

# Sonoma-Marín Coastal Regional Sediment Management Report

## Greater Farallones National Marine Sanctuary



March 2018

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## Cover photos

(top left) Bodega Harbor Dredging, Cea Higgins

(top right) Gleason Beach area, Doug George

(bottom left) Aerial view of Stinson Beach and Seadrift, Bob Wilson

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## Conversion Tables

### U.S. Customary to Metric

<b>Multiply</b>	<b>By</b>	<b>To Obtain</b>
feet (ft)	0.3048	meters (m)
yard (yd)	0.9144	meters (m)
miles (mi U.S. statute)	1.60935	kilometers (km)
square feet (ft <sup>2</sup> )	0.092903	square meters (m <sup>2</sup> )
acres (ac)	4047	square meters (m <sup>2</sup> )
cubic feet (ft <sup>3</sup> )	0.028317	cubic meters (m <sup>3</sup> )
cubic feet per second (cfs)	0.028317	cubic meters per second (cms)
cubic yards (yd <sup>3</sup> )	0.76456	cubic meters (m <sup>3</sup> )
tons (2000 pounds)	907.185	kilograms (kg)

### Metric to U.S. Customary

<b>Multiply</b>	<b>By</b>	<b>To Obtain</b>
meters (m)	3.281	feet (ft)
meters (m)	1.094	yard (yd)
kilometers (km)	0.6214	miles (mi U.S. statute)
square meters (m <sup>2</sup> )	10.76	square feet (ft <sup>2</sup> )
square meters (m <sup>2</sup> )	2.47x10 <sup>-4</sup>	acres (ac)
cubic meters (m <sup>3</sup> )	35.31	cubic feet (ft <sup>3</sup> )
cubic meters per second (cms)	35.31	cubic feet per second (cfs)
cubic meters (m <sup>3</sup> )	1.308	cubic yards (yd <sup>3</sup> )
kilograms (kg)	1.102x10 <sup>-3</sup>	tons (2000 pounds)

# Sonoma-Marín Coastal Regional Sediment Management Report

## Contents

List of Tables .....	viii
List of Figures.....	viii
EXECUTIVE SUMMARY .....	x
1 INTRODUCTION .....	1
2 DESCRIPTION OF STUDY REGION.....	2
2.1 Region and Area of Interest .....	2
2.2 Littoral Cell Concept and Regional Context.....	4
2.3 Physical Processes.....	4
2.3.1 Climate and Oceanography .....	4
2.3.2 Tidal Regime.....	9
2.3.3 Changes in Sea Level.....	9
2.4 Geology, Geomorphology and Physical Setting .....	10
2.5 Regional Sand Pathways/Budget.....	12
2.5.1 Sediment Sources .....	12
2.5.2 Sediment Sinks.....	13
2.5.3 Implications for Regional Sediment Management .....	13
2.6 Relevant Projects and Studies .....	14
2.6.1 Farallones Sanctuary <i>Climate Action Plan</i> .....	14
2.6.2 Local Coastal Program (LCP) Updates .....	14
2.6.3 Collaboration: Sea Level Marin Adaptation Response Team (C-SMART) .....	14
2.6.4 The Bolinas Lagoon Ecosystem Restoration Project.....	15
2.6.5 Our Coast, Our Future (OCOF).....	15
2.6.6 Hazard Exposure Reporting and Analytics (HERA).....	15
2.6.7 The Russian River Integrated Coastal Watershed Management Plan (RRICWMP)	16
2.6.8 Integrating Coastal Vulnerability Modeling and Land Use Planning Strategies (InVEST).....	16
2.6.9 Total Maximum Daily Loads.....	16
3 BIOLOGICAL RESOURCES.....	17
3.1 Habitats of the Region .....	17

3.1.1	Sandy Beaches and Coastal Dunes.....	17
3.1.2	Coastal Rivers and Creeks .....	18
3.1.3	Estuaries, including bays and lagoons .....	19
3.1.4	Rocky Shores .....	20
3.1.5	Kelp Forest .....	21
3.1.6	Continental Shelf and Nearshore Subtidal Communities.....	22
3.2	Managed Areas .....	24
3.2.1	State Marine Conservation Areas and Reserves.....	26
3.2.2	State Areas of Special Biological Significance .....	26
3.2.3	State Department of Parks and Recreation.....	29
3.2.4	National Parks Service.....	29
3.2.5	US Fish and Wildlife Service Farallon Islands National Wildlife Refuge .....	29
3.2.6	Bureau of Land Management National Conservation Lands .....	29
3.2.7	Bodega Marine Reserve .....	29
3.2.8	Local (regional, county or city managed) Parks.....	29
3.3	Fish and Wildlife of the Region.....	30
3.3.1	Marine and Coastal Birds.....	30
3.3.2	Marine Mammals .....	30
3.3.3	Fish.....	30
3.3.4	Terrestrial Flora .....	31
3.3.5	Benthic Fauna.....	31
4	ASSESSMENT OF COASTAL CHANGE AND CREATION OF PRIORITY ACTION AREAS	
	31	
4.1	Community Engagement.....	31
4.2	Identification of Sediment Challenged Areas.....	33
4.3	Description of Data Gaps.....	45
5	SEDIMENT MANAGEMENT MEASURES .....	45
5.1	Context for Formulation of Sediment Management Measures.....	45
5.2	Description and Comparison of Sediment Management Measures .....	46
5.3	Potential Sediment Sources.....	48
6	REGULATORY AND POLICY CONSIDERATIONS .....	49
6.1	Section Overview .....	49
6.2	Overview of the Regulatory Compliance Process for Sediment Management Projects	
	49	

