Appendix D

SLAMM Habitat Modeling Technical Memorandum

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memorandum

date	May 8, 2020
to	Walter Heady, The Nature Conservancy (TNC), Alyssa Mann (TNC)
cc	Heather Adamson, Association of Monterey Bay Area Governments (AMBAG)
from	Tiffany Cheng, PE, Bob Battalio, PE
subject	Wetland Habitat Evolution Modeling (SLAMM) for the Central Coast Highway 1 Climate Resiliency Study

Environmental Science Associates (ESA) has prepared this memorandum for The Nature Conservancy (TNC) to present the application of the Sea Level Affecting Marshes Model (SLAMM) to assess coastal habitat change and vulnerability with sea level rise (SLR) for roadway and railway adaptation scenarios developed from the Central Coast Highway 1 Climate Resiliency Study (Study). The results of SLAMM provide an updated assessment of ecological vulnerability in and around Elkhorn Slough and are inputs to the benefit cost analysis conducted by the Center for the Blue Economy (CBE), which is part of the wider evaluation of the adaptation scenarios. Contributions to this memo were made by Tiffany Cheng, PE and Bob Battalio, PE. ESA recognizes the assistance of Jonathan Clough of Warren Pinnacle Consulting with application of SLAMM.

1. Introduction

Human-driven modifications to Elkhorn Slough over the past 150 years have indelibly altered the tidal, freshwater and sediment processes that sustain estuarine habitats within the Slough. It is estimated that approximately half of the Slough's tidal marsh have been lost since the mid-19th century (Van Dyke and Wasson 2005). The construction of major transportation infrastructure, such as the existing Highway 1 corridor and railway, have had far-reaching consequences on tidal connectivity, sediment supply and resilience of adjacent habitats. The roadway and railway adaptation scenarios proposed in the Study were conceptualized to address both transportation and ecological resilience, specifically investigating restoration actions that could be concurrently planned as part of modifications made to transportation infrastructure.

Climate change induced sea level rise will result in widespread habitat conversion throughout the Slough, as marshes naturally adapt to rising water levels. Geospatial modeling tools, such as SLAMM, have been developed to predict changes in coastal wetland habitats under future sea level rise conditions. SLAMM simulates dominant processes governing coastal wetland migration and habitat conversions. Using inputs of existing topography, accretion rates, sea level rise and vegetation, SLAMM calculates habitat areas and maps habitat distribution over time. These outputs can be used to identify restoration and conservation opportunities for changing coastal habitats. This report summarizes the application of SLAMM to assess habitat evolution with sea level rise for a no action scenario (baseline conditions) and the range of roadway and railway adaptation scenarios developed for the study.

2. Methods

The study was performed with SLAMM Version 6.7, which includes features developed for California estuaries and perched lagoon systems (Warren Pinnacle Consulting, 2016). Earlier versions of SLAMM were developed for sites located in the east coast of the United States and did not adequately capture the range of California estuarine habitats and hydrology. The latest version includes a set of habitat classifications and conversion functions that are tailored to California.

Key inputs for topography and bathymetry, existing habitats, accretion and subsidence rates, and sea level rise for this study's SLAMM model are outlined below.

- *Topography and Bathymetry* - Figure D-1 shows the existing topography and bathymetry of Elkhorn Slough and adjacent areas, which was derived from the United States Geological Survey (USGS) 2017 ConED Topo-bathymetric Light Detection and Ranging (LiDAR) dataset and Elkhorn Slough surveys collected by California State University of Monterey Bay (CSUMB). Elevation corrections were prescribed at Hester Marsh in order to account for recent marsh restoration efforts. Elevations described within this study are referenced to North American Vertical Datum of 1988 (NAVD), which is a reference system established for vertical control surveying in the United States of America. The topography and bathymetry information were converted to 5-meter cells to provide adequate spatial resolution to capture habitat changes and reasonable model run time.

- *Existing Structures* – ESA coordinated with the California Department of Fish and Wildlife (CDFW) and the Central Coast Wetland Group (CCWG) to confirm locations and approximate heights of levee structures around Moss Landing Wildlife Area and parcels adjacent to Moro Cojo Slough. These were input into the model through a dike file.

- *Existing Vegetation Classification* - SLAMM requires existing conditions habitat mapping in order to evaluate habitat evolution over time. Present day vegetation classification for the study area was derived from National Wetlands Inventory (NWI) classifications and cross-walked to SLAMM habitat categories in the Coastal Assessment conducted by TNC and the State Coastal Conservancy (SCC) (Heady et al, 2018). These were additionally simplified to 10 categories for use in the cost-benefit analysis portion of the adaptation scenarios evaluation conducted by CBE (Table D-1).

- *Tidal Water Levels* - Tidal datums are used within the model as an input to the habitat evolution decision tree. For example, mean low water (MLW) is the boundary between open water and tidal flat, because it indicates the elevation at which land is always inundated (during an average day). If land is below MLW, it is assumed to be open water; if land is just above, it is tidal flat. The model uses NOAA tidal datums for Monterey, CA.

- *SLR Projections* – This study assumes sea level rise amounts of 2 ft by 2050 and 5 ft by 2100. These projections are similar to but a bit lower than the OPC 2018 Medium-High Risk Aversion scenario for Monterey Bay (CalNRA and OPC, 2018), but are consistent with sea level rise assumptions used in previous flood hazard mapping conducted for Coastal Resiliency Monterey and DELFT-3D hydrodynamic modeling for this study (OPC, 2013).

- *Accretion and Subsidence Rates* – Wetland elevation changes are affected by local sediment accumulation and loss. When compared against the average rate of sea level rise, the magnitude of this variable largely indicates whether or not a marsh is able to keep pace with increasing water levels. The Elkhorn Slough National Estuarine Research Reserve (ESNERR) provided average vertical accretion (+3.1 mm/yr) and subsidence rate (-1.6 mm/yr) for Elkhorn Slough, based off Sediment Elevation Table (SET) data collected at various locations.

SLAMM uses these model inputs and steps forward in time by raising the sea level and calculating changes to the topography, including horizontal recession by erosion and vertical growth by accretion. Based on the elevation and slope in each cell, SLAMM calculates a new inundation frequency for that cell. The model includes a set of conversion pathways for the habitat categories (e.g. Irregularly Flooded Marsh to Regularly Flooded Marsh to Tidal Flat) that it follows, as the inundation frequency of each cell changes.

Since SLAMM was developed primarily to examine the impact of changing water levels in estuarine habitats, it does not fully model coastal processes for beach and dune environments. Sea level rise will cause landward transgression (movement inland and up) of the beach-dune strands due to higher water levels and waves. These processes are included in the Coastal Resilience Mapping.

Table D-1. Cross-walk of CA-SLAMM Detailed Habitat Categories to Simplified Categories

CA-SLAMM Detailed Habitat Categories	CA-SLAMM Code	Simplified Habitat Categories
Agriculture	103	Agriculture
Seasonally Flooded Agriculture	110	
Developed Dry Land	101	Developed
Flooded Developed	102	
Irregularly Flooded Marsh	115	Estuarine Marsh
Regularly Flooded Marsh	120	
Estuarine Forested/Shrub Wetland	116	
Tidal Flat and Estuarine Panne	122	Tidal Flat
Tidal Channel	125	Tidal Channel
Estuarine Open Water	126	Open Water
Invertebrate Reef	118	
Artificial Estuarine Pond	105	
Open Ocean	127	
Freshwater Marsh	108	Fresh Marsh
Seasonal Freshwater Marsh	109	
Freshwater Forested/Shrub	112	
Tidal Freshwater Forested/Shrub	113	
Tidal Freshwater Marsh	114	
Inland Shore	107	N/A
Artificial Pond	104	N/A
Artificial Reef	117	Outer Coast
Ocean Beach	119	
Dunes	111	
Terrestrial Habitats	102	Terrestrial Habitats
Inland Open Water	106	Open Freshwater
Riverine Tidal	124	
Riverine/Open Water	123	

*These habitat categories did not appear in the study area and were not mapped.

3. Results

This section summarizes the results for the no action scenario (baseline conditions) and adaptation scenarios under future sea level rise conditions, assuming that wetland habitats are allowed to migrate into existing terrestrial, upland habitats. Areas identified as developed or agriculture are assumed to be protected throughout the entire duration of the run. Not allowing wetland habitat migration into the developed or agriculture land use categories yields more insight as to how much existing terrestrial, upland habitat would potentially be converted to marsh over the course of the century.

SLAMM allows the user to run scenarios where these land use categories are not protected and wetland habitat migration into these areas is allowed. Although not the explicit focus of the evaluation of the adaptation scenarios, these scenarios were re-run in order to provide additional context to the impact of present and future land-use planning decisions and are discussed at the end of the section.

Tables D-2 through D-5 provide a summary of predicted habitat areas for estuarine, terrestrial and open water habitats in the study area for Scenario 0 (No Action) and the adaptation scenarios.

Table D-2. Scenario C0 (No Action) - Predicted Habitat Areas for Major Habitat Categories

	Habitat Area (ac)			
	2020	**2050**	**2070**	**2100**
Estuarine Marsh	1685	971	464	260
Tidal Flat	1349	1634	1345	639
Terrestrial Habitats	3139	3082	3034	2970
Open Water	3737	4314	5197	6227

Table D-3. Scenarios C1A (2-Lane Elevated Highway) and C3A (4-Lane Elevated Highway) - Predicted Areas for Major Habitat Categories*

	Habitat Area (ac)		
	2050	**2070**	**2100**
Estuarine Marsh	1492	940	588
Tidal Flat	1242	1283	801
Terrestrial Habitats	3076	3028	2966
Open Water	4187	4785	5737

*These scenario variations assume that Highway 1 Reaches 1-4 are elevated on piles.

