APPENDIX F

Marine Biological Resources Technical Report

Marine Biological Resources Technical Report for the Buena Vista Lagoon Enhancement Project

FINAL

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1.0 INTRODUCTION

1.1 TECHNICAL APPROACH

This report specifically addresses shoreline and nearshore marine biological resources to a depth of approximately 100 ft between Oceanside Harbor and Agua Hedionda Lagoon. Biological resources within Buena Vista Lagoon are discussed and analyzed in a separate document. Given the similarity with recently completed projects such as RBSP II, existing conditions for RBSP II, updated where appropriate to reflect post-RBSP II conditions were utilized. Note that existing conditions information pre-RBSP II would still be considered valid given the general species assemblages that occur within the littoral system (U.S. Navy 1995, 1997a, and 1997b), and that despite the dynamic nature of the environment, the existing conditions information provided in this report is anticipated to be representative of the beach and nearshore habitat by the time sand is placed as part of the BVLEP.

The impact assessment includes evaluation of the potential for direct and indirect impacts to water and biological resources. The direct impact assessment considers impacts associated with dredging, disposal, anchoring, pipeline placement, placement of sand at receiver and nearshore receiver sites, and movement of vessels, vehicles, and equipment to these locations. The indirect impact assessment considers potential effects of turbidity during dredging and sand placement, potential for bacterial or contaminant release to waters during dredging, potential for accidental discharges, noise and other construction-related activity disturbance, and potential effects of sedimentation of nearshore hard-bottom areas associated with natural transport of sands due to wave action and currents. The sand is to be placed at two beach disposal sites at Oceanside and North Carlsbad Beaches, while the marginally suitable sediment is to be placed at the Oceanside nearshore location. These beach and nearshore locations have been permitted and used for this type of disposal numerous times in the past, with extensive physical monitoring. Data and conclusions from these previous projects were used to estimate both short-term and long-term shoreline and profile changes resulting from the Project alternatives (Everest 2014). The significance of impacts was evaluated according to estimated duration of impact (short-term or long-term), sensitivity of the affected habitat or resources, and potential relative change from existing conditions after project implementation.

1.2 PROJECT LOCATION AND LAGOON RESTORATION OVERVIEW

Buena Vista Lagoon is located in northern San Diego County and spans the boundaries of the cities of Carlsbad and Oceanside. The lagoon encompasses approximately 220 acres and is located within the Buena Vista Lagoon Ecological Reserve (Reserve) managed by the California Department of Fish and Wildlife (CDFW). The lagoon is fed by Buena Vista Creek and drains approximately 20 square miles of the Buena Vista Watershed into the Pacific Ocean. Figure 1-1 shows the location of the project site in a regional context, and Figure 1-2 shows the local project vicinity.

The lagoon is surrounded by urban development and traversed by a number of transportation corridors, all of which have contributed to a continual degradation of the lagoon over time. The Buena Vista Lagoon Enhancement Project (BVLEP) would enhance the lagoon to improve both its ecological and recreational values through implementation of one of a range of alternatives. The overall purpose of the proposed project is to enhance the biological and hydrological functions of the Buena Vista Lagoon to address increased sedimentation and invasive vegetation encroachment, as well as resulting declining coastal biodiversity, degrading water quality, water circulation restriction, and increased vector concerns. Accordingly, the primary objectives of the proposed project include the following:

- Enhance and maintain sensitive habitats and native species, including rare and endangered species, to promote coastal biodiversity within the region.
- Promote a system of native wetland and terrestrial vegetation communities that can be sustained given the opportunities and constraints of the Lagoon and anticipated sea level rise.
- Create conditions that curtail the growth and expansion of cattails, bulrushes, and invasive species.
- Protect, improve, and maintain water quality (e.g., reduce eutrophication) to meet water quality standards and address the 303(d) listed water quality impairments.
- Reduce vector concerns (e.g., potential for mosquito-borne disease) by minimizing potential mosquito breeding habitat.
- Maintain or reduce current flood risk to existing infrastructure and adjacent development.
- Maintain or enhance public access to the lagoon and recreation opportunities that are consistent with resource protection.
- Minimize cost of construction and maintenance.

Specific alternatives being evaluated are discussed in more detail in the following sections.

1.3 PROJECT ALTERNATIVES

The proposed project would address the continued degradation of the Buena Vista Lagoon through enhancement of its biological and hydrological functions. The analysis within this document and associated stakeholder/public input obtained through the environmental review process will drive selection of the preferred alternative. All alternatives identified in this document are analyzed at an equal level of detail to facilitate identification of the preferred alternative and the ultimate selection of an alternative for implementation. The alternatives carried forward for detailed analysis in this report include:

- Freshwater Alternative
- Saltwater Alternative
- Hybrid Alternative – Option A
- Hybrid Alternative – Option B

The proposed project also involves several design elements/considerations common to multiple built alternatives analyzed within this report, such as infrastructure improvements, that would be implemented as part of the enhancement project or by others. Those common project components include the boardwalk, proposed I-5 bridge replacement (implemented by Caltrans), and proposed North County Transit District (NCTD) Los Angeles-San Diego-San Luis Obispo (LOSSAN) Improvements (implemented by SANDAG), which would be implemented regardless of the enhancement alternative.

This report focuses on the potential effects of the project on the marine environment, particularly resulting from inlet creation (and subsequent ebb bar development) and/or materials placement in the littoral zone (e.g. on area beaches or in the nearshore). Therefore details of the alternatives below).

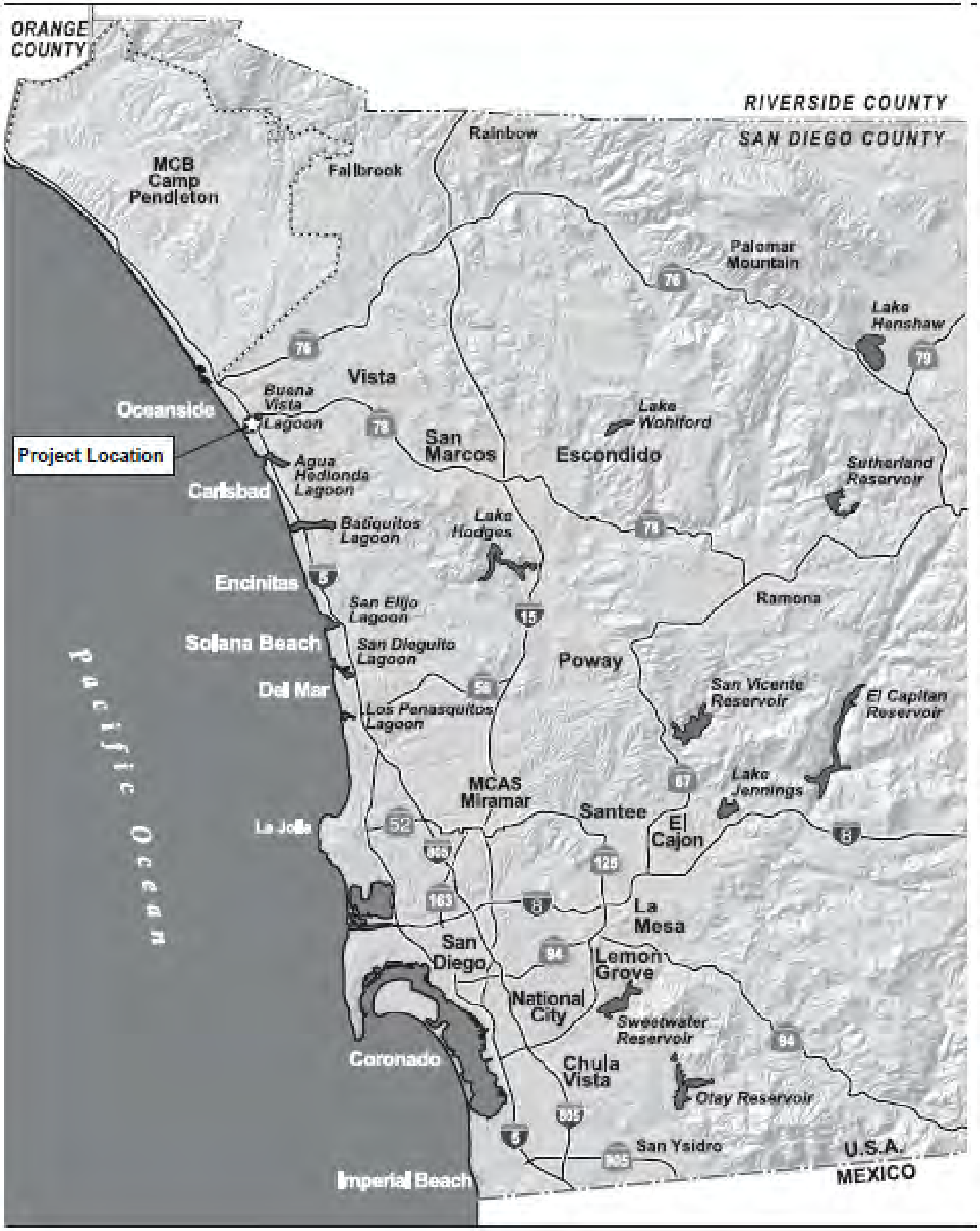
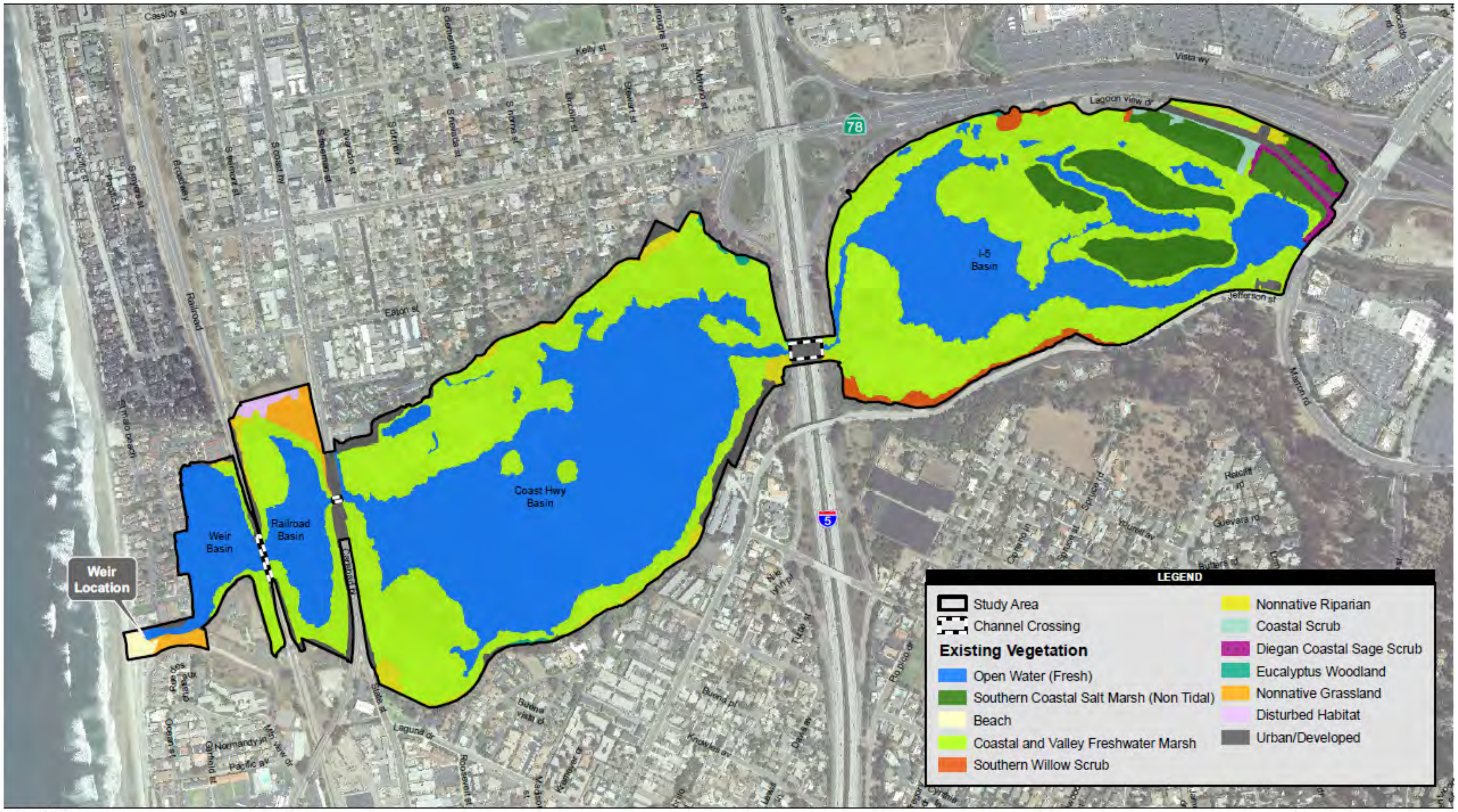


Figure 1-1. Regional Map.



Source: ; AECOM; Everest 2013

Figure 1-2. Project Location and Existing Habitat Distribution Map.

focus on inlet characteristics and sediment disposal needs associated with the alternatives only. Biological impacts associated with the lagoon enhancement itself are addressed in a separate Biological Technical Report for the Buena Vista Lagoon Enhancement Project (AECOM 2014

1.3.1 Alternatives Characteristics

Three alternatives have been identified for analysis for the BVLEP. They represent a range of alternatives based on water regime within the lagoon, and include the Freshwater, Saltwater, and Hybrid alternatives. This section provides a comparative look at the different components of each alternative using the baseline of existing conditions. Table 1-1 provides a summary of the habitat distribution under existing conditions and for the proposed enhancement alternatives. Table 1-2 provides a summary of existing hydraulic connections (i.e., infrastructure dimensions) and those proposed for each of the enhancement alternatives. Table 1-3 provides a summary of the materials removal and periodic maintenance requirements for each of the proposed enhancement alternatives. These tables summarize the alternatives proposed as part of the BVLEP. This report focuses on the inlet characteristics and materials removal (with respect to littoral zone sediment nourishment) for the different alternatives. More detail regarding the specific marine resource issues associated with each alternative is included below.

1.4 Freshwater Alternative

Under the Freshwater Alternative, the hydrologic regime of the lagoon would remain a freshwater system influenced primarily by freshwater entering the lagoon from the upstream watershed in the eastern portion of the system and along the boundary of the lagoon. No ocean inlet would be created under this alternative, so no effects to marine resources would be anticipated due to ebb bar development.

Under this alternative, portions of the lagoon would be dredged to provide water depths that would preclude cattail growth and expansion. Depending on the characteristics of the dredged material it would either be used beneficially as a source of beach material or disposed of as waste onsite or offsite.

Approximately 562,000 cy of sediment would be removed from the lagoon with 21,000 cy, 62,500 cy, 290,500 cy, and 188,000 cy of sediment removed from the Weir Basin, Railroad Basin, Coast Highway Basin and I-5 Basin, respectively. This is the net volume of sediment that would need to be removed in order to achieve the proposed habitat distribution shown in Figure 1-3. The final grade elevations are based on the 4-foot minimum water depth needed to preclude the growth of cattails.

Table 1-1. Existing and Proposed Habitat Distribution (Acreages).

Habitat Type	Existing Condition	Freshwater Alternative	Saltwater Alternative	Hybrid Alternative (Options A&B)
Alkali Marsh	--	9.2	--	--
Beach	0.6	1.3	0.8	0.8/0.8
Coastal and Valley Freshwater Marsh	96.2	24.7	--	--
Coastal Scrub	0.6	0.6	0.5	0.7/0.7
Deep Open Water	--	4.5	4.0	5.0/5.0
Diegan Coastal Sage Scrub	<0.1	0.6	0.8	2.1/2.1
Diegan Coastal Sage Scrub: Baccharis-Dominated	1.3	1.6	1.3	--
Disturbed Habitat	0.7	--	--	--
Eucalyptus Woodland	0.5	--	--	--
Mudflat	--	--	20.0	4.7/4.9
Nonnative Grassland	2.4	--	--	--
Nonnative Riparian	4.2	--	--	--
Open Water	106.8	134.4	51.0	67.1/66.2
Proposed Cattail Maintenance Area	--	32.9	--	--
Riparian Enhancement	--	4.5	6.56	4.6/4.6
Southern Coastal Salt Marsh (Non Tidal)	14.8	14.8	23.2	14.7/14.7
Southern Coastal Salt Marsh High	--	--	55.0	26.5/26.5
Southern Coastal Salt Marsh Low	--	--	33.2	6.3/6.5
Southern Coastal Salt Marsh Mid	--	--	35.4	20.3/20.6
Southern Willow Scrub	2.2	2.2	--	--
Transitional	--	<0.1	--	--
Urban/Developed	7.5	6.4	6.0	7.2/7.2

Table 1-2. Hydraulic Connection Summary.

Infrastructure	Hydraulic Connection			
	I-5 Bridge	Carlsbad Boulevard Bridge	Railroad Bridge	Weir/Inlet
Existing Conditions				
Weir Top Width (feet)	N/A	N/A	N/A	50 weir
Weir Invert Elevation (feet, NGVD)	N/A	N/A	N/A	+5.6
Channel Bottom Width (feet)	36	29	200	N/A
Channel Invert Elevation (feet, NGVD)	+2.0	-3.0	+3.0	N/A
Channel Side Slope (horizontal/vertical)	1.5/1	Vertical	4.5/1 (N Side) 18/1 (S Side)	N/A
Freshwater Alternative				
Weir Top Width (feet)	N/A	N/A	N/A	80 weir
Weir Invert Elevation (feet, NGVD)	N/A	N/A	N/A	+5.6
Channel Bottom Width (feet)	36	29	90	N/A
Channel Invert Elevation (feet, NGVD)	+2.0	-3.0	-2.5	N/A
Channel Side Slope (horizontal/vertical)	1.5/1	Vertical	8.5/1 (N Side) 11.5/1 (S Side)	N/A
Saltwater Alternative				
Channel Bottom Width (feet)	160	110	90	100 inlet
Channel Invert Elevation (feet, NGVD)	-2.5	-2.5	-2.5	-2.0
Channel Side Slope (horizontal/vertical)	2/1	Vertical	8.5/1 (N Side) 11.5/1 (S Side)	N/A
Hybrid Alternative				
Channel Bottom Width (feet)	36	110	90	100 inlet
Channel/Spillway Invert Elevation (feet, NGVD)	+5.6	-2.5	-2.5	-2.0
Channel Side Slope (horizontal/vertical)	1.5/1 (Existing)	Vertical	8.5/1 (N Side) 11.5/1 (S Side)	N/A

Table 1-3. Materials Removal and Maintenance Requirements.

	Freshwater Alternative		Saltwater Alternative		Hybrid Alternative	
	Vegetation	**Sediment**	**Vegetation**	**Sediment**	**Vegetation**	**Sediment**
Initial Volume Removed During Construction (cy)	129,000	562,000	211,000	781,000	148,500	833,000
I-5 Basin	29,500	188,000	92,000	320,500	29,500	188,000
Coast Highway Basin	89,500	290,500	103,500	293,000	103,500	488,000
Railroad Basin	9,500	62,500	14,000	101,000	14,000	95,000
Weir Basin	500	21,000	1,500	67,000	1,500	62,000
Estimated Volume Required for Removal during Maintenance and Location of Maintenance	NA[1]	NA[1]	TBP	27,000 Inlet/Weir Basin/Railroad Basin	TBP	27,000 Option A: Inlet/Railroad Basin/Coast Highway Basin Option B: Inlet/Weir Basin/Railroad Basin
Inlet Maintenance Frequency	NA	NA	TBP	Inlet/Weir Basin/Railroad Basin every 12-18 months	TBP	Option A: Inlet/Railroad Basin every 12-18 months. Coast Highway Basin every 5-10 years Option B: Inlet/Weir Basin/Railroad Basin every 12-18 months.
Construction Approach/Material Disposal	NA	NA	TBP	Backhoes, front loaders, scrapers, and dump trucks with disposal at North Carlsbad Beach south of inlet	TBP	Option A: Backhoes, front loaders, scrapers, and dump trucks with disposal at North Carlsbad Beach south of inlet. Dredge pipeline, bulldozers, scrapers with disposal at North Carlsbad south of inlet Option B: Backhoes, front loaders, scrapers, and dump trucks with disposal at North Carlsbad Beach south of inlet

[1] Sedimentation in the lagoon is anticipated under the freshwater alternative to occur due to fluvial flows and accumulate across the lagoon since the inlet would continue to be closed by a weir. Rates of sediment accumulation are assumed to be lower than historic rates due to the rapid urbanization of the watershed, which is at least 80% developed, leading to a decrease in sediment contained in runoff.

1.5 SALTWATER ALTERNATIVE

Under the Saltwater Alternative, the hydrologic regime of the lagoon would be changed from the existing freshwater system to a saltwater system influenced primarily by salt water entering the lagoon from an open tidal inlet during flood tides, as well as freshwater entering the lagoon from upstream and along the boundary of the lagoon. Water exiting the lagoon under the Saltwater Alternative would primarily occur during ebb tides (outgoing tides), with evapotranspiration and seepage providing additional output.

Under this alternative the existing 50-foot weir at the ocean outlet would be removed and replaced with an open tidal inlet to provide tidal exchange while improving flood performance. The tidal inlet would have a maximum width of 100 feet at an elevation of +4.0 feet, NGVD and an initial bottom (invert) elevation at -2.0 feet, NGVD. The inlet would be confined on the northern side by the existing stone revetment running along the San Malo complex, although improvements may be required depending on the integrity of the existing revetment. On the southern side, the inlet would be confined by the construction of a channel guide running from inside the Weir Basin seaward to the shoreline position established by the San Malo revetment to the north. Although still in the design phase, it is anticipated that the structural toe (bottom) of the channel guide would be between -5 feet, NGVD to -10 feet, NGVD and the crest (top) would extend no higher than +6.0 feet, NGVD. The channel guide would likely be constructed of stone.

Approximately 781,000 cy of sediment would be removed from the lagoon with 67,000 cy, 101,000 cy, 293,000 cy, and 320,500 cy of sediment removed from the Weir Basin, Railroad Basin, Coast Highway Basin, and I-5 Basin, respectively. This is the net volume of sediment that would need to be removed in order to achieve the proposed habitat distribution for the Saltwater Alternative, as shown in Figure 1-4. The final grade elevations are based on the inundation frequency range associated with each coastal salt marsh habitat type. Depending on the characteristics of the dredged material, it would either be used beneficially as a source of beach or nearshore material, or disposed of as waste either onsite or offsite.

1.6 HYBRID ALTERNATIVE

Under the Hybrid Alternative, the hydrologic regime of the lagoon would be changed from the existing freshwater system to a hybrid system influenced by both saltwater and freshwater, with a saltwater system created west of I-5 and a freshwater system maintained east of I-5. The hydrologic system west of I-5 would be influenced primarily by saltwater entering the system from an open tidal inlet during flood tides, as well as fresh water entering the lagoon just downstream from I-5 and along the boundary of the lagoon. Under the Hybrid Alternative, water would exit the lagoon primarily during ebb tides with evapotranspiration and seepage providing additional output. The hydrologic system east of I-5 would be controlled primarily by freshwater entering the system from upstream and along the boundary of the lagoon, and outputs via evapotranspiration and seepage, or overflow at the weir to be located under I-5.

There are two options under the Hybrid Alternative (Options A and B) differentiated by work within the Weir Basin and the future maintenance requirement. Under Hybrid Alternative, Option A, a channel would be constructed to connect the tidal inlet from the ocean area through the Weir Basin and into the Railroad Basin (Figure 1-5). Hybrid Alternative, Option B would achieve tidal exchange in the same manner as the Saltwater Alternative with an open tidal inlet connecting the ocean to the

Weir Basin (Figure 1-6). The channel constructed under Hybrid Alternative, Option A would result in a perched water level within the Weir Basin that would have a substantially muted tide range compared to Hybrid Alternative, Option B. A more consistent water level within the majority of the Weir Basin would result from construction of the channel guide. In addition, this feature would allow littoral sediment (sand) to bypass the Weir Basin and enter the Railroad Basin where some of it would settle to the bottom and some of it would continue into the Coast Highway Basin, settling to the bottom of that basin. This change in sedimentation associated with the littoral sediment would result in a maintenance regime different than the Saltwater Alternative and Hybrid Alternative, Option B.

Similar to the Saltwater Alternative, the existing 50-foot weir at the ocean outlet would be removed under this alternative and replaced with an open tidal inlet to provide tidal exchange to the portion of lagoon west of I-5 while also improving flood performance. The tidal inlet would have a maximum width of 100 feet at an elevation of +4.0 feet, NGVD and an initial bottom (invert) elevation at -2.0 feet, NGVD. The inlet would be confined on the northern side by the existing stone revetment running along the San Malo complex, although improvements may be required depending on the integrity of the existing revetment. On the southern side, the inlet would be confined by the construction of a channel guide running from inside the Weir Basin seaward to the shoreline position established by the San Malo revetment to the north. Although still in the design phase, it is anticipated that the structural toe (bottom) of the channel guide would be between -5 feet, NGVD to -10 feet, NGVD and the crest (top) would extend no higher than +6.0 feet, NGVD. The channel guide would likely be constructed of stone.

Approximately 833,000 cy of sediment would be removed from the lagoon with 62,000 cy, 95,000 cy, 488,000 cy, and 188,000 cy of sediment removed from the Weir Basin, Railroad Basin, Coast Highway Basin and I-5 Basin, respectively. This is the net volume of sediment that would need to be removed in order to achieve the proposed habitat distribution for the Hybrid Alternative. The final grade elevations are based on the inundation frequency range associated with each coastal salt marsh habitat type.

Depending on the characteristics of the dredged material, it would either be used beneficially as a source of beach or nearshore material or disposed of as waste either onsite or offsite.

1.7 NO PROJECT ALTERNATIVE

Under the No Project Alternative, the proposed enhancement of the lagoon would not be completed at the project site. The existing weir would remain in place. No removal of sediment or vegetation would occur, and no placement of materials in the littoral zone would result. No maintenance regime would be implemented to enhance the biological and hydrological functions of the lagoon.