6.2.1	Environmental Review Process .....	49
6.2.2	Agencies and Local Jurisdictions Involved in Review and Permitting of RSM Measures .....	50
6.2.3	Relevant Laws and Regulations .....	54
6.3	Federal Agencies Involved in Reviewing, Approving and/or Implementing Sediment Management Projects.....	54
6.3.1	NOAA, Greater Farallones National Marine Sanctuary .....	54
6.3.2	U.S. Army Corps of Engineers (USACE).....	57
6.3.3	U.S. Environmental Protection Agency (USEPA) .....	57
6.3.4	NOAA National Marine Fisheries Service (NMFS) .....	58
6.3.5	U.S. Fish and Wildlife Service (USFWS).....	58
6.3.6	U.S. Coast Guard (USCG) .....	59
6.3.7	National Park Service (Golden Gate National Recreation Area (GGNRA) and Point Reyes National Seashore (PRNS)) .....	59
6.3.8	Bureau of Ocean Energy Management (BOEM) .....	59
6.3.9	U.S. Forest Service (USFS) .....	59
6.4	State Agencies Involved in Reviewing, Approving and/or Implementing Sediment Management Projects.....	60
6.4.1	California Coastal Commission (CCC) .....	60
6.4.2	California State Lands Commission (CSLC) .....	61
6.4.3	State Water Resources Control Board (SWRCB) and Regional Water Quality Control Board (RWQCB).....	61
6.4.4	California Department of Fish and Wildlife (CDFW) .....	62
6.4.5	Department of Parks and Recreation (DPR) .....	62
6.4.6	Division of Boating and Waterways (DBW) .....	63
6.4.7	California Department of Forestry and Fire Protection .....	63
6.5	County/Local level.....	64
6.5.1	Sonoma County .....	64
6.5.2	Marin County .....	65
6.6	Resource Conservation Districts (RCDs) .....	65
7	RECOMMENDATIONS FOR REGIONAL SEDIMENT MANAGEMENT .....	65
7.1	Regional Recommendations .....	68
7.2	Site-specific Recommendations .....	70
8	IMPLEMENTATION AND GOVERNANCE STRUCTURE OPTIONS .....	131



8.1	Overview of Implementation Process for Sonoma-Marin CRSMR Recommendations	131
8.2	Development of a Governance Structure .....	131
8.2.1	Staffing Needs and Options for RSM Implementation .....	132
8.2.2	Other Governance Structure Responsibilities and Requirements.....	133
8.2.3	Examples of Governance Structures from Completed Coastal RSM Plans .....	133
8.3	Establish a Process for RSM Stakeholder Coordination.....	134
8.3.1	California Coastal Sediment Management Workgroup.....	135
8.3.2	State and Federal Agencies.....	135
8.3.3	Local Jurisdictions .....	136
8.3.4	Non-Governmental Organizations (NGOs).....	136
8.3.5	Other Stakeholders.....	136
8.4	Develop and Implement a Stakeholder Engagement Program.....	137
8.5	Establish and Maintain a Dedicated Funding Source .....	137
8.5.1	Federal Funding Sources.....	138
8.5.2	State Funding Sources .....	139
8.5.3	Local Funding Sources .....	140
8.5.4	Private Funding Sources.....	141
8.6	Investigate and Pursue Options for a Streamlined Permitting Program .....	141
8.7	Recommended Next Steps .....	144
8.8	Benefits of Regional Sediment Management (RSM) .....	144
9	REFERENCES .....	147
	Appendix A: Special Status Species .....	152
	Appendix B: Working Group Meeting Summaries .....	158
	Appendix C: Wave Data at Recommendation Sites .....	192
	Appendix D: Critical Habitat Locations .....	195

## List of Tables

Table 2-1. Tidal datums (ft) for maintained water level stations around the study area.....	9
Table 2-2. Known quantified sediment sources for the study area. ....	12
Table 2-3. Estimated sediment sinks for the study area. ....	13
Table 3-1. Coastal rivers and creeks in the study area.....	19
Table 4-1. GFNMS Advisory Council Sediment Management Working Group Members .....	32
Table 4-2. GFNMS Technical Advisory Committee Members .....	32
Table 4-3. Community features used for potential damage assessment due to sea level rise.....	36
Table 4-4. Data gaps identified through the CRSMR process. ....	45
Table 6-1 Key differences between NEPA and CEQA processes. ....	53
Table 6-2. Relevant Laws and Regulations Affecting Sediment Management Projects .....	55
Table 7-1. Locations of site-specific recommendations .....	66
Table 7-2. Terminology used in Sediment Management Recommendations .....	70

## List of Figures

Figure 2-1 Area of Interest (AOI) for the Sonoma-Marin Coastal Regional Sediment Management Report. ....	3
Figure 2-2 Modeled mean (top row) and extreme (top 5%, bottom row) significant wave height ( $H_s$ , m) for the AOI for each season. Hotter colors show larger $H_s$ while cooler colors indicate smaller $H_s$ . Data from Erikson et al., 2014. ....	7
Figure 2-3 Modeled mean (top row) and extreme (top 5%, bottom row) orbital velocities ( $U_w$ , m/s) for the AOI for each season. Hotter colors show faster $U_w$ while cooler colors indicate slower $U_w$ . Data from Erikson et al., 2014. ....	8
Figure 2-4 Sediment thickness (m) on the seafloor within the AOI. Hotter colors show thicker deposits and white indicates deposits close to 0. Data from the California Seafloor Mapping Program, USGS.....	11
Figure 3-1 Managed areas along the coast in Sonoma County, including offshore (MPAs), and onshore (parks under Federal, State, or county management). ....	27
Figure 3-2 Managed areas along the coast in Marin County, including offshore (MPAs, ASBS), and onshore (parks under Federal, State, or county management). ....	28
Figure 4-1 Shoreline change analysis within the AOI. Red indicates erosion and green shows accretion.	34
Figure 4-2 Sea level rise curves recommended by the California Coastal Commission (2015) for use in planning coastal activities. High-range projections correspond to a 24- and 66-in rise by 2050 and 2100 respectively. Mid-range projections are 12 and 24 inches for the identical timeframes.....	35
Figure 4-3 Miles of major roads (e.g., Highway 1) in Sonoma affected by sea level rise for the two projections. ....	38
Figure 4-4 Miles of minor roads (e.g., not Highway 1) in Marin affected by sea level rise for the two projections. ....	39
Figure 4-5 Acreage of critical habitat for California red-legged frog, Marbled Murrelet, tidewater goby, Western Snowy Plover, and Yellow Larkspur affected by sea level rise in study area for the two projections. The majority of critical habitat affected is in Marin County whereas Marbled Murrelet habitat is the primary one in Sonoma County near Salt Point State Park.....	40

