3.12 GLOBAL CLIMATE CHANGE, GREENHOUSE GAS EMISSIONS, AND SEA LEVEL RISE

This section describes global climate change, particularly with regard to the generation of greenhouse gas (GHG) emissions and potential impacts from sea level rise in the area surrounding Buena Vista Lagoon and the areas identified for materials disposal/reuse. This section also identifies pertinent policies and regulations governing GHG emissions and evaluates the impacts associated with implementation of the Enhancement Project and its alternatives.

3.12.1 EXISTING CONDITIONS

Certain gases in the earth's atmosphere, classified as greenhouse gases (GHGs), play a critical role in determining the earth's surface temperature. A portion of the solar radiation that enters the earth's atmosphere is absorbed by the earth's surface, and a smaller portion of this radiation is reflected back toward space. This infrared radiation (i.e., thermal heat) is absorbed by GHGs within the earth's atmosphere. As a result, infrared radiation released from the earth that otherwise would have escaped back into space is instead "trapped," resulting in a warming of the atmosphere. This phenomenon, known as the "greenhouse effect," is responsible for maintaining a habitable climate on the earth.

GHGs are present in the atmosphere naturally, are released by natural and anthropogenic sources, and are formed from secondary reactions taking place in the atmosphere. Natural sources of GHGs include the respiration of humans, animals, and plants; decomposition of organic matter; and evaporation from the oceans. Anthropogenic sources include the combustion of fossil fuels, waste treatment, and agricultural processes. The following GHGs are widely accepted as the principal contributors to human-induced global climate change:

- Carbon dioxide (CO_2),
- Methane (CH_4),
- Nitrous oxide (N_2O),
- Hydrofluorocarbons (HFCs),
- Perfluorocarbons (PFCs),
- Sulfur hexafluoride (SF_6), and
- Nitrogen trifluoride (NF_3).

Methane is the main component of natural gas and is associated with agricultural practices and landfills. Nitrous oxide is a colorless GHG that results from industrial processes, vehicle emissions, and agricultural practices. HFCs are synthetic chemicals used as a substitute for chlorofluorocarbons in automobile air conditioners and refrigerants. PFCs are produced as a byproduct of various industrial processes associated with aluminum production and the manufacturing of semiconductors. Sulfur hexafluoride is an inorganic, odorless, colorless, nontoxic, nonflammable GHG used for insulation in electric power transmission and distribution equipment and in semiconductor manufacturing. Nitrogen trifluoride is used in the electronics industry during the manufacturing of consumer items, including photovoltaic solar panels and liquid-crystal-display (i.e., LCD) television screens.

Global warming potential (GWP) is a concept developed to compare the ability of each GHG to trap heat in the atmosphere relative to CO_2. The GWP of a GHG is based on several factors, including the relative effectiveness of a gas to absorb infrared radiation and length of time (i.e., lifetime) that the gas remains in the atmosphere ("atmospheric lifetime"). The reference gas for GWP is CO_2; therefore, CO_2 has a GWP of 1. The other main GHGs that have been attributed to human activity include CH_4, which has a GWP of 28, and N_2O, which has a GWP of 265 (IPCC 2013). For example, 1 ton of CH_4 has the same contribution to the greenhouse effect as approximately 28 tons of CO_2. GHGs with lower emissions rates than CO_2 may still contribute to climate change, because they are more effective at absorbing outgoing infrared radiation than CO_2 (i.e., high GWP). The concept of CO_2-equivalents (CO_2e) is used to account for the different GWP potentials of GHGs to absorb infrared radiation.

GHG emissions related to human activities have been determined as "extremely likely" responsible (indicating 95 percent certainty) for intensifying the greenhouse effect and leading to a trend of unnatural warming of the earth's atmosphere and oceans, with corresponding effects on global circulation patterns and climate (ARB 2014c). The quantity of GHGs that it takes to ultimately result in climate change is not precisely known; however, no single project alone is expected to measurably contribute to a noticeable incremental change in the global average temperature, or to a global, local, or micro climate.

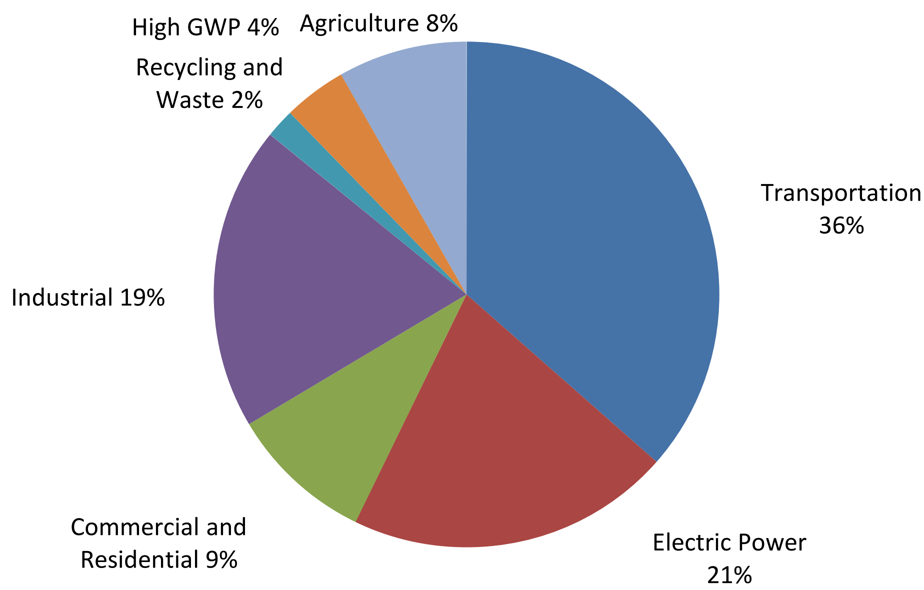
Greenhouse Gas Emission Sources

GHG emissions contributing to global climate change are attributable in large part to human activities associated with the transportation, industrial/manufacturing, electric utility, residential, commercial, and agricultural categories. The majority of CO_2 emissions are byproducts of fossil fuel combustion. CH_4, a highly potent GHG, is the primary component in natural gas and is associated with agricultural practices and landfills. N_2O is also largely attributable to agricultural practices and soil management.

For purposes of accounting for and regulating GHG emissions, sources of GHG emissions are grouped into emission categories. ARB identifies the following main GHG emission categories that account for most anthropogenic GHG emissions generated within California:

- *Transportation:* On-road motor vehicles, recreational vehicles, aviation, ships, and rail
- *Electric Power:* Production and use of electrical energy
- *Industrial:* Mainly stationary sources (e.g., boilers and engines) associated with process emissions
- *Commercial and Residential:* Area sources, such as landscape maintenance equipment, fireplaces, and consumption of natural gas for space and water heating
- *Agriculture:* Agricultural sources that include off-road farm equipment; irrigation pumps; crop residue burning (CO_2); and emissions from flooded soils, livestock waste, crop residue decomposition, and fertilizer volatilization (CH_4 and N_2O)
- *High GWP:* Refrigerants for stationary and mobile-source air conditioning and refrigeration, electrical insulation (e.g., SF_6), and various consumer products that use pressurized containers
- *Recycling and Waste:* Waste management facilities and landfills; primary emissions are CO_2 from combustion and CH_4 from landfills and wastewater treatment

ARB performs an annual GHG inventory for emissions of the major GHGs. As shown in Figure 3.12-1, California produced 459 million metric tons (MMT) of CO_2e in 2012 (ARB 2014d). Combustion of fossil fuels in the transportation category was the single largest source of California's GHG emissions in 2012, accounting for 36 percent of total GHG emissions in the state. The transportation category was followed by the electric power category (including in- and out-of-state sources), which accounts for 21 percent of total GHG emissions in California, and the industrial category, which accounts for 19 percent of the state's total GHG emissions (ARB 2014d).



Source: ARB 2014b

Figure 3.12-1. California GHG Emissions by Category

Global Climate Trends and Associated Impacts

The Intergovernmental Panel on Climate Change (IPCC) concluded that variations in natural phenomena, such as solar radiation and volcanoes, produced most of the warming from pre-industrial times to 1950, and had a small cooling effect afterward. However, after 1950, increasing GHG concentrations resulting from human activity, such as fossil fuel burning and deforestation, have been responsible for most of the observed temperature increase.

Warming of the climate system is now considered unequivocal, with global surface temperature increasing approximately 1.53 degrees °F over the last 140 years (IPCC 2013). The rate of increase in global average surface temperature has not been consistent; the last three decades have warmed at a much faster rate per decade (IPCC 2013).