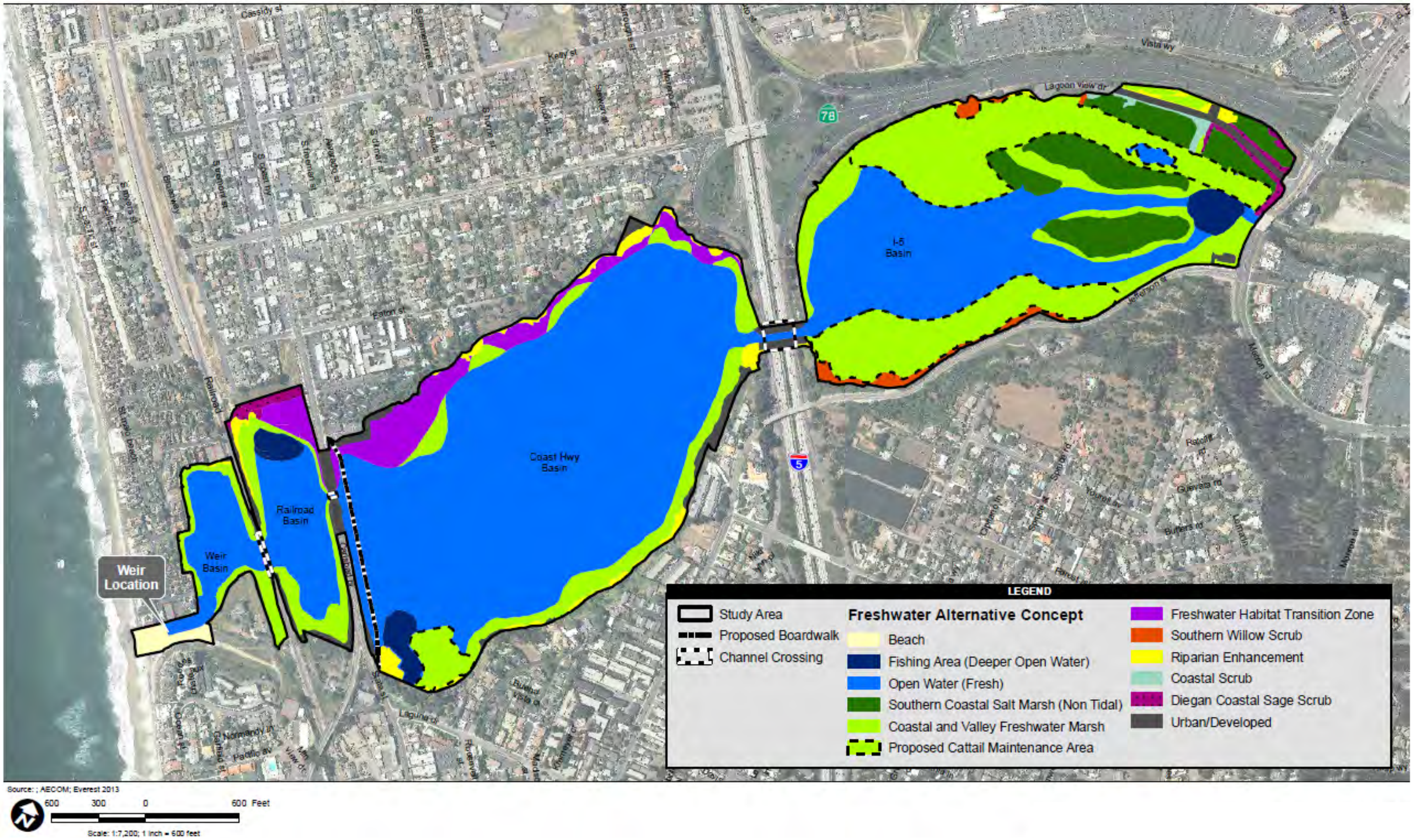


Figure 1-3. Proposed Freshwater Alternative Habitat Distribution.

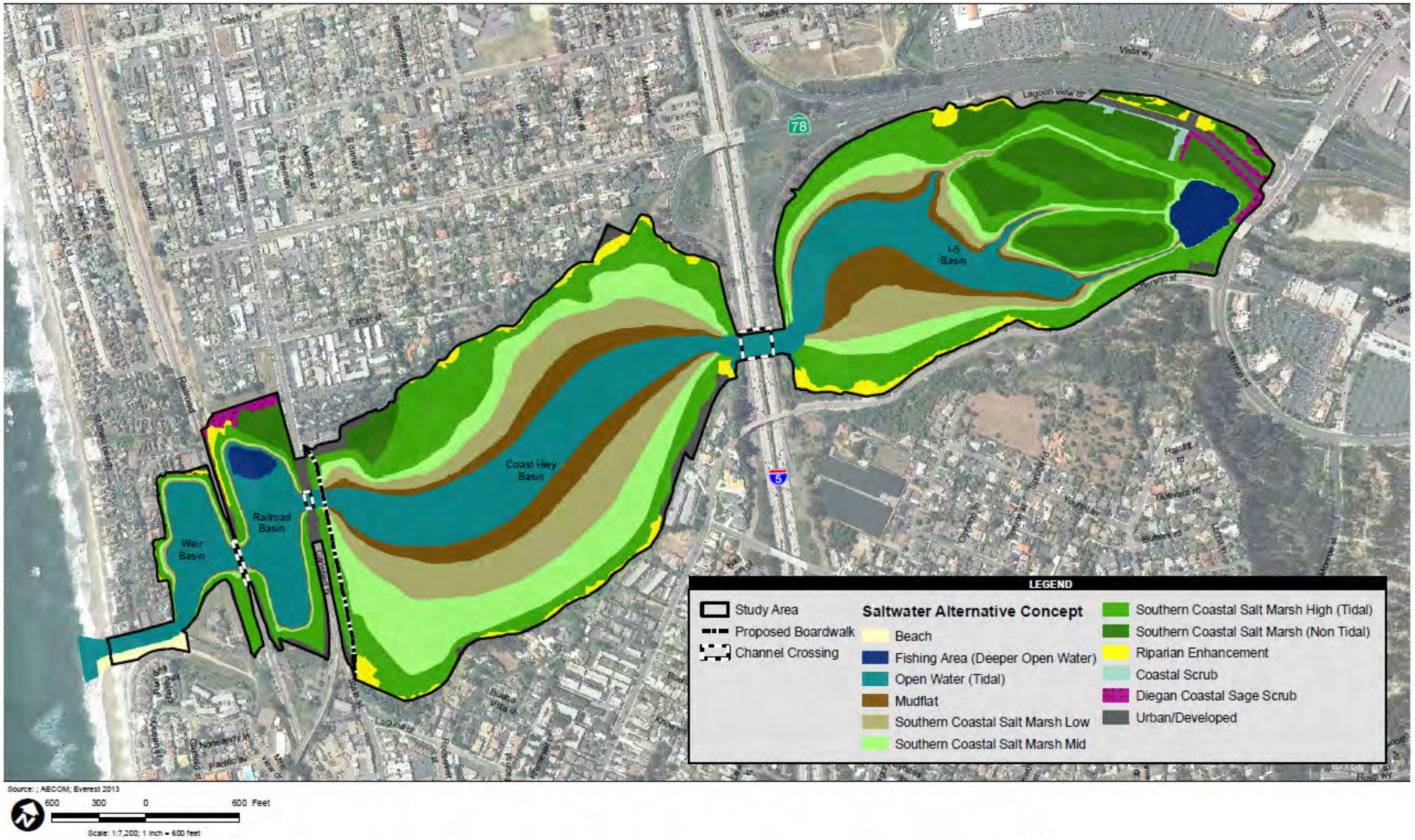


Figure 1-4. Proposed Saltwater Alternative Habitat Distribution.

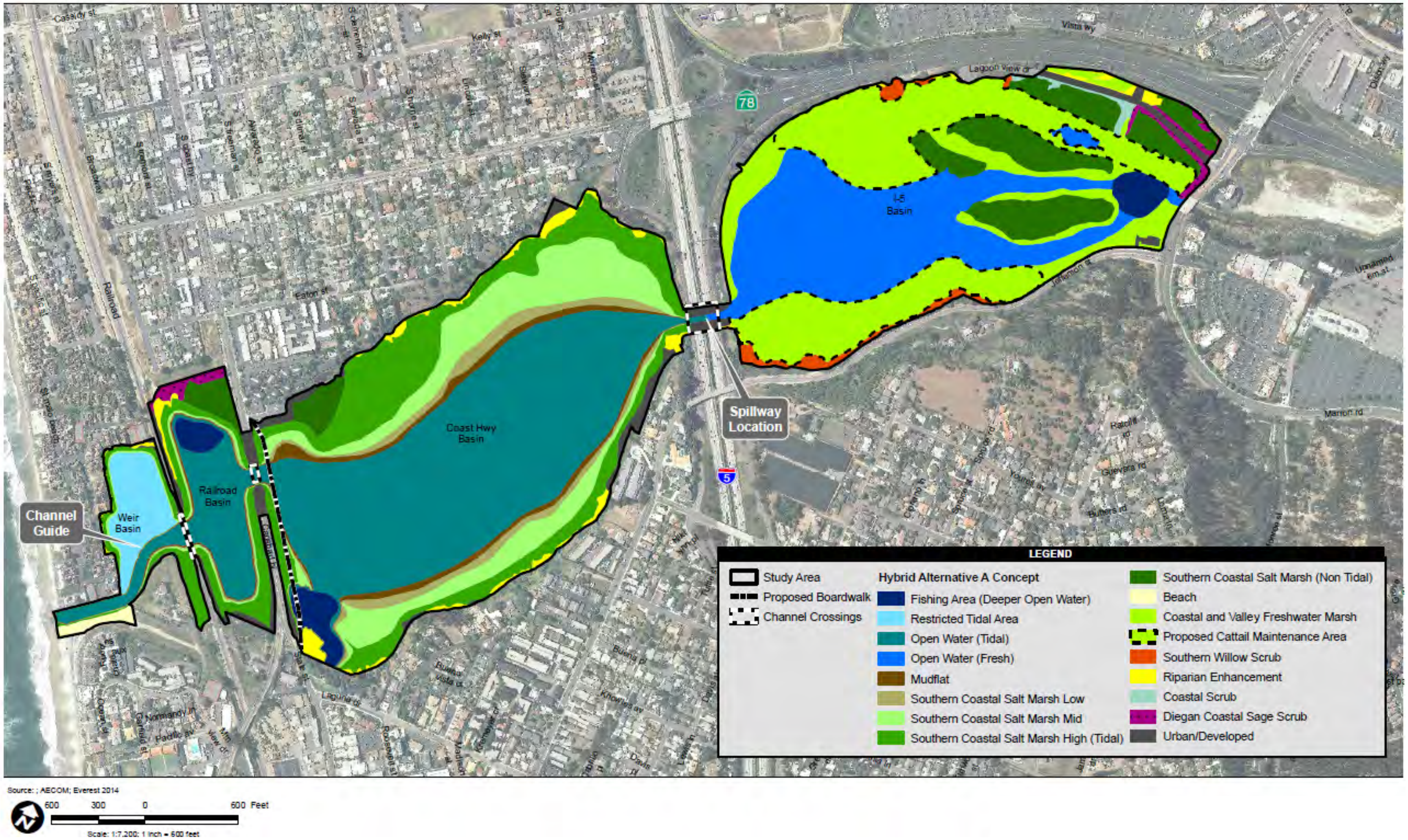


Figure 1-5. Proposed Hybrid Alternative Option A Habitat Distribution.

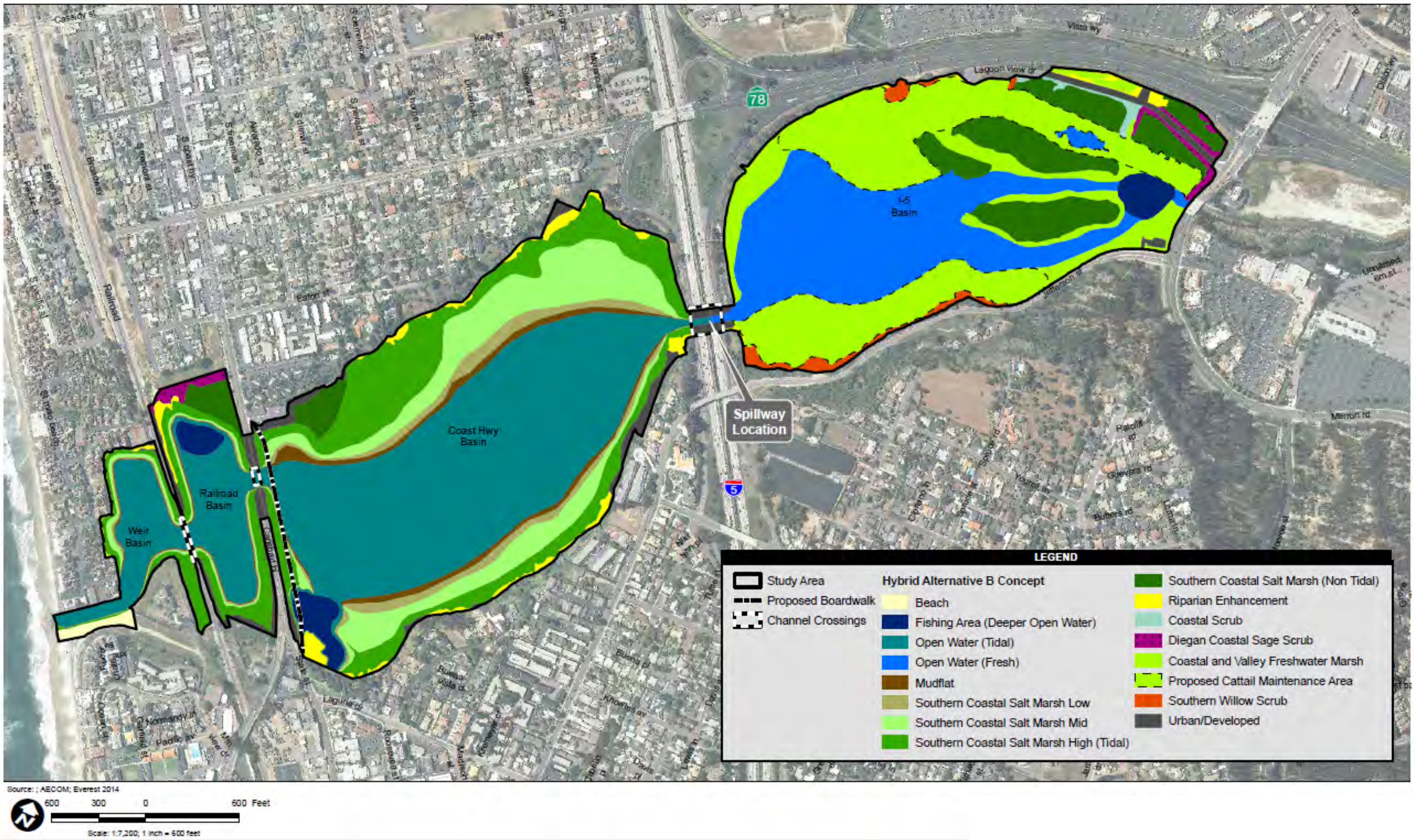


Figure 1-6. Proposed Hybrid Alternative Option B Habitat Distribution.

1.8 MATERIALS DISPOSAL/PLACEMENT

Vegetation and soil removal from the lagoon are the major construction activities associated with the proposed project. Depending on the alternative, implementation of the proposed project would involve the removal and subsequent disposal of approximately 128,600 cy to 211,100 cy of vegetation (mostly cattails). In addition, the proposed project would require the net excavation (cut) of approximately 556,000 cy to 815,000 cubic yards (cy) of sediment from the four basins. Placement of sediment removed and placed in the littoral zone has the potential to affect the marine environment, so that is the focus of this discussion.

1.8.1 Sediment

The proposed project would require the net excavation of approximately 746,000 cy of sediment from the four basins under the Saltwater Alternative, 556,000 cy of sediment under the Freshwater Alternative, and 815,000 cy of sediment under the Hybrid Alternative (both options). The distribution of earthwork between the four basins for each alternative is presented in Table 1-4.

Table 1-4. Earthwork Volume (cy) by Basin.

Alternative	Earthwork Volume (cy) by Basin				Total
	Weir	Railroad	Coast Highway	I-5	
Freshwater	21,000	62,500	290,500	188,000	562,000
Saltwater	67,000	101,000	292,500	320,500	781,000
Hybrid	61,500	95,500	488,000	188,000	833,000

Possible disposal options have been identified based on preliminary sediment characterization data regarding the content of sand in lagoon sediments. It is assumed that sediment with a sand content higher than 80 percent would be suitable for beneficial use as beach placement, and sediment with a sand content between 70 percent and 80 percent would be suitable for beneficial use as nearshore placement. It is assumed that sediment with less than 70 percent sand content would not be suitable for placement within the littoral zone and would require disposal at an offshore disposal site or in a lagoon disposal site.

Based on previous material characterization studies (Battelle 2003 and SAIC 2008), the sand contents for each basin at different depths were estimated and are summarized in Table 1-5. As shown in Table 1-5, most of the material from the two downstream basins (i.e., Weir Basin and Railroad Basin) is suitable to be placed on the beach or nearshore. In the Coast Highway Basin, sediment below 4 feet is suitable to be placed on the beach or nearshore. None of the sediment within the I-5 Basin would be suitable for beach or nearshore placement. It should be noted that the previous sediment characterization studies were based on composite samples of a few locations so further soil characterization investigations during future phases of the project would provide more precise soil characterization estimates.

Table 1-5. Estimated Sand Content Percentage by Basin.

Depth (feet)	Weir Basin	RR Basin	CH Basin	I-5 Basin
	Estimated Sand Content (%) for 2-ft Lifts			
0 - 2 1 - 2	74	65	37	12
2 - 3 3 - 4	82	80	62	23
4 - 5 5 - 6	78	88	81	34
6 - 7 7 - 8	96	84	80	35
8 - 9 9 - 10	98	84	78	44
10 - 11 11 - 12	99	84	77	53
12 - 13 13 - 14	99	84	77	53
14 - 15 15 - 16	99	84	77	53
16 - 17 17 - 18	99	84	77	53
18 - 19 19 - 20	99	84	77	53

Yellow denotes sand content > 80% - suitable for reuse; beach placement
Blue denotes sand content between 70% - 80% - suitable for reuse; nearshore placement
Grey denotes sand content < 70% - not suitable for reuse; disposal required

Because the sediment characterization is preliminary and it is possible different volumes of material could be identified as project implementation occurs, a range of sediment reuse/disposal options have been analyzed as part of the BVLEP, including placement of sediment in the littoral zone (e.g. on the beach or in the nearshore).

Specific locations have been carried forward for potential materials disposal/reuse based on historic project site boundaries, including the 2012 RBSP implemented by SANDAG and the Navy Homeporting Project. The latest SANDAG RBSP included two nearby beach locations, namely, Oceanside, and North Carlsbad. These sites, due to their proximity to the project site and their previously permitted capacity for materials placement (based on past projects), are determined to be suitable for materials placement for the proposed project. A matrix describing each of the materials disposal/reuse scenarios and maximum capacity per site is provided in Table 1-5 and shown in Figures 1-7 through 1-9. Under each of the alternatives, a combination of different strategies could be implemented based on sediment characteristics. Specific volumes anticipated for placement are included in Table 1-6 for reference, but the analysis in this report is based on placement of the total sand capacity at each site. The scenarios described and analyzed in this report therefore represent a "worst-case" scenario and reflect a maximum volume that could be placed at each location. The total capacity shown exceeds the amount of material needed to be disposed/reused for the construction of the BVLEP. Thus, only a portion of these disposal/reuse sites, or a portion of the volume (and footprints) identified may actually be used for materials placement under each alternative.

Table 1-6. Materials Disposal and Reuse Scenarios.

	Capacity Based on Historical Projects	Alternative		
		Freshwater	Saltwater	Hybrid
		Disposal Need: 562,000 cy	Disposal Need: 781,000 cy	Disposal Need: 833,000 cy
Approach 1 - Without An Overdredge Pit				
Beach				
Oceanside	420,000	49,000	110,000	129,500
North Carlsbad	225,000	0	0	0
Nearshore				
Oceanside	2,460,000	30,000	49,000	51,000
LA-5 ODMDS	N/A	483,000	622,000	652,500
Approach 2 – With An Overdredge Pit				
Beach				
Oceanside	420,000	175,000	232,500	255,000
North Carlsbad	225,000	0	0	0
Nearshore				
Oceanside	2,460,000	387,000	548,500	578,000
LA-5 ODMDS	N/A	0	0	0

Notes:

1. Materials placement quantities exceed amount to be disposed of, or reused, to allow flexibility at individual placement sites.
2. Onshore beach sand placement sites are consistent with the 2012 RBSP (SCH # 2010051063).Refer to Figures 1-7 through 1-9 for the proposed project's sand placement sites. While 2012 RBSP sites are proposed for use, the BVLEP would obtain permits for placement, since the 2012 RBSP was a one-time project implemented in 2012.
3. The nearhore placement site is consistent with the Oceanside nearshore beach replenishment site H identified in the Final EIS for the Development of Factiliiteis in San Diego/Coronado to Support the Homeporting of One NIMITZ Class Aircraft Carrier (Navy Homeporting EIS).
4. Sand Compatibility and Opportunistic Use Programs (SCOUP) sites are not included as an option for materials placement because the existing SCOUPs assume construction methods and other conditions that are not consistent with the BVLEP (e.g., daytime construction only).

cy = cubic yards

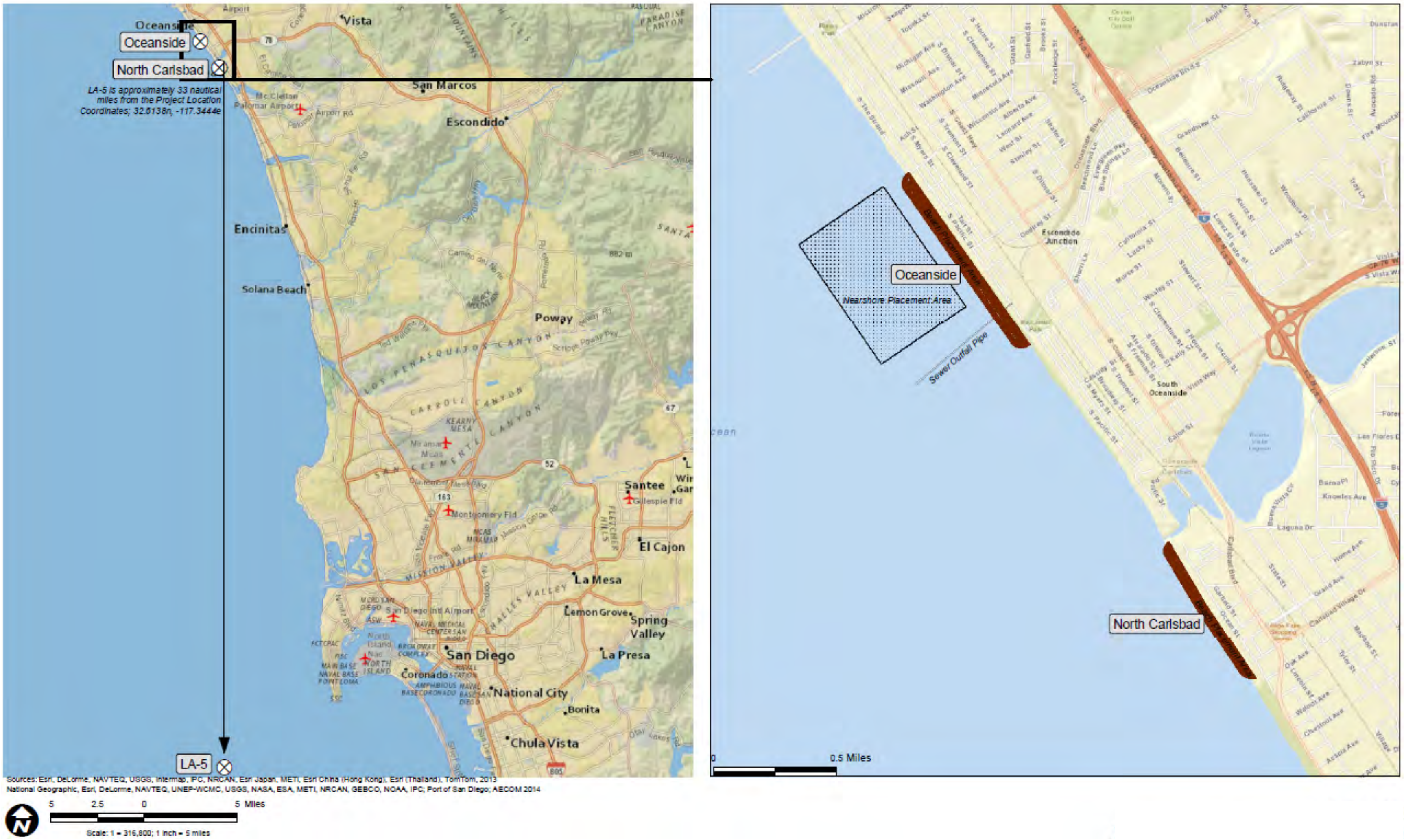


Figure 1-7. Potential Offsite Materials Placement Sites.

Figure 1-8. Oceanside Nearshore and Beach Placement Sites.

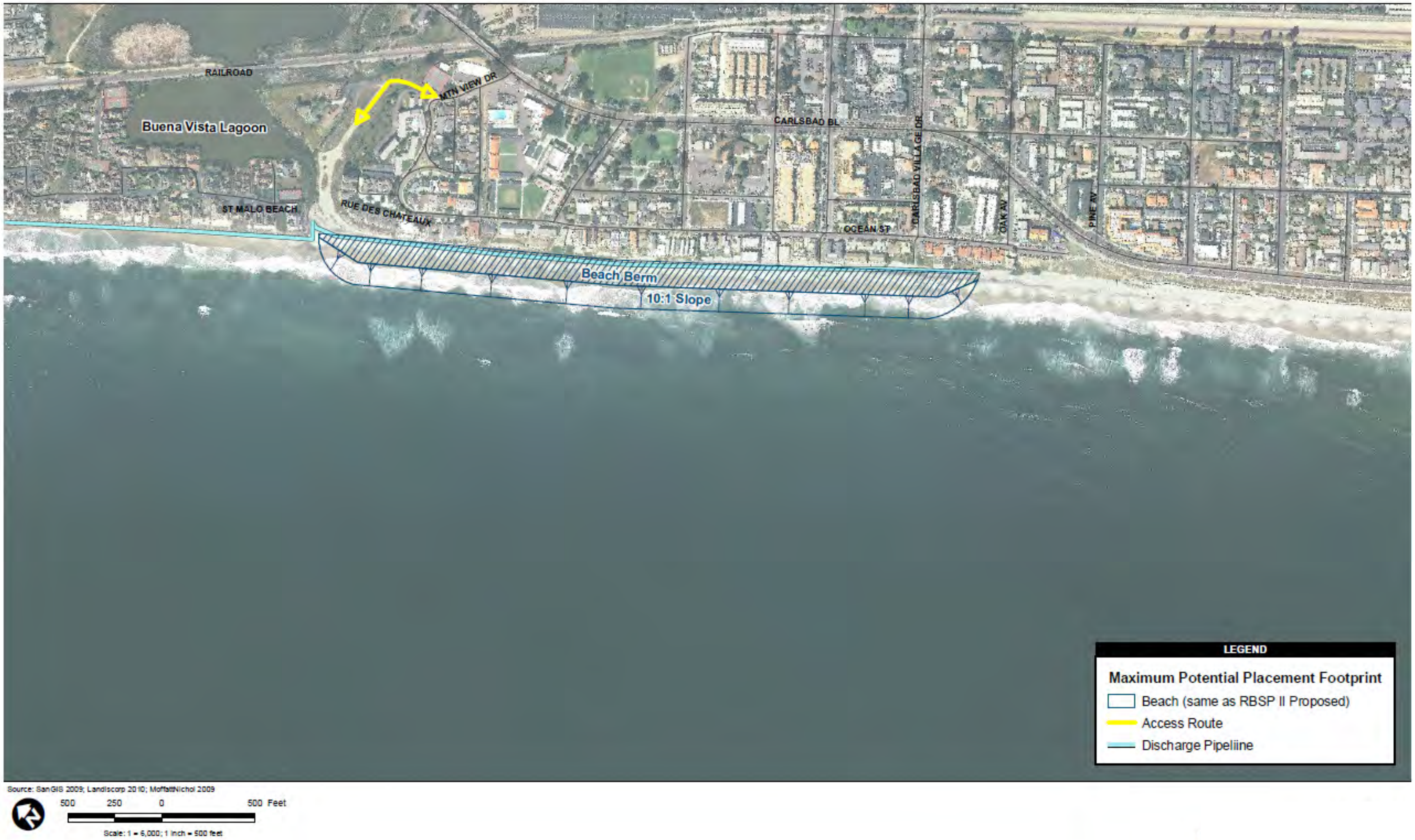


Figure 1-9. North Carlsbad Placement Site.