Figure 4-6 Miles of trails in Sonoma affected by sea level rise for the two projections. ....41

Figure 4-7 Miles of trails in Marin affected by sea level rise for the two projections. ....42

Figure 4-8 Number of public access points in Sonoma affected by sea level rise for the two projections. Access points are defined as those in the California Coastal Commission database. ....43

Figure 4-9 Number of public access points in Marin affected by sea level rise for the two projections. Access points are defined as those in the California Coastal Commission database. ....44

Figure 6-1 NEPA Compliance Flow Chart.....51

Figure 6-2 CEQA Process Flow Chart.....52

Figure 7-1 Locations of the 14 site-specific recommendations for sediment management activities.....67

Figure 8-1 Agency Involvement Matrix developed by the Technical Advisory Committee to indicate the degree of agency engagement for the different sediment management strategies. “Reefs” was separated from “Living Shorelines” for this table specifically although they are normally considered part of a living shoreline project. ....143

# EXECUTIVE SUMMARY

Along the Sonoma and Marin counties outer coastline, sediment challenges range from erosion of beaches, landslides, collapses of coastal bluffs, accumulation within bays and estuaries, and blockages of river mouths. The coastline is dominated by agricultural uses resulting in lower density of development than other portions of coastal California. Recreational uses vary considerably along the coastline with pockets of high use areas (e.g., Stinson Beach or Sonoma State Beaches) among miles of inaccessible and rocky shorelines. Bodega Harbor is the only Pacific Ocean port for the two counties, with some small landings along the coast for personal watercraft. Sediment management for this region focuses on natural habitat function and existing infrastructure (e.g., Highway 1).

A Coastal Regional Sediment Management Plan (CRSMP) is a guidance and policy document that discusses how Regional Sediment Management (RSM) can be applied in a rapid, cost-effective, and resource-protective manner. The Greater Farallones National Marine Sanctuary (GFNMS) lead a process financially supported by the State of California to develop coastal sediment management recommendations for the Sonoma and Marin County outer coasts (340 miles, including Tomales Bay). The process included the Sanctuary Advisory Council establishing a Sediment Management Working Group comprised of scientists, landowners, local stakeholders, and a Technical Advisory Committee composed of local, state, and federal agency representatives. The Technical Advisory Committee reviewed the recommendations for regulatory feasibility (is it feasible for the recommendations to be implemented under current regulations). The Advisory Council reviewed and compiled the recommendations into a Coastal Regional Sediment Management Report (CRSMR) and forwarded the report to the Sanctuary Superintendent with a request to share the report with the Coastal Sediment Management Workgroup (CSMW). The Sanctuary completed the Report and provided it to the CSMW to inform a CRSMP and the statewide Sediment Management Master Plan.

This Report presents 17 overarching regional recommendations and 14 site-specific recommendations, some of which include more than one location within a site; 8 are in Sonoma County and 6 are in Marin County. The proposed strategies are meant to initiate conversations at the local level to prepare the coast for the next 50 years of sediment management-related activity. The management strategy categories include Beach Nourishment, Living Shorelines, Research and Education, Armor, Indirect Sediment Management, Restoration, Dredge, and Managed Retreat. In addition, governance feasibility for each recommendation was considered at a high-level to identify current and future opportunities and challenges to implement the actions.

This Report followed a similar approach used to produce Coastal Regional Sediment Management Plans for other regions in California. However, the Report does not include a socio-economic study nor an environmental analysis. Additionally, sea level rise was incorporated into the coastline projections over three timeframes, but only focused on coastal beaches and excluded cliff evolution. As recommendations evolve into actions, socio-economic and environmental analyses will be conducted for projects. Other gaps identified in the process are included in the overarching regional recommendations.

# 1 INTRODUCTION

A Coastal Regional Sediment Management Plan (CRSMP) is a guidance and policy document that discusses how Regional Sediment Management (RSM) can be applied in a rapid, cost-effective, and resource-protective manner. The Greater Farallones National Marine Sanctuary (GFNMS) Advisory Council established a working group composed of scientists, landowners, local stakeholders (see Working Group Members) and agency representatives to develop coastal sediment management recommendations for the Sonoma and Marin County outer coasts. The Advisory Council reviewed, revised, and forwarded the recommendations to the Greater Farallones National Marine Sanctuary Superintendent who shared them with a Technical Advisory Committee composed of local, state, and federal agency representatives. The Technical Advisory Committee reviewed the recommendations for regulatory feasibility (is it feasible for the recommendations to be implemented under current regulations). The Advisory Council reviewed and compiled the revised recommendations into this Coastal Regional Sediment Management Report (CRSMR). The Advisory Council has forwarded the report to the Sanctuary Superintendent with a request to share the report with the Coastal Sediment Management Workgroup (CSMW) to inform a CRSMP and the statewide Sediment Management Master Plan.

