.

The larger 42 acre wetland would be built along an inset of Pier J, between Carnival Cruise Lines and the Pier J entrance jetties. A stretch of the Pier J shoreline was chosen due to lack of boating facilities, and avoids a small dock to the south. The larger 42-acre wetland alongside Pier J would require engineering a structure to build out into the bay, not unlike the ports which were also built out into the bay. This engineered wetland would allow for water and some sediment exchange. The perimeter of the wetland

would be a stone foundation of quarry run material with pre-cast concrete segments filled with ballast (rock). The interior would be sand or silt (fill material) covered with clean sand to reach required elevation. Most likely a cofferdam dam would be needed. Caisson perforations would be included to absorb wave energy. Recreational fishing access would be possible with the addition of a concrete cap atop the caisson structure, along the perimeter of the wetland.

The smaller wetland is a 10-acre patch just inside the mouth of the Los Angeles River. A tentative location has been preliminarily identified between Queens Way Bridge and the Queen Mary along the southwest shoreline of the Los Angeles River surrounding Harry Bridges Memorial Park. Its proximity to the existing Golden Shores Reserve wetland would facilitate exchange of species and support nursery function. The construction would be similar to the larger Pier J wetland described above.

Alternative 8 Oyster Bed Siting and Design Considerations

Oyster beds along the Alamitos Bay jetties would be placed in areas between -4' and -1.5' MLLW. They would total less than one acre (0.03 acres) but would provide important filtration as well as habitat value. Locating oyster beds at the far end of the jetties limits potential for human access.

Alternative 8 Remaining Features Siting and Design Considerations

Open Water Rocky Reef: Site selection and design considerations are the same as Alternative 4A. In addition to the 29 acres in Alternative 4A, an additional five patches, each >14 acres in size, increase the total acreage of open water rocky reef by 63 acres for a total of 102 acres.

Kelp Beds: Site selection and design considerations are the same as Alternative 2 and Alternative 4A for a total of 121 acres.

Nearshore Rocky Reef: Site selection and design considerations are the same as Alternative 4A for a total of 20 acres.

Eelgrass Beds: Site selection and design considerations are the same as Alternative 4A. A new 22 acre eelgrass bed, created by the Sandy Island, results in a total of 52 acres of eelgrass beds in Alternative 8.

Alternative 8 Monitoring/Adaptive Management and OMRR&R Considerations

Immediately following completion of construction, monitoring and adaptive management activities will take place for a period of 5-10 years, to ensure success of the ecosystem restoration project. The City will be responsible for OMRR&R following completion of construction. See Appendix F: Monitoring and Adaptive Management Plan (MAMP) for more details. Habitat specific MAMP and OMRR&R activities are outlined below.

Sandy Island: Under the MAMP, the sandy islands will be monitored annually using true-color aerial imaging, to estimate total vegetation cover on the islands and identify potential problem areas (i.e., areas where vegetation impedes nesting bird mobility and needs to be removed). Biologists will conduct qualitative vegetation surveys annually outside the breeding season to identify plant species that are present on the island. This information will be used to determine if measures are required to control non-native and/or non-target vegetation. Qualitative observations of sand movement, displacement, and erosion will be made during vegetation surveys to inform adaptive management and specific corrective actions. Yearly maintenance will be required to clean and groom the sand along with weeding and grubbing to limit the vegetative cover and invasive species. The sand cap is expected to be lost over time through natural processes and replaced with clean white sand would at least every 5 years to maintain the required elevation and beach shape.

Coastal Wetlands: Under the MAMP, the coastal wetland areas will be monitored annually. Wetland tidal flushing will be affected by changes in size of the inlet. The cross-sectional area of the wetland inlet(s) will be calculated during each survey (during similar tidal heights) to monitor accretion/erosion. Mudflat and subtidal invertebrates will be surveyed annually by core tubes and/or grab samples. Abundance, density, and biomass in each area will be reported. Sediment grain size samples will be collected. Wetland vegetation complexes will be surveyed annually to assess vegetation cover, species diversity, and assess the overall quality of wetland habitat. High quality wetland habitat will be characterized by healthy vegetation that increases in cover each year, limited cover by non-native species, and presence of species that are appropriate to the target community. Bird species composition and abundance will be surveyed by biologists twice per year: once in winter and once in spring. Observations will be recorded every 30 minutes during each six-hour survey period, consistent with the survey methods at Golden Shore Marine Reserve (MBC 2003).