As outlined in Table 1-6, two different construction approaches could be utilized for implementation of the BVLEP. One method, identified under Approach 1, would dredge materials in areas designated for grading to lower elevations and dispose of those dredged materials either on nearby beaches, the nearshore, or offshore or at upland landfills based on its characteristics (*e.g.,* proportion of sand and grain-size). Approach 2 would construct an overdredge pit to provide capacity for onsite disposal of fine-grained material and generate material that could be reused within the littoral zone, either on the beach or in the nearshore. The overdredge pit would be located in an area of the lagoon that contains high proportions of sand at depth, which would be placed on the beach and nearshore sites as the pit is excavated. That pit would then be backfilled with finer grained materials that would otherwise need to be disposed of at LA-5 Ocean Dredged Material Disposal Site (ODMDS). As a result, finer-grained materials are encapsulated onsite and no offsite disposal would be required under Approach 2. Construction of the overdredge pit and placement of beach and nearshore materials is described in more detail in Section 1.8, Construction Methods. Approach 1 assumes an overdredge pit would not be built within Buena Vista Lagoon, and no onsite retention of fine-grained material would occur. Under Approach 1, any fine-grained material would be disposed of at LA-5, and less material would be generated that could be reused either on the beach or in the nearshore, as identified in Table 1-6.

Inlet maintenance required under the Saltwater and Hybrid Alternatives would also result in materials to be disposed of, but material removed from the inlet is anticipated to be sandy and disposed of on the adjacent beach within North Carlsbad, and is not taken into account in Table 1-5, which focuses on the one-time beneficial use and disposal needs associated with initial project implementation. To provide full public disclosure and maximum flexibility during construction, all disposal/reuse scenarios are evaluated in this report. To facilitate identification of potential impacts associated with placement of material due to sediment reuse/disposal, materials disposal/reuse scenarios are evaluated independently throughout the document.

1.9 CONSTRUCTION METHODS, SCHEDULE, AND DESIGN FEATURES

This section describes the methods and equipment that would likely be used for construction of the proposed project enhancement alternatives, along with information regarding the construction schedule and design features. The construction methods for the proposed project were developed based on project requirements and site constraints, as well as experience with similar previous projects. The construction methodology and phasing ultimately used would be determined by the contractor selected for construction with due consideration to the requirements specified in permits, agreements, and approval documents. If the selected contractor chooses a construction methodology that is substantially different than what is presented herein, additional environmental review may be needed to verify that the project would not result in substantial environmental impacts beyond those identified and considered in this report.

1.9.1 General Construction Features

As noted previously, this report focuses on the potential effects of the project on the marine environment, particularly resulting from inlet creation (and subsequent ebb bar development) and/or materials placement in the littoral zone (e.g. on area beaches or in the nearshore).

1.9.2 Construction Equipment Mobilization and Demobilization

Excavation of sediment within the lagoon would be conducted using a moderate size cutterhead dredge (e.g., 18-inch to 24-inch). Pipelines to transport dredge sediment would also be brought to the site.

1.9.3 Dredging and Sediment Disposal/Placement

Sediment removal would occur, primarily using water based equipment such as dredges. Limited soil removal could occur in areas directly adjacent to the lagoon edge where disturbed, compacted areas provide access to the lagoon basins. Sediment would be dredged using a hydraulic cutterhead dredge from specific designated areas within each of the lagoon basins. Dredged materials would be directed via pipeline to the appropriate receiver beach or designated nearshore area for disposal/placement an offshore disposal site; or an interior overdredge pit, depending on the construction approach and quality of material.

Two options for the beneficial use and/or disposal of dredged sediment have been identified, as described in Section 1.8. The first approach would involve hydraulic dredging with beach nourishment and offshore placement. The second approach would involve hydraulic dredging with beach nourishment and lagoon placement. These two options are described below and represent the range of possible methods that would likely be considered by a contractor, given the site conditions and quantity of material.

Dredging and sand placement operations may occur up to 24 hours a day/6 days a week due to issues associated with starting and stopping these activities (e.g., sand settlement in pipelines that then requires resuspension, adding to the potential for pipeline clogs). Mobilization of construction equipment and material is expected to take one to two months to complete. Dredging within the lagoon is anticipated to take 12 to 24 months to complete. The dredging operation would be limited in area to the immediate vicinity of the dredge and sediment discharge locations (beach, nearshore, and within the lagoon). Restricting all construction to outside of the nesting season would substantially increase the construction schedule, and would double the time it would take to enhance the lagoon. Therefore, given the limited area and nature of this work, it is expected that the dredging operation would take place throughout the year with no shutdown during the nesting season. Demobilization of construction equipment and material is expected to take one to two months to complete. It is estimated that the entire construction program would take 15 months to 30 months to complete, with sand placement in the littoral zone occurring for up to 12 months.

Approach 1 – Hydraulic Dredging With Beach/Nearshore and Offshore Placement

Under this option, a hydraulic cutterhead dredge would dredge and transport the sediment within the four basins. Sediment suitable (>80 percent sand) for beneficial use as beach placement would be dredged and transported via pipeline to the placement site on each beach, where it would be spread along the beach using conventional construction equipment such as bulldozers, scrapers, dump trucks, and graders. The distance from the project site to the Oceanside or North Carlsbad receiver sites is approximately 2.5 miles. To transport material to the site, up to 2 booster pumps would be required along the pipeline at approximately 1 mile intervals. Possible booster pump locations include just south of the existing weir and an area adjacent to Loma Alta Creek.

Sand would be discharged from the pipeline at the placement site in a slurry of water and sediment. To minimize impacts to nearshore water quality, a shore parallel berm called a training dike would be constructed to form a settling basin where the slurry would be discharged. The material would be worked upcoast and downcoast from this settling basin. Sediment that is marginally suitable (70 percent – 80 percent sand) for beneficial use would be dredged and transported via pipeline to the nearshore area (Oceanside only), where it would be discharged in water ranging in depth from approximately -20 feet, NGVD29 to -30 feet, NGVD29. Material discharged into the nearshore would be released close to the sea bottom to minimize surface turbidity.

Sediment that is unsuitable for beneficial use (<70 percent sand) would be dredged and transported to a barge offshore via a pipeline system that connects the excavation site to the barge. Excess water contained in the dredged material in the barge would be decanted and transported back to the excavation site via pipeline for reuse in the dredging operation and to minimize water quality impacts. Once the barge has reached an acceptable load it would be towed to the Los Angeles Ocean Dredged Material Disposal Site, known as LA-5 ODMDS, located off the coast of San Diego approximately 6 miles from Point Loma. This site is shown in Figure 1-7 and is designated for the disposal of sediment dredged from Waters of the U.S. that is unsuitable for beneficial use yet is deemed clean enough to not cause significant harm to aquatic organisms. Once the barge reaches LA-5 the sediment would be discharged within the disposal site.

Approach 2 – Hydraulic Dredging With Beach/Nearshore and Lagoon Placement

Under this option, a hydraulic cutterhead dredge would dredge and transport the sediment within the four basins. Sediment that is suitable for beneficial use (>80 percent sand) would be dredged and transported to the beach where it would be spread along the beach using conventional construction equipment such as bulldozers, scrapers, dump trucks, and graders. As discussed in Approach 1, the two potential beach placement sites would be Oceanside and North Carlsbad. To minimize impacts to nearshore water quality, a training dike would be constructed to form a settling basin where the dredged sediment would be discharged. The sediment would be worked upcoast and downcoast from this settling basin. Sediment that is marginally suitable for beneficial use (70 percent – 80 percent sand) as beach nourishment would be dredged and transported via pipeline to the nearshore area (Oceanside only) where it would be discharged in water ranging in depth from approximately -20 feet, NGVD29 to -30 feet, NGVD29. Material discharged into the nearshore would be released close to the sea bottom to minimize surface turbidity.

Sediment that is unsuitable for beneficial use (<70 percent) would be placed in a pit within the lagoon created by overdredging (dredging deeper than required to create the final grade elevations). The Coast Highway Basin would be over dredged to create an “overdredge pit” measuring approximately 22 to 32 feet deep that can accommodate fine grained surface sediment from the Railroad Basin and Coast Highway Basin, and all sediment dredged from the I-5 Basin. The fine grained surface sediment in the Coast Highway Basin would be dredged and pumped to the area adjacent to the overdredge pit in the Coast Highway Basin for temporary stockpiling. The deeper sandy sediments in the Coast Highway Basin would be dredged and pumped to the beach for placement either directly on the beach or in the nearshore area. This operation would continue in the Coast Highway Basin until a pit of sufficient volume is created to contain all the fine grained sediment that is found above the proposed grade. The fine grained sediment would then be pumped into the pit. After the fine grained sediment in the Railroad Basin is moved to the overdredge pit in the Coast Highway Basin, the sandy sediment from the Railroad Basin would be pumped to the beach for beach nourishment either directly on the beach or in the nearshore area. Under Approach 2, the volumes of earthwork due to over-excavation and, backfill for each basin range from approximately 574,000 cy to 690,000 cy. This additional earthwork would not be required under Approach 1, since there is no excavation required for an overdredge pit. This approach would also maximize material available from the project that could be beneficially reused in the littoral zone, including on area beaches and in the nearshore. Under Approach 2, no disposal of sediment at LA-5 would be required.

1.9.4 Channel/Infrastructure Improvements

Saltwater and Hybrid Alternative

<u>Tidal Inlet Construction</u>

Construction of the tidal inlet is anticipated to require approximately 3-5 months. The first step would be to isolate the work area from fluvial water influence on the east side and ocean water influence on the west side. A temporary, sheetpile cofferdam would be placed on the landward side and an earthen dike would be constructed on the western side using onsite soil. Once the cofferdam and temporary dike are in place, the work area would be dewatered using pumps and hoses with the water pumped back into the lagoon. The water levels within the work area would be kept low during construction by continuous pumping. Once the work area water level is acceptable, the existing weir would be demolished and the material would be hauled offsite via dump truck for disposal at a landfill. The work area would then be cleared of vegetation and loose surface material, which would also be hauled offsite via dump truck for disposal at a landfill. The demolition would be conducted primarily with backhoes, although some hand labor may be needed in isolated areas. After demolition and clearing, excavation would be conducted at the channel guide (rock levee) and revetment locations to achieve final bottom elevation. Filter fabric would be placed along the bottom and then a bedding layer of quarry run would be placed on top of the filter fabric. An underlayer of rock would be placed on top of the bedding layer and then the armor layer would be placed on top of the underlayer. The rock would be hauled via dump truck to the site with backhoes and front loaders used to place the rock. With the rock structures complete, the inlet channel would be excavated to achieve final design elevations. The temporary cofferdam would be removed and the rest of the work area would be finished to final grade and condition, including the small beach area located directly to the south of the channel guide. Finally, the earthen dike would be removed and the channel excavated to final grade, thereby allowing tidal exchange between the ocean and lagoon.

The tidal inlet work would also include the construction of a rock revetment extending into the Weir Basin along the southern side and northern side wrapping around the eastern boundary of the San Malo complex. This structure would tie into the channel guide on the south side and the existing San Malo revetment on the north side. The first step would be to conduct excavation with backhoes to achieve final ground elevation. Filter fabric would be placed along the ground, as need, and then a bedding layer of quarry run would be placed on top of the filter fabric. An underlayer of rock would be placed on top of the bedding layer and then the armor layer would be placed on top of the underlayer. The rock would be hauled via dump truck to the site with backhoes and front loaders used to place the rock. This work would likely be conducted in wet conditions so no dewatering is anticipated for this component of work.

2.0 EXISTING CONDITIONS

2.1 Regional Overview

The project area is in the eastern Pacific Ocean coastal region referred to as the Southern California Bight (SCB), whose boundaries span from Point Conception, California, to Punta Eugenia, Baja California, and is directly affected by two ocean currents. The colder, more northerly California Current and the southern, warm-water California Countercurrent (also known as the Davidson Current) influences the ocean within the SCB. These two currents "mix" in the Santa Barbara Channel. The water within the southern portion of the SCB is generally warmer and more saline than that within the northern area (Hickey 1993). These differing conditions, as well as upwelling of cooler, nutrient-rich waters, influence the unusually diverse marine biota within the SCB (Murray and Littler 1981). The distribution of species within the SCB is also affected by the complex hydrography and geology of the region. The mainland shelf, which extends from shore to approximately -650 feet MLLW, comprises 6% of the 40,000-square-mile SCB.

Marine ecosystems and habitats off San Diego County include sandy beach, rocky reefs, sandy or soft ocean bottoms, kelp forests, seagrass beds, and submarine canyons. The coastal study area for this project includes the shoreline and nearshore habitats to a depth of approximately 100 feet. Deeper water habitats would not be influenced by the project or in the case of the LA-5 ODMDS where impacts have been assessed separately (USEPA 1987) and are not discussed further.

Sandy beach habitat supports shorebirds, including the threatened western snowy plover (*Charadrius alexandrines nivosus*), and provides spawning habitat for the state-managed California grunion (*Leuresthes tenuis*). Pismo clam (*Tivela stultorum*) beds occur in sandy substrate in localized areas extending from intertidal to nearshore depths. Soft-bottom habitats also support diverse invertebrate populations that are preyed upon by demersal fish living on or near the bottom. Nearshore reefs and kelp beds harbor a variety of macroalgae, invertebrate, and fish populations. Marine mammals forage on invertebrates and fish throughout the water column over hard or soft bottoms and within kelp beds. Marine biological resources also support important commercial fisheries, are the target of recreational fishing and diving, and are the subject of educational research.

Marine habitats provide important linkages to adjacent coastal wetland and terrestrial ecosystems. Several ecologically valuable coastal wetlands occur within the region. Migratory marine fish such as California halibut (*Paralichthys californicus*) use coastal wetlands as nursery habitats. Endangered California least tern (*Sterna antillarum browni*), which seasonally breed and nest at several coastal lagoons in the region, forage on small fish in the ocean as well as within coastal wetlands. Threatened snowy plover, which may be found at certain beaches, nest at several of the coastal wetlands within the region.

In many areas there is an abrupt transition to coastal bluffs or urbanized landscapes where beaches are backed by revetment or seawalls, or are adjacent to roads and other development. Several species of terrestrial insects, birds, and mammals live or forage within marine habitats. Vegetated dune or coastal strand habitats are limited and have only localized occurrence in the region. Several of the coastal wetlands within the study area are ecological preserves or reserves, and three in north San Diego County are State Marine Conservation Areas (SMCA) protected under the Marine Life Protection Act (MLPA).

2.2 MARINE SHORELINE AND OFFSHORE HABITATS

The characterization of marine resources in the study area was based on review of recent relevant reports (SANDAG 2011, USACE 2012) and Geographic Information System (GIS) data. Examples include:

- 2009 and 2010 reef dives and intertidal surfgrass mapping within the study area were used to provide representative information on reef heights and habitat quality indicators (SANDAG 2011).
- 2006 reef dives and intertidal surfgrass mapping within the study area were used to provide representative information on reef heights and habitat quality indicators (SAIC 2007).
- 2005 Post-construction monitoring report for RBSP I (AMEC 2005)
- 2004 LiDAR data were used to provide bathymetric information for portions of the study 50 area.
- 2003-2005 Coastal habitat study (SAIC 2006).
- 2002 California State Conservancy and SANDAG San Diego Nearshore Program GIS layers of bathymetry, hard substrate, and aquatic vegetation mapping served as the basis for reef and sensitive resource acreage calculations (SANDAG 2002).
  - Substrate GIS data enabled calculation of reef dimensions and acreage.
  - Vegetation GIS data enabled calculation of acreage by dominant and/or sensitive resource categories (i.e., surfgrass, giant kelp, understory algae).
  - 2000 reef dives and intertidal surfgrass mapping produced for the 2001 RBSP were used to provide additional representative information on reef heights and habitat quality indicators.

Information from above-described sources was considered for the description of baseline conditions for marine resources. The marine resource section is organized into the following subsections: habitats and associated organisms; an overview of essential fish habitat (EFH), plankton, birds, and mammals within the study area; and a summary of marine resources in the project area.

2.2.1 Habitats

Soft Bottom Communities

Soft-bottom habitats include sandy beaches and nearshore sandy or silty-sand bottoms. These are the predominant habitats in the region with sandy beaches covering approximately 80 percent of the shoreline in the SCB (CCC 1987). Sandy beaches are unstable habitats due to daily sand movement associated with waves and currents and larger-scale seasonal cycles of sand movement. Biological resource development on sandy beaches varies seasonally, generally being greater in spring to summer and less in fall to winter associated with seasonal sand erosion and accretion as well as reproduction and recruitment. Most sandy beach invertebrates are mobile and move up and down the beach with changes in tide level and some, such as the sand crab (*Emerita analoga*) migrate to the shallow nearshore during high tides and seasonal periods of beach erosion.

Sandy Beach

Common invertebrates observed on San Diego County sandy beaches include sand crabs, beach hoppers (*Megalorchestia* spp, *Orchestodea* spp.), amphipods (e.g., *Eohaustorius* spp.), isopods (e.g., *Excirolana* spp.), and other crustaceans; bean clam (e.g., *Donax gouldii*), and olive snail (*Olivella* *biplicata*); bloodworm (*Euzonus mucronata*) and other polychaetes worms (e.g., *Hemipodus borealis*, *Lumbrineris* spp., *Nephtys californiensis*, *Scololepis* spp.); and nemertean ribbon worms (Straughan 1981; SAIC 2006, 2007). In her 12-year study of sandy beaches from Estero Bay to Coronado, Straughan (1981) found that higher abundance and species diversity were found on long, gently sloping, relatively fine grain beaches with no periodically-exposed beach rock. Beaches that were short and steep, coarse-grained, and/or experienced more erosion had fewer organisms, and, in some cases, only sand crabs. Beaches within the study area prior to the 2001 RBSP were characterized as narrow and with various cobble coverage and, in some cases, had seasonally exposed bedrock. These beaches varied between having limited marine resources (sand crabs, worms), or slightly more developed marine resources (sand crabs, worms, and bean clams or amphipod crustaceans) (MEC 2000). Terrestrial insects are an important ecological component of the sandy beach and help break down washed ashore kelp and seagrass wrack. The wrack may harbor a variety of insects and invertebrates that are important prey items for gulls and shorebirds.

Pismo clams live in sandy areas from the intertidal zone to depths of 80 feet and may concentrate in beds in certain areas. Pismo clam beds may be persistent features due to the short benthic phase of their planktonic larvae (60 to 62 hours). Pismo clams are capable of rapid movement in the sediment due to their well-developed foot; they normally bury to a depth of 2 to 6 inches. The minimum legal size of 4.5 inches is reached at about the age of 5 years.

The California grunion (*Leuresthes tenuis*), which is a nearshore species that feeds on plankton, comes to shore to spawn on sandy beaches. Their spawning generally extends from March through August although start and end dates may vary earlier or later between years. The peak of spawning occurs April through June (Martin 2006). Grunion spawn at night on any or all of the 3 to 4 nights after the highest tide associated with each full or new moon and then only for a 1- to 3-hour period. Eggs incubate in the sand for approximately 10 days until the next tide series is high enough to reach them, when exposure to wave action triggers their hatching and the baby grunion are washed back into the sea. Grunion are managed as a game species by the California Department of Fish and Wildlife (CDFW), formerly the California Department of Fish and Game (CDFG), who post annually updated predicted spawning runs on the internet (www.dfg.ca.gov/marine/grunionschedule.asp). Beaches in the study area either had unsuitable substrate or were potentially only seasonally suitable for grunion spawning prior to the 2001 RBSP. After the 2001 RBSP, potential grunion spawning habitat was created, and in some areas habitat suitability extended through 2005 (SAIC 2006). Surveys following the 2012 RBSP indicated that beaches within the study area again appeared suitable for grunion spawning.

Sandy Subtidal

Soft-bottom nearshore communities have similar characteristics for a given water depth, sediment type, and wave energy. Thus, sandy nearshore communities off Oceanside would generally be similar to those found at similar depths and bottom type off Imperial Beach. The subtidal zone is classified into general regions, including the shallow subtidal to a depth of about -30 feet MLLW (generally corresponds to littoral zone), an inner shelf zone from about -30 to -80 feet MLLW, middle shelf from about -80 to -300 feet MLLW, and outer shelf zone from about -300 to -600 feet MLLW. Thus, the study region encompasses the shallow, inner shelf, and a small portion of the middle shelf zones.

Bottom-dwelling invertebrate species in the shallow subtidal zone are well adapted to shifting sediments and turbidity, with suspension feeders being the dominant group. Many of the sandy beach invertebrates move between the intertidal and shallow subtidal depths and additional species live on and within sediments within increasing distance offshore as wave energy diminishes toward the seaward limit of the littoral zone. Common species in the shallow subtidal of the study region include burrowing anemones, sea pansy, sea pen, purple globe crab (*Randallia ornata*), clams, snails, sand dollar, sea star, and tube worms (Table 2-1; U.S. Navy 1995, SAIC 2009).

Fish commonly found over sandy subtidal habitat off San Diego County beaches include barred surfperch (*Amphistichus argenteus*), California corbina (*Menticirrhus undulatus*), California halibut (*Paralichthys californicus*), queenfish (*Seriphus politus*), round stingray (*Urobatis halleri*), shovelnose guitarfish (*Rhinobatos productus*), spotfin croaker (*Roncador stearnsii*), and white croaker (USACE 1994, U.S. Navy 1997a and 1997b). Speckled sanddabs (*Citharicthys stigmaeus*) and bat rays (*Myliobatis californica*) also have been observed in these waters at depths of -3 to -10 m (-10 to -30 ft) MLLW. Schooling water column fish, abundant just beyond the surfzone, include northern anchovy, jack mackerel (*Trachurus symmetricus*), Pacific bonito (*Sarda chiliensis*), and topsmelt (*Atherinops affinis*) (Cross and Allen 1993, Garfield 1994).

The proposed nearshore disposal site falls within the inner shelf zone, which is influenced by oceanic swell. The number of species and abundances of bottom-dwelling macroinvertebrates is lower in the inner shelf compared to the middle and outer shelf depth zones. Polychaete worms and/or small, mobile crustaceans dominate the inner to middle shelf infaunal community. The most abundant species collected in sediment core samples at depths of -49 to -134 feet MLLW on the San Diego shelf include brittle stars, polychaete worms (e.g., *Aricidea* spp., *Diopatra* spp., *Mediomastus* spp., *Monticellina* spp., *Spiophanes* spp., *Sternaspis fossor*, and *Streblosoma crassibranchia*), and small crustaceans (*Heterophoxus oculatus*, *Photis* spp., and *Rhepoxynius* spp.) (SCCWRP 2003). Macroinvertebrate species living on or above the bottom comprising 80% or more of the abundance in trawls collected during the 2003 Regional Bight program included blackspotted shrimp (*Crangon nigromaculata*), California sand star (*Astropecten verrilli*), sea pens, and white sea urchin (*Lytechinus pictus*) (SCCWRP 2003). Fish species comprising 80% or more of the abundance in trawls on the inner shelf during the 2003 Regional Bight program included English sole (*Parophrys vetulus*), Pacific sanddab (*Citharichthys sordidus*), pink seaperch (*Zalembius rosaceus*), speckled sanddab, yellochin sculpin (*Icelinus quadriseriatus*), and white croaker (*Genyonemus lineatus*) (SCCWRP 2003). The most abundant species of the middle shelf include Dover sole (*Microstomus pacificus*), longspine combfish (*Zaniolepis latipinnis*), Pacific sanddab, speckled sanddab, and rockfish (*Sebastes* spp.). Twenty species of fish were observed by divers and collected by otter trawl at borrow sites SO-5 and SO-7 (MEC 2000). The most abundant fish included barred sand bass (*Paralabrax nebulifer*), California halibut, California lizardfish (*Synodus lucioceps*), English sole, horneyhead turbot (*Pleuronichthys verticalis*), queenfish, speckled sanddab, and white croaker

Hard-Bottom and Vegetated Habitats

Hard-bottom habitats are productive ecosystems that support a variety of plants and animals. They include rocky intertidal shores and nearshore reefs, and support vegetated habitats such as seagrass beds and kelp forests. Less than 15% of the coastline in San Diego County is estimated to be rocky. The species that associate with hard-bottoms differ greatly with depth, type of substratum (e.g., cobble, boulders, rocky outcrop, sandstone reef), and substrate relief height and complexity.

Rock or sandstone reefs provide hard substratum to which kelp and other algae can attach in the nearshore zone (<100 feet depth). In addition, many invertebrates such as sea anemones, sea fans, scallops, and sponges require hard substratum for attachment. The structural complexity of hard-bottom habitats shelter and provide foraging habitat for mobile invertebrates (e.g., lobster) and fish.

Table 2-1. Common organisms observed from soft bottom habitat in San Diego County.

Organism	Common Name	Scientific Name	Water Depth MLLW (ft)		
			-10	-20	-30
Algae			none found		
Invertebrate	Tube-dwelling Polychaete	*Diopatra ornata*		X	X
	Tube-dwelling Polychaete	*Diopatra splendissima*		X	X
	Tube-dwelling Polychaete	*Pista pacifica*		X	X
	Tube-dwelling Polychaete	*Loimia medusa*			X
	Tube-dwelling Polychaete	*Chaetopterus* spp.		X	
	Crab	*Pagurus* spp.		X	X
	Crab	*Pagurites* spp.		X	X
	Porcelain Crab	*Randallia ornata*		X	X
	Swimming Crab	*Portunus xantusii*		X	
	Elbow Crab	*Heterocrypta occidentalis*	X		
	Snail	*Olivella biplicata*	X	X	X
	Snail	*Polinices* spp.	X	X	X
	Snail	*Nassarius fossatus*		X	
	Razor Clam	*Ensis* spp.		X	
	Sea Star	*Astropecten armatus*		X	X
	Brittle Star	Ophiurodea		X	X
	Sand Dollar	*Dendraster excentricus*		X	
	Burrowing Anenome	*Harenactis attenuata*		X	X
	Burrowing Anenome	*Zaolutus actius*		X	X
	Sea Pansy	*Renilla kollikeri*		X	X
	Sea Pen	*Stylatula elongata*		X	X
Fish	Halibut	*Paralichthys californicus*	X	X	X
	Speckled Sanddab	*Citharichthys stigmaeus*	X	X	X
	Bat Ray	*Myliobatus californica*	X	X	X
	Shovelnose Guitarfish	*Rhinobatos productus*	X		X

Source: U.S. Navy 1995

The proportion of hard substrate habitat at any given time relates to rock relief height and time of year, with lower relief substrate subject to exposure or burial by sand associated with seasonal on and offshore sand movement or large waves associated with substantial storm events (e.g., El Niño).