During the same period when increased global warming has occurred, many other changes have occurred in other natural systems. Sea levels have risen; precipitation patterns throughout the world have shifted, with some areas becoming wetter and others drier; snowlines can rise, resulting in changes to the snowpack, runoff, and water storage; and numerous other conditions have been observed. Although it is difficult to prove a definitive cause-and-effect relationship between global warming and other observed changes to natural systems, there is a high level of confidence in the scientific community that these changes are a direct result of increased global temperatures caused by the increased presence of GHGs in the atmosphere (IPCC 2013).

Additional changes related to climate change can be expected by the year 2050 and on to the end of the century:

- California's mean temperature may rise 2.7°F by 2050 and 4.1°F to 8.6°F by the end of the century (CEC 2012). Temperatures in San Diego County may rise 3.1°F to 5.8°F during that same period (CEC 2014).
- Sea level rise is expected to continue, and the most recent climate science report, *Sea Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future*, has estimated that sea levels along the U.S. Pacific Coast would increase up to 24 inches by 2050 and up to 66 inches by 2100 (NRC 2012).
- Various California climate models provide mixed results regarding forecasted changes in total annual precipitation in the state through the end of this century. However, recent projections suggest that 30-year statewide average precipitation will decline by more than 10 percent (CEC 2012).

The relevant policies and regulations dictating global climate change at the project site and materials disposal sites are discussed within this section. A comprehensive description of applicable regulatory laws, plans, policies, and regulations is provided in Appendix B. Additional regulatory requirements pertaining to other specific topic areas, such as noise, air quality, water quality, etc., are discussed in their respective analysis sections.

3.12.2 SIGNIFICANCE CRITERIA

Greenhouse Gas Emissions

A significant impact to global climate change, GHG emissions, and sea level rise would occur if implementation of the Enhancement Project would result in any of the following:

A. Generation of GHG emissions, either directly or indirectly, that may have a significant impact on the environment; or

B. Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

Section 15064.7 of the CEQA Guidelines states that "a lead agency may consider thresholds of significance previously adopted or recommended by other public agencies." SDAPCD has neither quantitative thresholds nor specific guidelines for determining the significance of impacts under CEQA. In the absence of adopted CEQA guidelines from the SDAPCD or SANDAG, this analysis reviewed the guidelines on the levels of GHG emissions that other public agencies have used to evaluate whether a project's GHG emissions would constitute a cumulatively considerable incremental contribution to climate change in order to determine which one is most applicable to the project. The South Coast Air Quality Management District (SCAQMD) is the air district with adopted thresholds in closest proximity to the project location, and the County of San Diego is located in the same air basin as the project location.

- SCAQMD has adopted a significance threshold for GHG emissions of 10,000 MT CO_2e per year where SCAQMD is the lead agency for industrial projects (SCAQMD 2008).
- The County of San Diego has established a threshold of 900 MT CO_2e per year as a project-level GHG significance threshold that would apply to operational and construction emissions from land use development projects (San Diego County 2015).

The SCAQMD GHG CEQA Significance Threshold Stakeholder Working Group also recommended options for evaluating non-industrial projects including thresholds for residential, commercial, and mixed use projects (SCAQMD 2010). The draft thresholds released by the SCAQMD include possible thresholds of 3,000 MT CO_2e per year for all non-industrial projects and use of an efficiency metric of 4.8 MT CO_2e per "service population" per year. At the time of this analysis, these draft thresholds have not been adopted by the SCAQMD.

The County of San Diego's Recommended Approach to Addressing Climate Change in CEQA Documents was developed at the countywide level, and therefore is also applicable to the current project. The intent of the County of San Diego guidance is to provide a consistent, objective, and predictable evaluation of significant effects. The screening threshold of 900 MT CO_2e per year is based on the California Air Pollution Control Officers Association white paper (CAPCOA 2010). The screening threshold would capture more than 90 percent of development projects, allowing for mitigation toward achieving the state's GHG reduction goals (CAPCOA 2010). According to the County of San Diego, construction emissions may be amortized over the expected (long-term) operational life of a project, which can conservatively be estimated at 20 years, unless evidence is provided demonstrating a different project life. As discussed in Chapter 2, the project life for the Enhancement Project is designed for a 50-year period, which is typical for environmental enhancement efforts. Therefore amortization has been calculated over 50 years for this analysis.

The determination of the need for a climate change analysis must consider project-specific details that could contribute to a climate change impact. Since the project is primarily a construction-related project, no regional thresholds are directly applicable to the GHG emissions generated by the project. Therefore, the analysis considers both the annual construction-related

GHG emissions compared to the SCAQMD threshold of 10,000 MT CO_2e per year, and the amortized construction and operational emissions compared to the County of San Diego threshold of 900 MT CO_2e per year. Since the proposed project is primarily construction-related and does not involve residential or commercial land uses, these thresholds are considered the appropriate thresholds to determine whether the project is consistent with goals of Executive Order S-3-05 and Assembly Bill (AB) 32.

Sea Level Rise and Extreme Events

A major area of concern related to global climate change in San Diego County is sea level rise. Sea level rise will not be uniform, nor uniformly affect the state's population, infrastructure, and ecosystems. Executive Order S-13-08 was issued by Governor Edmund G. Brown on November 14, 2008, to enhance California's management of potential climate effects from sea level rise, increased temperatures, shifting precipitation, and extreme weather events. The California Natural Resources Agency was directed to coordinate with local, regional, state, and federal public and private entities to develop the California Climate Adaptation Strategy, which summarizes the best known science on climate change impacts to California, assesses California's vulnerability to the identified impacts, and then outlines solutions that can be implemented within and across state agencies to promote resiliency.

California agencies have developed guidance documents to address sea level rise for projects located in areas that would be subject to sea level rise. In March 2012, the California State Coastal Conservancy (SCC) issued a guidance document for projects funded by the SCC for assessing impacts and vulnerabilities of a project subject to sea level rise and extreme events. SANDAG developed the *San Diego Region Coastal Sea Level Rise Analysis* that presents the processes to determine sea levels for the San Diego coastal region to be utilized for the design of transportation infrastructure improvements in the North County Corridor (SANDAG 2013). In ~~October 2013~~August 2015, the CCC ~~staff prepared~~ adopted their ~~*Draft*~~ *Sea-Level Rise Policy Guidance* to provide a framework for addressing sea-level rise in local coastal programs and Coastal Development Permits (CCC 201~~3~~5).

Section 15126.2 of the CEQA Guidelines states that "the EIR should evaluate any potentially significant impacts of locating development in other areas susceptible to hazardous conditions (e.g., floodplains, coastlines, wildfire risk areas) as identified in authoritative hazard maps, risk assessments or in land use plans addressing such hazards areas." Even though the question of whether CEQA requires analyzing the impact of potential environmental conditions or events on a project continues to be litigated (e.g., *Ballona Wetlands Land Trust et al. v. City of Los Angeles*), this analysis also includes an evaluation of the project's vulnerability to sea level rise and extreme events for informational purposes only. This approach is consistent with Executive Order S-13-08, which recommends consideration of sea level rise to assess project vulnerability.

3.12.3 IMPACT ANALYSIS

This analysis focuses on the GHG emissions resulting from construction and subsequent maintenance activities of the Enhancement Project. This analysis evaluates the impacts of lagoon enhancement and material disposal together. The finding of significance for the CEQA thresholds cannot be determined separately and must be based on emissions for the entire project.

Greenhouse Gas Emissions

Freshwater Alternative

Temporary Impacts

Heavy-duty off-road equipment, material transport, and worker commutes during construction of the Enhancement Project would result in exhaust-related GHG emissions. GHG emissions generated by construction activities would be primarily in the form of CO_2. Although emissions of other GHGs, such as CH_4 and N_2O, are important with respect to global climate change, the emission levels of these other GHGs from on- and off-road vehicles used during construction are relatively small compared with CO_2 emissions, even when factoring in the relatively larger global warming potential of CH_4 and N_2O.

Construction-related emissions were estimated using emission factors from ARB's OFFROAD and EMFAC 2011 inventory models (ARB 2013). Construction emissions from the operation of diesel-fueled off-road equipment were estimated by multiplying daily usage (i.e., hours per day) and total days of construction by OFFROAD equipment-specific emission factors. GHG emissions from on-road motor vehicles were estimated using vehicle trips, VMT, and EMFAC2011 mobile source emission factors. The emission factors represent the fleet-wide average emission factors within San Diego County.