Table D-4. Scenarios C1B (2-Lane Elevated Highway) and C3B (4-Lane Elevated Highway) - Predicted Areas for Major Habitat Categories*

	Habitat Area (ac)		
	2050	**2070**	**2100**
Estuarine Marsh	1502	956	607
Tidal Flat	1240	1278	796
Terrestrial Habitats	3074	3025	2963
Open Water	4186	4782	5731

*These scenario variations assume that Highway 1 Reaches 1, 3 and 4 are elevated on piles and Reach 2 is elevated on fill embankment.

Table D-3. Scenario C2 (Managed Retreat/G12 Widening) - Predicted Areas for Major Habitat Categories

	Habitat Area (ac)		
	2050	**2070**	**2100**
Estuarine Marsh	1457	935	550
Tidal Flat	1255	1272	832
Terrestrial Habitats	3087	3038	2974
Open Water	4190	4783	5728

3.1 No Action Scenario (Scenario C0)

The SLAMM results for the No Action scenario are presented in Figures D-2, D-3, D-4 and D-5 at present day and three future time horizons (2050, 2070, and 2100).

At 2050 (Figure D-3), the projected sea level rise is about two feet. Estuarine marsh sub-habitats, including regularly-flooded and irregularly-flooded marsh, throughout the Slough convert to tidal flat and estuarine open water habitat categories. The model predicts tidal connectivity from the Slough to Upper Bennett Slough and Struve Pond, which is reflected in the areas converting to estuarine open water. The Catellus parcel by Moro Cojo Slough (presently grassland) floods and begins to convert to tidal flat and estuarine marsh habitat. Existing levees are reported by the model to convert to marsh due to their slightly higher elevation compared to adjacent land. The irregularly-flooded marsh habitat east of the Catellus parcel convert predominantly to tidal flat.

At 2070 (Figure D-4), the projected sea level rise is about three feet. Remaining estuarine marsh habitat convert to mudflat. The marsh complexes east of the railway are predicted to be drowned, without any restoration action to raise marsh plain grades. The land immediately adjacent to Reach 2 converts to regularly-flooded marsh, reflecting an opportunity area for creating future wetland habitat.

At 2100 (Figure D-5), most of Elkhorn Slough and Moro Cojo Slough convert to estuarine open water, under a projected sea level rise of approximately five feet. Approximately 260 acres of estuarine marsh habitat remain from the original 1,685 acres identified at existing conditions, representing an 85% loss. Only half (639 acres) of the existing tidal flat acreages (1,349 acres) remain at the end of the century. Where slopes allow, wetland habitats migrate up into terrestrial habitats on the fringes of Elkhorn Slough and north edge of Moro Cojo Slough. The model predicts approximately 169 acres of terrestrial habitat are predicted to be available for wetland habitat migration (agricultural and developed uplands are not included in this land conversion). Since agricultural lands are assumed protected, no wetland habitats migrate into the low-lying lands south of Moro Cojo Slough.

3.2 Scenarios C1A and C3A

The habitat modeling results for Scenarios C1A and C3A are presented together, since both scenarios assume that Highway 1 Reaches 1-4 will be elevated on piles under a 2-lane and 4-lane roadway. Although the model does not simulate the impacts to adjacent habitat associated with constructing a widened roadway facility, the habitat modeling yields valuable insight into potential future wetland habitat creation as a result of the levee ecotone design by Reach 2 and marsh restoration east of the railway.

At 2050 (Figure D-6), assuming 2 feet of sea level rise, the levee ecotone by Moss Landing Wildlife Area and Reach 2 produces 72 acres of estuarine marsh. Marsh complexes east of the railway are assumed to be restored with new tidal channel openings at North/Estrada Marshes and the larger of the Azevedo Ponds. Throughout Elkhorn Slough, areas of marsh that were not restored are converting to tidal flat.

At 2070 (Figure D-7), with 3 feet of sea level rise, the restored marsh complexes remain estuarine marsh habitat, while other areas where the marsh grade plain was not raised (by the main channel of the Slough) are converting to mudflat. The habitat conversion trends by Moro Cojo Slough are similar to the no action scenario.

At 2100 (Figure D-8), with 5 feet of sea level rise, approximately 52 acres of estuarine marsh habitat remain from the levee ecotone which is assumed to be constructed around mid-century. Portions of the estuarine marsh habitat in Parsons Slough, North/Estrada Marshes and Azevedo Ponds begin to convert to tidal flat. Approximately 588 acres of estuarine marsh habitat, from the levee ecotone and restored marsh complexes, remain at the end of the century.

3.3 Scenarios C1B and C3B

The habitat modeling results for Scenarios C1B and C3B are presented together, since both scenarios assume that Highway 1 Reaches 1, 3, 4 will be elevated on piles and Reach 2 will be elevated on a fill embankment under a 2-lane and 4-lane roadway. Figures D-9 through D-11 show the habitat evolution predicted for these scenarios. The difference in roadway footprint a 4-lane roadway width for Scenario C3B, compared to Scenario C1B (2-lane), is approximately 0.5 acre. The study is a planning level study and additional specific details may change this.

In Scenarios C1B and C3B, the marsh restoration east of the railway performs similarly to Scenarios C1A and C1B, where restored estuarine marsh areas remain mostly intact through the end of the century. Other areas within the domain (e.g. Elkhorn Slough west of the railway, Moro Cojo Slough) do not show much difference either. This is expected, since the primary change between the two sets of runs is the levee ecotone arrangement by Moss Landing Wildlife Area, depending on whether Reach 2 is elevated on fill or piles.

The levee ecotone design included in Scenarios C1B and C3B produces 83 acres of estuarine marsh habitat at 2050. By 2100, 70 acres remain. Approximately 607 acres of estuarine marsh habitat from levee ecotone and the restored marsh complexes remain at the end of the century.

3.4 Scenario C2

Scenario C2 assumes marsh restoration east of the railway complex only, with traffic diverted to G12 (widened to 4-lanes). No transportation or ecology adaptation actions are taken near the existing Highway 1 alignment.

Habitat trends outside of the marsh restoration areas track closely to those from the no action scenario, where most estuarine marsh converts to open water by 2100. The marsh restoration east of the railway in Scenario C2 performs similarly to that modeled in the other adaptation scenarios (Figures D-12 through D-14), with approximately 550 acres of estuarine marsh remaining at the end of the century, 290 acres of which due to the proposed marsh restoration.

3.5 General Trends under Varied Protection Schemes

Due to the complex nature of climate change adaptation for transportation infrastructure, which shapes the existing hydrology and ecology in the study domain, two sets of simulations were conducted for the no action and adaptation scenarios. This includes assuming 1) wetland habitat migration into agricultural lands, and 2) wetland habitat migration into all agricultural and developed lands. These additional model runs provide additional insight into how present and future land use management decisions could yield further ecological resilience for Moss Landing, Elkhorn Slough and Moro Cojo Slough.

The modeling results show that allowing wetland habitats to move into agricultural lands results in the conversion of farmland by Highway 1 Reaches 3 and 4 to regularly-flooded and irregularly-flooded estuarine marsh. Minimal habitat conversion for the agricultural lands north of Reach 2 is predicted by the model due to the higher grades. By 2050, overtopping occurs on the outer coast, represented by the model as open ocean. The flooding of the low-lying lands results in the conversion of approximately 1,100 acres of agricultural lands between Moro Cojo Slough and Castroville to estuarine marsh habitat and tidal flat habitat by 2100 (Figure D-15). An additional 182 acres of developed lands could convert to estuarine habitat by the end of the century.

4. Discussion

SLAMM predicts habitat conversions based on ground surface elevations, sea level rise, water levels, and existing habitat information. Habitat evolution is also influenced by a broader range of physical processes, such as watershed hydrology, evapotranspiration, ground surface slope, groundwater, soils and salinity. Given the limitations in available data for a large domain, full deterministic modeling of these processes over a century is not feasible. Despite model limitations, SLAMM's predictions in projected habitat evolution over the century provide an indication of future site condition under distinct sea level rise thresholds, even if there is variability in when those sea level rise values occur.

The modeling results from the no action scenario and the adaptation scenarios strongly support action to create and sustain estuarine marsh habitat acreages within the Slough. The proposed grading by Reach 2 for levee ecotone creation for Scenarios C1A, C1B, C3A and C3B will produce between 72 to 83 acres of estuarine marsh habitat, assuming construction by mid-century. Since this study is planning-level, if there is interest in pursuing this adaptation measure, the total number of estuarine marsh habitat acreages will likely be refined and could potentially be greater.

Similarly, although estuarine marsh habitat acreages decrease sharply across all scenarios, raising the marsh plain grade to future MHHW at mid-century for Parsons Slough, North/Estrada Marsh and Azevedo Ponds is predicted to have longevity over several decades. This action would enhance 700 acres, and around 290 acres of additional restored estuarine habitat remain at year 2100 (5 feet of sea level rise) as a consequence of proposed marsh restoration. As estuarine habitats throughout the Slough are drowned under sea level rise, the importance of these complexes and the ecosystem services they provide to the Slough will grow. The cost and difficulty of restoring marshes to higher tidal elevations after mid-century will increase substantively, given that many habitat acres may have already converted to estuarine open water.

From the SLAMM modeling, Scenarios C1B and C3B result in the greatest number of estuarine marsh habitat from the associated restoration adaptation actions across the different scenarios (607 acres remaining at 2100, compared to 260 acres from the no action scenario).

The model results also confirm that in addition to restoration of existing wetland habitat, present and future land use planning for low-lying agricultural lands by Reaches 3 and 4 will have a significant impact on how much wetland habitat will exist in the future. The parcels south and southwest of Moro Cojo Slough, if allowed to convert, represent a strong opportunity to mitigate wetland habitat loss (up to 50%) experienced by Elkhorn Slough under future sea level rise. Although outside the scope of this study, the evaluation of the adaptation scenarios confirms the continuing importance of a regional, integrated approach among stakeholders to foster ecological resilience throughout the study area.