The CSMW, co-chaired by the U.S. Army Corps of Engineers and the California Natural Resources Agency, works with other federal, state and local/regional entities to implement regional sediment management strategies to augment or restore natural processes along the entirety of the California coastline by:

- Identifying sediment-related problems along the California coast, such as beach erosion, wetland erosion/sedimentation, habitat loss, and water quality impairment.
- Defining the causes of sediment-related problems such as dams, debris basins, dredging, sand and gravel in-stream or back-beach mining, coastal structures, lack of project coordination, and inconsistent policies, procedures, and regulations.
- Providing a solid scientific framework and database regarding technical issues within the coastal environment to help visualize and support sediment management decisions.
- Providing a framework, through collaboration with federal, state, regional, and local governments, to address the sediment-related problems on a regional scale, such as littoral cells and/or watersheds.
- Developing and exporting new and existing analytical tools to assist in managing coastal resources.
- Providing a programmatic road map to plan, prioritize, and program future coastal resources projects.
- Fostering a collaborative approach among agencies to provide a consistent framework for project proponents.
- Establishing a streamlined process for coastal resources related project approvals.

Existing data and information are used to assess geologic and geomorphic processes, habitats and species of concern (terrestrial and marine), infrastructure at risk, public access, and regulations and policies that may influence sediment management. In addition, incorporating the influence of climate change and sea

level rise on sediment management strategies may result in a CRSMP that is useful for a long-term planning horizon (50 years). Community ownership of the CRSMP is encouraged by engaging with a diverse working group to ensure the plan is acceptable to counties, tribes, land-owners, infrastructure managers, and stakeholders.

Along the Sonoma and Marin counties outer coastline, sediment challenges range from erosion of beaches, landslides, collapses of coastal bluffs, accumulation within bays and estuaries, and blockages of river mouths. The coastline is dominated by agricultural uses resulting in lower density of development than other portions of coastal California. Recreational uses vary considerably along the coastline with pockets of high use areas (e.g., Stinson Beach or Sonoma State Beaches) among miles of inaccessible and rocky shorelines. Bodega Harbor is the only Pacific Ocean port for the two counties, with some small landings along the coast for personal watercraft. Sediment management for this region focuses on natural habitat function and existing infrastructure (e.g., Highway 1).

This Report followed a similar approach used to produce Coastal Regional Sediment Management Plans for other regions in California. However, the Report does not include a socio-economic study nor an environmental analysis. Additionally, sea level rise was incorporated into the coastline projections over three timeframes, but only focused on coastal beaches and excluded cliff evolution. As recommendations evolve into actions, socio-economic and environmental analyses will be conducted for projects. Other gaps identified in the process are included in the overarching regional recommendations.

## 2 DESCRIPTION OF STUDY REGION

### 2.1 Region and Area of Interest

The 340-mile long Sonoma-Marin CRSMR Area of Interest (AOI) lies within Greater Farallones National Marine Sanctuary (GFNMS) and the northern tip of Monterey Bay National Marine Sanctuary (MBNMS), with the northern boundary at the Gualala River on the Sonoma-Mendocino County line and the southern boundary at the Marin-San Francisco County line on the Golden Gate Bridge (Figure 2-1 **Error! Reference source not found.**). Tomales Bay, Bolinas Lagoon, Estero Americano, and Estero de San Antonio are included in the area of interest.

The Greater Farallones National Marine Sanctuary extends from the 39th parallel at Manchester Beach in Mendocino County to Rocky Point in Marin County and includes the waters surrounding the Farallon Islands. From east-to-west, the Farallones sanctuary extends from the mean high water line, with notable exceptions, to the continental margin at or about the 10,000 foot depth contour. The Farallones sanctuary is adjacent to Cordell Bank National Marine Sanctuary (CBNMS) on the north and east sides of CBNMS, and adjacent to MBNMS along the northern boundary of MBNMS. Shoreward, the Farallones sanctuary includes the Estero Americano, Estero de San Antonio, Tomales Bay and Bolinas Lagoon but does not include the Garcia River Estuary, Arena Cove, Gualala River Estuary, Russian River Estuary, Salmon Creek Estuary or Bodega Harbor. The Farallones sanctuary manages the northern portion of MBNMS from the San Mateo-Santa Cruz County line to Rocky Point in Marin County.