As shown in Table 3.12-1, construction emissions would total 3,687 MT CO_2e over the construction period for the LA-5 disposal scenario and 3,878 MT CO_2e for the overdredge pit. The annual construction-related GHG emissions for all disposal scenarios would not exceed the SCAQMD threshold of 10,000 MT CO_2e per year. The amortized construction-related emissions for the Freshwater Alternative would be approximately 78 MT CO_2e per year

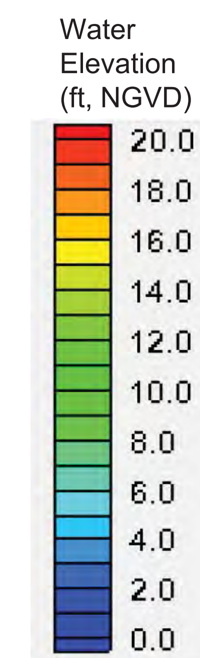
Freshwater Alternative

Saltwater Alternative

Hybrid Alternative (Option A)

Hybrid Alternative (Option B)

No-Project Alternative



Source: Everest International Consultants, Inc. & Battelle Memorial Institute 2003

0 1000 2000 Feet

Figure 3.12-2
Year 2050 100-year Storm Inundation Under Sea Level Rise

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(3,878 MT CO_2e / 50 years = 78 MT CO_2e). The amortized GHG emissions for all disposal scenarios would also not exceed the County of San Diego threshold of 900 MT CO_2e per year. **Therefore, construction of the Freshwater Alternative would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment, and this impact would be less than cumulatively significant (Criterion A).**

Table 3.12-1
Construction-Related GHG Emissions -- Freshwater Alternative

	Total GHG Emissions ($MT\ CO_2e$)	
LA-5	3,687	
Overdredge Pit	3,878	

Source: Modeled by AECOM 2014; for more detail see Appendix I

At the time of this writing, SANDAG has not adopted a Climate Action Plan that meets the requirements identified in CEQA Guidelines Section 15183.5. However, SANDAG published a Climate Action Strategy in 2010 that was prepared under a partnership with the California Energy Commission (SANDAG 2010). The Climate Action Strategy acts as a guide for SANDAG and local governments and policymakers in addressing climate change. Therefore, for the purposes of this analysis, the applicable GHG reduction plans to evaluate the Enhancement Project against are the statewide AB 32 Scoping Plan and the Climate Action Strategy. Projects that would be consistent with the goals and strategies of the AB 32 Scoping Plan and the Climate Action Strategy would be considered not to conflict with the state's purpose of reducing GHG emissions.

ARB's *First Update to the Climate Change Scoping Plan: Building on the Framework* includes measures to meet California's goal of reducing emissions to 1990 levels by 2020 and also reiterates the state's role in the long-term goal established in Executive Order S-3-05, which is to reduce GHG emissions to 80 percent below 1990 levels by 2050.

The Scoping Plan update confirms that California is on track to meet the 2020 emissions reduction target but will need to maintain and build upon its existing programs, scale up deployment of clean technologies, and provide more low-carbon options to accelerate GHG emission reductions, especially after 2020, in order to meet the 2050 target. However, the plan does not recommend additional measures for meeting specific GHG emissions limits beyond 2020. In general, the measures described in the plan are designed to meet emissions goals in 2020 and do not become increasingly stringent until after 2020.

The Scoping Plan update did not directly create any regulatory requirements for construction of the proposed project. ARB's Scoping Plan update includes a summary of actions completed to date that would address the AB 32 goals for 2020. In addition, the Scoping Plan update includes the following recommended actions that would indirectly address GHG emissions from construction activities:

- Propose “Phase 2” heavy-duty truck GHG standard standards.
- Expand upon 2013 zero emission vehicle (ZEV) Action plan for medium- and heavy-duty ZEVs.
- Enhance and strengthen the Low Carbon Fuel Standard with more aggressive long-term targets.
- Adopt the necessary regulations and/or policies to further support commercial markets for low-carbon transportation fuels.
- Complete the first phase of the Sustainable Freight Strategy, which will identify and prioritize actions through 2020 to move California toward a sustainable freight system.
- Provide expanded markets for clean passenger transportation, advanced technology trucks and equipment, low-carbon transportation fuels and energy, and related infrastructure.

The policies listed above are the only recommended actions that would apply to construction activities associated with the Enhancement Project. Policies formulated under the mandate of AB 32 that apply to construction-related activity, either directly or indirectly, are assumed to be implemented statewide and would affect the Enhancement Project should those policies be implemented before construction begins. The Freshwater Alternative would comply with any mandate or standards set forth by the Scoping Plan update. Since the Enhancement Project is consistent with the Scoping Plan update, it would be consistent with the goals and strategies of AB 32 and Executive Order S-3-05.

The Climate Action Strategy recognizes the importance of local and regional action to achieve statewide climate goals, and identifies how local jurisdictions can participate in achieving the goal. Because local governments have greater control over some areas, the Climate Action Strategy emphasizes those areas, including land use patterns, transportation infrastructure, and building construction and energy use, where the greatest impact can be made at the local level. The Climate Action Strategy does not include any measures that are applicable to construction activities associated with the Enhancement Project.

As discussed earlier, the Freshwater Alternative does not exceed the threshold of significance for GHG emissions. The approach to developing a threshold of significance for GHG emissions is to identify the level of emissions for which a project would not be expected to substantially conflict with existing California legislation that has been adopted to reduce statewide GHG emissions. The Freshwater Alternative would be required to comply with applicable regulations, including those developed as measures in the ARB Scoping Plan described above. The Climate Action Strategy does not include any measures that are applicable to construction activities associated with the Enhancement Project. **Therefore, construction of the Freshwater Alternative would not conflict with existing plans, policies, or regulations adopted for the purpose of reducing GHG emissions, and this impact would be less than cumulatively significant (Criterion B).**

<u>Permanent Impacts</u>

The Freshwater Alternative is not anticipated to generate new vehicle trips and would not generate additional activities related to maintenance or operations that would exceed existing levels. Since maintenance activities associated with the Freshwater Alternative would not require the use of additional off-road equipment and would not generate new vehicle trips, operations GHG emissions were not estimated for the Freshwater Alternative. **Therefore, operation and maintenance of the Freshwater Alternative would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment, and this impact would be less than cumulatively significant (Criterion A).**

As discussed above, the Freshwater Alternative would comply with any mandate or standards set forth by the Scoping Plan update. Since the Enhancement Project is consistent with the Scoping Plan update, it would be consistent with the goals and strategies of AB 32 and Executive Order S-3-05.

The policy measures included in the Climate Action Strategy are intended to be a list of potential options for consideration by SANDAG and local governments. The Climate Action Strategy includes the following goals and objectives that are applicable to the Enhancement Project:

- Goal 4. Protect Transportation Infrastructure from Climate Change Impacts.
- Objective 4b. Protect Transportation Infrastructure from Sea Level Rise and Higher Storm Surges.
    - Modify standards for the design, location, and construction of infrastructure to account for areas potentially subject to storm surge, sea level rise, and more frequent flooding events.
    - Address adaptation issues in the design and location of new projects and when improvements are made to existing infrastructure.

As discussed in more detail under “Sea Level Rise and Extreme Events” in this section, the Freshwater Alternative would improve the ability of the project area to respond to long-term climate impacts, such as increased sea level rise. The proposed Boardwalk deck elevation would be located above the 100-year flood water surface elevation (approximately 12 feet NGVD) to avoid impeding flood flows. The decrease in water surface elevation in all basins of the lagoon would also improve flood protection compared to existing conditions. Therefore, the Freshwater Alternative would be consistent with the goals of the Climate Action Strategy.

Therefore, operations and maintenance activities for the Freshwater Alternative would not conflict with existing plans, policies, or regulations adopted for the purpose of reducing GHG emissions. **This impact would be less than cumulatively significant (Criterion B).**

Saltwater Alternative

<u>Temporary Impacts</u>

As shown in Table 3.12-2, construction emissions would total 5,918 MT CO_2e over the construction period for the LA-5 disposal scenario and 6,020 MT CO_2e for the overdredge pit. The annual construction-related GHG emissions for all disposal scenarios would not exceed the SCAQMD threshold of 10,000 MT CO_2e per year. The evaluation of the amortized construction emissions compared to the County of San Diego significance threshold is included in the discussion of Permanent Impacts. **Therefore, construction of the Saltwater Alternative would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment, and this impact would be less than cumulatively significant (Criterion A).**

Table 3.12-2
Construction-Related GHG Emissions -- Saltwater Alternative

	Total GHG Emissions (MT CO_2e)
LA-5	5,918
Overdredge Pit	6,020

Source: Modeled by AECOM 2014; for more detail see Appendix I

As discussed earlier, the Saltwater Alternative does not exceed the threshold of significance for GHG emissions. The approach to developing a threshold of significance for GHG emissions is to identify the level of emissions for which a project would not be expected to substantially conflict with existing California legislation that has been adopted to reduce statewide GHG emissions. The Saltwater Alternative would be required to comply with applicable regulations, including those developed as measures in the ARB Scoping Plan. Since the Enhancement Project is consistent with the Scoping Plan update, it would be consistent with the goals and strategies of AB 32 and Executive Order S-3-05. The Climate Action Strategy does not include any measures that are applicable to construction activities associated with the Enhancement Project. **Therefore, construction of the Saltwater Alternative would not conflict with existing plans, policies, or regulations adopted for the purpose of reducing GHG emissions, and this impact would be less than cumulatively significant (Criterion B).**