5. References

Griggs et al, 2017. Griggs, G, Árvai, J, Cayan, D, DeConto, R, Fox, J, Fricker, HA, Kopp, RE, Tebaldi, C, Whiteman, EA (California Ocean Protection Council Science Advisory Team Working Group), 2017. Rising Seas in California: An Update on SLR Science. California Ocean Science Trust, April 2017. http://www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sea-level-rise-science.pdf

Heady, W. N., B. S. Cohen, M. G. Gleason, J. N. Morris, S. G. Newkirk, K. R. Klausmeyer, H. Walecka, E. Gagneron, M. Small. 2018. Conserving California's Coastal Habitats: A Legacy and a Future with Sea Level rise. The Nature Conservancy, San Francisco, CA; California State Coastal Conservancy, Oakland, CA. 143 pages.

Natural Resources Agency and Ocean Protection Council. 2018. State of California SLR Guidance 2018 Update. http://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf

National Resource Council (NRC). 2012. "SLR for the Coasts of California, Oregon, and Washington: Past, Present, and Future." Prepublication. National Academy Press: Washington, D. C.

Ocean Protection Council (OPC). 2013. State of California SLR Guidance Document, Developed by the Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT), with science support provided by the Ocean Protection Council's Science Advisory Team and the California Ocean Science Trust, March 2013 update: http://www.opc.ca.gov/webmaster/ftp/pdf/docs/2013_SLR_Guidance_Update_FINAL1.pdf

Van Dyke, E., Wasson, K. 2005. Historical Ecology of a Central California Estuary: 150 Years of Habitat Change. Estuaries 28, 173-189.

Warren Pinnacle Consulting, Inc. (WPC). 2016. SLAMM 6.7 Technical Documentation Sea Level Affecting Marshes Model, Version 6.7 beta.

6. Figures

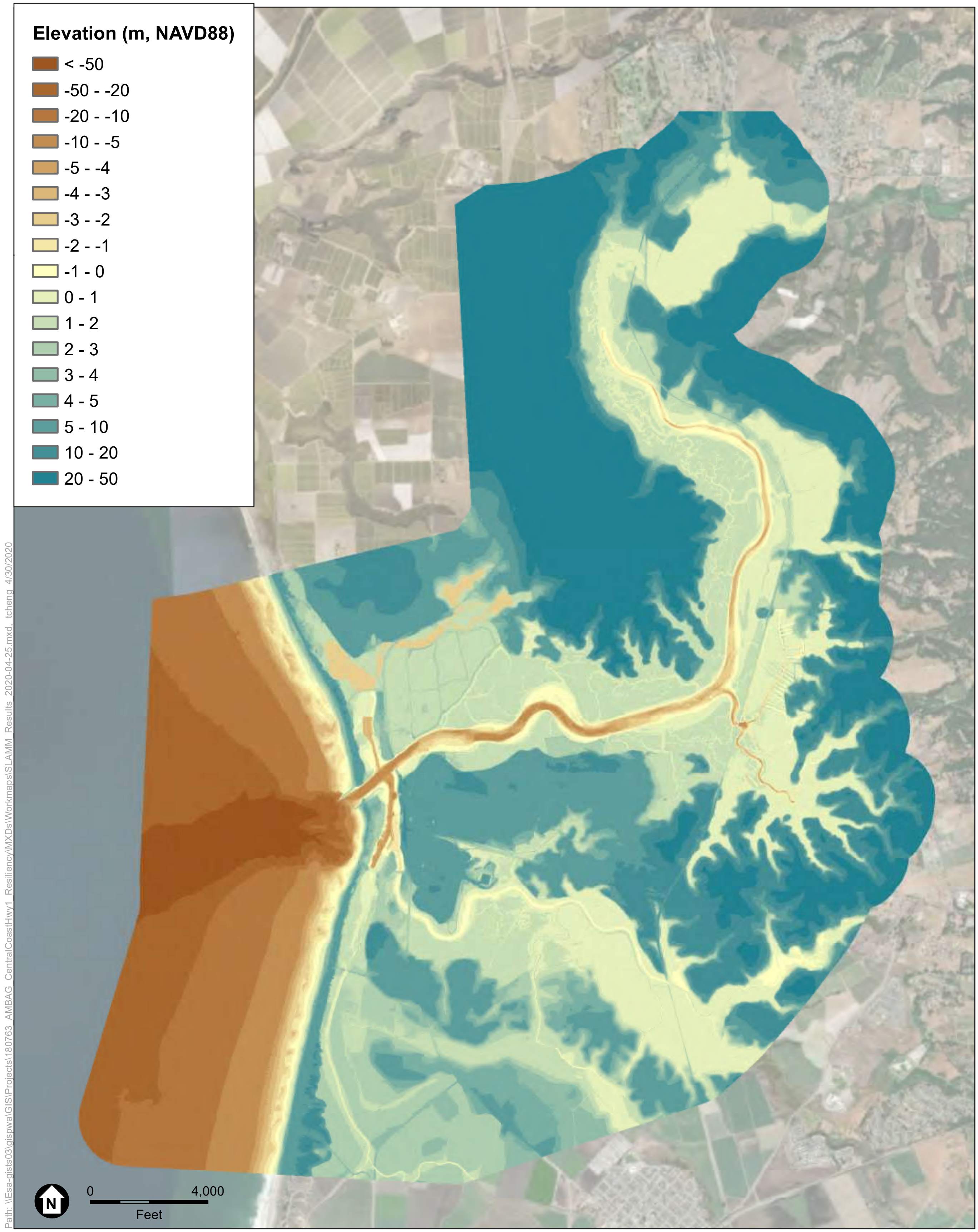
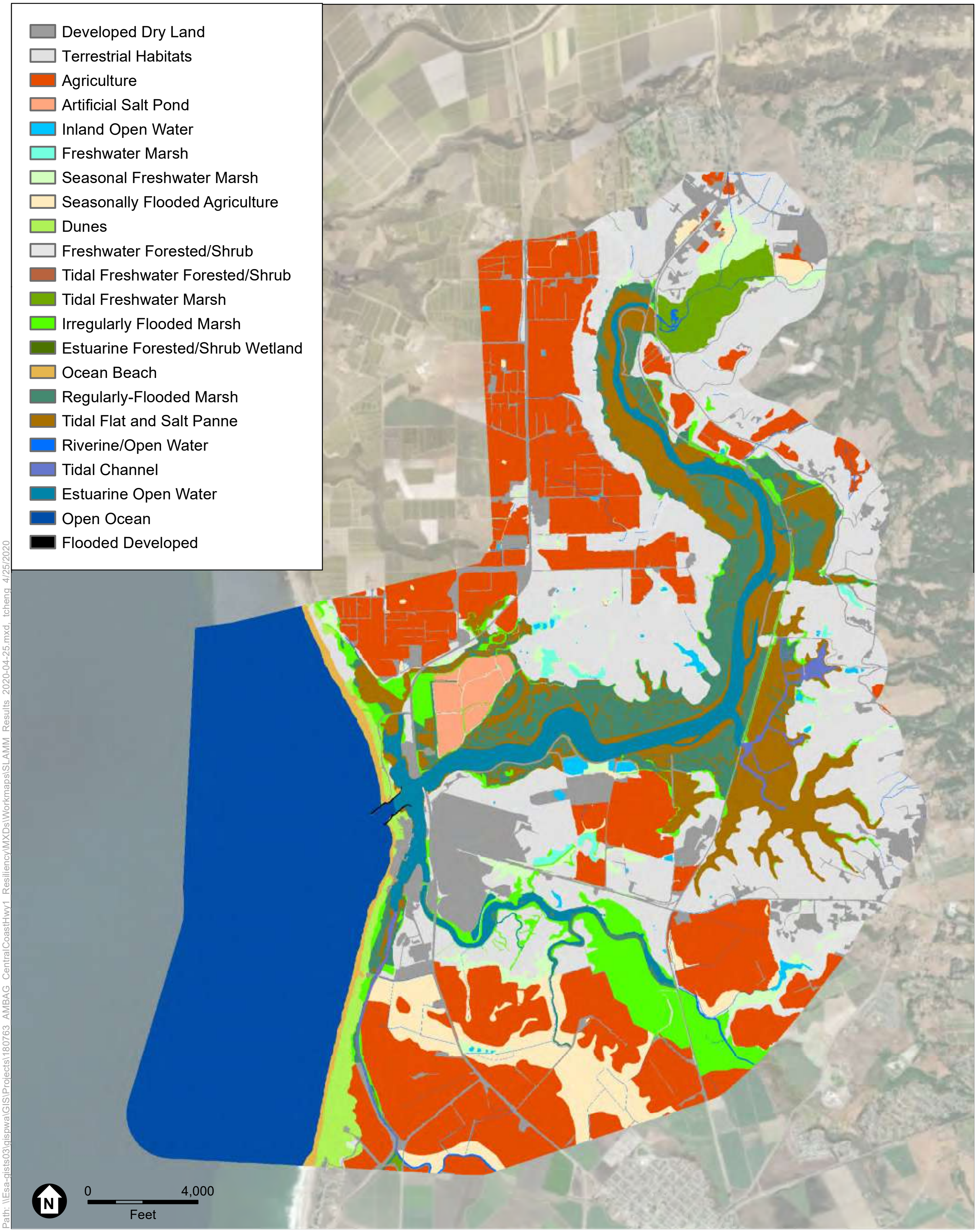


Figure D-1
SLAMM Topography and Bathymetry Input



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Central Coast Highway 1 Climate Resiliency Study