Maintenance would be required both for the tidal salt marsh interior and structural components. Maintenance of the hard structural components (caisson and foundation) will consist of repairing damages caused by large waves; such as replacing stone scoured out at the toe of the caisson or replacing individual caisson units that may have shifted during a storm event. Interior maintenance consists of monthly landscaping, cleaning and removal of unwanted species as well as replacement of the sediment lost from the system by tidal currents.

Oyster Beds: Under the MAMP, oyster reef area and height will be monitored annually by divers at the end of the growing season (late summer or early fall). Ambient water quality parameters will be monitored in the area of the oyster reefs by either data logging instruments or regularly scheduled surveys. No maintenance is expected to be performed on the oyster reefs.

Open Water Rocky Reef: MAMP and OMRR&R activities are the same as Alternative 4A.

Kelp Beds: MAMP and OMRR&R activities are the same as Alternative 4A.

Nearshore Rocky Reef: MAMP and OMRR&R activities are the same as Alternative 4A.

Eelgrass Beds: MAMP and OMRR&R activities are the same as Alternative 4A.

The table below describes how each plan meets the planning objectives.

Table ES-1: Comparison of Alternatives to Planning Objectives for Ecosystem Restoration

Objective / Sub-Objectives		Alternative 2	Alternative 4A	Alternative 8
Restore and support the sustained functioning of imperiled aquatic habitats such as kelp, rocky reef, coastal wetlands, and other types historically present in San Pedro Bay of sufficient quality and quantity to support diverse resident and migratory species within ESPB		Restores kelp beds, intertidal zone rocky reef, and eelgrass	Restores Alt 2 + open water zone rocky reef	Restores Alt 4A + two coastal wetlands, a sandy island, oyster beds, additional open water rocky reefs, and additional intertidal zone rocky reef and eelgrass
a.	*Increase the extent (total area) of complex aquatic habitats*	162 restored acres of 3 sensitive habitat types	201 restored acres of 3+ sensitive habitat types	372 restored acres of 6 sensitive habitat types
b.	*Increase the diversity and spatial heterogeneity of complex aquatic habitat types*	Adds kelp, intertidal rocky reef and eelgrass in new locations; 3 zones	Alt 2 plus open water rocky reef in new locations; 3+ zones	Alt 4A plus wetlands, sandy island and oysters in new locations; 5 zones
c.	*Increase the overall connectivity of complex aquatic habitat types by restoring habitat areas in a way to facilitate the movement of species between habitat nodes to support and enhance existing food webs.*	Open water kelp beds connect existing rocky reef/kelp beds at breakwater with new nearshore shoals; "U" shape benefit area	Alt 2 plus new open water rocky reefs provide "stepping stones" between breakwater and oil island rocky reef/kelp habitat with nearshore shoals; "Triangular" benefit area	Alt 4A plus 2 wetlands by LA River/ports and additional rocky reef by second oil island provides connectivity throughout ESPB; benefit area covers nearly all of project area

ES.4.2 Summary of Potential Environmental Impacts of the Final Array of Alternatives

Existing Conditions of the Affected Environment

This IFR provides a description of the existing environmental conditions in the Proposed Project Area for the following resource categories: Hydrology (Coastal and Shoreline Resources), Marine Geology and Geologic Hazards, Water Quality, Air Quality and Greenhouse Gases, Noise and Vibration, Biological Resources: Marine Habitats, Biological Resources: Special-Status Species, Significant Ecological Areas (SEAs), Biological Resources: Essential Fish Habitat, Biological Resources: Invasive Species, Cultural and Historical Resources, Aesthetics and Visual Resources, Ground and Vessel Traffic and Transportation, Land and Harbor Use, Socioeconomics, Recreation, Utilities & Public Services, and Public Health and Safety.

Environmental Impacts Evaluation of the Final Array of Alternatives

The table below summarizes the potential effects under each of the alternatives, including the No Action Alternative.

Table ES-2: Potential Effects under Each Alternative

Resource Category	Alternatives			
	No Action	2	4A	8
Hydrology (Coastal and Shoreline)	N	I	I	I
Marine Geology and Geologic Hazards	N	I	I	I
Water Quality	N	I	I	I
Air Quality	N	I	I	S
Noise	N	I	I	I
Biological Resources: Marine Habitats	N	I	I	I
Biological Resources: Special-Status Species	N	I	I	I
Biological Resources: Significant Ecological Areas	N	N	N	N
Biological Resources: Essential Fish Habitat	N	I	I	I
Biological Resources: Invasive Species	N	I	I	I
Cultural and Historic Resources	N	M	M	M
Aesthetic and Visual	N	I	I	I
Transportation	N	I	I	I
Land and Harbor Use	N	I	I	I
Socioeconomics	N	I	I	I
Recreation	N	I	I	I
Utilities and Public Services	N	I	I	I
Public Safety	N	I	I	I
S=Significant impacts I=Insignificant impacts (Less than Significant) M=Insignificant impacts with mitigation N=No impact - No Action Alternative is not evaluated for Significance				

Cumulative Impacts

NEPA requires that cumulative impacts be analyzed and disclosed. Cumulative impacts are impacts on the environment that would result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. (40 C.F.R. § 1508.7).