Permanent Impacts

As discussed in more detail in Chapter 2, the Saltwater Alternative would include a long-term monitoring program and may require construction activities associated with vegetation removal and inlet maintenance. The most intensive maintenance activities would involve inlet maintenance, which would occur approximately every 12 to 20 months. The estimates of operations emissions are based on similar assumptions to those for construction emissions, as the primary sources of emissions would be similar to those used in the construction phase, including dredges, off-road equipment, and on-road motor vehicle trips. The emissions associated with regular maintenance were estimated at 73 MT CO_2e. The amortized construction-related emissions for the Saltwater Alternative would be approximately 120 MT CO_2e per year (6,020 MT CO_2e / 50 years = 120 MT CO_2e). The impact determination for the County of San Diego threshold is based on the combined amortized construction-related and operational emissions of 193 MT CO_2e per year. The total amortized construction and operational emissions for all disposal scenarios would also not exceed the County of San Diego threshold of 900 MT CO_2e per year. **Therefore, operation and maintenance of the Saltwater Alternative would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment, and this impact would be less than cumulatively significant (Criterion A).**

The approach to developing a threshold of significance for GHG emissions is to identify the level of emissions for which a project would not be expected to substantially conflict with existing California legislation that has been adopted to reduce statewide GHG emissions. Maintenance activities for the Saltwater Alternative would be required to comply with applicable regulations, including those developed as measures in the ARB Scoping Plan. Since the Enhancement Project is consistent with the Scoping Plan update, it would be consistent with the goals and strategies of AB 32 and Executive Order S-3-05. As discussed in more detail under "Sea Level Rise and Extreme Events" in this section, the Saltwater Alternative would change the hydrologic regime of the lagoon from the existing freshwater system to a saltwater system. The new tidal inlet would enable the lagoon to drain incoming freshwater more efficiently and improve flood control during large storm events, leading to less potential in general for flooding hazards. To accommodate flood flows under the Carlsbad Boulevard bridge, including a 1-foot freeboard, the roadway elevation would be raised to 14 feet NGVD from the existing 9.6-foot NGVD elevation, which would also eliminate flooding of the roadway during design storm conditions. The Saltwater Alternative would be consistent with the goals of the Climate Action Strategy. **Therefore, the Saltwater Alternative would not conflict with applicable plan, policy, or regulation for the purpose of reducing GHG emissions, and this impact would be less than cumulatively significant (Criterion B).**

Hybrid Alternative

Temporary Impacts

As shown in Table 3.12-3, construction emissions would total 5,540 MT CO_2e over the construction period for the LA-5 disposal scenario and 5,041 MT CO_2e for the overdredge pit. The annual construction-related GHG emissions for all disposal scenarios would not exceed the SCAQMD threshold of 10,000 MT CO_2e per year. The evaluation of the amortized construction emissions compared to the County of San Diego significance threshold is included in the discussion of Permanent Impacts. **Therefore, construction of the Hybrid Alternative would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment, and this impact would be less than cumulatively significant (Criterion A).**

Table 3.12-3
Construction-Related GHG Emissions -- Hybrid Alternative

	Total GHG Emissions ($MT CO_2e$)
LA-5	5,540
Overdredge Pit	5,041

Source: Modeled by AECOM 2014; for more detail see Appendix I

As discussed earlier, the Hybrid Alternative does not exceed the threshold of significance for GHG emissions. The approach to developing a threshold of significance for GHG emissions is to identify the level of emissions for which a project would not be expected to substantially conflict with existing California legislation that has been adopted to reduce statewide GHG emissions. The Hybrid Alternative would be required to comply with applicable regulations, including those developed as measures in the ARB Scoping Plan. Since the Enhancement Project is consistent with the Scoping Plan update, it would be consistent with the goals and strategies of AB 32 and Executive Order S-3-05. The Climate Action Strategy does not include any measures that are applicable to construction activities associated with the Enhancement Project. **Therefore, construction of the Hybrid Alternative would not conflict with existing plans, policies, or**

regulations adopted for the purpose of reducing GHG emissions, and this impact would be less than cumulatively significant (Criterion B).

<u>Permanent Impacts</u>

As discussed in more detail in the project description, the Hybrid Alternative would include a long-term monitoring program and may require construction activities associated with vegetation removal and inlet maintenance. The most intensive maintenance activities would involve inlet maintenance, which would occur approximately every 12 to 20 months. The estimates of operations emissions are based on similar assumptions to those for construction emissions, as the primary sources of emissions would be similar to those used in the construction phase, including dredges, off-road equipment, and on-road motor vehicle trips. The emissions associated with regular maintenance were estimated at 73 MT CO_2e. The amortized construction-related emissions for the Hybrid Alternative would be approximately 111 MT CO_2e per year (5,540 MT CO_2e / 50 years = 111 MT CO_2e). The impact determination for the County of San Diego threshold is based on the combined amortized construction-related and operational emissions of 184 MT CO_2e per year. The total amortized construction and operational emissions for all disposal scenarios would be also not exceed the County of San Diego threshold of 900 MT CO_2e per year. **Therefore, operation and maintenance of the Hybrid Alternative would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment, and this impact would be less than cumulatively significant (Criterion A).**

The approach to developing a threshold of significance for GHG emissions is to identify the level of emissions for which a project would not be expected to substantially conflict with existing California legislation that has been adopted to reduce statewide GHG emissions. Since the Enhancement Project is consistent with the Scoping Plan update, it would be consistent with the goals and strategies of AB 32 and Executive Order S-3-05. As discussed in more detail under "Sea Level Rise and Extreme Events" in this section, the Hybrid Alternative would change the hydrologic regime of the lagoon from the existing freshwater system to a hybrid system influenced by both seawater and freshwater. The new tidal inlet would enable the lagoon to drain incoming freshwater more efficiently and improve flood performance during large storm events, leading to less potential in general for flooding hazards. The proposed Boardwalk deck elevation would be located above the 100-year flood water surface elevation to prevent flooding and the Carlsbad Boulevard bridge roadway elevation would be raised to accommodate flood flows under the bridge and eliminate flooding of the roadway during design storm conditions. The Hybrid Alternative would be consistent with the goals of the Climate Action Strategy. **Therefore, the Hybrid Alternative would not conflict with any applicable plan, policy, or regulation for**

the purpose of reducing GHG emissions, and this impact would be less than cumulatively significant (Criterion B).

No Project Alternative

Under the No Project Alternative, the proposed enhancement of the lagoon would not be completed at the project site. Since there is no increase in activities under the No Project Alternative, GHG emissions would also not increase. **Therefore, GHG emissions associated with the No Project Alternative would not be cumulatively significant (Criteria A and B).**

Sea Level Rise and Extreme Events

<u>Hydrology and Flooding</u>

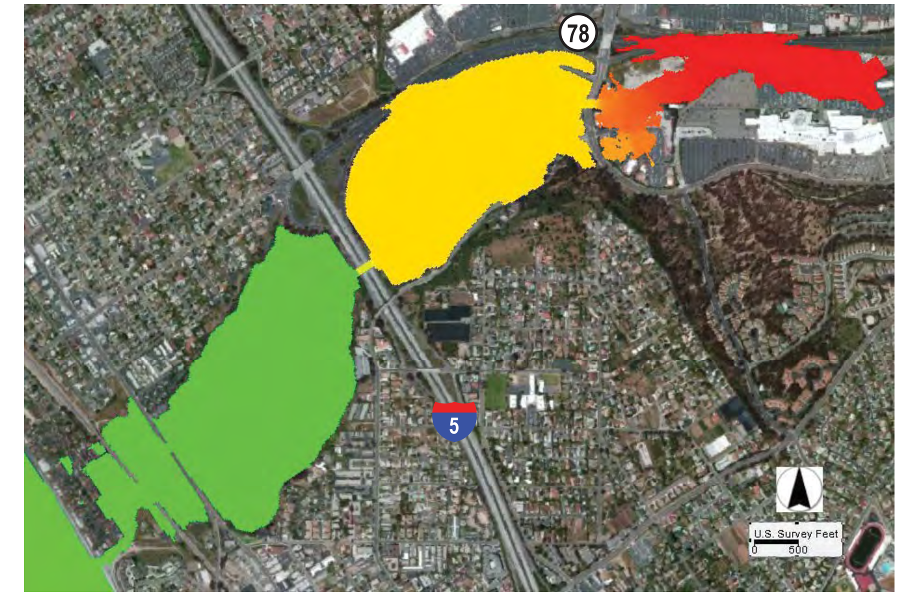
Buena Vista Lagoon will be subject to the impacts of climate change regardless of the alternative implemented. Vulnerabilities would be based on changes in temperature, precipitation (timing and amount), storm intensity, extreme heat days, sea level rise, and storm surges. The hydrology within Buena Vista Lagoon is largely driven by freshwater supplied from the upstream Buena Vista Creek watershed and less so by ocean tidal fluctuations along the coast. Storm-related storm surges in the ocean can also provide lagoon replenishment when seawater overtops the weir and beach berm.