Figure D-2
Scenario C0
Baseline Condition - 2020

ESA

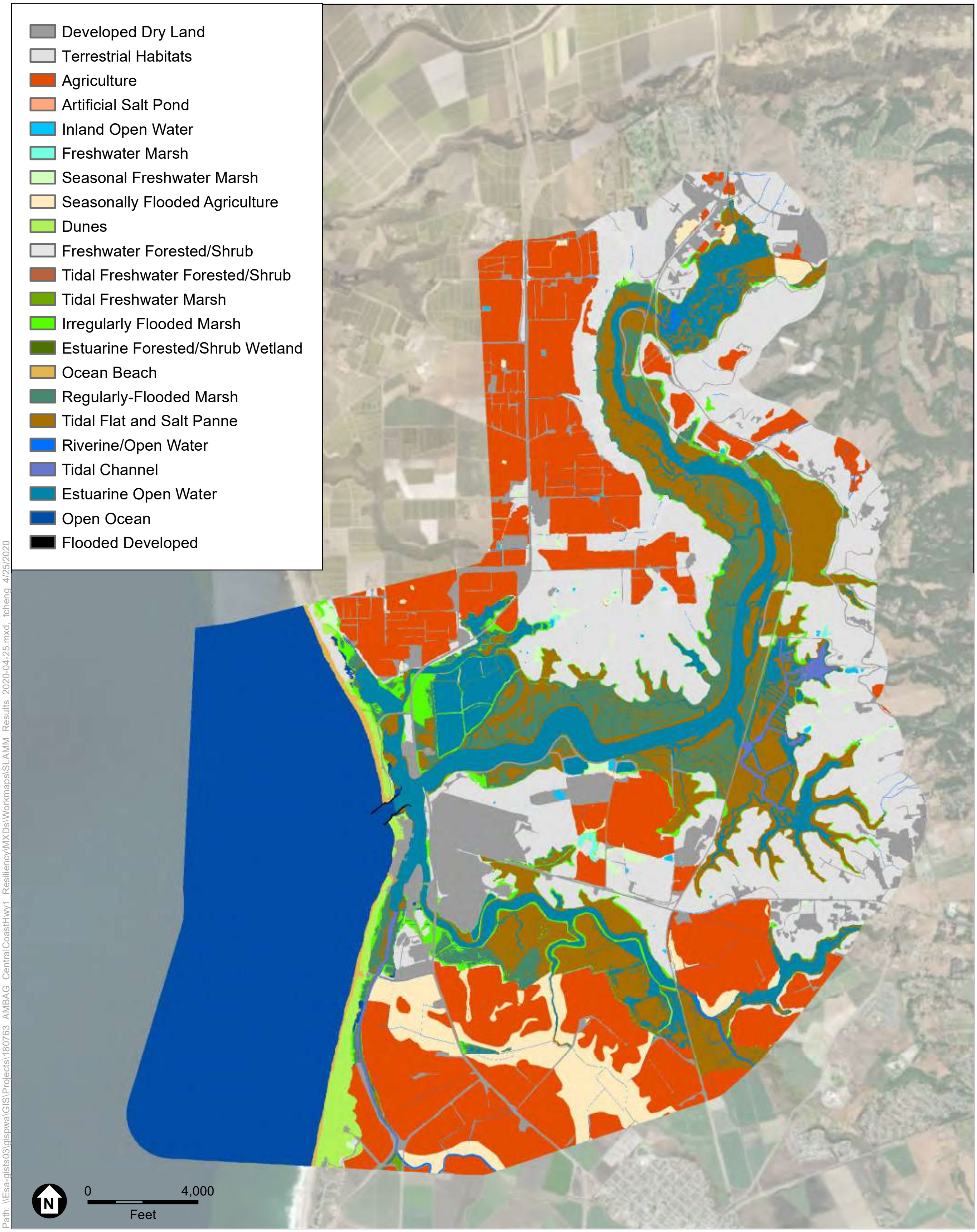

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Figure D-3
Scenario C0
Protect Developed Dry Land and Agriculture - 2050

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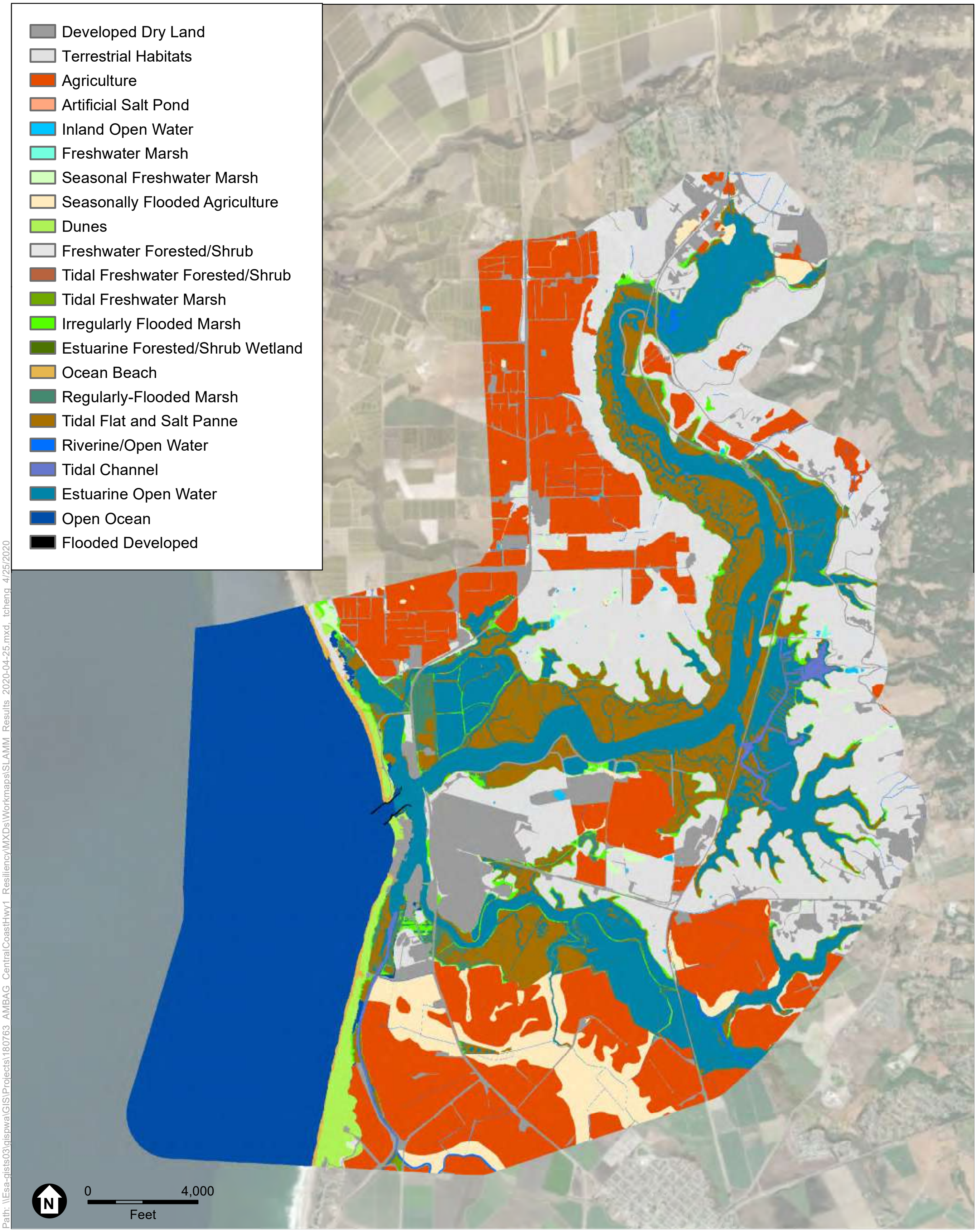

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Figure D-4
Scenario C0
Protect Developed Dry Land and Agriculture - 2070

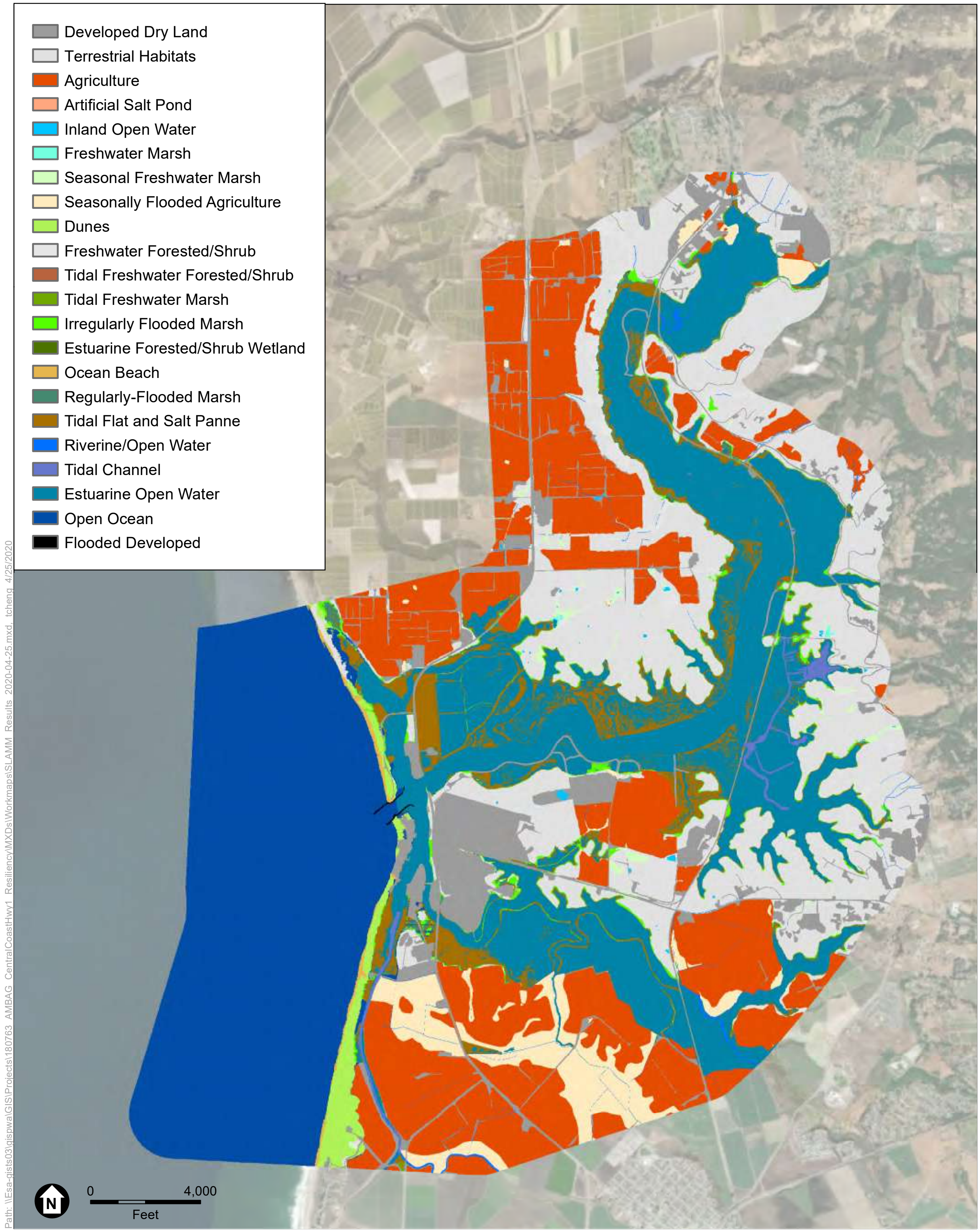

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Figure D-5
Scenario C0
Protect Developed Dry Land and Agriculture - 2100