Several physical factors influence the types and diversity of marine life associated with rocky habitats. Important substrate qualities include relief height (low, high), texture (smooth, pitted, cracked), size, and composition (sandstone, mudstone, basalt, granite). Substrates that are of higher relief, greater texture, and larger size generally have the richest assemblages of marine species. In contrast, low-lying rocks or reefs subject to sand scour from seasonal burial and uncovering typically are unvegetated or colonized by opportunistic species with annual life cycles or sand tolerant species. Cobbles on beaches, which get tumbled about by waves during the rise and fall of the tides, do not support plants or attached animals. However, cobbles in subtidal waters may support understory algae and kelp beds, although they are generally subject to greater annual variability due to their greater instability under storm surge and large wave conditions.

Estimated acreages of hard-bottom and vegetated habitats in the study region are given in Table 2-2. The acreage is based on the 2002 Nearshore Program Habitat Inventory GIS, which provides the

Table 2-2. Estimated hard-bottom and vegetated habitat acreage in the vicinity of the study area (from SANDAG 2011).

Jurisdiction	Bedrock 2002	Cobble 2002	Surfgrass 2002	Understory Kelp 2002	Kelp		
					2002	2005	2008
Oceanside	0.8	6.1	0	2.6	0	0	0
Carlsbad	239.2	157.0	23.4	330.8	42.0	4.8	152.7
Encinitas	751.0	0.9	81.9	469.2	225.5	10.4	355.2
Solana Beach	267.0	0	3.5	115.2	30.7	15.9	153.7
Del Mar	141.0	0	9.1	150.7	8.3	0	16.3
City of San Diego (Torrey Pines)	102.7	4.0	10.7	84.7	0.3	0	0.3

most comprehensive dataset of the spatial extent of hard-bottom and vegetated habitats off San Diego County. In addition, recent kelp cover acreages are provided. The acreage estimates are summarized by city and were computed by extending the jurisdictional boundaries offshore.

The data are valuable for identifying the general distribution and relative percentages of hard-bottom (rock, cobble) and different types of vegetated hard-bottom habitats (kelp, surfgrass, understory algae) within the local region (see Figures 2-1 through 2-3). However, acreage calculations should be viewed as estimates relative to current conditions. This limitation applies to both the hard-bottom and vegetated habitat. Because hard-bottom varies from cobble to high-relief reefs (greater than 3 feet in height), there is potential for variability in the amount of hard-bottom at any given time due to natural sand movement patterns in the littoral zone. This applies to low-relief rock and cobble subject to burial and uncovering by sand. The term “ephemeral reefs” has been used to describe hard-bottom areas that experience this type of disturbance.

Vegetated habitats also experience variability in cover between years due to a number of factors. Surfgrass is a sand-tolerant, perennial species that may be subject to less interannual variability. Studies suggest it may be more vulnerable to variability along its inshore distribution limit in the lower intertidal, where wave action and sand movement are greater. Kelp beds naturally die back and regrow each year, the extent of which is influenced by oceanographic and climate conditions. Key factors include water temperature, nutrient levels (tied to upwelling and current patterns), and storm-generated waves and sedimentation. Annual canopy cover of kelp beds off San Diego exhibited a general pattern of increase during colder water and decrease during warmer water oceanographic conditions. Kelp canopy was low after the 1998 El Nino, increased with the cooler La Nina conditions of 1999 to 2000, decreased again during a period of warmer than average temperatures and low nutrients, and rebounded in 2007. In addition, the San Diego Region experienced changes in kelp harvesting patterns. Observed canopies in 2008 were one of the best seen in the last 50 years (MBC 2009). Table 2-3 summarizes kelp canopy coverage in San Diego County from 2000 to 2011 relative to cold and warm water events. Kelp (particularly juvenile plants) also may be affected by predation by sea urchins. The understory algae category mapped in 2002 includes perennial species, as well as, opportunistic species that may exhibit annual variability associated with rock exposure or burial.

Biological resources associated with distinct hard-bottom habitats are summarized below, and include intertidal and nearshore reefs, surfgrass beds, and kelp beds of the study area.

Table 2-3. Kelp canopy coverage (acres) of San Diego County kelp beds from 2000 to 2011.

	Canopy Area (acres)											
Kelp Bed	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Oceanside	-	-	-	-	-	-	-	-	-	-	-	-
North Carlsbad	-	4.20	13.10	4.20	0.74	3.21	-	6.42	26.69	33.36	19.27	4.20
Agua Hedionda	-	-	<0.25	0.49	0.25	1.98	-	3.95	19.77	22.73	7.66	5.44
Encina Power Plant	0.49	7.17	23.97	43.98	16.56	0.25 -	-	20.02	75.61	53.13	43.49	20.76
Carlsbad State Beach	0.74	5.68	11.61	0.49	0.02	-	-	15.81	29.90	31.38	17.05	6.18
Leucadia	22.24	51.64	82.53	45.71	11.86	0.25	3.95	57.57	104.03	106.01	53.13	29.40
Encinitas	9.88	32.37	37.81	12.36	3.95	-	0.49	50.66	85.50	50.66	31.63	30.64
Cardiff	37.07	76.35	100.08	49.91	11.12 -	-	0.99	70.67	119.60	128.49	52.63	97.60
Solana Beach	49.42	100.57	120.58	60.54	5.44	22.98	0.07	112.92	203.36	124.79	81.05	124.54
Del Mar	1.48	3.71	8.65	7.41	-	-	-	9.14	14.08	10.87	9.39	18.29
Torrey Pines	-	-	-	-	-	-	-	-	0.25	0.10	0.74	7.66
La Jolla	308.88	631.34	831.74	851.01	254.27	215.72	28.91	679.53	1024.23	561.91	685.95	633.81
Point Loma	812.96	1624.44	938.73	1114.17	475.42	531.76	436.63	893.51	1636.54	1213.01	982.72	1040.79
Imperial Beach	4.94	19.27	51.89	20.51	47.20	98.84	98.84	368.92	468.25	212.75	0.99	37.56

Notes: "-" indicate no canopy was present during kelp overflights at given location
Values represent approximately the maximum coverage for each year. Areal estimates derived from charts based on infrared aerial photographs.
Source: MBC Applied Environmental Sciences 2012

Rocky Intertidal Zone

The intertidal zone, also known as the littoral zone, in marine aquatic environments is the area of the foreshore and seabed that is exposed to the air at low tide and submerged at high tide (i.e., the area between tide marks). Biological resource development on hard substrates in the intertidal zone varies with tide exposure, relief height and complexity, and oceanographic conditions, and on persistent, high-relief reefs exhibit a distinct zonation with tidal level (Reish 1972). The upper intertidal or splash zone is characterized by simple green algae (*Chaetomorpha* spp., *Enteromorpha* spp., *Ulva* spp.), acorn barnacles (*Cthamalus* spp.), limpets (*Collisella* spp., *Lottia* spp.), and periwinkles (*Littorina* spp.). California mussel (*Mytilus californianus*), gooseneck barnacle, aggregating sea anemones, chitons, hermit crabs, and a variety of marine snails (e.g., *Acanthina* spp., *Lithopoma undulosa*, *Kelletia kelletia*, *Ocenebra* spp., *Tegula* spp.) are commonly observed in the middle intertidal zone of rocky shores (Stewart 1982, MEC 2000). The low to minus intertidal zone of persistent reefs are characterized by a greater diversity of animals, including aggregating and green sea anemones (*Anthopleura elegantissima*), purple sea urchin (*Strongylocentrotus purpuratus*), California sea hare (*Aplysia californica*), crabs, marine snails, brittlestars (e.g., *Ophithrix* spp.), and starfish (*Asterina miniata*, *Pisaster* spp.). Wooly sculpin (*Clinocottus analis*) is one of the more commonly encountered fish in tidepools. Feather boa kelp (*Egregia menziesii*) may opportunistically recruit to exposed rock but rarely lives more than a year in the intertidal, although it is perennial in subtidal waters (Black 1974).

Hard-bottom benches occur under the sand at several of the beaches in north San Diego County. Several of the RBSP I receiver sites had sand scoured rocks or extensive cobbles that became exposed during winter prior to the RBSP I. The rocks had few resources (e.g., turf algae) or were bare. Seasonal rockiness substantially decreased after the RBSP I (SAIC 2006). High wave conditions removed several feet of sand from local beaches in January-February 2010, leaving many with a similar appearance of rockiness as before the RBSP I. Because these rock benches are low relief, they are naturally subject to sand influence and support few if any biological resources (SANDAG 2011).

Marsh birds, including great blue heron (*Ardea herodias*) and snowy egret (*Egretta thula*), gulls, and shorebirds forage on invertebrates and fish on exposed reefs and in tidepools.

Nearshore Reefs

Subtidal reefs in the shallow nearshore also exhibit considerable variation in resource development associated with the seasonal onshore and offshore migration of sand. Similar to intertidal reefs, substrate factors such as relief height, texture, composition, and size largely determine resource development (Ambrose et al. 1989). Historical average differences in sand depth between winter and summer generally range from 1 to 3 ft in the low intertidal and shallow nearshore depths (to -20 ft MLLW) of the study area (MEC 2000). Thus, reefs less than 3 ft in height are subject to varying degrees of sedimentation, which may range from complete to partial burial on a seasonal basis depending upon reef height and the amount of sand moving onshore and offshore. Resource development on the low-relief reefs can vary substantially on a seasonal basis associated with cycles of exposure and partial or complete sedimentation (MEC 2000). Because low-relief reef may be buried below the sand surface, sometimes it may only be distinguished by the presence of surfgrass and/or feather boa kelp, which because of their long blades or fronds may extend above the sand surface. Figures 2-1 through 2-3 depict nearshore resources in the vicinity of the project area.

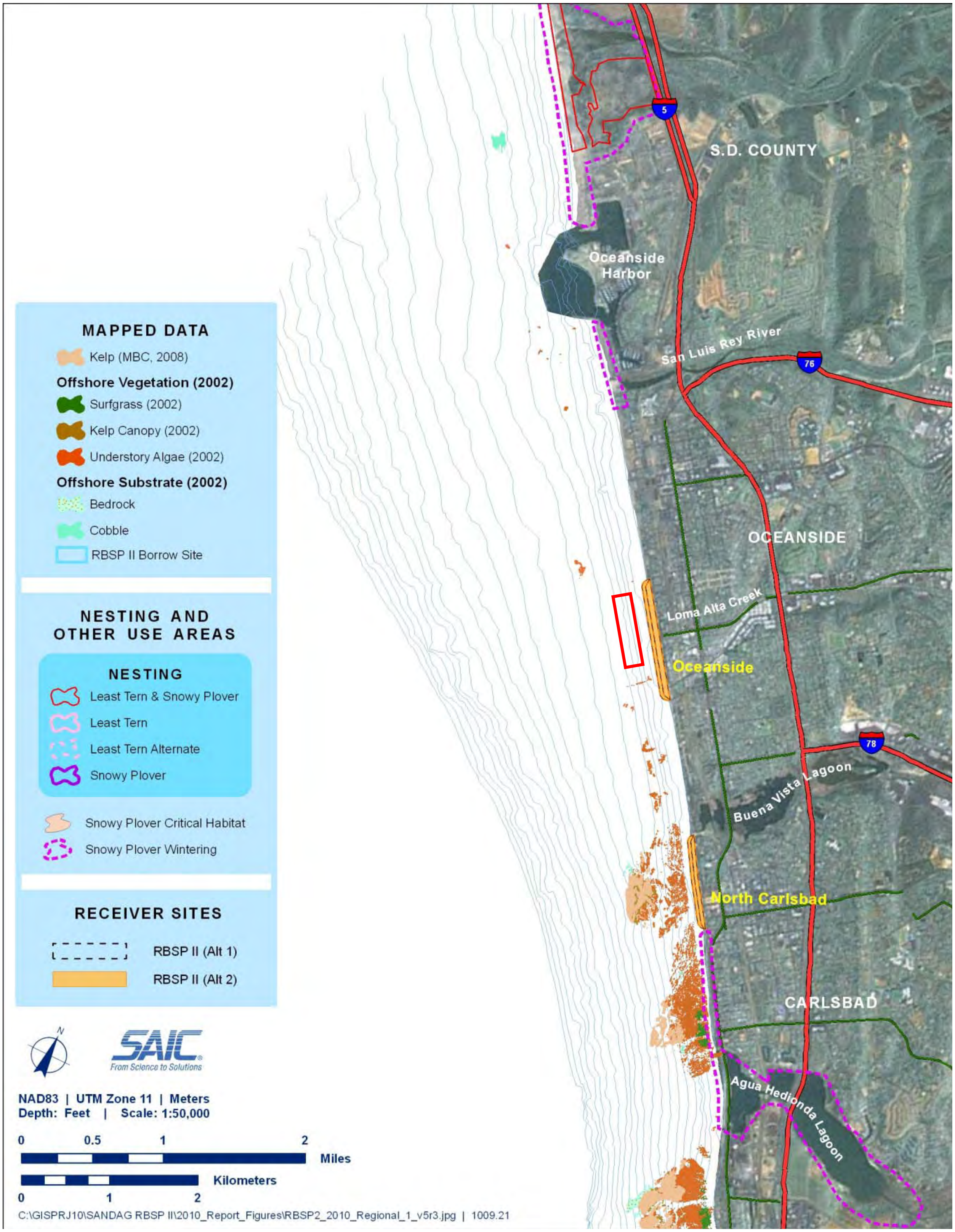


Figure 2-1. Nearshore resources and proposed receiver sites within the study area (from SANDAG 2011).

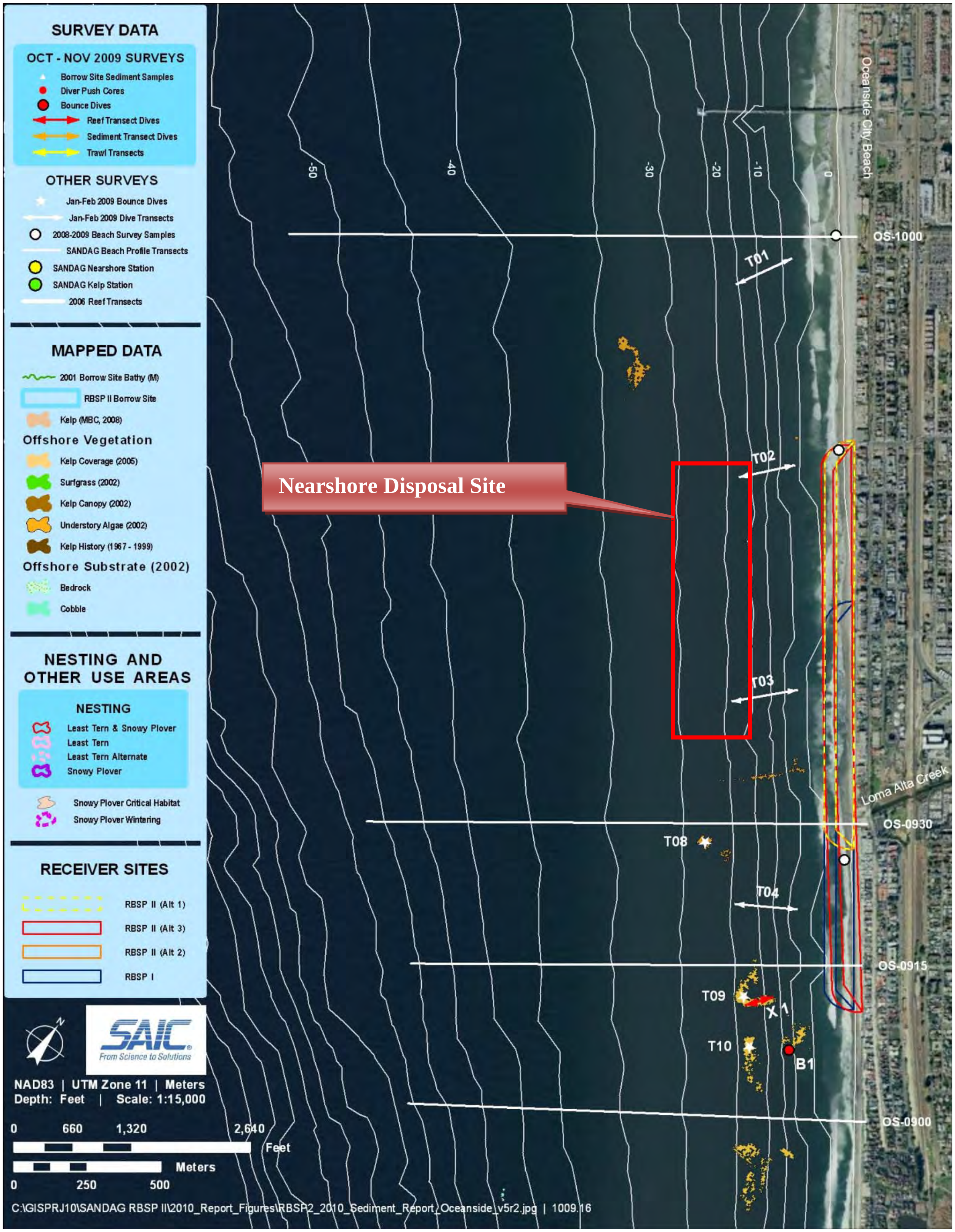


Figure 2-2. Sensitive habitats and nearshore resources in vicinity of proposed nearshore disposal footprint and Oceanside receiver site (after SANDAG 2011).

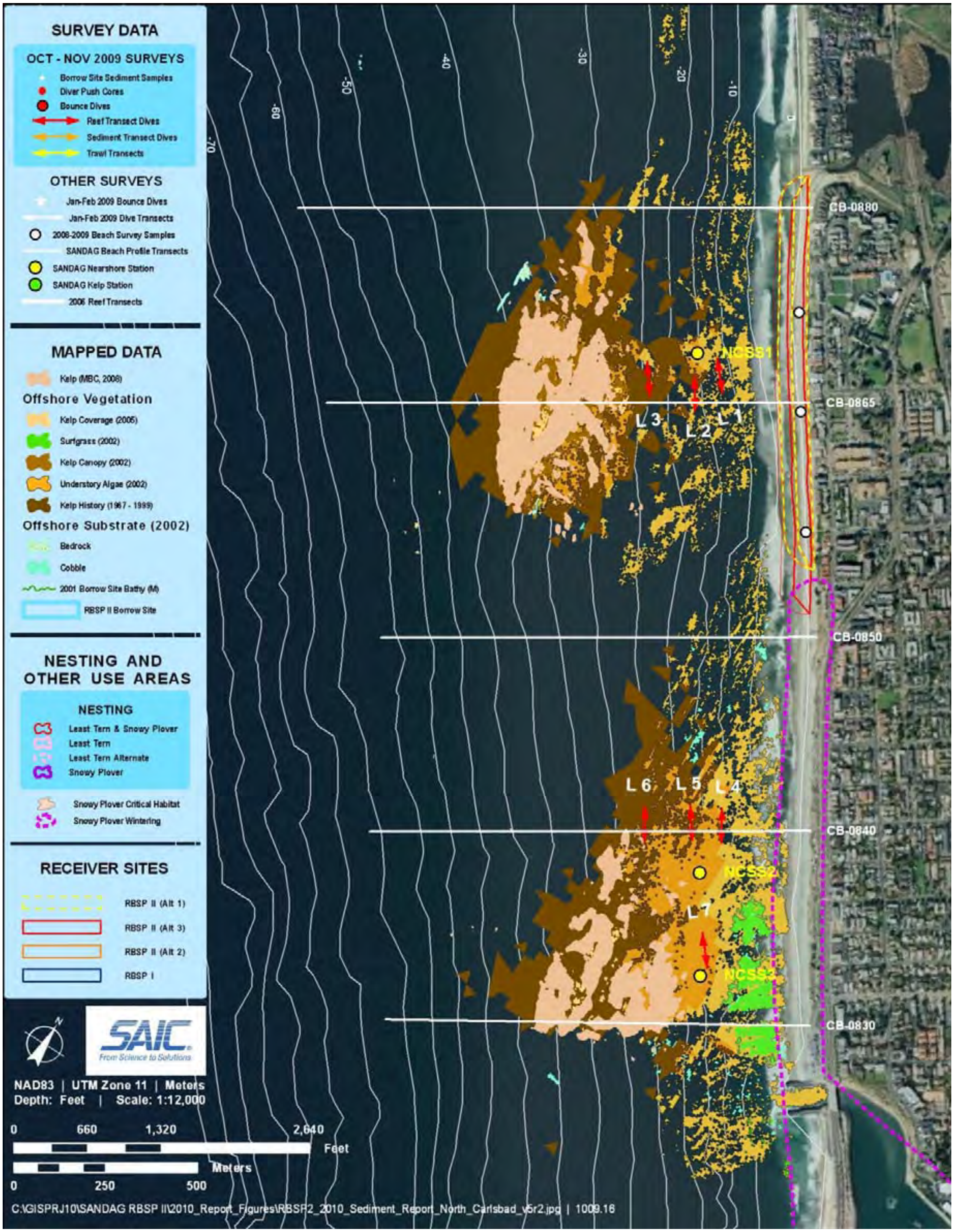


Figure 2-3. Sensitive habitats and nearshore resources in vicinity of North Carlsbad receiver site (from SANDAG 2011).

Hard substrate less than 2 ft in height tends to be poorly vegetated with annual or tolerant species (e.g., coralline algae, feather boa kelp, *Ulva*) that can develop rapidly when the surface becomes exposed from sand (Stewart 1991; MEC 2000). Invertebrates may or may not be associated with these lower relief reefs. While reefs above 3 ft in height, which generally extend above the height of seasonal sand movement, typically support more persistent marine resources.

Understory algae are common on nearshore reefs. Feather boa kelp is conspicuous growing up to 12 ft in length (Black 1974). The sea palm may co-occur with feather boa kelp at subtidal depths. Sea palms (*Eisenia arborea*) may live more than 10 years and grow to about 1 to 1.5 ft in height in areas of high surge, but they may reach up to 3 ft in height in deeper water. Their shorter height and occurrence on higher relief reefs suggests they may be less tolerant of sand sedimentation than surfgrass and feather boa kelp (AMEC 2005). A variety of smaller red algae (*Corallina* spp., *Erythroglossum californicum*, *Gigartina* spp., *Gracilaria* spp., *Jania* spp., *Lithothrix* spp. *Rhodoymenia* spp.) and brown algae (*Cystoseira osmundacea*, *Sargassum* spp., *Zonaria farlowi*) may co-occur with feather boa kelp and/or sea palms on nearshore reefs. Persistent reefs support hundreds of species of invertebrates (e.g., crabs, nudibranchs, sea urchins, scallops, sea stars, snails, sponges, tunicates, worms) and attract a variety of fish such as garibaldi (*Hypsypops rubicundus*), blacksmith (*Chromis punctipinnis*), and black perch (*Embiotoca jacksoni*).

Fish abundance on reefs is related to vegetative cover, substrate complexity, and relief; however, increases in relief height on reefs greater than 3 ft have minimal effects (Cross and Allen 1993). Fish associated with nearshore reef habitats within the study area include kelp bass (*Paralabrax clathratus*) and barred sand bass; black, shiner, walleye, and dwarf surfperches (Embiotocidae); señorita; California sheephead (*Semicossyphus pulcher*); garibaldi; opaleye (*Girella nigricans*); white seabass (*Atractoscion nobilis*); sargo (*Anisotremus davidsoni*); salema (*Xenistius californiensis*); giant kelpfish (*Heterostichus rostratus*); painted greenlings (*Oxylebius pictus*); and halfmoon (*Medialuna californiensis*). Table 2-4 summarizes common organisms observed from nearshore reefs in San Diego County.

Surfgrass Beds

Surfgrass (*Phyllospadix* spp.) generally grows on hard-substrate from approximately 0 to -20 ft MLLW, and may form conspicuous beds in the low intertidal to shallow subtidal zones of rocky beaches in San Diego County (Stewart 1991, MEC 2000). Surfgrass provides important habitat for a variety of algae, invertebrates, and fish, and up to 34 species of algae and 27 species of invertebrates may be associated with surfgrass on San Diego beaches (Stewart and Myers 1980). It also serves as a nursery habitat for California spiny lobster, *Panuliris interruptus* (Williams 1995). Figures 2-1 through 2-3 depict surfgrass resources in the vicinity of the project area.

The distribution of surfgrass is within the active portion of the beach profile characterized by seasonal onshore and offshore movement of sand. Surfgrass is considered a stress tolerant strategist that is morphologically adapted to withstand shifting sand movement (O’Brien and Littler 1977, Taylor and Littler 1982, Littler et al. 1983). Surfgrass has long shoots (3 to 5 ft) that can extend above a variety of sand depths, the shoots are protected from sand abrasion by fibrous sheaths, dense rhizomatous roots bind and enmesh with sand to form an effective anchor, and growth and colonization is by vegetative propagation of rhizomes and/or seasonal seed production (Stewart and Meyers 1980, Taylor and Littler 1982, Cooper and McRoy 1988, Stewart 1989, Williams 1995).

Table 2-4. Common organisms observed from hard bottom reefs in San Diego County.

Organism	Common Name	Scientific Name	Water Depth MLLW (ft)		
			-10	-20	-30
Algae	Brown	*Macrocystis pyrifera*			X
	Brown	*Cystoseira osmundacea*	X	X	X
	Brown	*Egregia menziesii*	X	X	X
	Brown	*Zonaria farlowi*	X		
	Red	*Gigartina* spp.	X	X	X
	Red	*Gracillaria sjoestedtii*	X	X	X
	Red	*Rhodymenia* spp.	X	X	X
	Red	*Lithothrix aspergillium*	X	X	X
	Red	*Jania* spp.	X	X	X
	Red	*Corallina* spp.	X	X	X
Surfgrass	Surfgrass	*Phyllospadix torreyi*	X		
Invertebrate	Nudibranch	*Phidiana crassicornis*	X	X	X
	California Spiny Lobster	*Paniluris interruptus*	X	X	X
	Kellet's Whelk	*Kelletia kelletii*	X	X	X
	Snail	*Armina californica*		X	X
	Cone Snail	*Conus californica*		X	X
	Olive Snail	*Olivella baetica*		X	X
	Snail	*Neverita draconis*		X	
	Leather Star	*Dermisterias imbrcata*		X	X
	Sea Star	*Pisaster giganteus*		X	X
	Sea Fan	*Muricea* spp.	X	X	X
Fish	Black Perch	*Embiotoca jacksoni*	X	X	X
	Shiner Surfperch	*Cymatogaster aggregata*	X	X	X
	Dwarf Surfperch	*Micrometrus minimus*	X	X	X
	White Sea Bass	*Atractoscion nobilis*	X	X	X
	Sargo	*Anisotremus davidsonii*	X	X	X
	Salema	*Xenistius californiensis*	X	X	X
	Giant Kelpfish	*Heterostichus rostratus*	X	X	X
	Painted Greenling	*Oxylebius pictus*	X	X	X
	Halfmoon	*Medialuna californiensis*	X	X	X
	Señorita	*Oxyjulis californica*	X	X	X
	Opaleye	*Girella nigricans*	X	X	X
	California Sheephead	*Semicossyphus pulcher*	X	X	X
	Garibaldi	*Hypsopops rubicundus*	X	X	X
	Northern Anchovy	*Engraulis mordax*	X	X	X
	Pacific or Chub Mackerel	*Scomber japonicus*	X	X	X

Source: U.S. Navy 1995

Surfgrass may recover relatively quickly from disturbance via re-growth if the rhizome mat remains intact (J. Engle, U.C. Santa Barbara, personal communication). However, recovery can take several years if the rhizome mat is removed (Stewart 1989, Turner 1985).