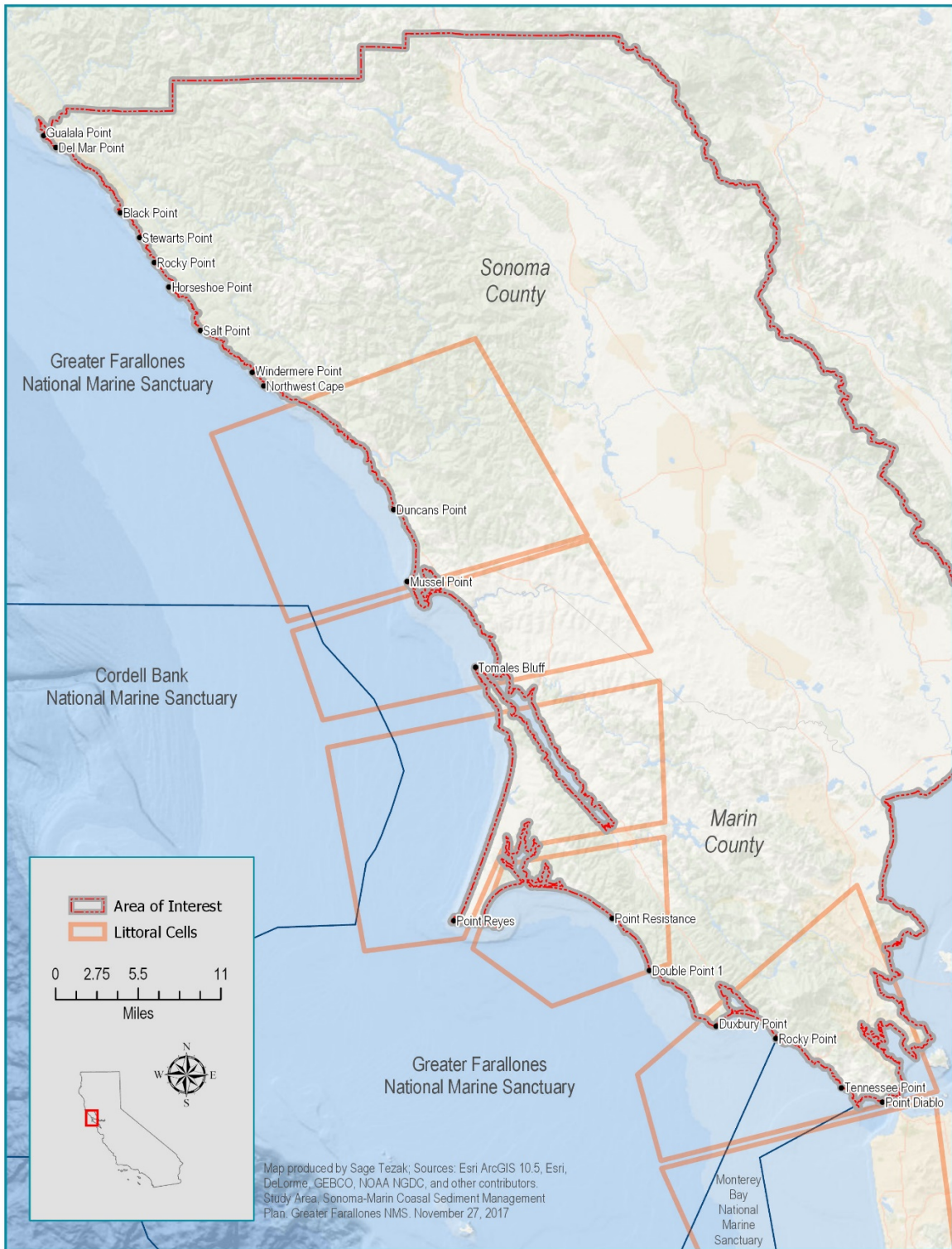


Figure 2-1 Area of Interest (AOI) for the Sonoma-Marin Coastal Regional Sediment Management Report.

## 2.2 Littoral Cell Concept and Regional Context

California's first littoral cell boundaries were published by Habel and Armstrong (1978). Originally called "coastal compartments" by Inman and Frautschy (1966), the idea of a littoral cell forms around the concept that a geographic region can be defined with negligible alongshore import/export of sediment and within which other imports and exports are based on specific physical processes and geomorphology (Rosati, 2005). Imports are typically rivers and coastal bluffs whereas exports are generally submarine canyons and deep basins. However, other coastal features influence the alongshore transport pathways: rocky headlands, reefs, islands, dune fields, and bays. Wave- and wind-driven currents are the primary forces behind sediment transport within a littoral cell with fluvial discharge influencing alongshore drift on a local scale.

Despite the widespread use of the littoral cell concept, recent research has explored the "hardness" of boundaries at headlands (George et al., 2015). In reality, no headland is expected to be an absolute boundary that stops the flow of sediment. This report uses a more nuanced approach to littoral cell boundaries that acknowledges sediment bypassing headlands. Climate change is expected to cause shifts in wave conditions and alongshore sediment transport (Adams et al., 2011) making quantification of sediment flux around headlands more important. Littoral cell boundaries at headlands could evolve as wave energy and incident angles fluctuate resulting in substantial changes to coastal geomorphology (e.g., changing the widths of beaches or accelerating cliff erosion).

Patsch and Griggs (2007) improved estimates of sediment budgets within 10 of 25 of California's littoral cells. Their refinements advanced understanding of the volumes of sediment circulating along portions of the coast; however none of the traditional littoral cells in the Sonoma-Marine AOI were included in their analysis. Those cells, as defined by Habel and Armstrong (1978) are from north to south, the Russian River Littoral Cell, Bodega Bay Littoral Cell, Pt. Reyes Littoral Cell, Drakes Bay Littoral Cell, and Bolinas Littoral Cell. Substantial data gaps have prevented estimates of sediment budgets for these cells, the area to the north, and between individual cells. Transport between the cells at Pt. Reyes has been debated for many decades with observational and numerical modeling results remaining in conflict (Cherry, 1964; Minard, 1971; Demirpolat, 1991; Barnard et al., 2013). The adjoining Bolinas and San Francisco littoral cells in the Gulf of the Farallones are a second location where constraining the sediment budget is not feasible due to the extreme dynamics observed at the mouth of the Golden Gate. As a result of widespread data gaps, geographic span, and uncertain integrity of the traditional littoral cell boundaries, the Sonoma-Marine outer coast was approached as a regional system rather than constrained by littoral cells.

## 2.3 Physical Processes

### 2.3.1 Climate and Oceanography

The Farallones sanctuary is located in the California Current, one of the world's four major wind-driven upwelling systems. Northerly winds drive a shallow surface layer that moves offshore due to the Coriolis Effect. This offshore (Ekman) transport of surface waters results in the upwelling of cold, nutrient-rich



waters from depth into sunlit surface waters to support a food-rich environment and promote the growth of organisms at all levels of the marine food web. The Point Arena region serves as an area that originates upwelled, nutrient-rich waters that are transported to the Gulf of the Farallones region over a period of five to seven days (Halle and Largier, 2011). Upwelling may be widespread at times, or localized at upwelling centers (e.g., Point Arena).