California guidelines for implementing the CEQA require a discussion of significant impacts resulting from incremental effects considered significant when viewed in combination with the effects of "past, present, and probable future projects", or in relation to "a summary of projections contained in an adopted general plan or related planning document" (Cal. Code. Regs, Title 14, § 1506(c) and § 15130(b)(1)(A)(B)).

Cumulative projects considered in this analysis included nearby ongoing or proposed dredge projects; capital improvement or development projects, and other reasonably foreseeable future actions. The results of this analysis concluded that there are no significant cumulative impacts that would occur as a result of implementing any of the action alternatives, except for cumulative impacts to air as a result of implementing Alternative 8.

Effects Found Not To Be Significant

Issues that were brought forward for the proposed East San Pedro Bay Ecosystem Restoration project for further analysis and included in this IFR included the following resource categories for which impacts were found to be less than significant: Hydrology (Coastal and Shoreline Resources), Marine Geology and Geologic Hazards, Water Quality, Greenhouse Gases, Noise and Vibration, Biological Resources: Marine Habitats, Biological Resources: Special-Status Species, Significant Ecological Areas (SEAs), Biological Resources: Essential Fish Habitat, Biological Resources: Invasive Species, Cultural and Historical Resources, Aesthetics and Visual Resources, Ground and Vessel Traffic and Transportation, Land and Harbor Use, Socioeconomics, Recreation, Utilities & Public Services, and Public Health and Safety. Cultural and historic resources impacts are less than significant for all action alternatives with the implementation of mitigation. The details of this analysis are found in Chapter 5.

Growth-Inducing Impacts

An important issue in California is whether a proposed action may directly or indirectly foster population growth and the consequent growth in demand for services and utilities, or may remove an obstacle that clears the path for the implementation of a separate development project. In this case, the proposed action is the restoration of offshore biological resources. The type or nature of the proposed action is such that population growth would not be an expected direct or indirect result. The proposed habitat restoration features under the action alternatives are not associated with a housing development project of any kind or with any project that would provide new services or utilities to facilitate the development of new housing. In addition, the proposed habitat restoration features are not actions that would be used as an offset or compensation measure for another proposed action. The proposed action would create new, short-term (temporary), construction employment, however, the levels of employment would be not statistically significant and as such would not result in an increase in the demand for housing or related services. For these reasons, the potential for growth inducement was considered, but eliminated from further detailed analysis.

Significant Unavoidable Adverse Effects

For air quality, significant and unavoidable impacts under NEPA for exceedance of the applicable General Conformity rate for NO_x, an ozone precursor would occur under Alternative 8 only. No significant impacts to air quality would occur under Alternatives 2 and 4A.

For all other resources, the action alternatives would result in less than significant impacts.

ES.4.3 Alternatives Comparison

The Final Array of Alternatives were compared against each other and evaluated first against the planning objectives, then against the P&G evaluation criteria of completeness, effectiveness, efficiency and acceptability. Additionally, the plans were evaluated using the four USACE comparison "accounts" including: (1) National Economic Development (NED); (2) Environmental Quality (EQ); (3) Regional Economic Development (RED); and (4) Other Social Effects (OSE). See Chapter 4 for more details on the comparisons. These criteria were considered along with the plans' environmental impacts summarized above, all provide information to the public in plan comparison and for identification of the TSP.

Completeness - The No Action plan is Incomplete compared to the action alternatives, with respect to the Study objectives. All three action alternatives are complete and planning objectives can be realized.

Effectiveness – The No Action alternative is Ineffective in that it does not support the Study sub-objectives of restoring habitat and increasing biodiversity. The three action alternatives strongly meet the planning objectives, as well as the national significance criteria described above. None of the

alternatives have significant impacts to resources except for significant and unavoidable adverse impacts to recreational fishing from coastal wetland in Alternative 8. Refer to Chapter 5, Table 5-1.