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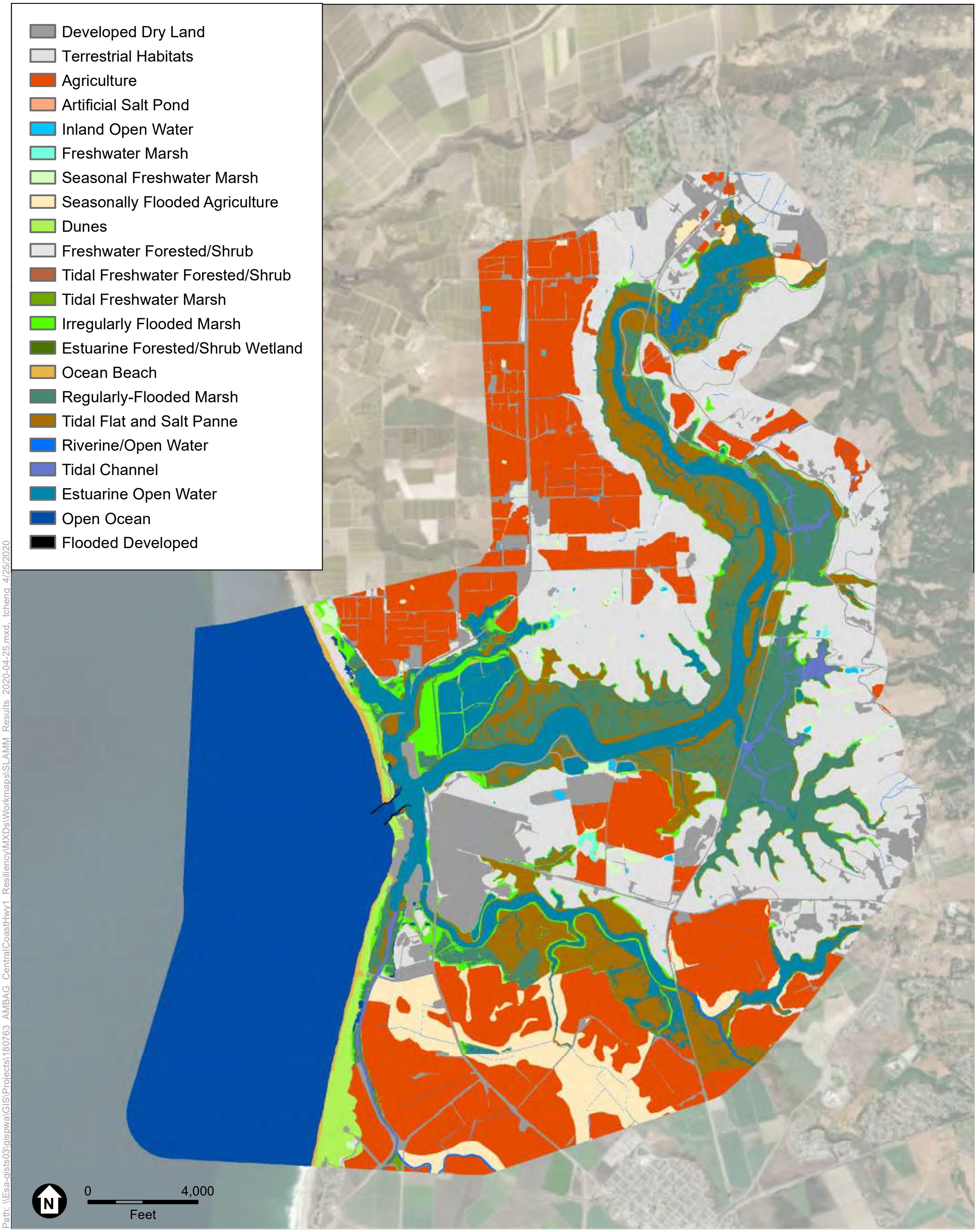

Central Coast Highway 1 Climate Resiliency Study

Figure D-6
Scenarios C1A and C3A
Protect Developed Dry Land and Agriculture - 2050

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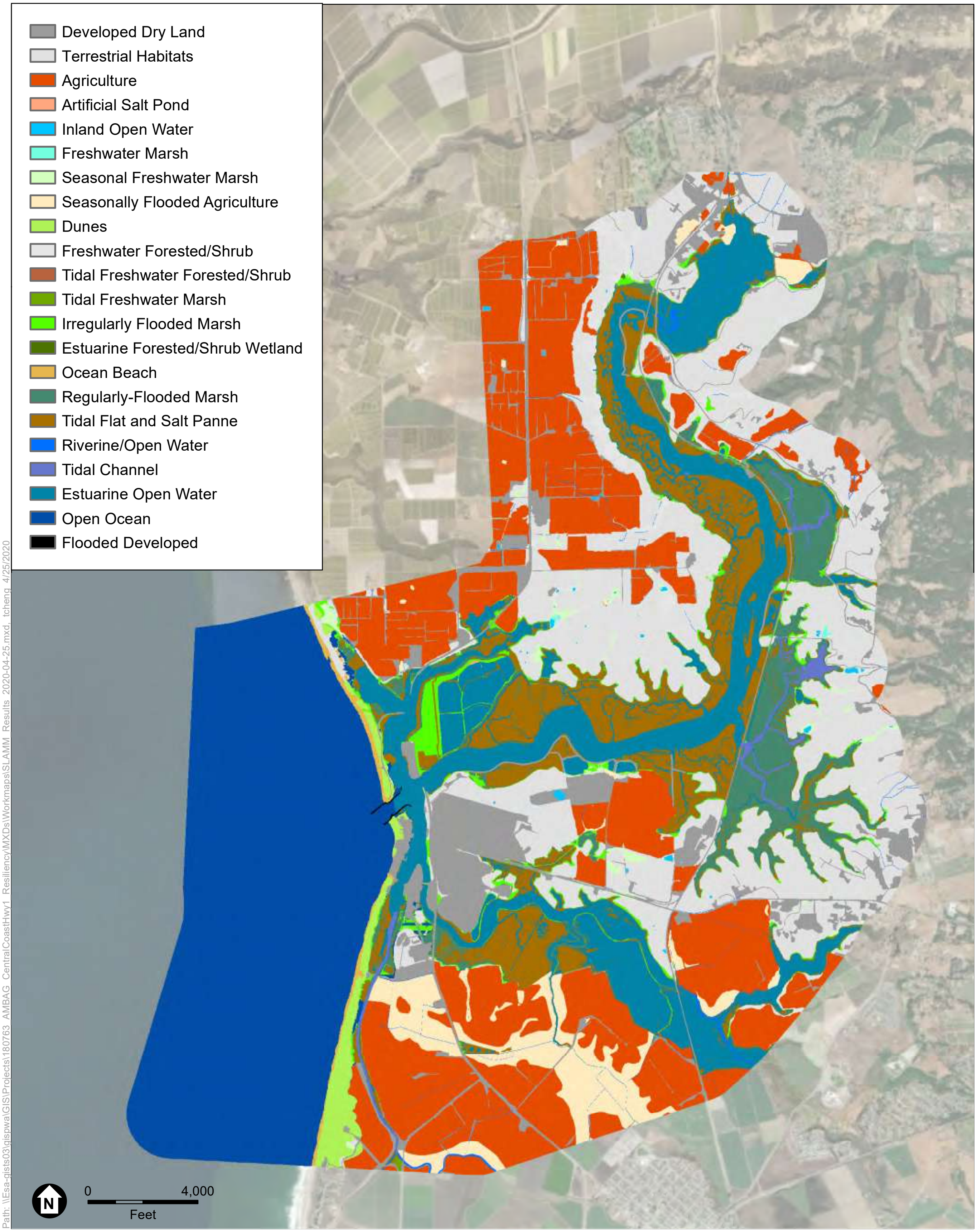

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Central Coast Highway 1 Climate Resiliency Study

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Figure D-7
Scenarios C1A and C3A
Protect Developed Dry Land and Agriculture - 2070