As discussed in Section 3.2 Hydrology, the potential for flooding within areas adjacent to the lagoon is currently a concern during large storm events. During large storm events, flood flows from the watershed entering the lagoon can overtop the weir and beach berm with erosive outflow to the ocean and erode the beach berm, leading to periods of ocean water entering the lagoon during high tide events.

Sea level rise could have widespread adverse consequences for California's coastal resources, including increased inundation, flooding, and coastal erosion. The most recent climate science report, *Sea Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future*, has estimated that sea levels along the U.S. Pacific Coast would increase up to 66 inches by 2100 (NRC 2012). SANDAG states that the most recent guidance from the Climate Action Team should be considered, and those recommendations are consistent with a sea level rise of 66 inches by 2100 (SANDAG 2013). The California Energy Commission has created an interactive website called Cal-Adapt to help planners assess regional and local impacts of climate change under different scenarios (CEC 2014). Table 3.12-4 describes predicted flood elevations for 2050 and 2100 under each alternative, and Figures 3.12-2 and 3.12-3 show the areas within the lagoon that would be at risk from flooding due to sea level rise.

Freshwater Alternative

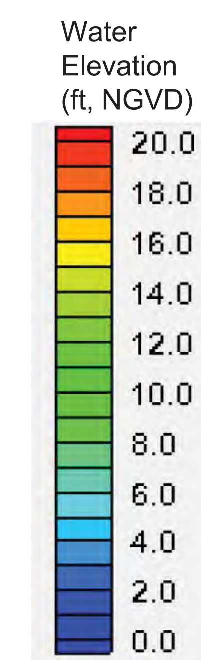
Saltwater Alternative



Hybrid Alternative (Option A)

Hybrid Alternative (Option B)

No-Project Alternative



Source: Everest International Consultants, Inc. & Battelle Memorial Institute 2003

0 1000 2000 Feet

Figure 3.12-3
Year 2100 100-year Storm Inundation Under Sea Level Rise

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Table 3.12-4
Modeled 100-Year Storm Event Water Elevations with Sea Level Rise

Sea Level Conditions	Alternative	Maximum Water Elevation (ft, NGVD)			
		Weir Basin	Railroad Basin	Coast Highway Basin	I-5 Basin
2015	Existing Conditions	12.1	12.1	12.1	15.8
	Freshwater Alternative	9.6	9.7	10.4	15.4
	Saltwater Alternative	7.0	7.3	7.7	8.2
	Hybrid A	6.6	6.8	7.1	15.9
	Hybrid B	6.6	6.8	7.1	15.9
2050	No Project Conditions	12.7	12.8	12.9	16.9
	Freshwater Alternative	9.6	9.7	10.4	15.4
	Saltwater Alternative	7.5	7.9	8.3	8.8
	Hybrid A	7.1	7.4	7.9	16.0
	Hybrid B	7.1	7.4	7.9	16.0
2100	No Project Conditions	13.1	13.2	13.3	17.0
	Freshwater Alternative	10.0	10.2	10.6	15.4
	Saltwater Alternative	9.5	9.8	10.4	10.8
	Hybrid A	9.1	9.3	9.7	16.0
	Hybrid B	9.1	9.3	9.7	16.0

As aging infrastructure is gradually phased out and replaced with new construction, new projects should be elevated to consider future higher water levels. SANDAG indicates that projects should consider sea level rise scenarios in combination with 50-year and 100-year storm flow events. Bridges located closer to the coastline should develop site-specific analyses that estimate both the 100-year fluvial storm flood level and extreme wave crest. Tsunamis have the potential to impact the study area, and the concern from a tsunami is the increase in flow velocities under bridges from high current velocities. Consequently, bridges should be designed with additional scour protection on both sides of the bridge abutments and be supported on piles/piers to resist erosion.

The CCC also indicates that projects should acknowledge and address sea level rise as necessary in planning and permitting decisions. Adaptation measures can be implemented to minimize risks from sea-level rise and protect coastal resources. The CCC provides a list of potential adaptation measures that are organized into categories, such as shoreline management. Shoreline management describes actions to proactively preserve or manage a shoreline area and includes programs for beach nourishment and dredging management.

Freshwater Alternative

The Freshwater Alternative would increase the hydraulic efficiency of Buena Vista Lagoon over existing conditions by removing vegetation and sediment in open water areas to improve inter-basin flow exchange, as well as flood protection. The hydrologic regime of the lagoon would remain a freshwater system influenced primarily by upstream watershed drainage into the I-5 Basin at the east end of the lagoon.

Potential flood water elevations throughout the lagoon would be improved through the incorporation of a new, larger weir that would enable the lagoon to drain incoming freshwater more efficiently and improve flood control during large storm events, leading to less potential in general for flooding hazards. The proposed Boardwalk deck elevation would be located above the 100-year flood water surface elevation (approximately 12 feet NGVD) to avoid impeding flood flows. The decrease in water surface elevation in all basins of the lagoon would also improve flood protection compared to existing conditions. These benefits compared to the No Project Alternative would continue into the future, as shown in Table 3.12-4. **Overall, the Freshwater Alternative would improve the ability of the project area to respond to long-term climate impacts, such as increased sea level rise.**

Saltwater Alternative

The Saltwater Alternative would change the hydrologic regime of the lagoon from the existing freshwater system to a saltwater system, influenced primarily by seawater entering the lagoon through an open tidal inlet during flood tides. The new tidal inlet would enable the lagoon to drain incoming freshwater more efficiently and improve flood control during large storm events, leading to less potential in general for flooding hazards. The lagoon channel network and infrastructure improvements would enhance hydraulic connectivity between the lagoon and ocean, and allow fluvial flows to drain from the lagoon more efficiently.

The proposed Boardwalk deck elevation would be located above the 100-year flood water surface elevation at approximately 12 feet NGVD to prevent flooding. To accommodate flood flows under the Carlsbad Boulevard bridge, including a 1-foot freeboard, the roadway elevation would be raised to 14 feet NGVD from the existing 9.6-foot NGVD elevation, which would also eliminate flooding of the roadway during design storm conditions. Improved circulation and drainage would generally reduce the potential for flooding to occur within the lagoon and along adjacent infrastructure during large storm events. Flood conditions would be greatly improved throughout the lagoon compared to existing conditions. These benefits compared to the No Project Alternative would continue into the future, as shown in Table 3.12-4. **Therefore, the**

Saltwater Alternative would improve the ability of the project area to respond to long-term climate impacts, such as increased sea level rise.

Hybrid Alternative

The Hybrid Alternative would change the hydrologic regime of the lagoon from the existing freshwater system to a hybrid system influenced by both seawater and freshwater, with a saltwater system created west of I-5 and a freshwater system maintained east of I-5. Similar to the Saltwater Alternative, new channels would be created, existing channels would be expanded, and infrastructure would be improved to minimize constrictions and allow tidal exchange and enhanced circulation.

Hydrology throughout the lagoon would be enhanced through improved infrastructure and new and expanded channels. The new tidal inlet would enable the lagoon to drain incoming freshwater more efficiently and improve flood performance during large storm events, leading to less potential in general for flooding hazards.

The Hybrid Alternative would provide flood reduction potential compared to existing conditions. These benefits compared to the No Project Alternative would continue into the future, as shown in Table 3.12-4. The lagoon channel network and infrastructure improvements would enhance hydraulic connectivity between the lagoon and ocean, and allow fluvial flows to drain from the lagoon more efficiently. The new 100-foot-wide tidal inlet would improve flood performance over existing conditions. The proposed Boardwalk deck elevation would be located above the 100-year flood water surface elevation to prevent flooding and the Carlsbad Boulevard bridge roadway elevation would be raised to accommodate flood flows under the bridge and eliminate flooding of the roadway during design storm conditions. **Therefore, the Hybrid Alternative would improve the ability of the project area to respond to long-term climate impacts, such as increased sea level rise.**

No Project Alternative

Under the No Project Alternative, tidal flows would continue to be restricted due to the existing weir at the ocean outlet and the lagoon would remain a freshwater-dominated system. No vegetation or sediment removal would occur and no improvements to infrastructure would occur to minimize constrictions at crossings to create better flow throughout the basins. As a result, poor lagoon circulation (i.e., tidal exchange), surface water drainage, and flood protection would remain the same as current conditions. As indicated in Figure 3.12-2, sea level rise would be projected to inundate additional areas by 2100. Table 3.12-4 shows that flood water elevations would continue to rise compared to existing conditions. **Therefore, no change in the climate change impacts would result under the No Project Alternative.**

<u>Habitat Distributions</u>

Projected sea level rise scenarios as discussed above would ultimately lead to a shift in habitat distribution within the lagoon. Even under enhancement scenarios that would maintain freshwater conditions in the near term, habitats would eventually shift to salt water tolerant habitat types. The timing of habitat conversion would depend on the rate of saltwater intrusion and water levels in the lagoon as sea level rises. Anticipated water levels and salinity and their effects on habitat conversion under each of the enhancement alternatives, as well as the No Project Alternative, are discussed below.