Although surfgrass is adapted to sand accretion, the amount of sand affects its health and growth. The timing of sand cover also appears important. Pelchner (1996) found that the amount of carbohydrates stored in summer months from photosynthesis was important to the survival of plants over winter and early spring. Experimental manipulations showed that surfgrass was less healthy without any sand cover (more shoots, but less leaf biomass), whereas sand depths up to 2 inches optimized growth (more leaf biomass and productivity). However, sand depths of 5 inches resulted in less carbohydrate storage, which if it occurred during summer reduced plant biomass and potential survival over winter. Based on surveys conducted in 2010, surfgrass normally experience sand depths ranging from 1 to 10 inches at in the vicinity of the study site (SANDAG 2011). Critical thresholds of sand cover are not well understood and may vary depending on site-specific conditions related to factors such as exposure (e.g., tides, wave energy).

Fish commonly found in surfgrass habitats off San Diego include barred sand bass, black perch, blacksmith, garibaldi, opaleye, señorita (*Oxyjulis californica*), and topsmelt (DeMartini 1981, MEC 1995).

Kelp Forests/Beds

Southern California kelp forests are dominated by giant kelp (*Macrocystis pyrifera*), which grows at depths between -20 and -120 ft MLLW (Aleem 1973, Leet et al. 1992). Kelp attaches to hard substrate by means of a holdfast, and fronds may grow to heights that exceed the water depth, forming leafy canopies at the water surface. Giant kelp, and its associated hard bottom habitat, supports a diverse community of algae, invertebrates, and fish. Invertebrates found in kelp beds include lobster, sea stars, sea urchins, and molluscs. Surfperch, rockfish (*Sebastes* spp.), cabezon (*Scorpaenichthys marmoratus*), lingcod (*Ophiodon elongatus*), and wrasses (senorita, rock wrasse, and sheephead) are common.

In addition, kelp beds provide food for marine birds and mammals. Gulls commonly scavenge on the surface canopy, and cormorants, pelicans, and terns feed on schooling fish near the edge of the canopy (Foster and Schiel 1985). Seals, sea lions, and whales forage within kelp beds, and kelp is commercially harvested for food products, fertilizers, adhesives, paints, pharmaceuticals, rubbers, and textiles (Foster and Schiel 1985, Bakus 1989).

Aerial photography has been used to map and quantify the surface area of kelp canopies offshore southern California for a number of years. The density and distribution of the kelp canopy exhibits seasonal and interannual variability related to a variety of physical and chemical factors (e.g., nutrient concentrations, sedimentation, temperature, turbidity). Kelp beds in Southern California commonly deteriorate to some degree during summer and fall when temperatures are higher and nutrient concentrations are lower (Foster and Schiel 1985, Tegner and Dayton 1987). Kelp beds also may show dramatic die-back during El Niño and recovery during La Niña conditions.

Giant kelp is adversely affected by sedimentation and turbidity. Large amounts of shifting sediment can bury small plants and prevent settling of microscopic spores, both of which can reduce kelp beds (Dayton et al. 1984). El Niño conditions, which result in high waves, higher-than-average temperatures, and low nutrients, have been linked to periodic and widespread reductions in kelp canopy. Kelp canopy has substantially regrown in the region since the 1997-1998 El Niño (Table 2-3).

Figures 2-1 through 2-3 depict kelp bed resources in the vicinity of the project area, and Table 2-3 summarizes the surface area of kelp canopies off San Diego County from 2000 to 2011.

2.2.2 Essential Fish Habitat

EFH is managed under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). This Act protects waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity (Magnuson-Stevens Act, 16 U.S.C. 1801 et seq.). The entire coastal area ranging from the mean high tide level to offshore depths represents EFH within the study area. The Pacific Groundfish and Coastal Pelagic fishery management plans (FMPs) apply to EFH in the study region. The habitat designations associated with those plans are defined below.

EFH for species in the Pacific Groundfish FMP, which applies to 89 fish species (e.g., flatfish, rockfish, sharks) is identified as all waters and substrate within the following areas:

- Depths less than or equal to 11,480 ft to mean higher high water level (MHHW) or the upriver extent of saltwater intrusion, defined as upstream and landward to where ocean-derived salts measure less than 0.5 ppt during the period of average annual low flow;
- Seamounts in depths greater than 11,482 ft as mapped in the EFH assessment GIS; and
- Areas designated as Habitat Areas of Particular Concern (HAPCs) (e.g., seagrass, kelp canopy, estuaries, rocky reef).

EFH for species in the Pacific Groundfish FMP also is relevant to species designated in the Nearshore Fishery Management Plan (NFMP), which are generally managed by the state (CDFG 2002). For instance, 16 of the 19 species designated in the NFMP are officially designated in the Pacific Groundfish FMP, including 13 species of rockfishes (black, black-and-yellow, blue, brown, calico, China, copper, gopher, grass, kelp, olive, quillback, and treefish - *Sebastes* spp.), California scorpionfish (*Scorpaena gutatta*), Cabezon (*Scorpaenichthys marmoratus*), and kelp greenling (*Hexagrammos decagrammus*). Three species designated in the NFMP are not specifically designated in the Pacific Groundfish FMP (rock greenling – *Hexagrammous lagocephalus*, California sheephead - *Semicossyphus pulcher*, and monkeyface prickleback - *Cebidichthys violaceus*) and are actively managed by the state; however, designated groundfish EFH (including HAPC) generally is relevant because these three species are associated with rocky reef, kelp bed, or surfgrass habitats (CDFG 2002).

EFH for species in the Coastal Pelagic FMP, which applies to four fish and one invertebrate species (e.g., anchovy, sardine, Pacific mackerel, jack mackerel, and market squid) is identified as all waters and substrate within the following areas:

- All marine and estuarine waters from the shoreline to the limits of the Exclusive Economic Zone (EEZ), which extends approximately 200 nautical miles offshore; and
- Water surface boundary, which is the water column between the thermoclines where temperatures range from 10 to 26 degrees Centigrade.

EFH encompasses nearshore areas adjacent to the receiver sites, as well as, nearshore disposal and offshore disposal sites. Nearshore areas characterized by reef, seagrass, estuaries, or kelp canopy are more specifically defined as HAPCs. Note that this report only addresses EFH within the nearshore environment, since EFH associated with the lagoon is addressed separately in another report.

2.3 PLANKTON

Plankton includes a diverse group of microscopic plants (phytoplankton), larval fish and eggs (ichthyoplankton), and other animals (zooplankton). The most abundant component of the plankton community is the phytoplankton, which aggregate near the surface where primary production occurs. They are grazed upon by zooplankton and ichthyoplankton and small fishes such as anchovies, which are in turn fed upon by larger fishes, birds, mammals, and man. Thus, phytoplankton are the primary producers in the marine food web.

There are over 280 species of phytoplankton recorded from California coastal waters (Riznyk 1977); however, species composition of the community at any particular location at any given time exhibits considerable variability as the plankton drift with the currents (Goodman et al. 1984). The most common types of phytoplankton that may be expected within the study area include centric diatoms, pennate diatoms, dinoflagellates, and coccolithophores. Under certain oceanographic conditions, blooms of dinoflagellates (e.g., *Gonyaulax polyedra*) may cause red tide conditions. Decreased water clarity typically is associated with red tides.

Zooplankton that would be expected within the study area include microscopic animals (e.g., radiolarians, ciliates, foraminifera), larval forms of macroinvertebrates (e.g., crabs, lobster, shrimps, molluscs), and animals that live within the plankton community (e.g., arrow worms, copepods, cladocerans, ctenophores, salps). Larger zooplankton (greater than 35 mm) serve as a major food source for fish.

Ichthyoplankton includes larvae and eggs of resident fish that spawn nearshore, migratory species, and subarctic and temperate/tropical species whose spawning ranges extend into the area (Loeb et al. 1983). Vertical and cross-shelf variations in species composition vary with season. A study off San Diego County documented that larvae with persistently higher concentrations within 1 mile of shore include cheekspot goby (*Ilypnus gilberti*), giant kelpfish (*Heterostichus rostratus*), bay goby (*Lepidogobius lepidus*), and unidentified larvae of blennies, clinids, and silversides. The larvae of northern anchovy (*Engraulis mordax*), queenfish (*Seriphus politus*), and white croaker (*Genyonemus lineatus*) tended to concentrate nearshore between 1 and 2.5 miles offshore, although queenfish and white croaker had a more inshore distribution during spring and summer.

2.4 MARINE-ASSOCIATED BIRDS

Seabirds and shorebirds are commonly observed along southern California beaches. Seabirds such as cormorants, pelicans, and terns forage for fish offshore. Gulls may feed on fish and invertebrates, and are notable scavengers. Shorebirds probe for marine invertebrates in the damp sands of the intertidal zone and may feed on small fish and crustaceans in tide pools. However, in areas of beach erosion, foraging opportunities for shorebirds decrease. Shallow sand depths and exposed cobble and/or bedrock support few invertebrate prey. Approximately 50 species of marine-associated birds have been reported to occur along the shoreline and adjacent nearshore ocean between Carlsbad and Del Mar (MEC 2000). A total of 12 species of birds were observed along the shoreline during a September 2002 reconnaissance survey (Table 2-5).

Table 2-5. Birds observed along the shoreline within the Encinitas and Solana Beach study area, September 2002 (from USACE 2012).

Scientific Name	Common Name
Pelecanus occidentalis	brown pelican - FE, SE
Phalacrocorax auritus	double-crested cormorant - CSC
Charadrius vociferus	killdeer
Actitis macularia	spotted sandpiper
Arenaria melanocephala	black turnstone
Calidris alba	sanderling
Catoptrophorus semipalmatus	willet
Limosa fedoa	marbled godwit
Numenius phaeopus	whimbrel
Larus delawarensis	ring-billed gull
Larus heermanni	Heermann's gull
Larus occidentalis	western gull

FE = Federal Endangered; SE = State Endangered; CSC = California Species of Special Concern

The most commonly observed seabirds within the study area during the September 2002 survey included Heerman's gull (*Larus heermanni*), ringed-billed gull (*Larus delawarensis*), and western gull (*Larus occidentalis*). Other commonly observed seabird species in the ocean waters offshore northern San Diego County include the Federal and state endangered California brown pelican *(Pelecanus occidentalis californicus*); surf scoter (*Melinita perspicillata*); western grebe (*Aecmophorus occidentalis*); and double-crested (*Phalacrocorax auritus*), Brandt's (*P. pencillatus*), and pelagic (*P. pelagicus*) cormorants. Terns, including the state and Federal endangered California least tern (*Sterna antillarum browni*), elegant tern (*S. elegans*), Caspian tern (*S. caspia*), and Forster's tern (*S. forsteri*), also sometimes forage in nearshore waters of the project area.

The most commonly observed shorebirds during the September 2002 survey were black turnstone (*Arenaria melanocephala*), marbled godwit (*Limosa fedoa*), sanderling (*Calidris alba*), whimbrel (*Numenius phaeopus*), and willet (*Caloptrophorus semipalmatus*). Marsh birds, including great blue heron, great egret, and black-crowned night heron (*Nycticorax nycticorax*), were observed foraging on exposed reefs south of Swami's during the May 2002 surfgrass mapping survey. Other commonly observed and/or expected shorebirds in the project area include killdeer (*Charadrius vociferus*), black-bellied plover (*Pluvialis squatarola),* wandering tattler (*Heteroscelus incanus*), and spotted sandpiper (*Actitis macularia*).

The most commonly observed birds at RBSP II receiver sites in November 2008, July 2009, and January 2010 included Heerman's gull (*Larus heermanni*), western gull (*Larus occidentalis*), black-bellied plover (*Pluvialis squatorola*), marbled godwit (*Limosa fedoa*), western sandpiper (*Calidris mauri*), whimbrel (*Numenius phaeopus*), and willet (*Tringa semipalmata*). The western snowy plover was observed on the wider beach adjacent to the Batiquitos receiver site and at the Cardiff receiver site. The endangered California least tern (*Sterna antillarum browni*) and the elegant tern (*Thalasseus elegans*) were observed in flight near the jetties of Batiquitos Lagoon during beach surveys of the nearby Batiquitos receiver site.

2.5 MARINE MAMMALS

Common dolphins (*Delphinus delphis*) and bottlenose dolphins (*Tursiops truncatus*) occur in the surf zone and in offshore waters. Pacific white-sided dolphins (*Lagenorhynchus obliquidens*) and Risso's dolphins (*Grampus griseus*) also are known to occur seasonally in southern waters of the SCB.

California gray whales (*Eschrichtius robustus*) migrate through the study area. The southbound migration through the SCB begins in December and lasts through February; the northbound migration is February through May. Gray whales migrate up to 125 miles offshore along three pathways through the SCB. The project area lies within the nearshore migration path, which extends from the shoreline to approximately 12 miles offshore.

Harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californicus*) haul out on sandy beaches, but haul-outs are localized or infrequent on beaches in the region. An established harbor seal haul-out area occurs at La Jolla, which is miles from any of the proposed beaches in the study area. No established sea lion haul-out locations occur in the local vicinity.

2.6 THREATENED AND ENDANGERED SPECIES

Federally listed and state-listed species under the federal and state endangered species acts (FESA and CESA, respectively) with the potential to occur in the project area primarily include two marine-associated birds (California least tern and western snowy plover). Other listed species with the potential to occur in the project area potentially affected by indirect impacts (e.g., noise, sand transport) include the Belding's savannah sparrow, light-footed clapper rail, and abalone. The California brown pelican was recently delisted (federal and state), but remains a state Fully Protected species. Pelicans forage on fish in nearshore waters and are expected to occur in the project area. These species are described in greater detail below.

Although certain San Diego lagoons were included in proposed critical habitat for the endangered tidewater goby, none are included in the final rule (USFWS 2008). The tidewater goby does not occur in open ocean habitat, preferring slack water in estuaries and lagoons. Therefore, this species is not discussed further.

Federal-listed marine turtles occasionally are sighted in warm-water areas of estuaries and bays in the region, but do not come to shore on beaches in the study area. Other recently delisted species with low potential to be affected by the project include the American peregrine falcon (*Falco peregrinus*) (federal and state delisted) and gray whale (federal delisted). For these reasons, the above-mentioned species are not discussed further.

Access routes to the receiver sites transition from urban roads directly to the beach or are at locations that are unvegetated. No dune, strand, marsh vegetation, or native plant communities occur within 200 ft of beach access locations.

2.6.1 Abalone

Two species of abalone are listed as federal endangered species, the black abalone (*Haliotis cracherodii*) and the white abalone (*Haliotis sorenseni*). Both species are associated with reef habitats. The black abalone occurs in shallow subtidal and intertidal rocky habitats throughout southern California. The population of this species has been severely reduced by a wasting disease caused by a bacteria-like organism (Federal Register Vol. 74, No. 9). Abalone are broadcast spawners, but adults must be at a close distance (e.g., within a few feet) for reproduction to be successful. This life history characteristic in combination with depleted stocks limit the ability of these species to naturally recover. Reefs in the project area are potential habitat for this species; however, there are few recent reports of their occurrence. The white abalone generally occurs in water depths between 66 and 200 ft (NMFS 2008), which is outside the littoral zone subject to sand transport effects. Natural hard bottom greater than 66 ft does not occur in the project area; therefore, white abalone would not be expected to be affected by the project. The project area is not designated critical habitat for either abalone species.

2.6.2 California Least Tern

The California least tern is a federal and state listed endangered species. This species is a seasonal migrant to San Diego and nests in colonies at constructed nest sites in coastal wetlands and on sandy beaches with sparse vegetation. It forages in shallow water (generally less than 3 feet deep) within one to two miles from shore, but foraging up to five miles from nest sites has been documented. The least tern nesting season is April 1 to September 15, and San Diego County nesting sites are located near the Santa Margarita River on USMCB Camp Pendleton, Batiquitos Lagoon, Mission Bay, mouth of San Diego River, Silver Strand, San Diego Bay, and Tijuana Estuary NERR. Nesting locations in the vicinity of project area are shown in Figures 2-1. Recent breeding status of the species at nesting locations in the vicinity of the project area (i.e., Camp Pendleton and Batiquitos Lagoon) are shown in Table 2-6.

2.6.3 Western Snowy Plover

The western snowy plover is a federal and state listed threatened species. This small shorebird is a resident in San Diego and nests at constructed nest sites in coastal wetlands, alkali flats at river mouths, salt evaporators, and on sandy beaches with sparse vegetation. Snowy plover forages on marine-estuarine invertebrates and terrestrial and marine-associated insects, including those associated with kelp wrack washed ashore on sandy beaches. The nesting season extends from March 1 to September 15.

USFWS designated Critical Habitat for snowy plover in north San Diego County includes portions of Batiquitos Lagoon, Los Penasquitos Lagoon, and within the west basin of San Elijo Lagoon, with recent nesting observed in Batiquitos Lagoon and Camp Pendleton. Results of recent summer surveys are shown in Table 2-7, and recent nesting and potential overwintering locations are shown in Figures 2-1 and 2-3.

Table 2-6. Status of Least Tern Breeding in the vicinity of the study area, 2009-2012.

Site	Sub-colony	2009		2010		2011		2012	
		Min	Max	Min	Max	Min	Max	Min	Max
MCB Camp Pendleton-		1639	1639	1691	1691	1014	1510	507	1231
	Red Beach	0	0	0	0	0	0	0	0
	White Beach	85	85	108	108	77	130	36	118
	Delta Beach	12	12	6	6	3	3	0	0
	Santa Margarita River- N Beach N	413	413	417	417	145	281	141	278
	Santa Margarita River- N Beach S	1037	1037	1084	1085	756	1056	304	796
	Santa Margarita River- Saltflats	56	56	54	54	22	29	10	21
	Santa Margarita River- Saltflats Island	36	36	21	22	11	11	17	20
Batiquitos Lagoon		576	620	458	480	519	522	550	562
	W1	28	28	26	27	22	22	17	18
	W2	381	385	287	301	463	466	445	453
	E1	153	187	119	124	28	28	57	60
	E2	0	0	0	0	0	0	0	0
	E3	14	20	26	28	6	6	31	31

Table 2-7. Results of summer window surveys for snowy plovers in the vicinity of the study area, 2006-2012.

Site	2006	2007	2008	2009	2010	2011	2012
Camp Pendleton	127	94	117	120	169	162	170
Oceanside			0			0	4
Buena Vista Lagoon			0				0
Agua Hedionda			0				0
Carlsbad SB	0	0					0
S. Carlsbad S.B.	0	0	1	1	1	0	3
Batiquitos Lagoon	14	8	5	3	3	6	2

Source: USFWS 2012
Note: blanks indicate no survey was conducted.

2.6.4 Belding's Savannah Sparrow

Belding's savannah sparrow is a state-listed endangered species. Belding's savannah sparrows are found in coastal salt marshes from Santa Barbara south to San Diego County. This species nests exclusively in pickleweed (*Salicornia* sp.) and is often found in and around the margins of tidal flats, but would be unlikely to occur along the bluffs or shoreline because of a lack of suitable habitat. They occur at Aqua Hedionda Lagoon, Batiquitos Lagoon, Buena Vista Lagoon, San Elijo Lagoon, San Dieguito Lagoon, Los Penasquitos Lagoon, and Tijuana Estuary NERR/Tijuana Slough NWR (James and Stadtlander 1991, Zembal and Hoffman 2010, National Audubon Society 2010). The breeding season of Belding's savannah sparrow is mid-March through mid-August.

2.6.5 Light-Footed Clapper Rail

Light-footed clapper rail is a federal and state listed endangered species. It is a hen-sized marsh bird that nests in the lower intertidal zone of coastal salt marshes where dense stands of cordgrass are present. They also build nests in pickleweed. Light-footed clapper rails also may nest in freshwater marshes, although less common. Their breeding season is mid-March to mid-August. They require shallow water and mudflats for foraging, with adjacent higher vegetation for cover during high water. In San Diego County, pairs have been detected during one or more years in the following coastal wetlands over the past 10 years: Santa Margarita Lagoon, Buena Vista Lagoon, Aqua Hedionda Lagoon, Batiquitos Lagoon, San Elijo Lagoon, San Dieguito Lagoon, Los Penasquitos Lagoon, Kendall-Frost Reserve, San Diego River, San Diego Bay, and Tijuana Slough NWR.

This species primarily nests in middle and inner portions of the wetlands subject to tidal or freshwater influence. Reported locations of pairs in 2006 and 2007 were primarily in the inner basin at Aqua Hedionda Lagoon; central and inner basins at Buena Vista Lagoon; inland of El Camino Real in the San Dieguito River Valley; southeastern part of Los Penasquitos Lagoon; and central and inner basins of San Elijo Lagoon (Zembal et al. 2008). Most nesting at Batiquitos Lagoon occurs in the central and eastern Basins; however, six pairs were vocalizing from the western tern island and one pair was detected in the northeast corner of the west basin in 2007 (Zembal et al. 2008).

2.6.6 California Brown Pelican

The California brown pelican is a protected species in California. They are found in the open ocean and other coastal salt waters along the southern California coast throughout the year. This species is tolerant of human activity near its daytime roosts and readily utilizes various manmade structures (e.g., piers, breakwaters, buoys) as roosting sites. Known breeding locations include offshore islands such as Anacapa and Santa Barbara Islands in southern California and islands off the coast of northwestern Baja California, Mexico.

2.7 COASTAL LAGOONS

Coastal wetlands discussed in this section include estuaries, lagoons, and streams that occur in the vicinity of the proposed receiver sites or borrow sites. Coastal wetlands in the vicinity of the proposed receiver sites include the San Luis Rey River, Loma Alta Creek, Buena Vista Lagoon, Agua Hedionda Lagoon, and Batiquitos Lagoon.

Several of the wetlands are ecological reserves, as listed below. State Marine Parks or Marine Reserve designations refer to waters below the mean high tide line within the larger ecological reserves and include:

- Buena Vista Lagoon – State Marine Park (Ecological Reserve)
- Aqua Hedionda Lagoon – State Marine Reserve (Ecological Reserve)
- Batiquitos Lagoon – State Marine Park (Ecological Reserve)

Batiquitos Lagoon is also designated as a State Marine Conservation Areas under the California Marine Life Protection Act.

Coastal wetlands include some combination of open water, channels, mudflats, salt marsh, and upland habitats. Creeks and rivers with outlets to the ocean provide long corridors of open water including transition from salt freshwater, stream banks, and often include adjacent riparian (freshwater influenced shrubs and trees) habitats. Due to their diversity of habitats, coastal wetlands are sensitive areas that support primary living, foraging, and reproductive habitat for hundreds of species of invertebrates, fish, birds, and plants (CCC 1987). San Diego coastal wetlands with open inlets to the ocean are important nursery habitats for marine fish and all are important foraging and stopover locations for migratory birds along the Pacific Flyway. In addition, the coastal wetlands support several endangered and threatened animal and plant species.

Habitat quality and ecosystem functions of estuaries and lagoons are highly influenced by their surrounding watershed and connection to the ocean. Erosion and runoff may lead to habitat degradation associated with sediment buildup and reduced tidal exchange. Estuaries and lagoons also are sediment sinks for sands moving along the coastline and may require periodic dredging or excavation to maintain an open inlet to tidal exchange.

Brief descriptions of the coastal wetlands within the study area are given below, starting from the north and proceeding south (from SANDAG 2011).

2.7.1 San Luis Rey River

The San Luis Rey River outlet is approximately 1.5 miles north of the proposed Oceanside receiver site alternatives. The ocean mouth is open intermittently due to the presence of a sand barrier and low fresh water flows. The San Luis Rey River wetland excluding the river corridor covers approximately 294 acres and has a watershed area of 560 square miles. The watershed is located below Henshaw Dam, which has reduced the average sediment yield of the river to the coast by approximately 32 percent (Slagel and Griggs 2006). The effects of sediment trapping by Henshaw dam has been exacerbated with other effects such as channelization and instream sand and gravel mining (Kondolf 1997). In addition, water from the San Luis Rey River is diverted approximately ten miles downstream of Henshaw Dam to serve the municipal drinking water needs of customers in Escondido and Vista (www.projectcleanwater.org). The river is listed an impaired water body with high levels of high levels of chloride and total dissolved solids. Riparian habitat is the dominant habitat type followed by estuarine open water. Endangered California least terns forage near the mouth of the river and nest further north at U.S. Marine Corps Base Camp Pendleton. Upstream riparian areas support other endangered species such as the least Bell's vireo and southwestern willow flycatcher. The draft Southern California Steelhead Recovery Plan designates the San Luis Rey as a high priority watershed (NMFS 2009).

2.7.2 Loma Alta Creek/Slough

The proposed Oceanside receiver site alternatives are located on the beach directly in front of the creek. The Loma Alta Creek (or slough) is a seasonal freshwater creek that discharges into the ocean near Buccaneer Beach Park. The Creek is just over seven miles long and is urbanized along most of its length (www.oceansideclean waterprogram.org/lac_w.asp). It is listed as an impaired water body with high levels of bacteria and nutrients. The creek flows under Pacific Street through a cement culvert. The outlet area crosses a small steep sand beach that is defined by rip-rap on both sides. A small freshwater marsh is located east of the outlet area. During the dry season, the creek outlet to the ocean is closed by a sand berm.

2.7.3 Buena Vista Lagoon

Buena Vista Lagoon is located approximately 1,000 ft downcoast of the proposed Oceanside receiver site alternatives and is adjacent to the North Carlsbad receiver site alternatives. Buena Vista Lagoon is a State Ecological Reserve managed by the CDFW. Historically, it was a tidal lagoon; however, since 1940 the inlet has been closed by a man-made weir (a dam used to raise the lagoon's water level and control flow at the mouth). The lagoon covers approximately 223 acres with the primary habitats being fresh/brackish water and marsh, although there is a small remnant coastal saltmarsh. The lagoon historically received discharges of secondary treated wastewater and has experienced sewage spills. The accumulated sludge, plant detritus, excess nutrients, and contained basin combine to cause eutrophic conditions. The lagoon is considered an impaired water body with high levels of bacteria, nutrients, and sediment. Over 82 species of wildlife have been documented at the lagoon (Coastal Environments 2000). The lagoon is a migratory bird stopover point and general habitat for herons, egrets, dabbling and diving ducks. The lagoon supports endangered species such as the light-footed clapper rail and Belding's savannah sparrows. Endangered California least tern and fully protected California brown pelican may forage in the lagoon. Although proposed as critical habitat for the tidewater goby in 2000, Buena Vista was excluded in the final designation of critical habitat for the species (USFWS 2008).