Efficiency - The No Action alternative lacks provision of benefits. Alternative 2 and 8 are Best Buy Plans, while Alternative 4A is a Cost Effective Plan. Due to Alternative 8's high cost and higher incremental average annual cost per average annual habitat unit (AAC/AAHU), an efficiency metric, than Alternatives 2 and 4A, it received a medium weight for efficiency, while the other two action alternatives received strong weights. The following table summarizes benefits and costs for the Final Array of Alternatives. Alternatives 2 and 4A have relatively lower first and operation, maintenance, repair, rehabilitation and restoration (OMRR&R) costs than Alternative 8. Alternative 8 has roughly twice the output as Alternative 4A, but at over four times the first cost. Alternative 2 is the most efficient of the Final Array Alternatives, as shown by its low AAC/AAHU. However, Alternative 4A has only a slightly higher AAC/AAHU while providing substantially greater output. Alternative 8, while providing a significant increase in output, is much less efficient than Alternatives 2 and 4A.

Table ES-3: Costs and Benefits

Item	No Action	ALT 2	ALT 4A	ALT 8
First Cost	$0	$83,587,000	$140,908,000	$560,681,000
OMRR&R	$0	$207,000	$251,000	$5,853,000
Average Annual Cost	$0	$3,407,000	$5,689,000	$27,892,000
AAHUs	0.0	125.4	160.9	307.3
AAC/AAHU	$0	$27,200	$35,400	$90,800
Zones with Restoration	0	3	3+	5
Restored Acres	0	162	201	372
First Cost/Restored Acre	$0	$516,000	$701,000	$1,507,000

Acceptability - Finally, all alternatives are acceptable with regards to applicable laws, regulations and public policies. To further gage acceptability, non-Federal sponsor, resource agencies and science community, maritime stakeholders, residents and recreational interests were solicited. Regarding Alternatives 2 and 4A, the City and resource agencies generally do not have concerns, other than refinements to design and locations of nearshore shoals and other features. Recreational boaters expressed concerns with increased kelp beds. Some residents and surfers desire increased wave activity at the beaches, which the alternatives do not provide. Other residents are pleased with placement of rocky reef/eelgrass shoals offshore, likely reducing coastal erosion. Some maritime and recreational stakeholders expressed concerns about the location of the large coastal wetland by Pier J. These concerns were taken into account as alternatives were formulated.

ES.4.4 National Ecosystem Restoration Plan / Tentatively Selected Plan

Alternative 4A is the National Ecosystem Restoration (NER) Plan, and is identified as the Tentatively Selected Plan (TSP) after evaluation of the three action alternatives based on Completeness, Effectiveness, Efficiency and Acceptability. The NER Plan reasonably maximizes ecosystem restoration benefits compared to costs. It is Complete in that it accounts for all necessary investments and actions to realize the planning objectives. It is Effective in that it directly restores over 200 acres of aquatic habitat and generates 161 AAHUs. It provides connectivity for productive habitats including open water rocky reef, intertidal zone rocky reef, eelgrass and open water kelp. The NER Plan provides habitat for key life stages of a diverse population of fish and other aquatic species, primarily by providing foraging, sheltering and critical nursery functions that support population health and growth. The NER Plan also

provides sustainable resilience and redundancy to withstand stressors and occasional habitat loss events.