Table 3.12-5 identifies projected habitat distributions under each alternative at 2050 and 2100, assuming a sea level rise of 2 feet and 5.5 feet, respectively. These projections are based on the California Ocean Protection Council Guidelines described in the Hydraulics Report (Appendix C). This predicted distribution is relatively speculative, however, as it accounts for only sea level rise, which is one of many anticipated components of climate change. Other trends, such as changes in rainfall and weather patterns, are extremely difficult to predict, and are not accounted for in this prediction.

Freshwater Alternative

2050

Under the Freshwater Alternative, the new 80-foot weir at the ocean outlet would continue to impound freshwater coming into the lagoon from the surrounding watershed.

By 2050, 2 feet of sea level rise is predicted; the elevation of the weir would remain at +5.6 feet NGVD, and water elevations in the lagoon would not be consistently elevated compared to post-enhancement conditions. In addition, since ocean water levels would remain under the elevation of the weir, it would continue to prevent tidal exchange with the lagoon under most conditions. As sea level rises, events in which the weir would be overtopped would occur more frequently, and the water would become gradually more brackish, although it is not anticipated to be considered saline (above 30 parts per thousand or [ppt]) by 2050.

The influence of gradually increasing saltwater volumes in the lagoon from overtopping events is difficult to predict because it depends on a number of variables, including volume of saltwater, extent of saltwater inundation, and freshwater input volumes into the lagoon. As water becomes

Table 3.12-5
Projected Future Habitat Distributions (2050 and 2100) under Sea Level Rise

Habitat Type	Freshwater Alternative (acres)			Saltwater Alternative (acres)			Hybrid Alternative A/B (acres)			No Project (acres)		
	Post-Enhancement	2050	2100	Post-Enhancement	2050	2100	Post-Enhancement	2050[2]	2100	Existing Conditions	2050	2100
Beach	1.3	1.3	1.3	0.8	0.8	0.8	0.8	0.5	0.3	0.6	0.6	0.6
Coastal and Valley Freshwater Marsh	24.7	24.7	1.5	0	0	0	10.2	10.2	1.5	96.2	96.2	45.4
Coastal Scrub	0.6	0.6	0.6	0.5	0.5	0.3	0.7	0.6	0.6	0.6	0.6	0.6
Deep Open Water	4.5	4.5	4.6	4.0	4.0	4.0	5.0	5.1	5.1	0	0	0
Diegan Coastal Sage Scrub	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.7	0.6	<0.1	<0.1	0
Diegan Coastal Sage Scrub: Baccharis-Dominated	1.6	1.6	1.6	1.3	1.3	1.1	1.3	1.3	1.3	1.3	1.3	1.3
Disturbed	0	0	0	0	0	0	0	0	0	0.7	0.7	0.7
Freshwater Habitat Transition Zone - Wetland	7.6	7.6	0	0	0	0	0	0	0	0	0	0
Freshwater Habitat Transition Zone - Nonwetland	1.6	1.6	0	0	0	0	0	0	0	0	0	0
Mudflat	0	0	0.8	20	58.6	30.3	4.7	21.4	17.8	0	0	0
Muted Tidal	0	0	0	0	0	0	5.0	5.0	0	0	0	0
Nonnative Grassland	0	0	0	0	0	0	0	0	0	2.4	2.4	2.4
Nonnative Riparian[4]	0	0	0	0	0	0	0	0	0	4.2	4.2	3.6
Open Water (Fresh)	133.4	0	0	0	0	0	32.1	0	0	106.8	0	0
Open Water (Tidal)	0	0	186.4	51	76.9	154.6	62.1	67.9	166.8	0	0	123.9
Open Water (Brackish)	0	133.4	0	0	0	0	0	32.1	0	0	106.8	29.5
Proposed Cattail Maintenance Area	32.9	32.9	0	0	0	0	30.5	30.5	0	0	0	0
Riparian Enhancement	4.5	4.5	2.5	6.6	6.2	6.0	4.6	4.0	4.0	0	0	0
Southern Coastal Salt Marsh (Non Tidal)	14.8	14.8	1.1	23.2	22.4	2.0	17.9	16.9	1.3	14.8	14.8	14.6
Southern Coastal Salt Marsh High	0	0	20.3	55	30.6	14.7	26.5	13.7	19.4	0	0	5.4
Southern Coastal Salt Marsh Low	0	0	2.9	33.2	14.0	15.7	6.3	7.2	4.9	0	0	0
Southern Coastal Salt Marsh Mid	0	0	4.4	35.4	16.2	2.6	20.3	12.9	7.7	0	0	0
Southern Willow Scrub	2.2	2.2	2.1	0	0	0	2.2	2.2	2.1	2	2	2.1
Developed[1]	8.0	8.0	7.6	6.5	6.0	5.4	7.3	6.1	4.9	8.7	8.7	8.2
Subtotal – Wetland Area[2]	**217.9**	**217.9**	**222.0**	**221.8**	**222.7**	**223.9**	**220.6**	**222.9**	**224.5**	**217.8**	**217.8**	**218.8**
Subtotal – Non-Wetland Area[3]	**20.4**	**20.4**	**16.3**	**16.5**	**15.6**	**14.4**	**17.7**	**15.1**	**13.0**	**20.6**	**20.6**	**19.5**
Total Acreage[1]	**238.3**	**238.3**	**238.3**	**238.3**	**238.3**	**238.3**	**238.3**	**238.3**	**238.3**	**238.3**	**238.3**	**238.3**

[1] Totals may not add due to rounding and slight differences in project study area.
[2] Wetland areas include coastal and valley freshwater marsh, mudflat, muted tidal, open water (all types), cattail maintenance area, and southern coastal salt marsh (all types).
[3] Non-wetland areas include beach, coastal scrub, Diegan coastal sage scrub (including baccharis-dominated), disturbed, nonnative grassland, nonnative riparian, riparian enhancement, southern willow scrub, and developed.
[4] Freshwater habitat transition zone is expected to function as both wetland and non-wetland, and the acreage for each type is included in the appropriate subtotal.

gradually more saline through 2050, it is anticipated that water would become brackish. Southern cattails (*Typha domingensis*), and the freshwater marsh habitat they represent, would continue to persist. Major habitat conversions, other than the increasing salinity of open water habitats, are not anticipated occur by 2050. Research shows that cattails survive in brackish conditions of up to 20–25 ppt, but given the complexities above it is impossible to predict exactly when this threshold would be surpassed (Beare 1987). Figure 3.12-4 shows projected habitat distributions in 2050 under the expected brackish conditions; this habitat distribution is the same as proposed post-enhancement, since habitat conversion would not yet have occurred.

2100

By 2100, 5.5 feet of sea level rise is projected to occur. With the weir elevation remaining at +5.6 NGVD, this amount of sea level rise could result in frequent overtopping events. Salinity would continue to increase, and is anticipated to reach the 30 ppt threshold for saline water indicated above prior to 2100. Open water within the lagoon, which would make up more than half of its total area, would convert from brackish to fully tidal. Even before reaching this 30 ppt cutoff, it is anticipated that the lagoon's cattail population would gradually die off between 20–25 ppt. By 2100, nearly all of the freshwater marsh and cattail maintenance area habitat would convert to either open water or one of the salt marsh habitat types, depending on elevation. Figure 3.12-4 shows the generalized projected habitat distribution for the Freshwater Alternative in 2050 and 2100, and Table 3.12-5 describes the anticipated acreage of each habitat for each year.

Saltwater Alternative

2050

Because the Saltwater Alternative would open the lagoon to tidal influence, habitat distributions under the Saltwater Alternative would be influenced by sea level rise more quickly than the other alternatives. Generally, sea level rise would lead to an increase in open water and mudflat areas (anticipated to increase by approximately 50 percent and 300 percent, respectively). As elevational ranges for each habitat move upward, expansion of higher marsh habitats would be restricted by development surrounding the lagoon. Approximately half of tidal salt marsh habitats (high, low, and mid) would be maintained in 2050.