2.7.4 Agua Hedionda Lagoon

The ocean inlet to Agua Hedionda Lagoon is located approximately 4,000 ft south of the proposed North Carlsbad receiver site alternatives and approximately 1.5 miles north of the proposed South Carlsbad North receiver site alternatives. Aqua Hedionda has been a tidal lagoon since 1954 when San Diego Gas and Electric completed a large-scale dredging project to provide a deep water basin and cooling water for the Encina Power Plant, which is now owned and operated by NRG Energy. The lagoon is approximately 400 acres in size and consists primarily of open water habitat. Tidal mudflats occur along the shore and eelgrass occurs subtidally along the shoreline. A coastal salt marsh occurs at the eastern end of the lagoon. These habitats support approximately 70 species of fish, 175 species of benthic invertebrates, 192 species of birds, and 100 species of plants (www.aguahedionda.org). The salt marsh supports endangered Belding's savannah sparrow and light-footed clapper rails. California brown pelican feed and roost at the lagoon, and endangered California least tern forage on small fish. Although proposed as critical habitat for the tidewater goby in 2000, Aqua Hedionda Lagoon was excluded in the final designation of critical habitat for the species (USFWS 2008). The outer lagoon supports a commercial aquaculture facility, Carlsbad Aquafarm, which uses the outer lagoon for growing abalone, clams, mussels, oysters, and red seaweed. Hubbs Sea World Research Institute operates a fish hatchery for white seabass for ocean enhancement. A portion of the inner lagoon is considered an impaired water body with high levels of Coliform bacteria and sediment. Two pair of jetties maintain tidal flow and power plant circulation; the northern jetties serve as an ocean inlet to the lagoon and the southern jetties serve as the warm water discharge from the power plant. The entrance to the lagoon undergoes maintenance dredging annually or biannually and dredge materials are used to replenish beaches north, between, and south of the inlet and discharge jetties.

2.7.5 Batiquitos Lagoon

The ocean inlet to Batiquitos was completed in 1997, which restored the lagoon to tidal flushing. The inlet is located just north of the Encinitas study area boundary. The lagoon is managed as a State Ecological Reserve by the CDFW. The primary habitat is estuarine open water followed by coastal salt marsh. Nesting islands support endangered California least terns and threatened western snowy plover. The lagoon supports over 150 bird species, 65 fish species, and a diverse variety of marsh plants (www.batiquitosfoundation.org). The lagoon also functions as habitat for marine and estuarine species of invertebrates and fish. Routine dredging is required to maintain hydrological circulation within the lagoon.

Under the MLPA, Batiquitos Lagoon eastward of the Interstate Highway 5 Bridge was designated as a SMCA. Take of all living marine resources is prohibited except for take pursuant to operation and maintenance, habitat restoration, research and education, maintenance dredging and maintenance of artificial structures inside the conservation area per any required federal, state and local permits, or activities pursuant to Section 630, or as otherwise authorized by the department. Boating, swimming, wading, and diving are prohibited within the conservation area.

2.8 RECEIVER SITES

The proposed receiver sites are same as those that were used for RBSP I and II, and were described in terms of habitat and species identified within its boundaries (i.e., footprint) as well as nearby sensitive resources (SANDAG 2011). Sensitive resources are defined at the habitat level to include vegetated nearshore reefs and kelp beds, and at the species level to include threatened or endangered species. Potential suitability of receiver sites as spawning habitat for California grunion are noted in the text. Generally, sandy beaches with gentle slopes and sufficient beach width above the mean high tide line to support egg incubation would be suitable, while beaches with substantial cobble, steep slopes, or with complete wave run-up over average high tides would not be suitable. The site assessment considers the potential for suitability to change during the course of the grunion spawning season, which primarily ranges from March to August, due to natural seasonal sand level changes on beaches.

The closest distances to sensitive habitats from receiver site boundaries are summarized in Table 2-8. The closest distances to least tern and snowy plover nesting sites are summarized in Table 2-9. The types of habitats observed at the receiver sites and documented in the nearshore in their vicinities are summarized in Table 2-10. Hard-bottom and vegetated habitats in the vicinity of the receiver and nearshore disposal sites are shown in Figures 2-1 through 2-3.

Table 2-8. Estimated closest distances to hard bottom and vegetated habitats from the seaward boundary of proposed receiver sites (from SANDAG 2011).

Proposed Receiver Sites	Distance (ft) From Receiver Site to Hard Bottom or Vegetated Habitats				
	Hard Bottom (2002)	Intertidal Surfgrass (2002)	Subtidal Surfgrass (2002)	Understory Algae (2002)	Kelp Bed (2008)
Oceanside	1600	>3 miles	>2miles	1600	6700
North Carlsbad	200	>9000	450	200	1400

Note: Historical kelp bed represents maximum extent of kelp across multiple years, 1967-2002; Distances are estimates based on receiver site footprints, 2002 Habitat Inventory maps, and 2008 kelp cover.

Table 2-9. Estimated closest distances to least tern and snowy plover nest sites (from SANDAG 2011).

Receiver Sites	Nearest Nest Site	Distance	
		Miles	Kilometers
Oceanside	Camp Pendleton	3.1	5.0
North Carlsbad	Camp Pendleton	4.9	7.9

Active nesting within last 5 years.

Table 2-10. Summary of habitats at the proposed receiver sites and in the nearshore vicinity (from SANDAG 2011).

Receiver Site	Intertidal	Subtidal to -10 ft MLLW	Subtidal -11 to -20 ft MLLW	Subtidal -20 to -30 ft MLLW
Oceanside	Sand, cobble variable, rip-rap revetment at back beach	Sand and localized rocks	Sand and localized rocks, sparse surfgrass, understory algae	Sand and localized rocks, understory algae, kelp
North Carlsbad	Sand	Sand and reef, understory algae	Sand and reef, sparse surfgrass, understory algae	Sand and reef, kelp, sea fans, understory algae
Nearshore Disposal Site	N/A	N/A	Sand	Sand

2.8.1 Oceanside Receiver Site

Within Receiver Site Boundaries

The Oceanside receiver site extends from Wisconsin Avenue south to Morse Street. The fill would extend up to 4,100 linear feet (LF) and include up to 420,000 cy of sand. The proposed site is similar to RBSP I but has been shifted 1,800 feet north. The intertidal habitat is predominantly sand. Sand depths measured in November 2008 ranged from 15 to greater than 48 inches and averaged more than 2 ft across tide zones. Cobbles occurred throughout the tide zone, ranging from sparse to common in the mid-tide zone, but were sparse in high and low tide zones.

Organisms observed in the sand habitat included sand crabs, bean clams, and polychaete worms. No Pismo clams were collected and no sign of established Pismo clam beds were observed in the low tide zone. Kelp and surfgrass wrack was sparse and localized on the beach. Potential habitat suitability for grunion spawning may be limited due to wave run-up to riprap under spring high tide conditions, but suitability may vary over the course of the grunion season with seasonal migration of sand.

Riprap shore protection occurs along the back beach of the site; the wetted sand line indicated wave runup to the riprap zone. Green algae, acorn barnacles, limpets, and gray littorine snails occurred in localized areas where the revetment was in the high tide splash zone. No surfgrass was observed on hard substrates.

Birds observed during the 2008 survey and 2009 and 2010 site visits included Heerman's, herring (*Larus argentatus*), and western gulls (*Larus occidentalis*); marbled godwit (*Limosa fedoa*), sanderlings (*Calidris alba*), willets (*Tringa semipalmata*), great egret (*Ardea alba*); rock pigeon (*Columba livia*); and American crow (*Corvus brachyrhynchos*). California brown pelican were observed in flight. Generally, more gulls were seen on the wider beach near Oceanside Pier than along the narrower beach of the proposed receiver sites.

Nearby Sensitive Resources

The predominant habitat offshore is sand. No Pismo clam beds were observed along soft-bottom transects surveyed at water depths of 10 to 30 ft directly offshore and upcoast of the proposed receiver sites (SAIC 2009).

Limited hard-bottom and vegetated habitats occur approximately 500 to 1,800 ft offshore approximately 1,600 ft downcoast for Alternatives 1 and 2, and are directly offshore with Alternative 3. The largest of the hard-bottom areas has low-relief rocks (<1 to 2 ft) and cobble with localized occurrence of surfgrass, giant kelp, feather boa kelp, sea palm, and sea fan as well as common occurrence of turf algae. Surfgrass is localized with sparse occurrence. Surfgrass, feather boa kelp, and turf also occur on a smaller, adjacent patch reef. The occurrence of sensitive indicators varied on rock heights according to distance offshore. Rocks located approximately 700 to 1,000 ft offshore were surveyed in November 2009; sensitive indicators were observed on rock heights of 1 to 2 ft and no sensitive indicators were seen on rock heights < 1ft. Rocks approximately 1,100 to 1,200 ft offshore were surveyed in January 2009; all rocks were < 1 ft and approximately 30% of the surveyed area had sparse occurrence of sensitive indicators. No vegetation or turf algae occurred on most of the hard-bottom habitat with heights < 1 ft. The closest kelp bed in 2008 was more than 1 mile downcoast.

The closest endangered least tern and threatened snowy plover nesting sites are located at Marine Corps Base Camp Pendleton more than 3 miles from the receiver site. The closest potential snowy plover wintering area is located near the San Luis Rey river more than 1 mile from the receiver site alternatives.

2.8.2 North Carlsbad Receiver Site

Within Receiver Site Boundaries

The North Carlsbad receiver site is located south of Buena Vista Lagoon and extends for up to 3,100 ft to Oak Street. Up to 225,000 cy of sand would be placed at this site. Beach habitat is predominantly sandy within the boundaries of the receiver site alternatives. Sand depths averaged between 28 and 41 inches across tide zones during the July 2009 survey. Bean clams, juvenile Pismo clams (1.5 to 2 inches), polychaete worms, ribbon worms, and amphipod and sand crab crustaceans were collected. No sign of established Pismo clam beds was observed. Beach width and sand depths appeared suitable for grunion spawning. Sand erosion was evident after January 2010 with greater beach slope, presence of cobbles, and exposure of small unvegetated sandstone reef patches in the swash zone. No marine life was observed on the cobble or sandstone rocks.

Birds observed during the 2009 survey and 2010 site visit included Heerman’s and western gulls; two species of shorebirds (western sandpiper [*Calidris mauri*] and willets); elegant tern; rock pigeon; and American crow. California brown pelican and great blue heron were observed in flight.

Nearby Sensitive Resources

The closest intertidal surfgrass is located more than 1 mile downcoast, but was mapped within ½ mile of the site in 2000. Nearshore reef and scattered rocks occur approximately 200 feet offshore the proposed receiver site. The greatest concentration of reef occurs offshore the central portion of the receiver site and decreases in development in both up- and downcoast directions. Hard bottom with understory algae occurs approximately 200 ft offshore the site boundaries. Surfgrass, sea palm, and feather boa kelp were observed on reef heights ranging from 1 to 4 feet on the central portion of the reef within 450 and 700 ft of the site boundaries during the November 2009 dive survey. Giant kelp, sea palm, feather boa kelp, and sea fans were on reef located approximately 1,200 feet offshore the boundaries of the receiver site alternatives. A well-developed kelp bed was mapped approximately 1,400 ft offshore the site boundaries in 2008.

The closest endangered least tern and threatened snowy plover nesting sites are located more than 4 miles upcoast at Marine Corps Base Camp Pendleton. The closest potential snowy plover wintering area is located within 200 ft of the downcoast boundary of the receiver site.

2.9 NEARSHORE PLACEMENT SITE

Nearshore nourishment would occur at the closest nearshore receiver site proposed and permitted by the U.S. Navy for the San Diego Homeporting Project in 1997 (U.S. Navy 1995). This site is located off the coast of Oceanside between Loma Alta Creek and the municipal pier in nearshore waters ranging in depth from -20 FT, NGVD to -30 FT NGVD (Figure 1-7). The habitat within the footprint can be characterized as sandy subtidal habitat (Figure 2-2). Common organisms include tube-dwelling polychaetes, sea stars, crabs, halibut, snails, clams, and cnidarians such as burrowing anemones, sea pens, and sea pansies (U.S. Navy 1995). The site is more than 500 ft from substrate supporting kelp canopy mapped in 2002, the City of Oceanside wastewater discharge pipeline is located approximately 500 ft downcoast, and the closest nearshore reefs at depths less than -30 ft are located approximately 2,500 ft away.

3.0 IMPACT ANALYSIS

This impact analysis only addresses shoreline and nearshore marine biological resources, and not biological resources within Buena Vista Lagoon or LA-5 ODMDS. Potential impacts to marine biological resources would primarily be related to resuspension of sediment during the dredging, transport, and placement of dredged materials. Direct impacts to marine biological resources may occur through burial or smothering of organisms during sand placement at receiver and stockpile sites, equipment-related damage to habitats or animals during construction activities. Indirect impacts may result from reductions in marine water quality associated with dredging and sand placement activities, sediment transport related to movement of sands from the receiver sites, noise from construction equipment, or interference of normal movement or behaviors of animals due to temporary construction activities or long term changes in the environment. Indirect impacts may result in reduction in habitat quality, interference with foraging or impaired growth, diminished reproduction, or interruption of wildlife movement. Direct and indirect impacts from the project on biological resources are assessed in this section.

An impact to marine biological resources would be considered significant if a project alternative results in:

- A direct adverse effect on the population of a threatened or endangered species or the loss or disturbance of important habitat for a listed species;
- A long-term net loss in the habitat value of a sensitive biological habitat. For the purposes of this analysis, kelp beds, and well-developed rocky intertidal and surfgrass beds are considered sensitive biological habitats;
- Substantial impedance to the breeding, movement or migration of fish or wildlife;
- Substantial loss to the population of any native fish, wildlife or vegetation. For the purpose of this analysis, substantial is defined as a change in a population that is detectable over natural variability for a period of five years or more; and/or
- Substantial adverse impact on Essential Fish Habitat.

The significance of the impacts was evaluated according to the estimated duration of the impact (short-term or long-term), sensitivity of the affected habitat, and relative change from existing conditions.

3.1 FRESHWATER ALTERNATIVE

Under the Freshwater Alternative, approximately 562,000 cy of sediment would be removed from the lagoon (Table 1-6). Under Approach 1 (no overdredge pit), up to 49,000 cy would be placed at the Oceanside Receiver site, up to 30,000 cy would be placed at the nearshore disposal site, and up to 483,000 cy would be disposed of at the LA-5 ODMDS. Under Approach 2 (with overdredge pit), up to 175,000 cy would be placed at the Oceanside receiver site and up to 387,000 cy would be placed at the nearshore disposal site.

3.1.1 Direct Impacts from the Freshwater Alternative

Beach nourishment would result in direct impacts due to sand placement within the receiver and nearshore site footprints. Other direct impacts may result from construction vehicle or equipment damage during construction activities. Indirect impacts would occur from turbidity generated during construction of the receiver sites, construction noise and activity disturbance to wildlife, and transport of sand away from the site via natural coastal processes up and down the coast and on and offshore.

Receiver Sites

Construction of the beach receiver sites would result in burial impacts to small marine invertebrates (e.g., clams, sand crabs, worms). During beach nourishment, large volumes of sand are placed above and through the intertidal zone. The amount of sand overburden varies in thickness across the footprint of the fill. From the back beach to the top of the slope, where sand depths would be deeper, all benthic organisms would be smothered. Organisms also would be buried under decreasing depths of sand towards the toe of the slope. The loss of benthic organisms within the receiver site footprint is an expected and unavoidable impact of beach replenishment projects. Most invertebrates within the receiver site footprint are not expected to survive, but studies have shown that some mobile animals are able to escape or burrow out from the outer or leading edges of the beach fills where overburden depths are generally 2 ft or less (NRC 1995). However, burrowing ability substantially decreases over short time frames (Mauer et al. 1986).

Most studies have reported rapid recovery within 1 year or less for sandy beach intertidal animals after beach nourishment (NRC 1995, Greene 2002, SAIC 2007b). This begins almost immediately after cessation of construction. Recovery occurs via two mechanisms, one is by animals that migrate to the affected area from surrounding habitat, and the second is from recruitment from the plankton. Substantial recovery of invertebrate abundance, species number, and biomass occurred within 4 months after placement of 1 mcy of sand at Imperial Beach (Parr et al. 1978), within a larger area than the RBSP I receiver site. Habitat functions were studied for 3 years after the RBSP I at several beach sites in Encinitas, and were found to be enhanced relative to prior to the RBSP I in having: increased invertebrate prey variety earlier in the season, greater sand depths and grunion habitat suitability, and increased bird use of wider beach habitat across tide conditions (SAIC 2006). Habitat enhancement also was observed after the RBSP I on an adjacent beach within 1,500 ft downcoast of the Cardiff receiver site, although seasonal differences in habitat quality varied more at that site than the receiver site.

Sand Placement

The primary direct impact associated with beach nourishment is burial of beach invertebrate animals (e.g., clams, sand crabs, worms) living within the substrate at the receiver site. There is the potential to directly impact California grunion individuals or eggs by equipment damage or sand burial, if sand placement or site mobilization activities took place within 10 to 14 days of a spawning run. Other direct impacts may result from equipment damage associated with placement of pipelines to pump sediment to the beaches, operation of vehicles to move and spread sand at the receiver sites, and movement of vehicles and equipment during access to and from the receiver site. Placement of pipelines would occur across the beach face or along the back of the beach. No sensitive habitats occur in these areas within the receiver sites. A pre-construction survey would be conducted of all pipeline routes to ensure no sensitive resources would be directly impacted by the placement. With this measure, impacts would remain less than significant.

During the grunion season, construction activities and vehicles have the potential to damage eggs in the upper intertidal, if eggs are present. As part of RBSP I and II, a pre-construction habitat assessment to determine potential suitability for grunion spawning was conducted and implementation of a grunion monitoring program during construction to avoid and minimize adverse effects to this species during their spawning season. Vehicle routes also would be along the beach. Therefore, impacts would remain less than significant.

The area of direct impact to beach habitat and invertebrate resources was conservatively estimated for each approach by using the predicted volume and its relative percentage of the entire fill site from the top of the back beach to the toe of the slope (Table 3-1). Actual impact to biological resources would be less at some sites given that marine invertebrates do not inhabit back beach non-tidal areas and some would escape mortality along the constructed slope and leading edge of the fill. The temporary habitat disturbance would not be substantially adverse or significant on a regional scale because sandy beach habitat is the dominant shoreline habitat in San Diego County and disturbance of sandy beach habitat functions would be temporary. After construction, sandy beach organisms would begin recolonizing the site almost immediately with recovery anticipated in relatively short timeframes (weeks. months, to < 1 year) depending on when each site is nourished within the overall construction schedule. Because beach construction is anticipated to take 12 to 24 months to complete, receiver sites would be in various stages of recovery over the course of the construction period; thereby, minimizing potential impacts to other wildlife from temporary reductions in invertebrate prey at individual receiver site locations. Therefore, impacts would remain less than significant.

Table 3-1. Estimated direct impact acreage with proposed sand placement per approach for Freshwater Alternative.

Receiver Site	**Dimensions**		**Acres**	**Capacity Based on Historical Projects (cy)**	**Approach 1 (acres)**	**Approach 2 (acres)**
	Length (ft)	**Width (ft)**				
Onshore						
Oceanside	4,100	319	30	420,000	3.5	12.5
North Carlsbad	3,100	260	18.5	225,000	0	0
Nearshore						
Oceanside (nearshore)	3,170	2,285	166	2,460,000	2.0	26.1

Direct impacts are summarized below for each receiver site.

<u>Oceanside</u>

The maximum receiver site footprint is approximately 30 acres with placement of 420,000 cy (Table 3-1). Under Approach 1, approximately 3.5 acres would be impacted, and under Approach 2, approximately 12.5 acres would be impacted. Habitat within the site boundaries is sand and cobble, and no sensitive hard bottom or vegetated habitat occurs within the site boundaries. Marine invertebrates living within the sands would be killed from burial and construction activities, but the reduction in invertebrates would be temporary. Recovery would occur within several months, the speed of which would depend on project timing. Impacts to grunion would be avoided and minimized by pre-construction habitat assessments, monitoring, or other conditions established during the permitting process. Therefore, direct impacts would be expected to be less than significant.

North Carlsbad

The maximum receiver site footprint would be approximately 18.5 acres with placement of 225,000 cy (Table 3-1). Under Approaches 1 and 2, 0 acres would be impacted. Habitat within the site boundaries is sand and cobbles, and sandstone was exposed in the lower intertidal after the January 2010 storm. No sensitive hard bottom or vegetated habitat occurs within the site boundaries. Similar to the Oceanside receiver site, direct impacts to marine life within the fill footprint would not be substantially adverse, and impacts to grunion would be avoided and minimized by pre-construction habitat assessments, monitoring, or other conditions established during the permitting process. Therefore, direct impacts would be expected to be less than significant.

Nearshore Placement Site

The maximum nearshore disposal site footprint would be approximately 166 acres with placement of 2,460,000 cy (Table 3-1). Under Approach 1, approximately 2.0 acres would be impacted, and under Approach 2, approximately 26.1 acres would be impacted. Habitat within the site boundaries is sand. There would be a temporary reduction in benthic invertebrate biomass and alteration of the benthic community species composition at the nearshore disposal site associated with the sediment disposal. Studies indicate that recovery of the benthic invertebrate community depends on several factors such as placement method, local environmental conditions, hydrodynamics, and sediment infill rates. Reported recovery rates for dredging nearshore sandy subtidal habitat generally range from 2 to 4 years when hydrodynamics and sediment characteristics are not substantially changed within the dredged area (Oliver et al. 1977, Newell et al. 1998, Burlas et al. 2001, SAIC 2007b). Therefore, direct impacts would be less than significant.

3.1.2 Indirect Impacts from Freshwater Alternative

The following types of potential indirect impacts may result from sand placement:

- forage reduction or alteration;
- disturbance, displacement, or interference;
- turbidity;
- sedimentation; and
- other construction issues.

In addition, benefits also would occur to sandy habitats after placement of additional sand on beaches. Monitoring after RBSP I demonstrated that beach nourishment enhanced sandy beach habitat functions at several beaches (SAIC 2006). This was most noticeable at beaches that transitioned from either cobble-covered beaches supporting few biological resources or beaches with highly seasonal periods of productivity coincident with seasonal sand accretion and erosion. The primary benefit was to increase the persistence of sandy beach habitat across seasons such that habitat was suitable early in the season to support the onset of the grunion spawning season and invertebrate recruitment period. This enhancement resulted in increased invertebrate diversity earlier in the season, increased bird use across tide conditions, and enhanced habitat for grunion spawning (e.g., increased beach width and reduction in cobble) Similar beneficial impacts would be anticipated after implementation of this project.

Each type of indirect impact is assessed for habitats and general wildlife. Potential indirect impacts to federally listed or state-listed endangered or threatened species are summarized at the end of this section. Many of the impacts can be generalized across the project receiver sites and are therefore not specifically discussed with respect to each site. Indirect impacts to nearshore resources due to project sedimentation could have localized effects; however, and these potential effects are discussed according to receiver site below.

Forage Reduction, Alteration, or Modification

There is potential for indirect effects to shorebird foraging from burial of invertebrates within the footprint of the receiver site. Each receiver site has unaffected shoreline nearby and recolonization of the receiver site by invertebrates would be rapid (e.g., weeks to months) following the conclusion of sand placement activities. Therefore, impacts would be less than significant.

Temporary attraction of birds, particularly gulls, to the discharge location is anticipated based on observations from RBSP I and other beach nourishment projects. The birds are attracted to the sand-slurry pumped onto the beach or its return water, where they opportunistically forage on deceased invertebrates and organic debris originating from the borrow site. Similarly, fish that feed on plankton or small organic particles may be attracted to turbidity plumes associated with hydraulic dredge-pump sediment projects; presumably to feed on discharged organic particulates. Fish-feeding birds may be attracted in turn to an increased concentration of fish where water clarity is sufficient for them to locate their prey. Such effects are temporary and therefore, impacts would be less than significant.

No adverse effects on seabird or waterbird foraging were observed with implementation of RBSP I (AMEC 2002). Bird surveys in areas of the borrow and receiver sites identified no effects of dredging or discharge turbidity on bird foraging behavior or locations. Turbidity plumes are expected to be similar to those experienced during RBSP I and II; localized and short-term in duration. Therefore, impacts would be less than significant.

Disturbance, Displacement, or Interference

Operational noise from equipment and activities has the potential to disturb shorebirds, gulls, and other coastal birds that may forage or rest on beaches at or near receiver sites. This impact would not be substantially adverse and would remain less than significant because (1) disturbance effects would be temporary and limited to the period of construction; (2) the proximity of unaffected shoreline adjacent to the receiver sites that provides foraging opportunities; and, the (3) the forage base at the receiver site would rapidly recover following the conclusion of sand placement activities.

Artificial night lighting has the potential to disturb or attract wildlife. Grunion have been documented to spawn in the vicinity of beach disposal operations, including RBSP I. Some reports suggest that grunion spawning may be reduced in well-lighted areas, while other reports document spawning near lighted areas such as piers. It is not well understood to what extent grunion may be attracted or displaced from spawning at a beach from artificial lighting or other equipment-related disturbance. Impacts to grunion would be less than significant because habitat suitability assessments and monitoring during construction as discussed above would be used to minimize impacts to the species.

Turbidity

The primary indirect impact from the Freshwater Alternative includes potential degradation of water quality through the generation of turbidity by dewatering dredged material at the beach, nearshore disposal site, and if used, offshore barges. Turbidity can have a number of effects on marine biota. Reduction of water clarity or ambient light levels can impact primary production of plankton, inhibit plant growth or recruitment of plants in vegetated habitats, reduce foraging efficiency of a variety of animals, or cause physiological stress in organisms unable to move away from the turbid water. Sedimentation associated with the settlement of suspended sediment from turbidity plumes has the potential to impact organisms or plant recruitment in hard-bottom habitats. Sedimentation generally is less of a concern for soft-bottom habitats unless within spawning grounds.

Turbidity within the ocean environment is naturally variable depending on wave climate and season. Monitoring data from seven California beach nourishment projects indicate that turbidity measurements with a nephelometer were below or within ranges measured during storm or high wave conditions (SAIC 2007). Turbidity would be expected to be localized to the discharge location, generally within 500 feet or less. Plumes would be expected to be largely confined within the surf zone but may be incorporated by rip currents and carried farther offshore. Because the sediments are generally sandy, project-related turbidity is expected to quickly settle and plumes would be temporary.

While it is assumed that Best Management Practices (BMPs) such as screening the material would occur, turbidity plumes would still be generated. Turbidity can be influenced by many factors, including characteristics of dredged material, water depth, and hydrodynamic forces (mixing, currents, etc.). The degree of turbidity depends largely on the size of the sediment particles. Extremely fine material such as clay and silt have a tendency to quickly go into suspension during the dredging process and stay suspended for a longer time due to their small settling velocities. Fines may be expected to settle on the order of several hours at the 45 to 75 foot depths, while coarser-grained materials, such as sands, would tend to settle on the order of several minutes at similar depths (SANDAG 2011).