During the spring-summer upwelling season (typically March to August), strong northwest winds drive surface waters offshore and cold deep waters are upwelled to the surface over the continental shelf (Largier et. al, 1993). The California Undercurrent carries cold high-salinity waters north at depth along the shelf-edge and is a source for upwelled waters. These waters are rich in nutrients and feed very high levels of primary production near-surface. The resultant phytoplankton blooms are the foundation of the rich food webs, involving zooplankton, benthic and pelagic invertebrates, fish, birds, and mammals. Spring-summer currents over the middle and outer shelf flow strongly southward parallel to the shore during upwelling, but nearshore flow patterns are mixed. San Francisco Bay and other nearshore outflows are carried both north and south by prevailing coastal currents and eddies. During brief periods of weak winds (relaxation periods), much of the inner and mid-shelf Gulf of the Farallones waters reverse direction and flow north. In the fall, upwelling winds weaken and water temperatures increase. Known as the relaxation season, this period (typically August to November) is characterized by northward flows and onshore movement of oceanic surface waters (warmer and lower salinity). Periods of upwelling winds can occur during the fall.

Winter in the region is characterized by rain-bearing cold fronts, accompanied by westerly and southerly winds, which drive surface currents northward and downwelling over the shelf. After the fall transition period and the weakening of the upwelling winds, northward flow is more common (sometimes referred to as the Davidson Current period). While storm fronts characterize the months of December through March, upwelling winds are equally common and many upwelling events are also observed at this time of year. During the downwelling events, warm oceanic surface waters move onshore and land runoff is held nearshore. Large plumes of terrestrial runoff from the mainland are also subject to the Coriolis Effect, hence San Francisco Bay and Russian River outflow typically remains close to shore. Water originating from San Francisco Bay flows north around Point Reyes after major rain and runoff events.

Wave climate is defined as the distribution of wave height, period, and direction averaged over a period of time for a particular location (Wiegel, 1964). The nearshore wave climate depends on the offshore wave climate caused by prevailing winds and storms and on the bottom topography, which tends to modify the waves (Herbich and Walters, 1982). The USGS recently conducted extensive wave modeling using 32 years of observational wave data by the Wave Information System (WIS) of the USACE. The modeling results characterize the wave climate by season from offshore to the coastline and provide information as a mean and as the 95th percentile for significant wave height ( $H_s$ ) (Figure 2-2**Error! Reference source not found.**) and wave orbital velocity ( $U_w$ ) (Figure 2-3**Error! Reference source not found.**) (Erikson et al., 2014). The influence of major promontories (e.g., Pt. Reyes, Bodega Head) and lesser ones is seen in the wave shadowing that occurs behind the headlands. In general, the Sonoma coastline and Marin north of Pt. Reyes experiences larger  $H_s$  and faster  $U_w$  than south of Pt. Reyes. Despite the focusing of wave energy on the San Francisco Bar, southern Marin does not have the same

exposure to waves as the rest of the study area. However, large wave events do occur at some locations, such as to the west of Bolinas. .