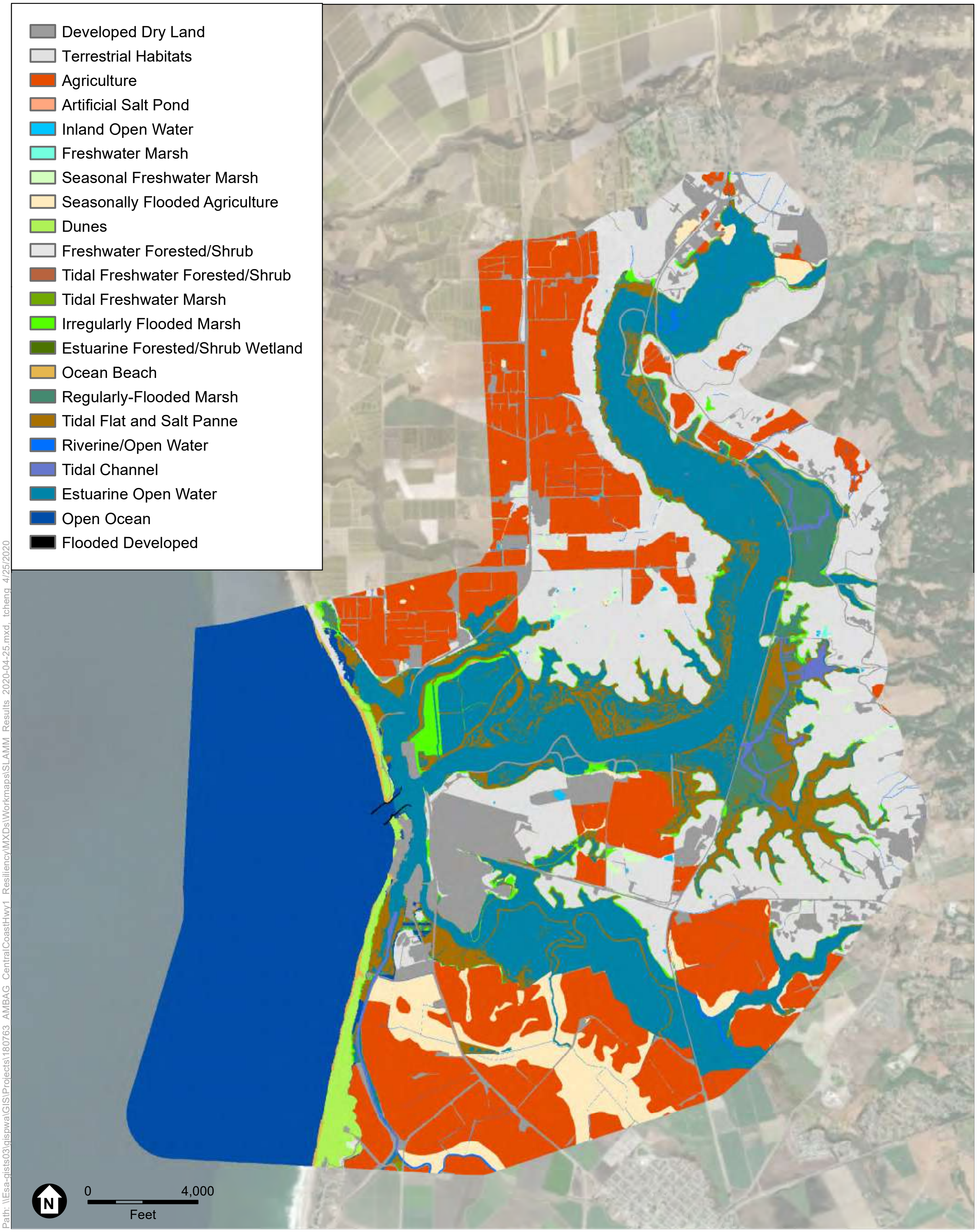

Figure D-8
Scenarios C1A and C3A
Protect Developed Dry Land and Agriculture - 2100

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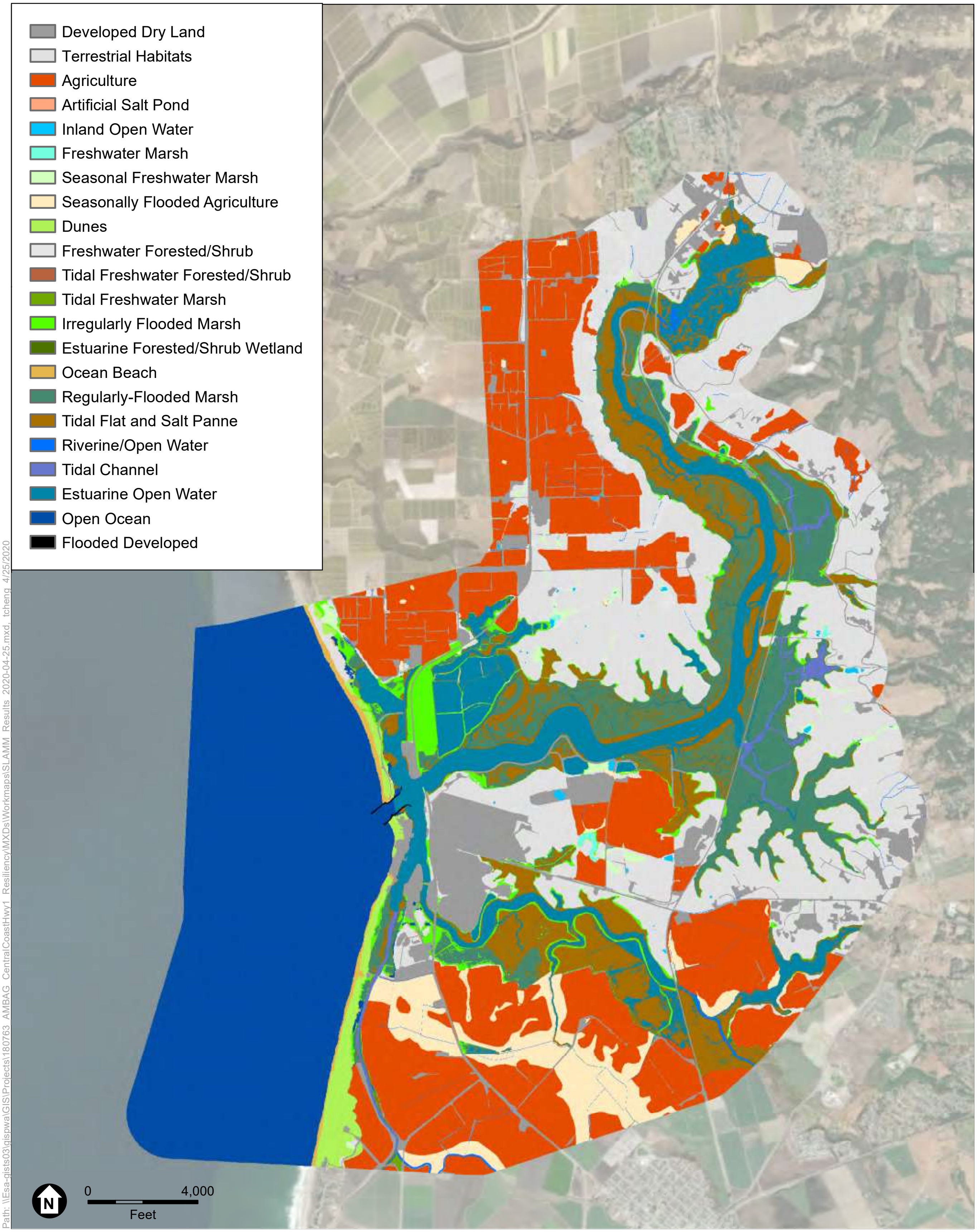

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Figure D-9
Scenarios C1B and C3B
Protect Developed Dry Land and Agriculture - 2050

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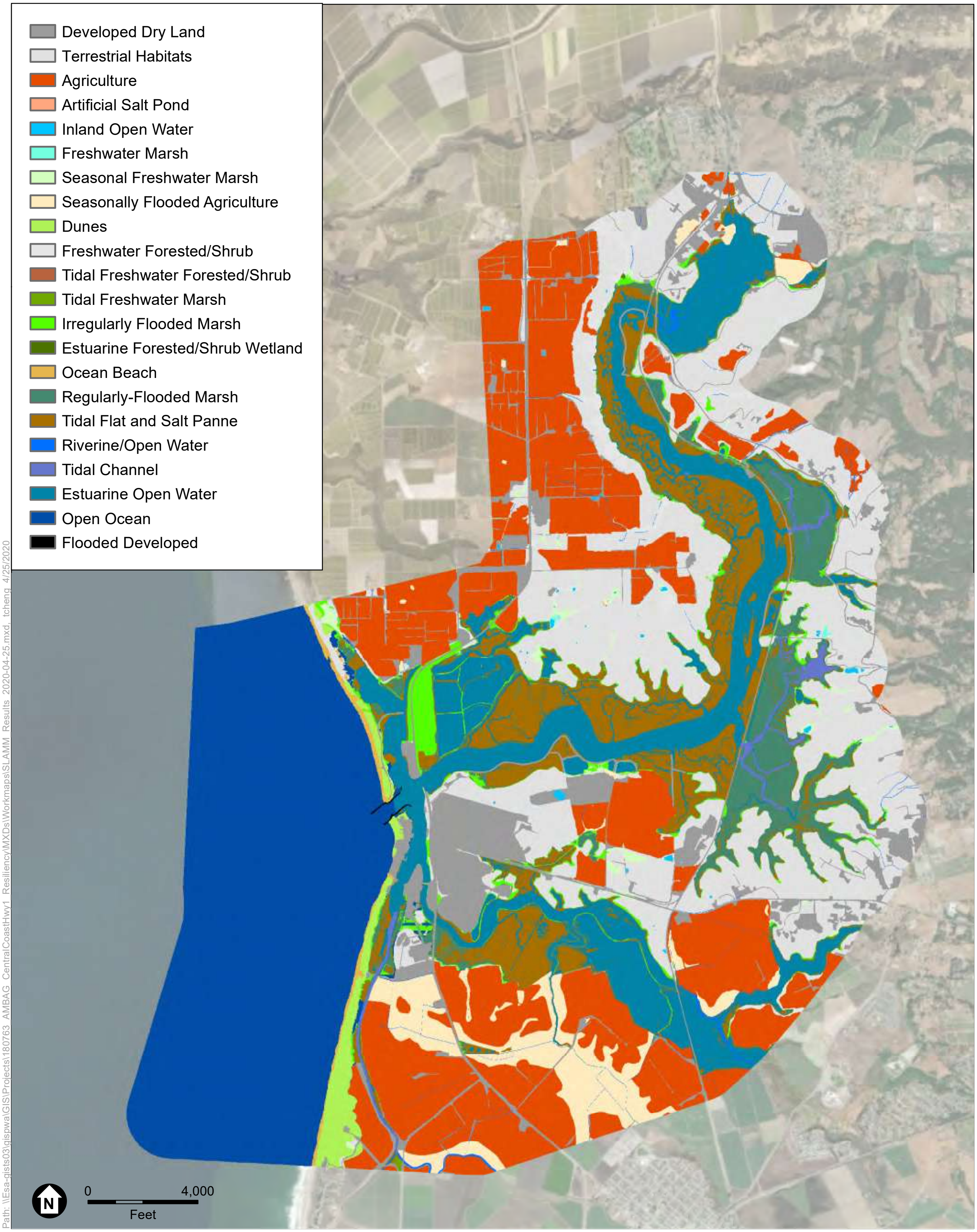