2100

By 2100, more than half of the area within the lagoon would become tidal open water habitat. Much of that area would come from the conversion of mudflat and salt marsh habitats, most of

Source: ; AECOM; Everest 2015

0.25 0.125 0 0.25 Mile

Scale: 1:15,840; 1 inch = 0.25 Mile

Figure 3.12-4
Freshwater Alternative Generalized Habitat Distribution with Sea Level Rise

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which would (all except low marsh) would be substantially reduced between 2050 and 2100. However, the amount of tidal open water habitat under the Saltwater Alternative would still be substantially less than under the Freshwater Alternative and would be balanced by a greater proportion of remaining mudflat and salt marsh habitats than under other alternatives. As shown in Figure 3.12-5 and detailed in Table 3.12-5, the balance of habitats within the lagoon would shift away from vegetated salt marsh and toward open water areas.

Hybrid Alternative

2050

Under the Hybrid Alternative, both options, a weir with elevation of +5.6 feet NGVD would be placed under the I-5 bridge to maintain a freshwater hydrologic regime in the I-5 Basin. Similar to lagoon conditions anticipated under the Freshwater Alternative, this weir would only occasionally be overtopped with the 2 feet of sea level rise anticipated by 2050. For the reasons described in the Freshwater Alternative discussion, the precise salinity of the I-5 Basin is difficult to predict because of the number and complexity of the variables involved. Generally, however, the water in the I-5 Basin would become gradually more brackish without reaching levels of salinity that would kill cattails and shift the habitat to saltwater marsh, and habitat distributions would remain generally the same as those proposed under post-enhancement conditions. Habitat in the saltwater portion of the lagoon west of I-5 would undergo similar conversion as the Saltwater Alternative, with a general increase in open water and mudflat and a decrease in tidal salt marsh. High and marsh in particular would be limited in potential expansion and would lose nearly half of its acreage as sea level rises. General anticipated habitat distributions are shown in Figures 3.12-6 and 3.12-7.

2100

Similar to the Freshwater Alternative, the projected 5.5 feet of sea level rise in 2100 would result in gradually more frequent overtopping of the I-5 weir and the area of tidal open water within the lagoon is projected to more than double. Prior to 2100, increasing salinity would be anticipated to reach the 20–25 ppt threshold beyond which cattails cannot survive, and existing freshwater marsh east of I-5 would gradually convert to saltmarsh habitat. The portion of the lagoon west of I-5 would continue to undergo an increase in open water and mudflat habitat and a decrease in levels of salt marsh. The muted tidal area in the northern Weir Basin created under the Hybrid Alternative, Option A is projected to persist until 2050, while that area would continue to be open water habitat under Option B. By 2100, however, sea level rise would overtop the barrier separating the muted tidal area and the area would be converted to full tidal influence. These conversions are anticipated to occur prior to 2100, and projected habitat distributions for 2100 are shown in Figures 3.12-7 and 3.12-8; acreages are detailed in Table 3.12-5.

No-Project Conditions

2050

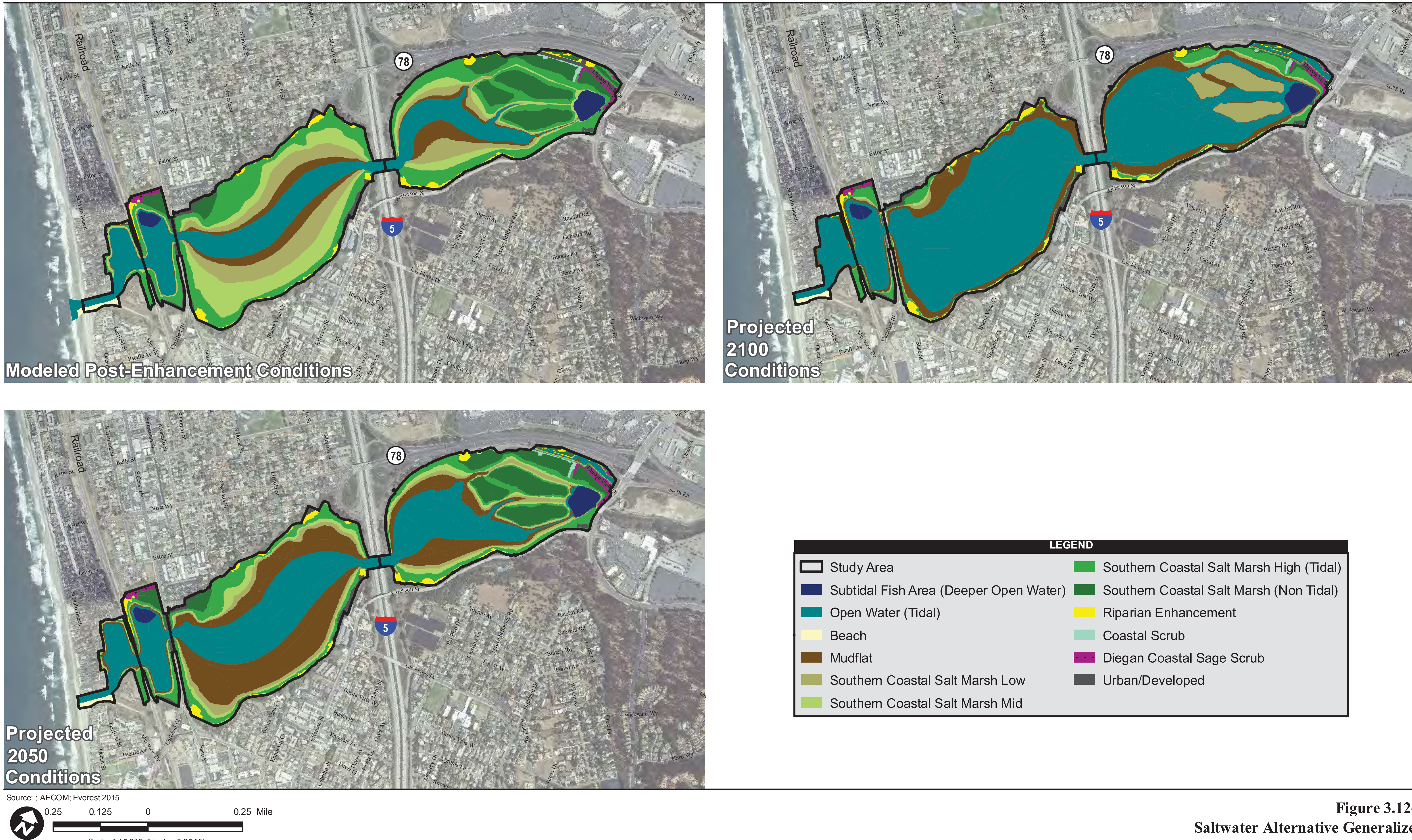
Under the No Project Alternative, the existing outlet weir, with an elevation of 5.6 NGVD, would remain in place. With 2 feet of sea level rise projected by 2050, average water levels in the lagoon would remain below the level of the weir, although more frequent overtopping would occur as sea level rises. With increased tidal exchange between the ocean and lagoon, water in the lagoon basins would gradually become brackish as described in the other alternatives. It is not anticipated that salinity levels in any of the lagoon basins would reach the die-off point for cattails by 2050, however, and habitat distributions would remain similar to those that currently exist, as shown in Figure 3.12-8 and as identified in Table 3.12-5.

2100

With the 5.5 feet of sea level rise anticipated by 2100, frequent weir overtopping would result in increased levels of salinity within the lagoon. As tidal open water begins to overtake other habitats throughout the lagoon, it is anticipated that the water in all basins except the I-5 basin would become saline (salinity greater than 30 ppt) by 2100. The I-5 basin is projected to remain brackish, however, and below the salinity cut-off for cattail mortality. Therefore, cattails could persist in the I-5 Basin in areas where the water is less than 4 feet deep. Taking into account anticipated continued sedimentation in the I-5 Basin, cattails and freshwater marsh habitat could extend throughout the I-5 Basin. Overall acreage of freshwater marsh habitat within the lagoon, however, would decrease by approximately 50 percent. Projected habitat distributions 2100 are shown in Figure 3.12-8, and acreages are detailed in Table 3.12-5.