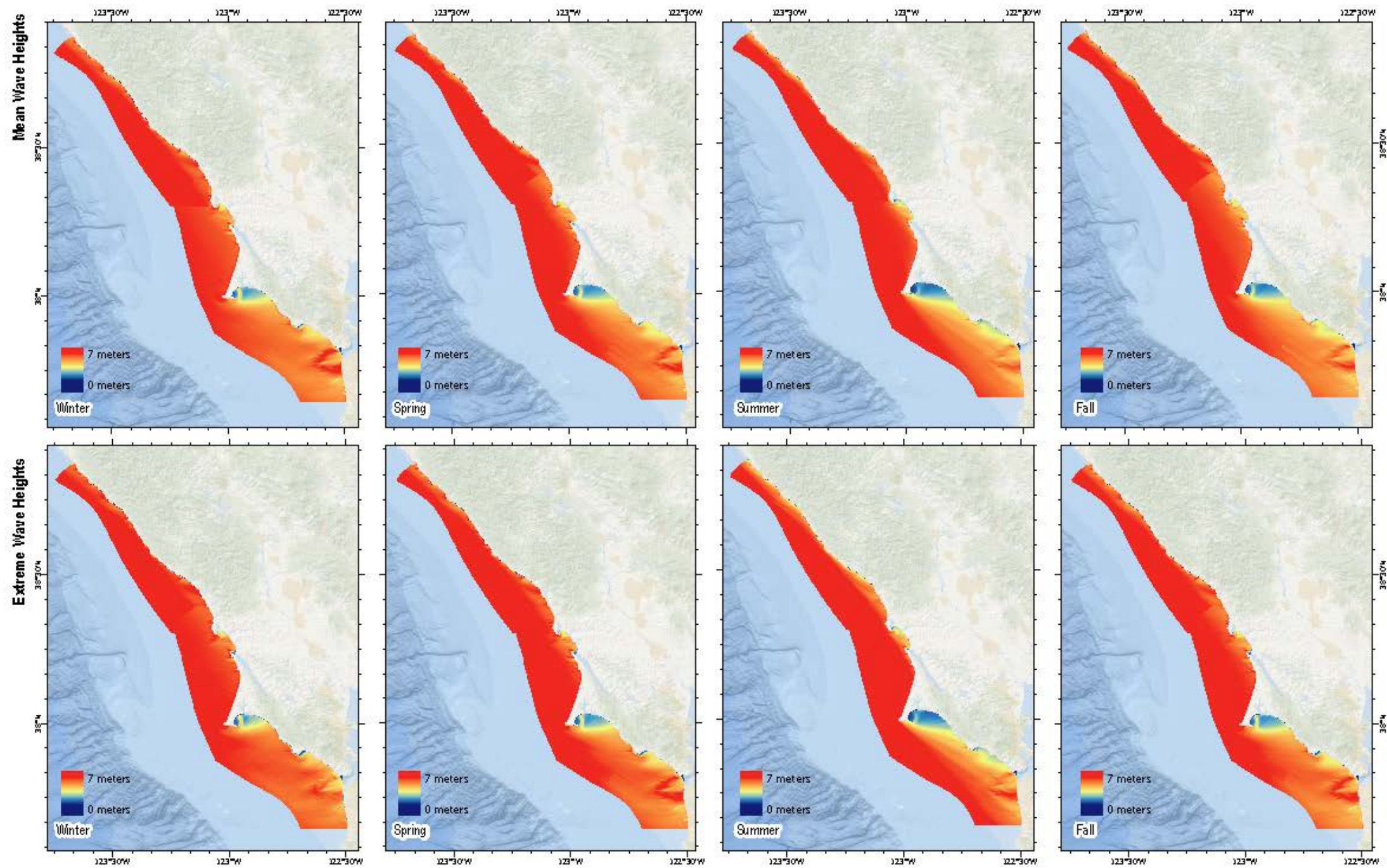


Figure 2-2 Modeled mean (top row) and extreme (top 5%, bottom row) significant wave height ( $H_s$ , m) for the AOI for each season. Hotter colors show larger  $H_s$  while cooler colors indicate smaller  $H_s$ . Data from Erikson et al., 2014.

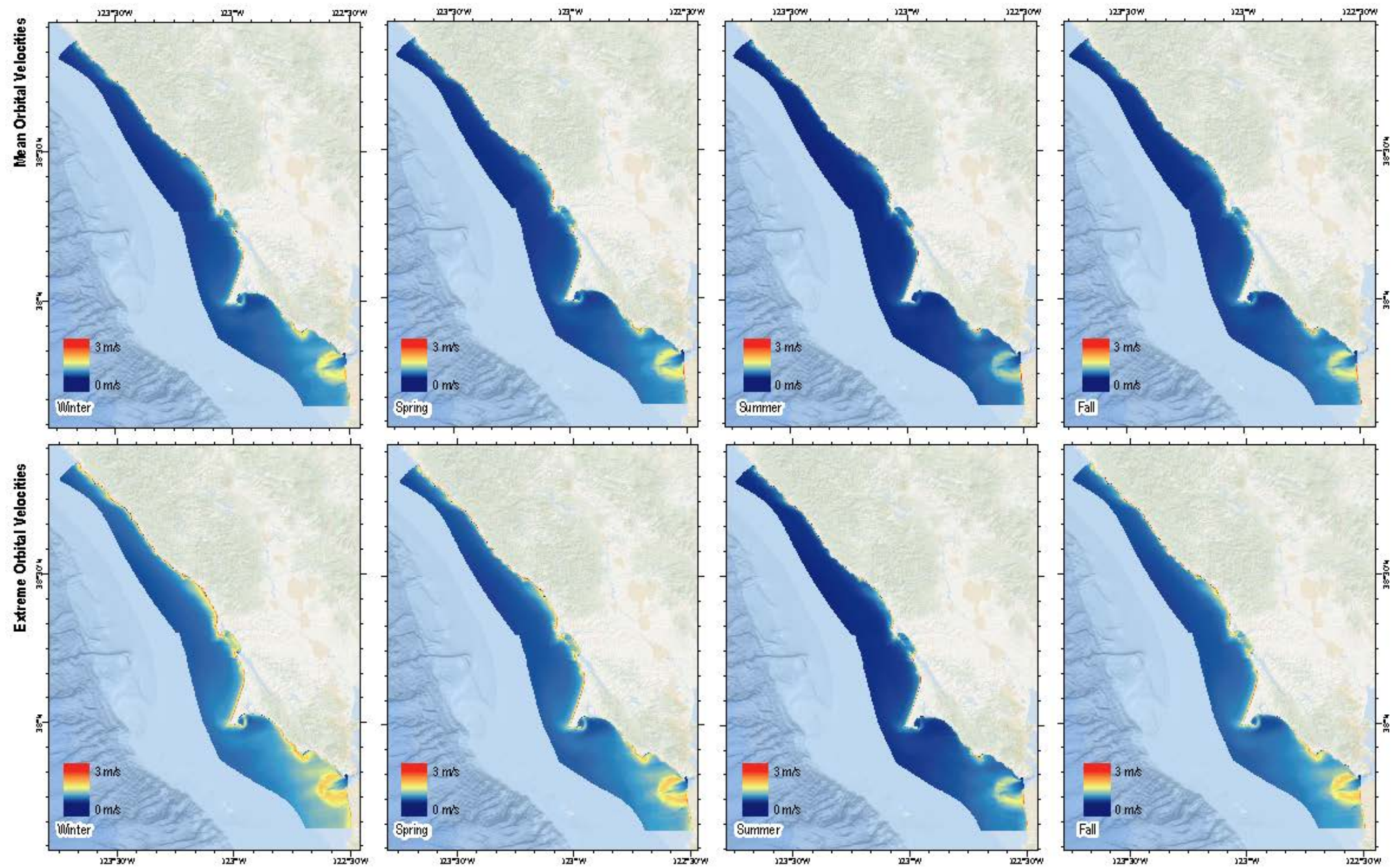


Figure 2-3 Modeled mean (top row) and extreme (top 5%, bottom row) orbital velocities ( $U_w$ , m/s) for the AOI for each season. Hotter colors show faster  $U_w$  while cooler colors indicate slower  $U_w$ . Data from Erikson et al., 2014.