The elevated suspended solids concentrations in turbidity plumes reduce water clarity/light transmittance, and increase discoloration. Table 3-2 shows the estimated sediment plume length expected to occur from depositing sediments at disposal sites at onshore and nearshore locations. These estimates assume a median particle size of 0.20 millimeter (mm) and a settling velocity of 0.08 feet per second (ft/s), were calculated by the following formula: water depth/particle settling velocity x current speed (feet/sec), which is the material anticipated for either beach or nearshore placement.

The estimated plume distance on any given day will vary according to the grain size characteristics of the material dredged during that day, turbulence, current speed, and to what depth in the water column the particles are resuspended. Use of the overall mean grain size diameter represents an indication of average plume extent. Silt/clays resuspended during dredging may travel longer distances than indicated in the table. Under maximum expected current speeds (0.5 to 1.5 knots), the range of predicted downcurrent plumes range from approximately 900 to 1,600 ft (Table 3-2).

Table 3-2. Estimated sediment plume length at potential disposal sites (after SANDAG 2011).

Disposal/Reuse Location	Current Velocity (knots)	Depth (ft)	Plume Length (ft)
Onshore	1.5–3.0	10	313 – 625
Nearshore	1.5–3.0	15	469 – 938
Nearshore	0.5–1.5	25	781 – 1,563

Resuspension of sediments can also affect other water quality parameters such as dissolved oxygen and pH within the zone of influence. As noted above, this will depend on numerous environmental factors, although it is anticipated any effects would be short-term and localized. Therefore, no long-term reductions in water quality would be anticipated due to the diluting capacity of the ocean, localized nature of the turbidity plumes, and rapid dissipation once dredging operations ceased. Therefore, impacts to other water quality parameters would be less than significant

Since it is assumed that the material is suitable for either nearshore or ocean disposal, and permitted to be disposed of, no impacts are anticipated from potential effects associated with contaminants.

Sediment that is unsuitable for beneficial use (<70 percent sand) would be dredged and transported to a barge offshore via a pipeline system that connects the excavation site to the barge. Excess water contained in the dredged material in the barge would be decanted and transported back to the excavation site via pipeline for reuse in the dredging operation and to minimize nearshore water quality impacts.

During placement at the receiver site, turbidity would be minimized by the construction of training dikes that would promote settlement of sediment on the beach and lower the amount of suspended sediment that is lost to the return waters. This design feature was implemented during RBSP I and II, and found to be effective for minimizing turbidity plumes at the receiver sites. With this project design feature, suspended sediment concentrations would be reduced, thereby minimizing potential effects associated with the range of exposure durations that may occur depending on equipment type and differences in receiver site configurations. Therefore, impacts would be less than significant.

Plankton, Pelagic Fish, and Marine Mammals

As discussed above, the effects of suspended particulates on plankton are generally considered negligible because of the limited area affected and short exposure time as they drift through the affected areas. Similarly, potential effects on fish would be limited and temporary in nature, and a number of studies have documented variable responses by fish that range from attraction to avoidance. Pelagic fish offshore of the receiver sites, and any marine mammals that ventured close to shore, would not be expected to be adversely affected because the turbidity would remain localized and short term, and similar to conditions that may be experienced during storm events. Therefore, impacts would be less than significant.

Kelp

Kelp beds occur from approximately 1,400 to 6,700 ft offshore of the receiver sites, which is outside the distance that turbidity plumes would be expected to travel offshore unless carried by rip currents. In the unlikely event that turbidity did extend offshore, the particulate concentration would be expected to be low as to have a negligible effect on the kelp bed. Therefore, impacts would be less than significant.

Vegetated Reefs

Nearshore vegetated reefs have the potential to be impacted by reduced light transmittance and siltation associated with turbidity plumes. Turbidity also has the potential to cause physiological stress, reduced feeding, or displacement of mobile marine invertebrates or fish in reef areas. Actual effects would depend on the concentration and duration of turbidity. While marine invertebrates and bottom-associated fish are generally tolerant of high turbidity such as naturally occurs during high wave or storm conditions, adverse effects may result from exposure to very high concentrations or moderate to high concentrations for prolonged periods. As noted, turbidity plumes associated with the project would be relatively small, localized, and of short duration. Furthermore, suspended sediment concentrations in turbidity plumes would be minimized by use of training dikes, a key project design feature. Therefore, impacts would be less than significant.

Sedimentation

Beach sand placed on receiver sites would eventually be washed by waves and redistributed offshore and alongshore through natural processes. There is the potential for sand introduced into the system to indirectly impact sensitive habitats and resources if sand deposits on those resources occur at sufficient depth and persistence to result in burial or degradation of those resources. To estimate potential impacts to sensitive habitats, a suite of indicator species of relatively higher quality reef habitats has been identified. As defined in Section 2.0, sensitive indicator species consist of surfgrass, feather boa kelp, sea fans, sea palms, and giant kelp.

Evaluating potential indirect sedimentation impacts is complex and impact conclusions must be determined in light of the dynamic ocean system, where seasonal and annual changes in sand elevation naturally occur, and an understanding must be developed of the life history of sensitive species and their relative distribution on nearshore reefs. Numerical modeling has been successfully used to predict and simulate changes in shoreline morphology for RBSP I and II (SANDAG 2011). For these projects, shoreline modeling positions were output at each model cell within the GENESIS model domain. For each profile, the average shoreline position was calculated including data from one half the distance to the next downcoast profile up through one half the distance to the next upcoast profile. Net differences between each project alternative and the without project condition were calculated. These net shoreline changes at each profile location were then converted into sand volumes using v/s ratios. These sand volumes were distributed across the profiles using historical cross shore sand thickness distributions. Sand thicknesses were interpolated between the profiles where data were non-existent. Model outputs consisted of predictions of with-project sand level increases produced at 10 ft intervals in the onshore-offshore direction along the profiles. Sand increase predictions were provided from the onshore beach to offshore distances corresponding to approximately-30 ft MLLW, which was defined as the average depth of beach closure for North County beaches. The sand level increase predictions were provided for both spring and fall seasons each year for five years and ten years after project implementation.

The sand is to be placed at two beach disposal sites at Oceanside and North Carlsbad Beaches which have been previously modeled for RBSP I and II, while the marginally suitable sediment is to be placed at the Oceanside nearshore location. These beach and nearshore locations have been permitted and used for this type of disposal numerous times in the past, with extensive physical monitoring.

Data and conclusions from these previous projects were used to estimate both short-term and long-term shoreline and profile changes resulting from the Project alternatives (Everest 2014).

For the Freshwater Alternative under Approach 1 (no overdredge pit), up to 49,000 cy would be placed at the Oceanside Receiver site and up to 30,000 cy would be placed at the nearshore placement site. The total volume is much less than the USACE Dredge Disposal, the permitted Navy Homeporting, RBSPI, and RBSPII. Therefore, the long-term (e.g., 3 to 10 years) shoreline and profile changes for those this alternative should be less than those predicted, permitted, and experienced for those projects (Everest 2014), and no long-term burial of habitat with sensitive indicators was predicted (SANDAG 2011 and U.S. Navy 1997). Therefore, impacts from the Freshwater Alternative – Approach 1 would be less than significant.

For the Freshwater Alternative under Approach 2 (with overdredge pit), up to 175,000 cy would be placed at the Oceanside receiver site and up to 387,000 cy would be placed at the nearshore disposal site. The total volume is much less than the USACE Dredge Disposal, the permitted Navy Homeporting, RBSPI, and RBSPII. Therefore, the long-term (e.g., 3 to 10 years) shoreline and profile changes for those this alternative should be less than those predicted, permitted, and experienced for those projects (Everest 2014), and no long-term burial of habitat with sensitive indicators was predicted (SANDAG 2011 and U.S. Navy 1997). Therefore, impacts from the Freshwater Alternative – Approach 2 would be less than significant.

Other Construction Issues

Operation of equipment on the beach or dredges and support vessels has the potential to introduce contaminants to the marine environment from minor spills and leaks. The potential for accidental discharge also could result from collision with or by another vessel. The probability of both types of accidental discharges is considered low. The dredging contractor would be required to develop a Spill Prevention Control and Containment plan (SPCC) prior to initiating construction. If a spill occurred, the contractor would utilize BMPs to prevent long-term degradation of water quality. For these reasons, impacts to biological resources from accidental discharges would be less than significant.

3.1.3 Threatened and Endangered Species

California Least Tern

Dredging at the lagoon and placement of sand at the receiver sites would generate turbidity that would be expected to be localized and rapidly dissipate based on the sandy nature of the sediment. Plumes would be expected to be similar to those generated during RBSP I, and monitoring demonstrated that turbidity plumes during RBSP I complied with RWQCB 401 certification requirements as well as specified environmental permitting conditions to protect least tern foraging. The environmental conditions required that water clarity in the upper 3 feet of surface waters not be reduced by more than 2.47 acres in the vicinity of borrow or receiver sites. Monitoring documented that plumes were typically much smaller than 2.47 acres and at the receiver sites were mainly restricted to the surf zone except when carried offshore by localized rip currents (AMEC 2002). The receiver sites are located more than 3 miles from least tern nesting sites and would not be expected to affect foraging of the species based on the localized nature of turbidity plumes expected during construction. No adverse effects on bird foraging were observed with implementation of the RBSP I (AMEC 2002) and similar findings were reported during monitoring of least tern foraging behavior during beach nourishment at Surfside-Sunset, California (MEC 1997). Therefore, impacts would be less than significant.

Western Snowy Plover

The lagoon is located approximately 6 miles from snowy plover critical habitat located adjacent to Batiquitos Lagoon. This species nests at Batiquitos Lagoon, and has been observed to forage at the beach in the vicinity of the Batiquitos receiver site. Since no construction would occur within designated or proposed critical habitat, impacts from the Freshwater Alternative would be less than significant.

3.1.4 Essential Fish Habitat

As discussed in Section 2.2.2, the proposed project would encompass designated EFH, including nearshore areas adjacent to receiver sites, as well as the areas located farther offshore. In addition to EFH designations, certain areas may also be designated as HAPCs. HAPCs are discrete subsets of EFH that provide important ecological functions. HAPCs are vulnerable to degradation (50 C.F.R. 600.815[a][8]). Regional Fishery Management Councils may designate a specific habitat area as an HAPC in the FMP based on one or more of the following reasons: (1) importance of the ecological function provided by the habitat; (2) the extent to which the habitat is sensitive to human-induced environmental degradation; (3) whether, and to what extent, development activities are, or will be, stressing the habitat type; and (4) rarity of the habitat type (50 C.F.R. 600.815[a][8]). The HAPC designation does not confer additional protection or restrictions upon an area but can help prioritize conservation efforts.

Impacts to EFH are typically determined based on whether a project reduces quality and/or quantity of EFH, regardless of the degree to which that impact occurs. Based on the Magnuson-Stevens Act, adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species, and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 C.F.R. 600.810(a)). By definition, the threshold to have an adverse impact to EFH is low; however, the nature of the impact can be further qualified based on the type of impact (e.g., temporary or permanent). This is distinctly different from an adverse or significant impact determination made under NEPA and CEQA, which takes into account the context and intensity of a potential impact. Therefore, this section refers to impacts to EFH in terms of compliance with the Magnuson-Stevens Act and does not reflect impact severity as defined under NEPA, although a significant or permanent adverse impact to EFH would qualify as a significant impact under NEPA.

Less than significant impacts to water column EFH and soft-bottom benthic habitat at the nearshore construction area are anticipated and would constitute temporary adverse impacts (e.g., temporary turbidity plume due to dredging or disturbance to soft bottom habitat from pipeline and anchors, loss of prey items). Similarly, temporary adverse impacts to lifestages of managed species are expected to occur as a result of the project. Based on the analysis in the preceding sections, substantial adverse effects to quality or quantity of hard-bottom benthic habitat EFH and HAPCs (e.g., rocky reefs) are not anticipated. Protective measures have been implemented to avoid and/or minimize these impacts.

3.2 Saltwater Alternative

Under the Saltwater Alternative, approximately 781,000 cy of sediment would be removed from the lagoon (Table 1-6). Under Approach 1 (no overdredge pit), up to 110,000 cy would be placed at the Oceanside Receiver site, up to 49,000 cy would be placed at the nearshore disposal site, and up to 622,000 cy would be disposed of at the LA-5 ODMDS. Under Approach 2 (with overdredge pit), up to 232,500 cy would be placed at the Oceanside receiver site and up to 548,500 cy would be placed at the nearshore disposal site. It is estimated that approximately 27,000 cy of sediment would be removed annually for maintenance and disposed near the lagoon mouth (Table 1-3).

3.2.1 Direct Impacts from Saltwater Alternative

Beach nourishment would result in direct impacts due to sand placement within the receiver site footprints. Other direct impacts may result from construction vehicle or equipment damage during construction activities. Indirect impacts would occur from turbidity generated during construction of the receiver sites, construction noise and activity disturbance to wildlife, and transport of sand away from the site via natural coastal processes up and down the coast and on and offshore.

Receiver Sites

<u>Sand Placement</u>

The area of direct impact to beach habitat and invertebrate resources was conservatively estimated for each approach by using the predicted volume and its relative percentage of the entire fill site from the top of the back beach to the toe of the slope (Table 3-3). Actual impact to biological resources would be less at some sites given that marine invertebrates do not inhabit back beach non-tidal areas and some would escape mortality along the constructed slope and leading edge of the fill. The temporary habitat disturbance would not be substantially adverse or significant on a regional scale because sandy beach habitat is the dominant shoreline habitat in San Diego County and disturbance of sandy beach habitat functions would be temporary. After construction, sandy beach organisms would begin recolonizing the site almost immediately with recovery anticipated in relatively short timeframes (weeks. months, to < 1 year) depending on when each site is nourished within the overall construction schedule. Because beach construction is anticipated to take 12 to 24 months to complete, receiver sites would be in various stages of recovery over the course of the construction period; thereby, minimizing potential impacts to other wildlife from temporary reductions in invertebrate prey at individual receiver site locations. Therefore, impacts would be less than significant.

Table 3-3. Estimated direct impact acreage with proposed sand placement per approach for Saltwater Alternative.

Receiver Site	Dimensions		Acres	Capacity Based on Historical Projects (cy)	Approach 1 (acres)	Approach 2 (acres)
	Length (ft)	Width (ft)				
Onshore						
Oceanside	4,100	319	30	420,000	7.9	16.6
North Carlsbad	3,100	260	18.5	225,000	0	0
Nearshore						
Oceanside (nearshore)	3,170	2,285	166	2,460,000	3.3	37.0

Direct impacts are summarized below for each receiver site.

<u>Oceanside</u>

The maximum receiver site footprint is approximately 30 acres with placement of 420,000 cy (Table 3-3). Under Approach 1, approximately 7.9 acres would be impacted, and under Approach 2, approximately 16.6 acres would be impacted. Habitat within the site boundaries is sand and cobble, and no sensitive hard bottom or vegetated habitat occurs within the site boundaries. Marine invertebrates living within the sands would be killed from burial and construction activities, but the reduction in invertebrates would be temporary. Recovery would occur within several months, the speed of which would depend on project timing. Impacts to grunion would be avoided and minimized by pre-construction habitat assessments, monitoring, or other conditions established during the permitting process. Therefore, direct impacts would be less than significant.

<u>North Carlsbad</u>

The maximum receiver site footprint would be approximately 18.5 acres with placement of 225,000 cy (Table 3-3). Under Approaches 1 and 2, 0 acres would be impacted. Habitat within the site boundaries is sand and cobbles, and sandstone was exposed in the lower intertidal after the January 2010 storm. No sensitive hard bottom or vegetated habitat occurs within the site boundaries. Similar to the Oceanside receiver site, direct impacts to marine life within the fill footprint would not be substantially adverse, and impacts to grunion would be avoided and minimized by pre-construction habitat assessments, monitoring, or other conditions established during the permitting process. Therefore, direct impacts would be less than significant.

<u>Nearshore Placement Site</u>

The maximum nearshore disposal site footprint would be approximately 166 acres with placement of 2,460,000 cy (Table 3-3). Under Approach 1, approximately 3.3 acres would be impacted, and under Approach 2, approximately 37.0 acres would be impacted. Habitat within the site boundaries is sand. There would be a temporary reduction in benthic invertebrate biomass and alteration of the benthic community species composition at the nearshore disposal site associated with the sediment disposal. Studies indicate that recovery of the benthic invertebrate community depends on several factors such as placement method, local environmental conditions, hydrodynamics, and sediment infill rates.

Reported recovery rates for dredging nearshore sandy subtidal habitat generally range from 2 to 4 years when hydrodynamics and sediment characteristics are not substantially changed within the dredged area (Oliver et al. 1977, Newell et al. 1998, Burlas et al. 2001, SAIC 2007b). Therefore, direct impacts would be less than significant.

3.2.2 Indirect Impacts from the Saltwater Alternative

The following types of potential indirect impacts may result from sand placement:

- forage reduction or alteration;
- disturbance, displacement, or interference;
- turbidity;
- sedimentation; and
- other construction issues.

In addition, benefits also would occur to sandy habitats after placement of additional sand on beaches. Monitoring after RBSP I demonstrated that beach nourishment enhanced sandy beach habitat functions at several beaches (SAIC 2006). This was most noticeable at beaches that transitioned from either cobble-covered beaches supporting few biological resources or beaches with highly seasonal periods of productivity coincident with seasonal sand accretion and erosion. The primary benefit was to increase the persistence of sandy beach habitat across seasons such that habitat was suitable early in the season to support the onset of the grunion spawning season and invertebrate recruitment period. This enhancement resulted in increased invertebrate diversity earlier in the season, increased bird use across tide conditions, and enhanced habitat for grunion spawning (e.g., increased beach width and reduction in cobble). Similar beneficial impacts would be anticipated after implementation of this project.

Each type of indirect impact is assessed for habitats and general wildlife. Potential indirect impacts to federally listed or state-listed endangered or threatened species are summarized at the end of this section. Many of the impacts can be generalized across the project receiver sites and are therefore not specifically discussed with respect to each site. Indirect impacts to nearshore resources due to project sedimentation could have localized effects, however, and these potential effects are discussed according to receiver site below.

Forage Reduction, Alteration, or Modification

There is potential for indirect effects to shorebird foraging from burial of invertebrates within the footprint of the receiver site. Each receiver site has unaffected shoreline nearby and recolonization of the receiver site by invertebrates would be rapid (e.g., weeks to months) following the conclusion of sand placement activities. Therefore, impacts would be less than significant.

Temporary attraction of birds, particularly gulls, to the discharge location is anticipated based on observations from RBSP I and other beach nourishment projects. The birds are attracted to the sand-slurry pumped onto the beach or its return water, where they opportunistically forage on deceased invertebrates and organic debris originating from the borrow site. Similarly, fish that feed on plankton or small organic particles may be attracted to turbidity plumes associated with hydraulic dredge-pump sediment projects; presumably to feed on discharged organic particulates. Fish-feeding birds may be attracted in turn to an increased concentration of fish where water clarity is sufficient for them to locate their prey. Such effects are temporary and therefore, impacts would be less than significant.

No adverse effects on seabird or waterbird foraging were observed with implementation of RBSP I (AMEC 2002). Bird surveys in areas of the borrow and receiver sites identified no effects of dredging or discharge turbidity on bird foraging behavior or locations. Turbidity plumes are expected to be similar to those experienced during RBSP I and II; localized and short-term in duration. Therefore, impacts would be less than significant.

Disturbance, Displacement, or Interference

Operational noise from equipment and activities has the potential to disturb shorebirds, gulls, and other coastal birds that may forage or rest on beaches at or near receiver sites. This impact would not be substantially adverse and would remain less than significant because (1) disturbance effects would be temporary and limited to the period of construction; (2) the proximity of unaffected shoreline adjacent to the receiver sites that provides foraging opportunities; and, the (3) the forage base at the receiver site would rapidly recover following the conclusion of sand placement activities.

Artificial night lighting has the potential to disturb or attract wildlife. Grunion have been documented to spawn in the vicinity of beach disposal operations, including RBSP I. Some reports suggest that grunion spawning may be reduced in well-lighted areas, while other reports document spawning near lighted areas such as piers. It is not well understood to what extent grunion may be attracted or displaced from spawning at a beach from artificial lighting or other equipment-related disturbance. Impacts to grunion would be less than significant because habitat suitability assessments and monitoring during construction as discussed above would be used to minimize impacts to the species.

Turbidity

Turbidity has the potential to indirectly impact plankton, fish, marine mammals, kelp, and vegetated reefs. Turbidity within the ocean environment is naturally variable depending on wave climate and season. Monitoring data from seven California beach nourishment projects indicate that turbidity measurements with a nephelometer were below or within ranges measured during storm or high wave conditions (SAIC 2007b). As discussed in Section 3.1.2, turbidity would be expected to be localized to the discharge location, generally within 500 feet or less. Plumes would be expected to be largely confined within the surf zone but may be incorporated by rip currents and carried farther offshore. Because the sediments are generally sandy, project-related turbidity is expected to quickly settle and plumes would be temporary.

Turbidity would be minimized by the construction of training dikes that would promote settlement of sediment on the beach and lower the amount of suspended sediment that is lost to the return waters. This design feature was implemented during RBSP I and II, and found to be effective for minimizing turbidity plumes at the receiver sites. With this project design feature, suspended sediment concentrations would be reduced, thereby minimizing potential effects associated with the range of exposure durations that may occur depending on equipment type and differences in receiver site configurations. Therefore, impacts would be less than significant.

Plankton, Pelagic Fish, and Marine Mammals

As discussed above, the effects of suspended particulates on plankton are generally considered negligible because of the limited area affected and short exposure time as they drift through the affected areas. Similarly, potential effects on fish would be limited and temporary in nature, and a number of studies have documented variable responses by fish that range from attraction to avoidance. Pelagic fish offshore of the receiver sites, and any marine mammals that ventured close to shore, would not be expected to be adversely affected because the turbidity would remain localized and short term, and similar to conditions that may be experienced during storm events. Therefore, impacts would be less than significant.

Kelp

Kelp beds occur from approximately 1400 to 6700 ft offshore of the receiver sites, which is outside the distance that turbidity plumes would be expected to travel offshore unless carried by rip currents. In the unlikely event that turbidity did extend offshore, the particulate concentration would be expected to be low as to have a negligible effect on the kelp bed. Therefore, impacts would be less than significant.

Vegetated Reefs

Nearshore vegetated reefs have the potential to be impacted by reduced light transmittance and siltation associated with turbidity plumes. Turbidity also has the potential to cause physiological stress, reduced feeding, or displacement of mobile marine invertebrates or fish in reef areas. Actual effects would depend on the concentration and duration of turbidity. While marine invertebrates and bottom-associated fish are generally tolerant of high turbidity such as naturally occurs during high wave or storm conditions, adverse effects may result from exposure to very high concentrations or moderate to high concentrations for prolonged periods. As noted, turbidity plumes associated with the project would be relatively small, localized, and of short duration. Furthermore, suspended sediment concentrations in turbidity plumes would be minimized by use of training dikes, a key project design feature. Therefore, impacts would be less than significant.

Sedimentation

The sand is to be placed at two beach disposal sites at Oceanside and North Carlsbad Beaches which have been previously modeled for RBSP I and II, while the marginally suitable sediment is to be placed at the Oceanside nearshore location. These beach and nearshore locations have been permitted and used for this type of disposal numerous times in the past, with extensive physical monitoring. Data and conclusions from these previous projects were used to estimate both short-term and long-term shoreline and profile changes resulting from the Project alternatives (Everest 2014).

For the Saltwater Alternative under Approach 1 (no overdredge pit), up to 110,000 cy would be placed at the Oceanside Receiver site and up to 49,000 cy would be placed at the nearshore disposal site. The total volume is much less than the USACE Dredge Disposal, the permitted Navy Homeporting, RBSPI, and RBSPII. Therefore, the long-term (e.g., 3 to 10 years) shoreline and profile changes for those this alternative should be less than those predicted, permitted, and experienced for those projects (Everest 2014), and no long-term burial of habitat with sensitive indicators was predicted (SANDAG 2011 and U.S. Navy 1997). Therefore, impacts from the Saltwater Alternative – Approach 1 would be less than significant.

For the Saltwater Alternative under Approach 2 (with overdredge pit), up to 232,500 cy would be placed at the Oceanside receiver site and up to 548,000 cy would be placed at the nearshore disposal site. The nearshore volume is slightly higher than the USACE Dredge Disposal, but significantly lower than the permitted Navy Homeporting, with the beach placement approximately 55% of the RBSP I and II volume. Therefore, the long-term (e.g., 3 to 10 years) shoreline and profile changes for those this alternative should be less than those predicted, permitted, and experienced for those projects (Everest 2014), and no long-term burial of habitat with sensitive indicators was predicted (SANDAG 2011 and U.S. Navy 1997). Therefore, impacts from the Saltwater Alternative – Approach 2 would be less than significant.

For the Saltwater Alternative, the ebb bar was also incorporated into the analysis, using a conservative analytical approach by comparing ebb bar sedimentation results from an adjacent lagoon (i.e., Batiquitos Lagoon). It was assumed that approximately 100,000 cy of the sediment would migrate to the beach and this volume was incorporated into the GENESIS modeling. The analytical approach was applied to the remaining 400,000 cy to determine the dispersion of the material over time. The results predicted an ebb-bar at Buena Vista Lagoon which would extend 250 ft offshore, stretch 1700 ft alongshore, and be centered at the lagoon mouth. In addition, it is estimated that approximately 27,000 cy of sediment would be removed annually for maintenance and disposed near the lagoon mouth (Table 1-3). No sensitive hard bottom or vegetated habitat occurs within this area. Therefore, impacts would be less than significant

Other Construction Issues

Operation of equipment on the beach or dredges and support vessels has the potential to introduce contaminants to the marine environment from minor spills and leaks. The potential for accidental discharge also could result from collision with or by another vessel. The probability of both types of accidental discharges is considered low. The dredging contractor would be required to develop a Spill Prevention Control and Containment plan (SPCC) prior to initiating construction. If a spill occurred, the contractor would utilize BMPs to prevent long-term degradation of water quality. For these reasons, impacts would be less than significant.

3.2.3 Threatened and Endangered Species

California Least Tern

Dredging at the lagoon and placement of sand at the receiver sites would generate turbidity that would be expected to be localized and rapidly dissipate based on the sandy nature of the sediment. Plumes at the offshore sites would be expected to be similar to those generated during RBSP I, and monitoring demonstrated that turbidity plumes during RBSP I complied with RWQCB 401 certification requirements as well as specified environmental permitting conditions to protect least tern foraging. The environmental conditions required that water clarity in the upper 3 feet of surface waters not be reduced by more than 2.47 acres in the vicinity of borrow or receiver sites. Monitoring documented that plumes were typically much smaller than 2.47 acres and at the receiver sites were mainly restricted to the surf zone except when carried offshore by localized rip currents (AMEC 2002). The receiver sites are located more than 3 miles from least tern nesting sites and would not be expected to affect foraging of the species based on the localized nature of turbidity plumes expected during construction. Therefore, impacts would be less than significant.

Western Snowy Plover

The lagoon is located approximately 6 miles from snowy plover critical habitat located adjacent to Batiquitos Lagoon. This species nests at Batiquitos Lagoon, and has been observed to forage at the beach in the vicinity of the Batiquitos receiver site. Since no construction would occur within designated or proposed critical habitat, impacts from the Saltwater Alternative would be less than significant.