Materials Disposal/Reuse

The vast majority of material from the enhancement project would be placed either on the beach or in the nearshore depending upon the alternative. These activities would occur as early as 2017, which is well before extreme sea level rise or extreme events associated with climate change would be noticeable. However, it is possible that increased beach widths from onshore placement could provide temporary localized protection for structures on top of eroding bluffs, or infrastructure close to sea level and subject to ocean action. Placed material is anticipated to disperse throughout the littoral cell and the volume of sand added to the entire littoral system from this one event would not be large enough to be noticeable over time. The placement of sand



Source: ; AECOM; Everest 2015

Figure 3.12-5
Saltwater Alternative Generalized Habitat Distribution with Sea Level Rise

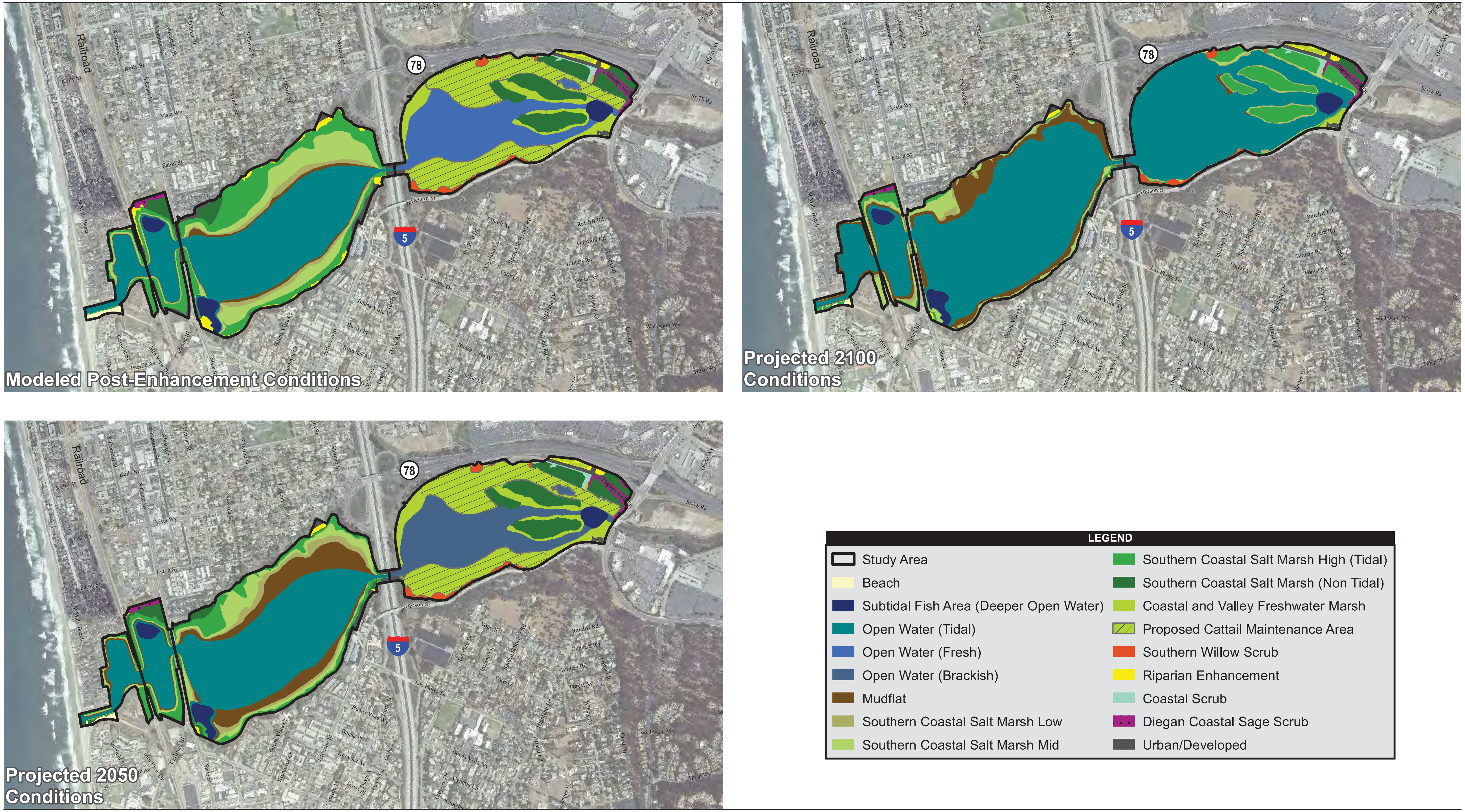
Path: P:\2013\60288954_BVLEP_EIR\06GIS\6.3_Layout\Reports\EIR\Saltwater_SLR_new.mxd, 4/30/2015, steinb

Source: ; AECOM; Everest 2015

0.25 0.125 0 0.25 Mile

Scale: 1:15,840; 1 inch = 0.25 Mile

Figure 3.12-6
Hybrid A Alternative Generalized Habitat Distribution with Sea Level Rise

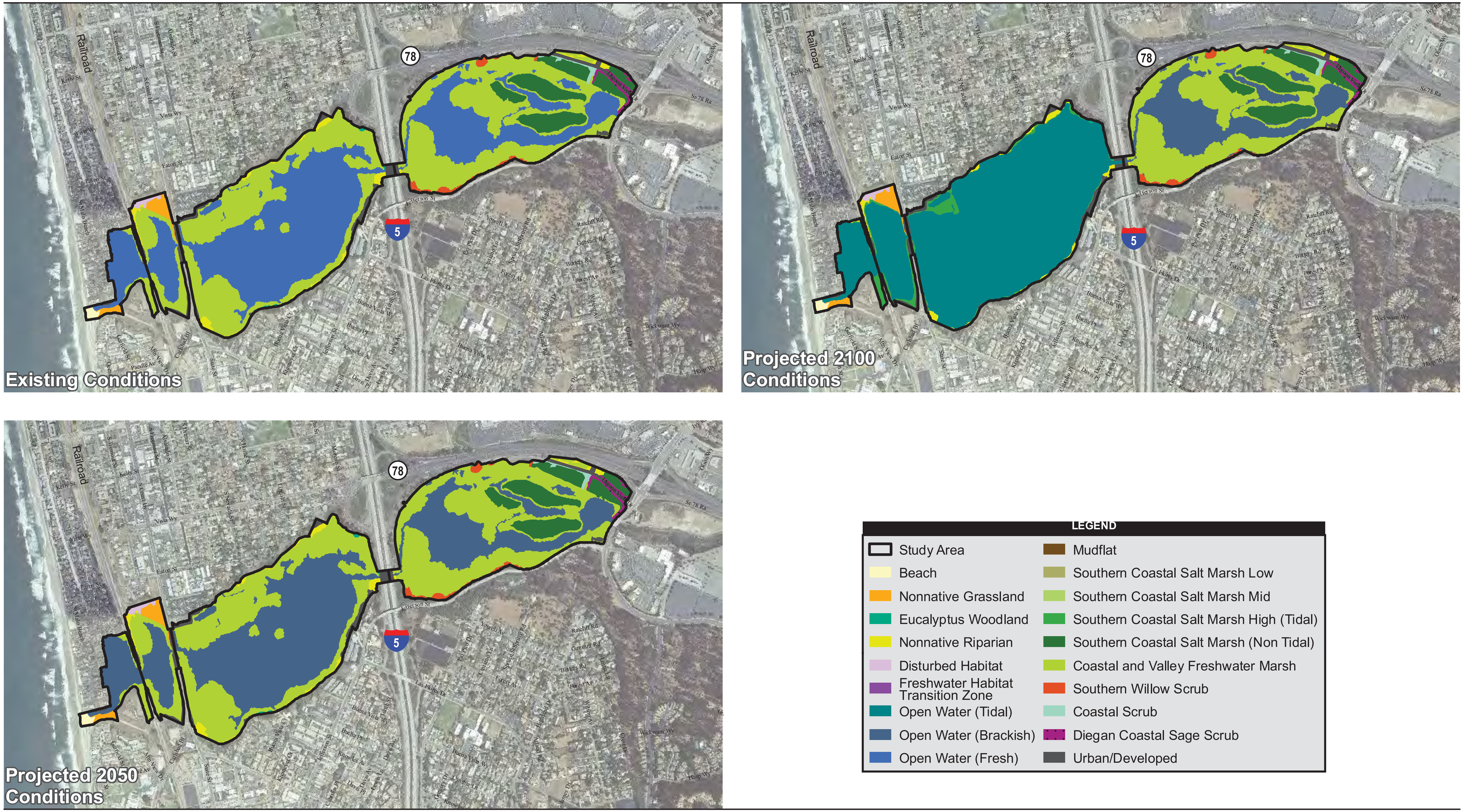


Source: ; AECOM; Everest 2015

0.25 0.125 0 0.25 Mile

Scale: 1:15,840; 1 inch = 0.25 Mile

Figure 3.12-7
Hybrid B Alternative Generalized
Habitat Distribution with Sea Level Rise



Source: ; AECOM; Everest 2013

0.25 0.125 0 0.25 Mile

Scale: 1:15,840; 1 inch = 0.25 Mile

Figure 3.12-8
No Project Alternative Generalized Habitat Distribution with Sea Level Rise

on beaches can reduce erosion, enhance recreation, or preserve or enhance the aesthetic and habitat value of beaches (CCC 2013). These actions are most effective for areas with some existing beach, such as the Oceanside or North Carlsbad beaches. Therefore, the materials disposal scenarios for all project alternatives would be consistent with recommended adaptation measures for climate change impacts.

3.12.4 MITIGATION MEASURES

No mitigation measures are required.

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