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Figure D-10
Scenarios C1B and C3B
Protect Developed Dry Land and Agriculture - 2070

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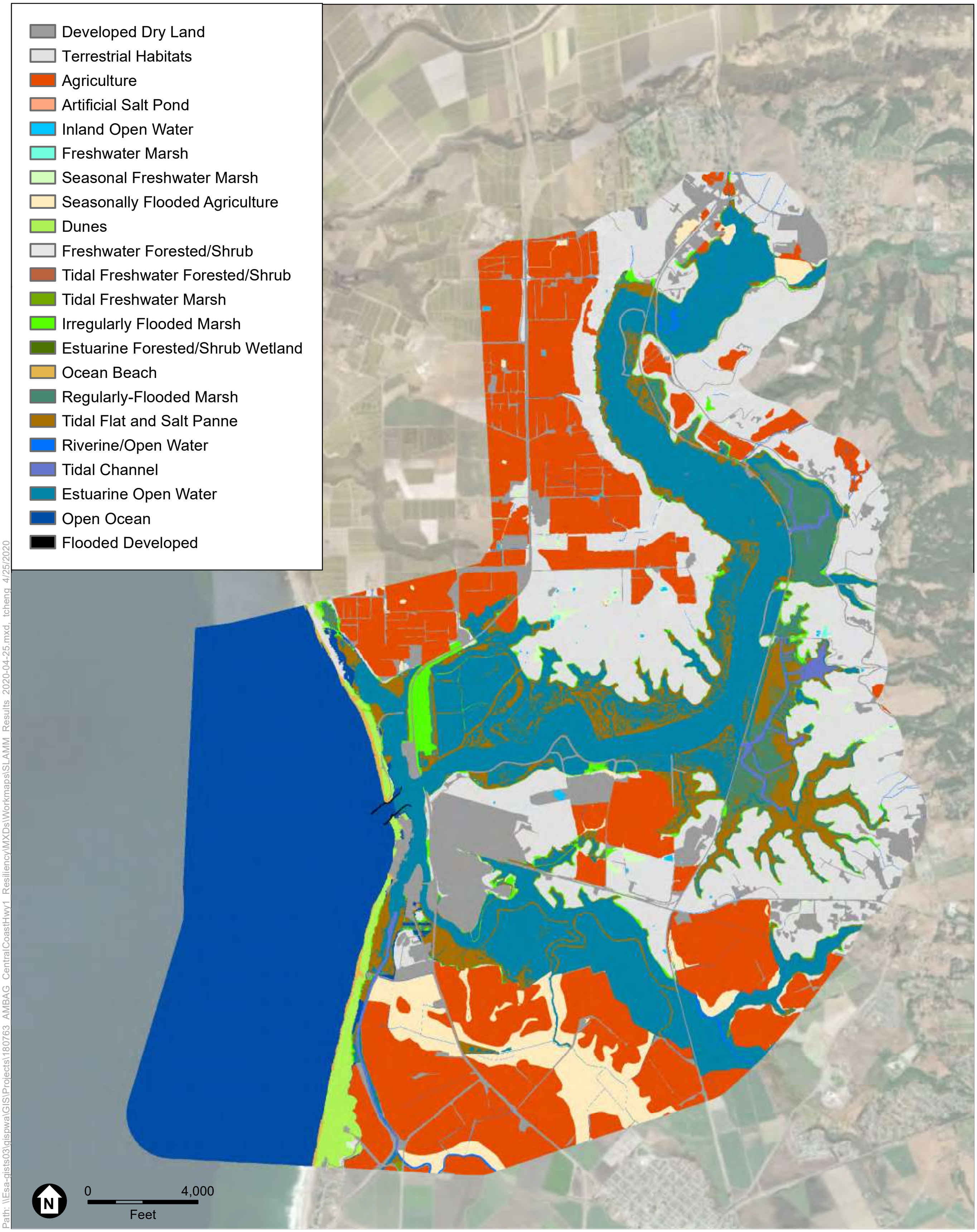

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Central Coast Highway 1 Climate Resiliency Study

Figure D-11
Scenarios C1B and C3B
Protect Developed Dry Land and Agriculture - 2100

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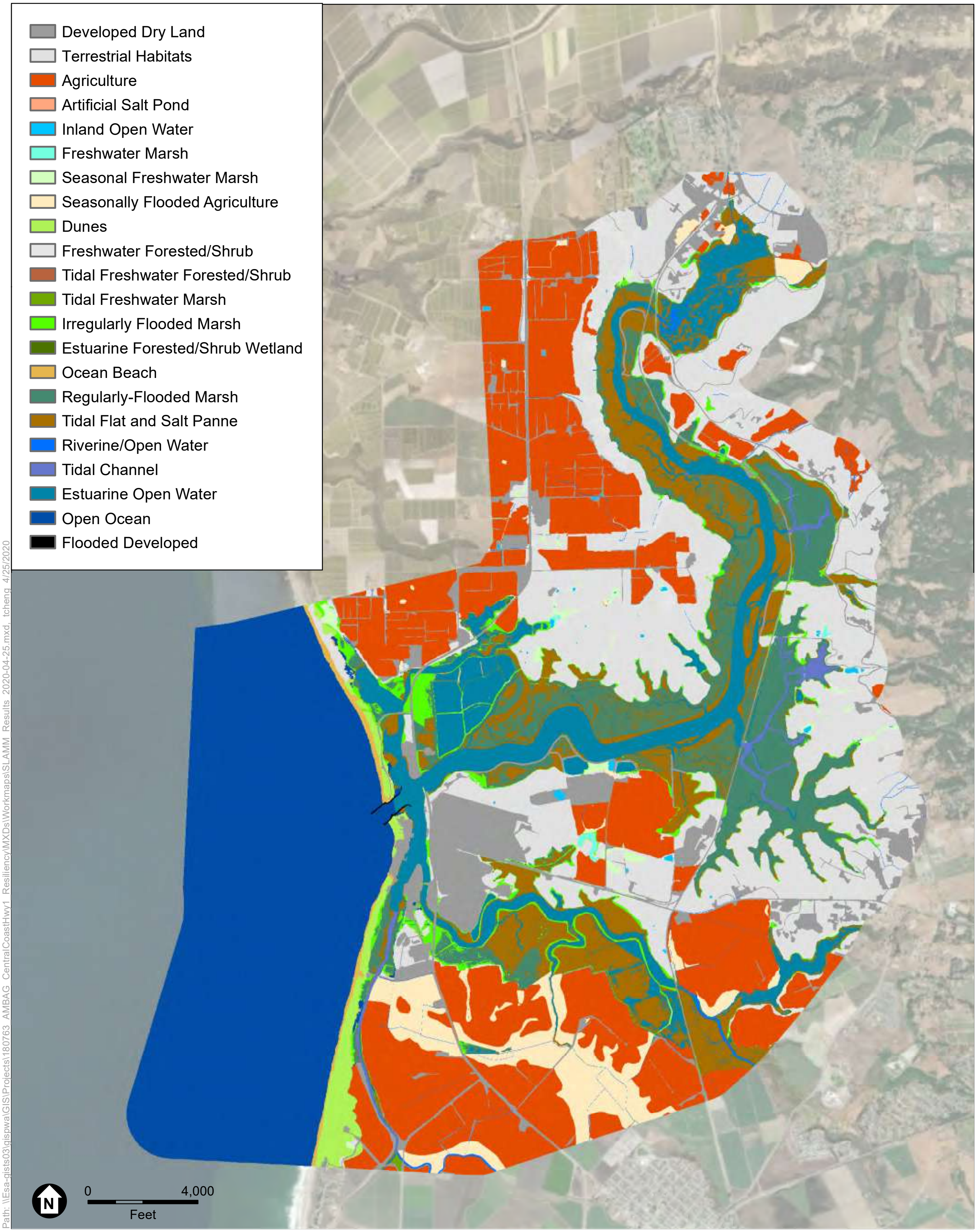

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Central Coast Highway 1 Climate Resiliency Study