3.2.4 Essential Fish Habitat

As discussed in Section 2.2.2, the proposed project would encompass designated EFH, including nearshore areas adjacent to receiver sites, as well as the areas located farther offshore. In addition to EFH designations, certain areas may also be designated as HAPCs. HAPCs are discrete subsets of EFH that provide important ecological functions. HAPCs are vulnerable to degradation (50 C.F.R. 600.815[a][8]). Regional Fishery Management Councils may designate a specific habitat area as an HAPC in the FMP based on one or more of the following reasons: (1) importance of the ecological function provided by the habitat; (2) the extent to which the habitat is sensitive to human-induced environmental degradation; (3) whether, and to what extent, development activities are, or will be, stressing the habitat type; and (4) rarity of the habitat type (50 C.F.R. 600.815[a][8]). The HAPC designation does not confer additional protection or restrictions upon an area but can help prioritize conservation efforts.

Impacts to EFH are typically determined based on whether a project reduces quality and/or quantity of EFH, regardless of the degree to which that impact occurs. Based on the Magnuson-Stevens Act, adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species, and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 C.F.R. 600.810(a)). By definition, the threshold to have an adverse impact to EFH is low; however, the nature of the impact can be further qualified based on the type of impact (e.g., temporary or permanent). This is distinctly different from an adverse or significant impact determination made under NEPA and CEQA, which takes into account the context and intensity of a potential impact. Therefore, this section refers to impacts to EFH in terms of compliance with the Magnuson-Stevens Act and does not reflect impact severity as defined under NEPA, although a significant or permanent adverse impact to EFH would qualify as a significant impact under NEPA.

Less than significant impacts to water column EFH and soft-bottom benthic habitat at the nearshore construction area are anticipated and would constitute temporary adverse impacts (e.g., temporary turbidity plume due to dredging or disturbance to soft bottom habitat from pipeline and anchors, loss of prey items). Similarly, temporary adverse impacts to lifestages of managed species are expected to occur as a result of the project. Based on the analysis in the preceding sections, substantial adverse effects to quality or quantity of hard-bottom benthic habitat EFH and HAPCs (e.g., rocky reefs) are not anticipated. Protective measures have been implemented to avoid and/or minimize these impacts.

3.3 HYBRID ALTERNATIVE – OPTIONS A AND B

Under the Hybrid Alternative Options A and B, approximately 833,000 cy of sediment would be removed from the lagoon (Table 1-6). Under Approach 1 (no overdredge pit), up to 129,500 cy would be placed at the Oceanside Receiver site, up to 51,000 cy would be placed at the nearshore disposal site, and up to 652,500 cy would be disposed of at the LA-5 ODMDS. Under Approach 2 (with overdredge pit), up to 255,000 cy would be placed at the Oceanside receiver site and up to 578,000 cy would be placed at the nearshore disposal site. It is estimated that approximately 27,000 cy of sediment would be removed annually for maintenance and disposed near the lagoon mouth (Table 1-3).

3.3.1 Direct Impacts from Hybrid Alternative – Options A and B

Beach nourishment would result in direct impacts due to sand placement within the receiver site footprints. Other direct impacts may result from construction vehicle or equipment damage during construction activities. Indirect impacts would occur from turbidity generated during construction of the receiver sites, construction noise and activity disturbance to wildlife, and transport of sand away from the site via natural coastal processes up and down the coast and on and offshore.

Receiver Sites

Sand Placement

The area of direct impact to beach habitat and invertebrate resources was conservatively estimated for each approach by using the predicted volume and its relative percentage of the entire fill site from the top of the back beach to the toe of the slope (Table 3-4). Actual impact to biological resources would be less at some sites given that marine invertebrates do not inhabit back beach non-tidal areas and some would escape mortality along the constructed slope and leading edge of the fill. The temporary habitat disturbance would not be substantially adverse or significant on a regional scale because sandy beach habitat is the dominant shoreline habitat in San Diego County and disturbance of sandy beach habitat functions would be temporary. After construction, sandy beach organisms would begin recolonizing the site almost immediately with recovery anticipated in relatively short timeframes (weeks. months, to < 1 year) depending on when each site is nourished within the overall construction schedule. Because beach construction is anticipated to take 12 to 24 months to complete, receiver sites would be in various stages of recovery over the course of the construction period; thereby, minimizing potential impacts to other wildlife from temporary reductions in invertebrate prey at individual receiver site locations. Therefore, impacts would be less than significant.

Direct impacts are summarized below for each receiver site.

Oceanside

The maximum receiver site footprint is approximately 30 acres with placement of 420,000 cy (Table 3-4). Under Approach 1, approximately 9.3 acres would be impacted, and under Approach 2, approximately 18.2 acres would be impacted. Habitat within the site boundaries is sand and cobble, and no sensitive hard bottom or vegetated habitat occurs within the site boundaries. Marine

Table 3-4. Estimated direct impact acreage with proposed sand placement per approach for Hybrid Alternative – Options A and B.

Receiver Site	Dimensions		Acres	Capacity Based on	Approach 1	Approach 2
	Length (ft)	Width (ft)				

				Historical Projects (cy)	(acres)	(acres)
Onshore						
Oceanside	4,100	319	30	420,000	9.3	18.2
North Carlsbad	3,100	260	18.5	225,000	0	0
Nearshore						
Oceanside (nearshore)	3,170	2,285	166	2,460,000	3.4	39.0

invertebrates living within the sands would be killed from burial and construction activities, but the reduction in invertebrates would be temporary. Recovery would occur within several months, the speed of which would depend on project timing. Impacts to grunion would be avoided and minimized by pre-construction habitat assessments, monitoring, or other conditions established during the permitting process. Therefore, direct impacts would be less than significant.

<u>North Carlsbad</u>

The maximum receiver site footprint would be approximately 18.5 acres with placement of 225,000 cy (Table 3-4). Under Approaches 1 and 2, 0 acres would be impacted. Habitat within the site boundaries is sand and cobbles, and sandstone was exposed in the lower intertidal after the January 2010 storm. No sensitive hard bottom or vegetated habitat occurs within the site boundaries. Similar to the Oceanside receiver site, direct impacts to marine life within the fill footprint would not be substantially adverse, and impacts to grunion would be avoided and minimized by pre-construction habitat assessments, monitoring, or other conditions established during the permitting process. Therefore, direct impacts would be less than significant.

<u>Nearshore Placement Site</u>

The maximum nearshore disposal site footprint would be approximately 166 acres with placement of 2,460,000 cy (Table 3-4). Under Approach 1, approximately 3.4 acres would be impacted, and under Approach 2, approximately 39.0 acres would be impacted. Habitat within the site boundaries is sand. There would be a temporary reduction in benthic invertebrate biomass and alteration of the benthic community species composition at the nearshore disposal site associated with the sediment disposal. Studies indicate that recovery of the benthic invertebrate community depends on several factors such as placement method, local environmental conditions, hydrodynamics, and sediment infill rates. Reported recovery rates for dredging nearshore sandy subtidal habitat generally range from 2 to 4 years when hydrodynamics and sediment characteristics are not substantially changed within the dredged area (Oliver et al. 1977, Newell et al. 1998, Burlas et al. 2001, SAIC 2007b). Therefore, direct impacts would be less than significant.

3.3.2 Indirect Impacts from the Hybrid Alternative – Options A and B

The following types of potential indirect impacts may result from sand placement:

- forage reduction or alteration;
- disturbance, displacement, or interference;
- turbidity;
- sedimentation; and
- other construction issues.

In addition, benefits also would occur to sandy habitats after placement of additional sand on beaches. Monitoring after RBSP I demonstrated that beach nourishment enhanced sandy beach habitat functions at several beaches (SAIC 2006). This was most noticeable at beaches that transitioned from either cobble-covered beaches supporting few biological resources or beaches with highly seasonal periods of productivity coincident with seasonal sand accretion and erosion. The primary benefit was to increase the persistence of sandy beach habitat across seasons such that habitat was suitable early in the season to support the onset of the grunion spawning season and invertebrate recruitment period. This enhancement resulted in increased invertebrate diversity earlier in the season, increased bird use across tide conditions, and enhanced habitat for grunion spawning (e.g., increased beach width and reduction in cobble). Similar beneficial impacts would be anticipated after implementation of this project.

Each type of indirect impact is assessed for habitats and general wildlife. Potential indirect impacts to federally listed or state-listed endangered or threatened species are summarized at the end of this section. Many of the impacts can be generalized across the project receiver sites and are therefore not specifically discussed with respect to each site. Indirect impacts to nearshore resources due to project sedimentation could have localized effects, however, and these potential effects are discussed according to receiver site below.

Forage Reduction, Alteration, or Modification

There is potential for indirect effects to shorebird foraging from burial of invertebrates within the footprint of the receiver site. Each receiver site has unaffected shoreline nearby and recolonization of the receiver site by invertebrates would be rapid (e.g., weeks to months) following the conclusion of sand placement activities. Therefore, impacts would be less than significant.

Temporary attraction of birds, particularly gulls, to the discharge location is anticipated based on observations from RBSP I and other beach nourishment projects. The birds are attracted to the sand-slurry pumped onto the beach or its return water, where they opportunistically forage on deceased invertebrates and organic debris originating from the borrow site. Similarly, fish that feed on plankton or small organic particles may be attracted to turbidity plumes associated with hydraulic dredge-pump sediment projects; presumably to feed on discharged organic particulates. Fish-feeding birds may be attracted in turn to an increased concentration of fish where water clarity is sufficient for them to locate their prey. Such effects are temporary and therefore, impacts would be less than significant.

No adverse effects on seabird or waterbird foraging were observed with implementation of RBSP I (AMEC 2002). Bird surveys in areas of the borrow and receiver sites identified no effects of dredging or discharge turbidity on bird foraging behavior or locations. Turbidity plumes are expected to be similar to those experienced during RBSP I and II; localized and short-term in duration. Therefore, impacts would be less than significant.

Disturbance, Displacement, or Interference

Operational noise from equipment and activities has the potential to disturb shorebirds, gulls, and other coastal birds that may forage or rest on beaches at or near receiver sites. This impact would not be substantially adverse and would remain less than significant because (1) disturbance effects would be temporary and limited to the period of construction; (2) the proximity of unaffected shoreline adjacent to the receiver sites that provides foraging opportunities; and, the (3) the forage base at the receiver site would rapidly recover following the conclusion of sand placement activities.

Artificial night lighting has the potential to disturb or attract wildlife. Grunion have been documented to spawn in the vicinity of beach disposal operations, including RBSP I. Some reports suggest that grunion spawning may be reduced in well-lighted areas, while other reports document spawning near lighted areas such as piers. It is not well understood to what extent grunion may be attracted or displaced from spawning at a beach from artificial lighting or other equipment-related disturbance. Impacts to grunion would be less than significant because habitat suitability assessments and monitoring during construction as discussed above would be used to minimize impacts to the species.

Turbidity

Turbidity has the potential to indirectly impact plankton, fish, marine mammals, kelp, and vegetated reefs. Turbidity within the ocean environment is naturally variable depending on wave climate and season. Monitoring data from seven California beach nourishment projects indicate that turbidity measurements with a nephelometer were below or within ranges measured during storm or high wave conditions (SAIC 2007). As discussed in Section 3.1.2, turbidity would be expected to be localized to the discharge location, generally within 500 feet or less. Plumes would be expected to be largely confined within the surf zone but may be incorporated by rip currents and carried farther offshore. Because the sediments are generally sandy, project-related turbidity is expected to quickly settle and plumes would be temporary.

Turbidity would be minimized by the construction of training dikes that would promote settlement of sediment on the beach and lower the amount of suspended sediment that is lost to the return waters. This design feature was implemented during RBSP I and II, and found to be effective for minimizing turbidity plumes at the receiver sites. With this project design feature, suspended sediment concentrations would be reduced, thereby minimizing potential effects associated with the range of exposure durations that may occur depending on equipment type and differences in receiver site configurations. Therefore, impacts would be less than significant.

Plankton, Pelagic Fish, and Marine Mammals

As discussed above, the effects of suspended particulates on plankton are generally considered negligible because of the limited area affected and short exposure time as they drift through the affected areas. Similarly, potential effects on fish would be limited and temporary in nature, and a number of studies have documented variable responses by fish that range from attraction to avoidance. Pelagic fish offshore of the receiver sites, and any marine mammals that ventured close to shore, would not be expected to be adversely affected because the turbidity would remain localized and short term, and similar to conditions that may be experienced during storm events. Therefore, impacts would be less than significant.

Kelp

Kelp beds occur from approximately 1400 to 6700 ft offshore of the receiver sites, which is outside the distance that turbidity plumes would be expected to travel offshore unless carried by rip currents. In the unlikely event that turbidity did extend offshore, the particulate concentration would be expected to be low as to have a negligible effect on the kelp bed. Therefore, impacts would be less than significant.

Vegetated Reefs

Nearshore vegetated reefs have the potential to be impacted by reduced light transmittance and siltation associated with turbidity plumes. Turbidity also has the potential to cause physiological stress, reduced feeding, or displacement of mobile marine invertebrates or fish in reef areas. Actual effects would depend on the concentration and duration of turbidity. While marine invertebrates and bottom-associated fish are generally tolerant of high turbidity such as naturally occurs during high wave or storm conditions, adverse effects may result from exposure to very high concentrations or moderate to high concentrations for prolonged periods. As noted, turbidity plumes associated with the project would be relatively small, localized, and of short duration. Furthermore, suspended sediment concentrations in turbidity plumes would be minimized by use of training dikes, a key project design feature. Therefore, impacts would be less than significant.

Sedimentation

The sand is to be placed at two beach disposal sites at Oceanside and North Carlsbad Beaches which have been previously modeled for RBSP I and II, while the marginally suitable sediment is to be placed at the Oceanside nearshore location. These beach and nearshore locations have been permitted and used for this type of disposal numerous times in the past, with extensive physical monitoring. Data and conclusions from these previous projects were used to estimate both short-term and long-term shoreline and profile changes resulting from the Project alternatives (Everest 2014).

For the Hybrid Alternative Options A and B under Approach 1 (no overdredge pit), up to 129,500 cy would be placed at the Oceanside Receiver site and up to 51,000 cy would be placed at the nearshore disposal site. Since the nearshore nourishment is much less than the USACE Dredge Disposal, it can be expected that the short-term changes to the shoreline and profiles from this nearshore disposal will be negligible (Everest 2014). The Oceanside receiver site component has about 31% of the volume placed during the smaller of the RBSPs. Therefore the shoreline changes at Oceanside from this alternative are expected to be much less than those from either RBSP. Therefore, impacts from the Hybrid Alternative Options A and B – Approach 1 would be less than significant.

For the Hybrid Alternative Options A and B under Approach 2 (with overdredge pit), up to 232,500 cy would be placed at the Oceanside receiver site and up to 548,000 cy would be placed at the nearshore disposal site. Since the nearshore nourishment is similar to the USACE Dredge Disposal, which resulted in negligible changes to the shoreline and profiles, it can be expected that the short-term changes to the shoreline and profiles from this nearshore disposal would also be negligible (Everest 2014). The Oceanside receiver site component has about 61% of the volume placed during the smaller of the RBSPs. Therefore the shoreline changes at Oceanside from this alternative are expected to be much less than those from either RBSP. Therefore, impacts from the Hybrid Alternative Options A and B – Approach 2 would be less than significant.

For the Hybrid Alternative Options A and B, the ebb bar was also incorporated into the analysis, using a conservative analytical approach by comparing ebb bar sedimentation results from an adjacent lagoon (i.e., Batiquitos Lagoon). It was assumed that approximately 100,000 cy of the sediment would migrate to the beach and this volume was incorporated into the GENESIS modeling. The analytical approach was applied to the remaining 400,000 cy to determine the dispersion of the material over time. The results predicted an ebb-bar at Buena Vista Lagoon which would extend 250 ft offshore, stretch 1700 ft alongshore, and be centered at the lagoon mouth. In addition, it is estimated that approximately 27,000 cy of sediment would be removed annually for maintenance and disposed near the lagoon mouth (Table 1-3). No sensitive hard bottom or vegetated habitat occurs within this area. Therefore, impacts would be less than significant

Other Construction Issues

Operation of equipment on the beach or dredges and support vessels has the potential to introduce contaminants to the marine environment from minor spills and leaks. The potential for accidental discharge also could result from collision with or by another vessel. The probability of both types of accidental discharges is considered low. The dredging contractor would be required to develop a Spill Prevention Control and Containment plan (SPCC) prior to initiating construction. If a spill occurred, the contractor would utilize BMPs to prevent long-term degradation of water quality. For these reasons, impacts would be less than significant.

3.3.3 Threatened and Endangered Species

California Least Tern

Dredging at the lagoon and placement of sand at the receiver sites would generate turbidity that would be expected to be localized and rapidly dissipate based on the sandy nature of the sediment. Plumes at the offshore sites would be expected to be similar to those generated during RBSP I, and monitoring demonstrated that turbidity plumes during RBSP I complied with RWQCB 401 certification requirements as well as specified environmental permitting conditions to protect least tern foraging. The environmental conditions required that water clarity in the upper 3 feet of surface waters not be reduced by more than 2.47 acres in the vicinity of borrow or receiver sites. Monitoring documented that plumes were typically much smaller than 2.47 acres and at the receiver sites were mainly restricted to the surf zone except when carried offshore by localized rip currents (AMEC 2002). The receiver sites are located more than 3 miles from least tern nesting sites and would not be expected to affect foraging of the species based on the localized nature of turbidity plumes expected during construction. Therefore, impacts would be less than significant.

Western Snowy Plover

The lagoon is located approximately 6 miles from snowy plover critical habitat located adjacent to Batiquitos Lagoon. This species nests at Batiquitos Lagoon, and has been observed to forage at the beach in the vicinity of the Batiquitos receiver site. Since no construction would occur within designated or proposed critical habitat, impacts from the Hybrid Alternative would be less than significant.

3.3.4 Essential Fish Habitat

As discussed in Section 2.2.2, the proposed project would encompass designated EFH, including nearshore areas adjacent to receiver sites, as well as the areas located farther offshore. In addition to EFH designations, certain areas may also be designated as HAPCs. HAPCs are discrete subsets of EFH that provide important ecological functions. HAPCs are vulnerable to degradation (50 C.F.R. 600.815[a][8]). Regional Fishery Management Councils may designate a specific habitat area as an HAPC in the FMP based on one or more of the following reasons: (1) importance of the ecological function provided by the habitat; (2) the extent to which the habitat is sensitive to human-induced environmental degradation; (3) whether, and to what extent, development activities are, or will be, stressing the habitat type; and (4) rarity of the habitat type (50 C.F.R. 600.815[a][8]). The HAPC designation does not confer additional protection or restrictions upon an area but can help prioritize conservation efforts.

Impacts to EFH are typically determined based on whether a project reduces quality and/or quantity of EFH, regardless of the degree to which that impact occurs. Based on the Magnuson-Stevens Act, adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species, and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 C.F.R. 600.810(a)). By definition, the threshold to have an adverse impact to EFH is low; however, the nature of the impact can be further qualified based on the type of impact (e.g., temporary or permanent). This is distinctly different from an adverse or significant impact determination made under NEPA and CEQA, which takes into account the context and intensity of a potential impact. Therefore, this section refers to impacts to EFH in terms of compliance with the Magnuson-Stevens Act and does not reflect impact severity as defined under NEPA, although a significant or permanent adverse impact to EFH would qualify as a significant impact under NEPA.

Less than significant impacts to water column EFH and soft-bottom benthic habitat at the nearshore construction area are anticipated and would constitute temporary adverse impacts (e.g., temporary turbidity plume due to dredging or disturbance to soft bottom habitat from pipeline and anchors, loss of prey items). Similarly, temporary adverse impacts to lifestages of managed species are expected to occur as a result of the project. Based on the analysis in the preceding sections, substantial adverse effects to quality or quantity of hard-bottom benthic habitat EFH and HAPCs (e.g., rocky reefs) are not anticipated. Protective measures have been implemented to avoid and/or minimize these impacts.

4.0 SUMMARY

The impact assessment included evaluation of the potential for direct and indirect impacts to onshore and nearshore marine biological resources from implementation of the BVLEP. The study area included shoreline and nearshore habitats to a depth of approximately 100 ft between Oceanside and Agua Hedionda Lagoon.

The direct impact assessment considered potential impacts associated with placement of sand at onshore and nearshore receiver sites, and relevant associated activities (e.g., anchoring, pipeline placement, and movement of vessels, vehicles, and equipment to these locations). The indirect impact assessment considered potential impacts associated with construction (e.g., noise, disturbance, turbidity, accidental discharges) and post-construction movement of sands by waves and currents (e.g., sedimentation of nearshore areas with sensitive hard-bottom habitats).

Four project alternatives with two approaches each were evaluated:

- Under the Freshwater Alternative, approximately 562,000 cy of sediment would be removed from the lagoon. Under Approach 1 (no overdredge pit), up to 49,000 cy would be placed at the Oceanside Receiver site, up to 30,000 cy would be placed at the nearshore disposal site, and up to 483,000 cy would be disposed of at the LA-5 ODMDS. Under Approach 2 (with overdredge pit), up to 175,000 cy would be placed at the Oceanside receiver site and up to 387,000 cy would be placed at the nearshore disposal site.

- Under the Saltwater Alternative, approximately 781,000 cy of sediment would be removed from the lagoon. Under Approach 1 (no overdredge pit), up to 110,000 cy would be placed at the Oceanside Receiver site, up to 49,000 cy would be placed at the nearshore disposal site, and up to 622,000 cy would be disposed of at the LA-5 ODMDS. Under Approach 2 (with overdredge pit), up to 232,500 cy would be placed at the Oceanside receiver site and up to 548,500 cy would be placed at the nearshore disposal site.

- With respect to marine biological resources, both Options A and B under the Hybrid Alternative are similar with approximately 833,000 cy of sediment being removed from the lagoon. Under Approach 1 (no overdredge pit), up to 129,500 cy would be placed at the Oceanside Receiver site, up to 51,000 cy would be placed at the nearshore disposal site, and up to 652,500 cy would be disposed of at the LA-5 ODMDS. Under Approach 2 (with overdredge pit), up to 255,000 cy would be placed at the Oceanside receiver site and up to 578,000 cy would be placed at the nearshore disposal site.

The following is a summary of the major findings of the impact evaluations:

1. Direct and indirect impacts to water resources would be less than significant.

   - Turbidity would be generated from placement of sediments at receiver nearshore receiver sites. However, no appreciable changes in other water quality parameters, including dissolved oxygen, pH, nutrients, bacteria, or chemical contaminants are anticipated. Factors considered in this assessment include the relatively localized nature of the expected turbidity plumes for the majority of the dredging period and diluting capacity of the receiving environment. Based on grain size characteristics at the material, turbidity plumes generally would be expected to be localized within 2,000 ft from the disposal operation.

- Because lagoon sediments suitable for beneficial reuse consist of clean sands, runoff from the receiver beaches would not contain contaminants, bacteria, excess nutrients, or other materials with a high oxygen demand, or otherwise degrade water quality in the surfzone.

- Turbidity is expected to be localized based on grain size characteristics of sediments. However, there is the potential for turbidity plumes of greater dimensions if discharge waters are carried beyond the surfzone by rip currents. Confining the discharge behind temporary training dikes constructed of sand was found to be effective for keeping nearshore turbidity plumes localized offshore the receiver sites during implementation of RBSP I and II, and would similarly be implemented with BVLEP.

- Turbidity levels would return to background conditions within hours of the cessation of dredging or discharge operations consistent with observations during the RBSP I and II, as well as, other beach nourishment projects involving placement of sands with low silt/clay content.

- Water quality monitoring would be required as part of the Section 404 dredging and discharge permit and Section 401 water quality certification. If monitoring indicated exceedances, dredge or discharge operations would need to be modified to ensure compliance with the permit to protect beneficial uses of waters.

2. Direct impacts to biological resources would be less than significant.

    - Maximum direct impact of approximately 18 acres of beach habitat and approximately 39 acres of nearshore sandy subtidal habitat with implementation of the Hybrid Alternative.

    - Sand placement at the beach and nearshore receiver sites would result in unavoidable loss of small marine invertebrates (e.g., clams, crabs, worms) within the footprints of construction, representing forage for other invertebrates, fish, and additionally, birds at the receiver sites. Recovery of benthic organisms would begin almost immediately after cessation of construction via two mechanisms, one by animals that migrate to the affected area from surrounding habitat, and the other by recruitment from the plankton. Substantial recovery rates would be expected within 1 year for sandy beach habitat and within 4 years at the offshore sites based on results of other projects. This would be a temporary and relatively small impact regionally, representing less than 1% of the soft bottom habitats at similar depths within the county.

3. Direct impacts to sensitive hard-bottom habitats would be avoided and minimized using similar measures that were implemented successfully with RBSP I and II, and therefore, would be less than significant.

    - Receiver site locations were selected to avoid direct impacts to sensitive hard-bottom habitat.

- A pre-construction survey would be conducted of all pipeline routes to ensure that no sensitive hard-bottom resources would be directly impacted.

- A minimum 500-ft buffer would be maintained between construction areas and natural hard-bottom habitats.

- Vessel transportation corridors would be established to avoid transiting of kelp beds to the maximum extent possible.

4. Direct and indirect impacts to threatened and endangered species and other wildlife would be avoided and minimized, and therefore, would be less than significant.

   - Training dikes would be used to minimize turbidity plumes at receiver sites, which would minimize interference with foraging activities of seabirds, fish, and other wildlife. Turbidity plume monitoring would be conducted during the breeding season within 1 mile of nesting sites for the endangered least tern, which visually forages on fish, to ensure plumes are localized and water clarity is not substantially reduced.

   - Pre-construction habitat assessments would be conducted to determine potential habitat suitability of the receiver sites for California grunion spawning, and monitoring would be conducted during predicted runs, as warranted, to ensure that appropriate measures are taken during construction to avoid significant impacts to this managed fishery species. Details of the specific grunion monitoring program and protective measures would be defined via the permitting process in coordination with the resource agencies.

5. Beneficial indirect impacts to sandy beach habitat are anticipated. Beach nourishment is expected to enhance sandy beach habitat within the region. Beneficial impacts to marine resources, including greater seasonal development of invertebrate populations, and better beach conditions for grunion spawning, shorebird foraging, and bird resting were documented with RBSP I and II.

6. Indirect impacts to sensitive nearshore hard-bottom habitats would be less than significant. These beach and nearshore locations have been permitted and used for this type of disposal numerous times in the past, with extensive physical monitoring. Data and conclusions from these previous projects were used to estimate both short-term and long-term shoreline and profile changes resulting from the project alternatives, and given the volumes proposed, shoreline changes are expected to at or below those observed from previous projects.

7. In addition to the beach and nearshore nourishment, some changes to the shoreline and nearshore profile are expected as a result of the new ebb-bar that would develop just offshore the lagoon inlet. It is expected that the ebb-bar would be a maximum of 2.5 ft thick, 250 ft wide offshore, and 1700 ft long (alongshore). No sensitive hard bottom or vegetated habitat occurs within this area. Therefore, impacts would be less than significant.

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