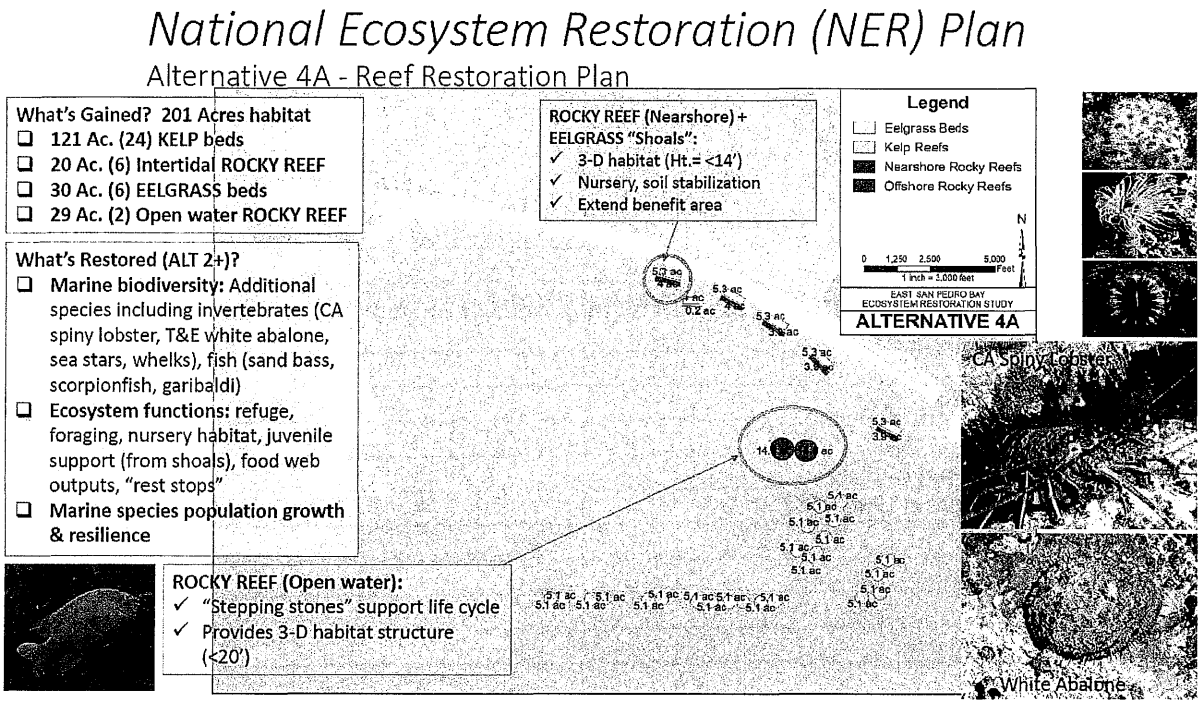

Figure ES-3: National Ecosystem Restoration (NER) Plan

The NER Plan is Efficient in that the incremental cost is considered "worth it" in terms of maximizing net ecosystem restoration benefits.

The following table provides a summary of project first costs, as well as average annual benefits and costs for the NER Plan. Investment Cost includes interest during construction, based upon a 37 month period of construction. Total annual costs include annualized investment costs plus annual OMRR&R costs, and are estimated at $5.689 million.

Table ES-4: Economic Table for the NER Plan and Project Costs and Benefits

Project First Cost (FY 2018 Price Levels)	
Total Project First Cost	**$140,908,000**
LERRD – Lands & Damages	$1,356,000
Construction	$85,303,000
Monitoring & Adaptive Management	$1,908,000
Planning Engineering & Design (PED)	$7,419,000
Construction Management	$3,210,000
Contingency (51%)	$41,712,000
Average Annual Costs & Benefits Summary (FY 2018 Price Levels, 2.75% Discount Rate)	
Interest during Construction	$5,895,000
Investment Cost	**$146,803,000**
Annualized Investment Cost	$5,438,000
OMRR&R	$251,000
Total Average Annual Cost (AAC)	**$5,689,000**
Average Annual Habitat Units (AAHU)	160.9
AAC/AAHU	$35,400
Zones with Restoration	3
Restored Acres	200.7
First Cost/Restored Acre	$702,100

Finally the NER Plan is Acceptable with regards to applicable laws, regulations and public policies. The non-Federal sponsor supports the NER plan. Resource agencies and the science community generally support the restoration measures, with anticipated refinements to the conceptual design and locations of features for the Final IFR. Large vessel maritime stakeholders, including the Navy, would not be impacted by the restoration features in the NER Plan, and therefore are expected to support the NER Plan. Small boats and some nearshore recreational activities may experience some impacts which will be addressed in more detail during the pre-construction engineering and design (PED) phase. Residents and recreational stakeholders vary in their support for a plan without and with breakwater modifications. It is anticipated Peninsula Beach residents may support placement of rocky reef/eelgrass shoals offshore, likely reducing coastal erosion.

As the non-Federal sponsor for the study, the City is responsible for project implementation in partnership with the Corps. The total project first cost is just under $141 million, which would be cost-shared between the federal government (65%) and City (35%). The federal costs are estimated at approximately $91,590,200, with non-federal costs estimated at approximately $49,317,800. Project first costs include the pre-construction planning, engineering and design costs, construction costs of restoration features, LERRD values, and contingencies. The cost sharing requirements for the TSP are provided in Chapter 6.

ES.4.5 Summary of Tentatively Selected Plan

The key features of the TSP are 200.7 acres of restoration of kelp beds, rocky reef and eelgrass habitat within ESPB. These restored habitats will bolster the bay's ability to support marine biodiversity populations beyond its current productivity. This is accomplished through identifying the optimal placement locations and restoration designs based on engineering and scientific studies. Restored habitat will provide increased nursery, protective shelter, foraging and food production functions. Placement of rocky reef and kelp beds provide "stepping stones" between existing and restored habitat patches, boosting the life cycle capabilities of these habitats. The total first cost (including real estate, monitoring and adaptive management, PED, construction management and contingency) is estimated to be $140,908,000. This IFR details the planning process and technical analysis for the TSP.

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