Figure D-12
Scenario C2
Protect Developed Dry Land and Agriculture - 2050

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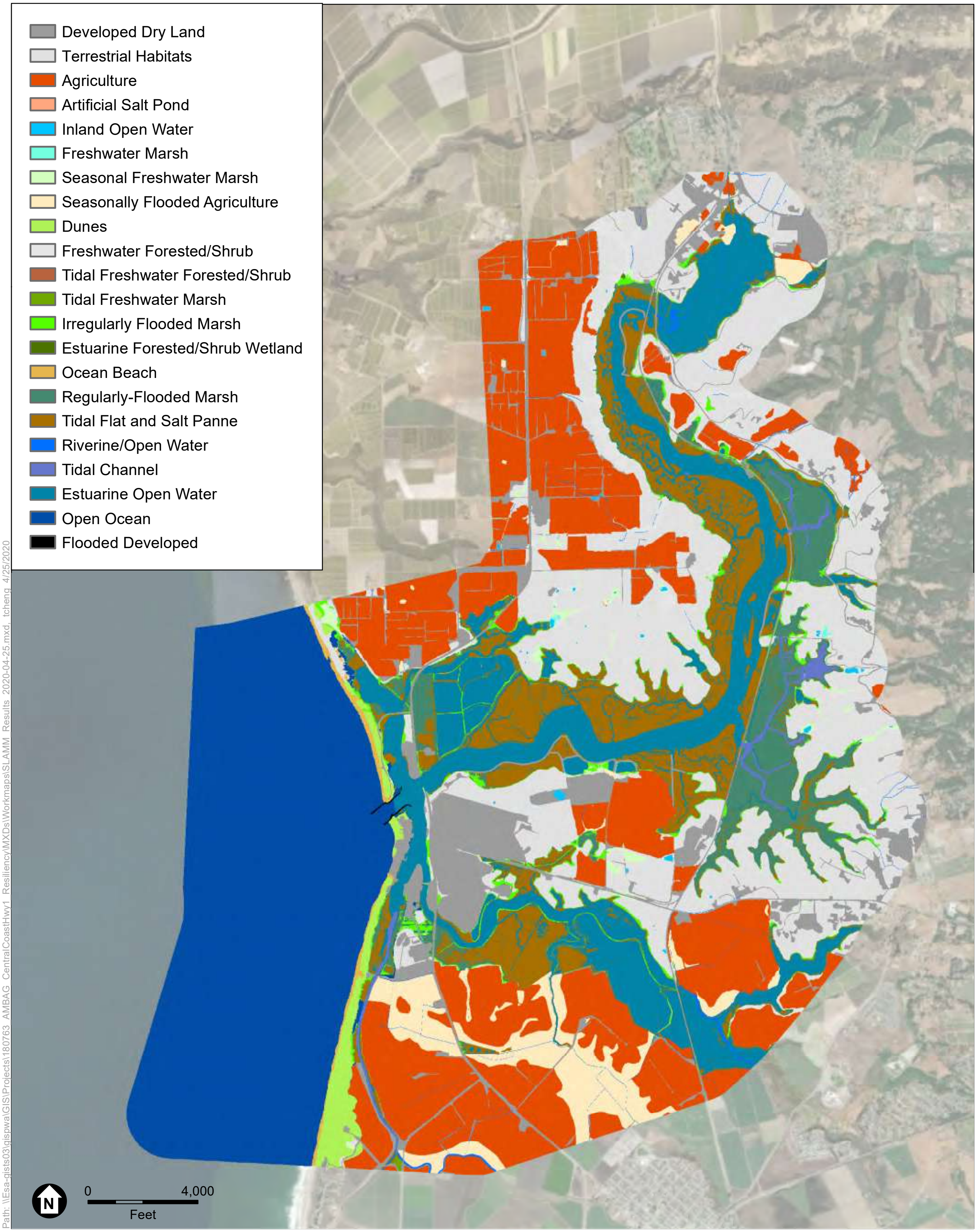

Central Coast Highway 1 Climate Resiliency Study

Figure D-13
Scenario C2
Protect Developed Dry Land and Agriculture - 2070

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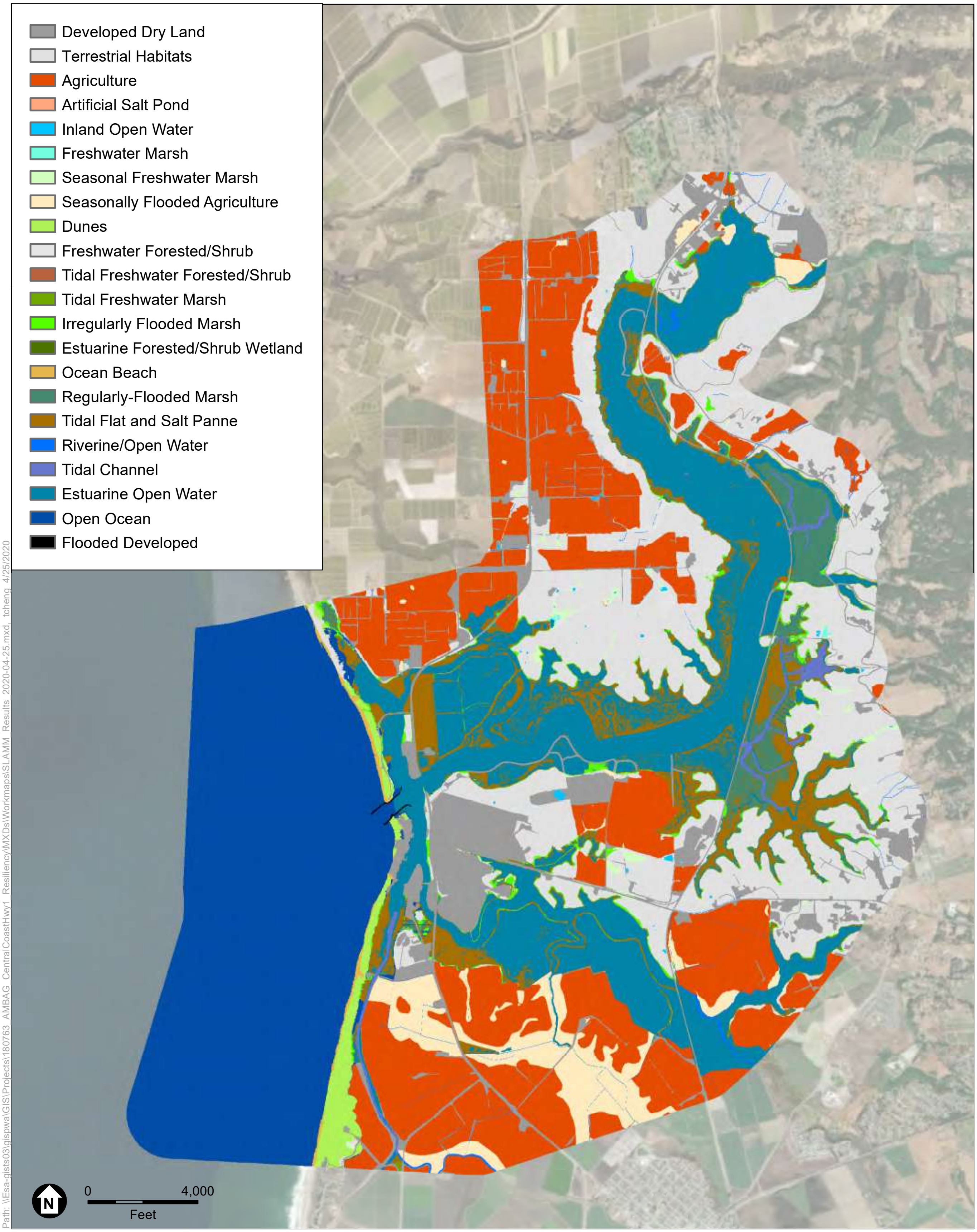

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Central Coast Highway 1 Climate Resiliency Study

Figure D-14
Scenario C2
Protect Developed Dry Land and Agriculture - 2100

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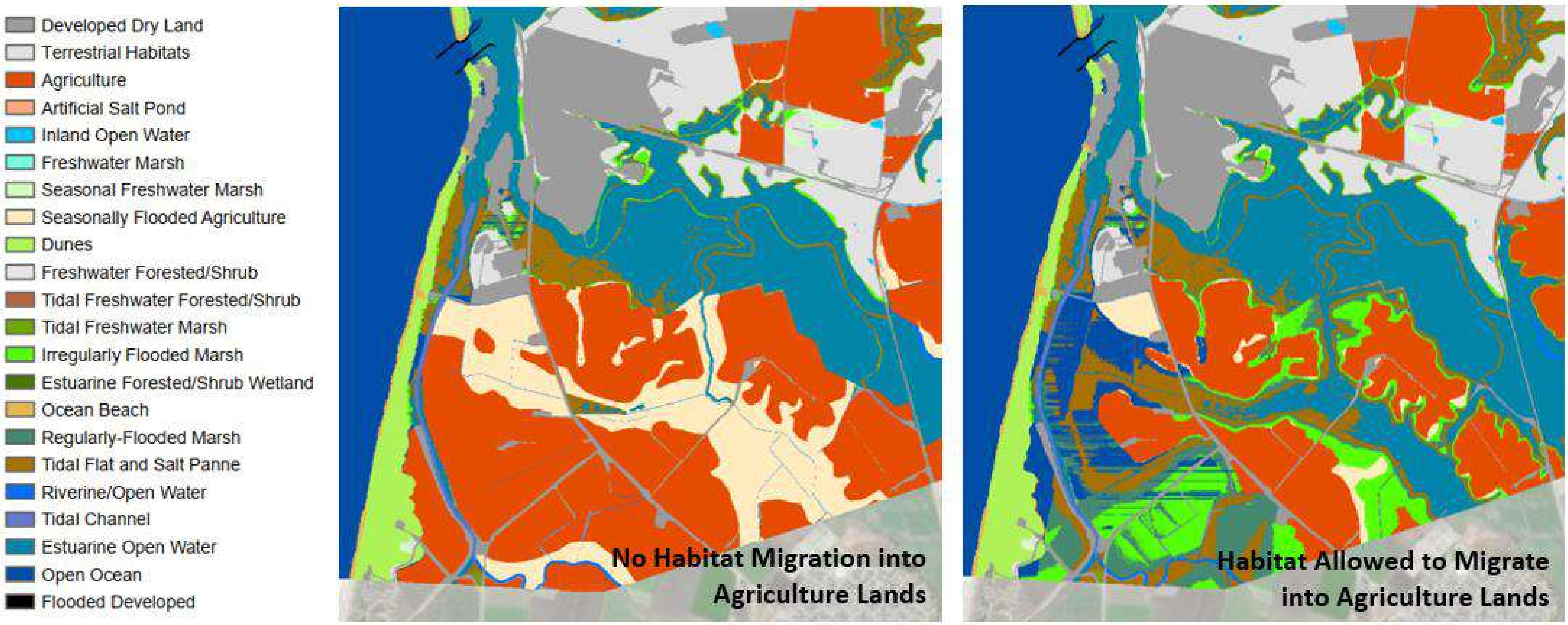

Figure D-15
Conversion of Agricultural Lands by Reaches 3 and 4