### 2.3.2 Tidal Regime

The tidal regimes across the study area vary only slightly depending on the coastal morphology and bathymetry. The range of MHHW to MLLW tides at NOAA maintained stations and interpreted locations (Table 2-1) show an average of 5.48 feet, although the tidal range inside Bolinas Lagoon is notably smaller than the other observational locations.

Table 2-1. Tidal datums (ft) for maintained water level stations around the study area.

	<b>Pt. Arena (9416841)</b>	<b>Bodega Harbor entrance*</b>	<b>Tomales Bay entrance*</b>	<b>Inverness, Tomales Bay*</b>	<b>Pt. Reyes (9415020)</b>	<b>Bolinas (9414958)</b>	<b>San Francisco (9414290)</b>
<b>MHHW</b>	34.81	5.70	5.20	5.30	9.72	6.63	11.82
<b>MHW</b>	34.14	5.00	4.50	4.60	9.06	6.02	11.21
<b>MSL</b>	32.08	-	-	-	7.06	4.55	9.10
<b>MLW</b>	30.10	1.20	1.00	0.90	5.14	3.02	7.11
<b>MLLW</b>	28.94	0	0	0	3.96	2.23	5.98
<b>MHHW- MLLW</b>	5.86	5.70	5.20	5.30	5.77	4.40	5.84

\*-Data from Nautical Chart 18643, relative to MLLW only

### 2.3.3 Changes in Sea Level

Sea level rise has been minimal on the West Coast for the last decades potentially because of changes to ocean circulation associated with the Pacific Decadal Oscillation (Bromirski et al., 2011). Even with this suppression of sea level rise, long-term records at the San Francisco and Pt. Reyes water level stations show upward trends of 0.19 cm/yr (0.07 in/yr) from 1980 to the present. When local vertical land movement from tectonic activity is incorporated, sea level rise trends can reverse (land moving upward) or be enhanced (land moving downward). For example, the 1906 San Francisco earthquake caused 25-35 cm (9-14 in) of subsidence in Bolinas Lagoon (Gilbert 1906, 1907, 1908; Bergquist, 1978). The lack of information for most of the study area hampers a deeper understanding of local trends. For example, the only actively monitored station in the National Geodetic Survey Continuously Operating Reference Station (CORS) network within the study area was installed at Bodega Head in 2006 (P183); however, data are available online for only a portion of 2017. Despite the shortcomings in the existing data, sea level rise should be considered when describing the study area as water levels play a vital role in sediment management activities.

## 2.4 Geology, Geomorphology and Physical Setting

The San Andreas Fault Zone straddles the coast of both counties and has shaped the coastal and offshore areas forming sandy beaches, rocky cliffs, open bays (Bodega Bay, Drakes Bay, and Bolinas Bay) and enclosed bays or estuaries (Bollinas Lagoon, Tomales Bay, Estero Americano, and Estero de San Antonio). The coastal geology varies extensively with a mix of Franciscan sandstones, cherts, green serpentines, Monterey shales, granites, basalts, crystalline limestones, quartzites, and the sedimentary deposits of the Merced Formation (Galloway, 1977; Clark and Brabb, 1997; and Blake et al., 2000). The mix of hard rock, soft rock, and easily mobilized sediment deposits has created a highly diverse coastal morphology. According to the coastal habitat classifications of the Environmental Sensitivity Index, the Sonoma County coast is comprised of 47% rocky, 31% riverine/estuarine, 14% beach, and 8% bay shorelines; Marin County consists of 49% bay, 28% beach, 16% rocky, and 7% riverine/estuarine shorelines (Environmental Sensitivity Index, 2008). Prominent headlands that were identified by George et al. (2015) as influencing sediment transport have varied geologies: Goat Rock (metagraywacke), Bodega Head (quartz-diorite and sandstone), and Point Reyes (sandstone and granodiorite).

The portion of the Farallones sanctuary that is offshore of San Francisco is characterized by the widest continental shelf on the West Coast of the contiguous United States. In the Gulf of the Farallones region, the shelf reaches a width of 32 nautical miles (59 km) and narrows to a width of 15 nautical miles (28 km) in the Point Arena region. Shoreward of the shelf break and Farallon Islands, the continental shelf is both sandy and muddy, containing large underwater sand dunes and mid-shelf mudbelts (Drake and Cacchione, 1985; Demirpolat, 1991). The San Gregorio Fault intersects the San Andreas Fault north of Bollinas Lagoon and depressions between the two produced grabens onshore (Bollinas Lagoon) and offshore (Bollinas graben). Other important features that resulted from tectonic activity include the Marin Headlands on the north side of the Golden Gate, the terrane deposits of Bodega Head and assemblage at Pt. Reyes, and the long and narrow shape of Tomales Bay. Sediment thickness on the seabed varies extensively, ranging from less than 1 m thick around Bodega Head where rocky reefs dominate, to dozens of meters thick (actual thickness unknown) off the mouth of the Russian River and in the Bollinas graben (Figure 2-4 **Error! Reference source not found.**) (Johnson et al., 2015).

The two Esteros are typically closed during summer and fall by seasonally formed sandbars, isolating the estuaries from the ocean. Other rivers influence conditions in the nearshore zone, including those that may seasonally close in some years: Gualala River, Russian River, and Salmon Creek. Tomales Bay and Bollinas Lagoon, remain open to the ocean year-round. Water and water-borne materials in these rivers, streams, bays and lagoon are exchanged with the open ocean through tidal currents, although inner bay and lagoon waters may take a long time to exchange. The open bays are sheltered from prevailing southerly currents by headlands and points projecting westward and are important retention areas for suspended material.

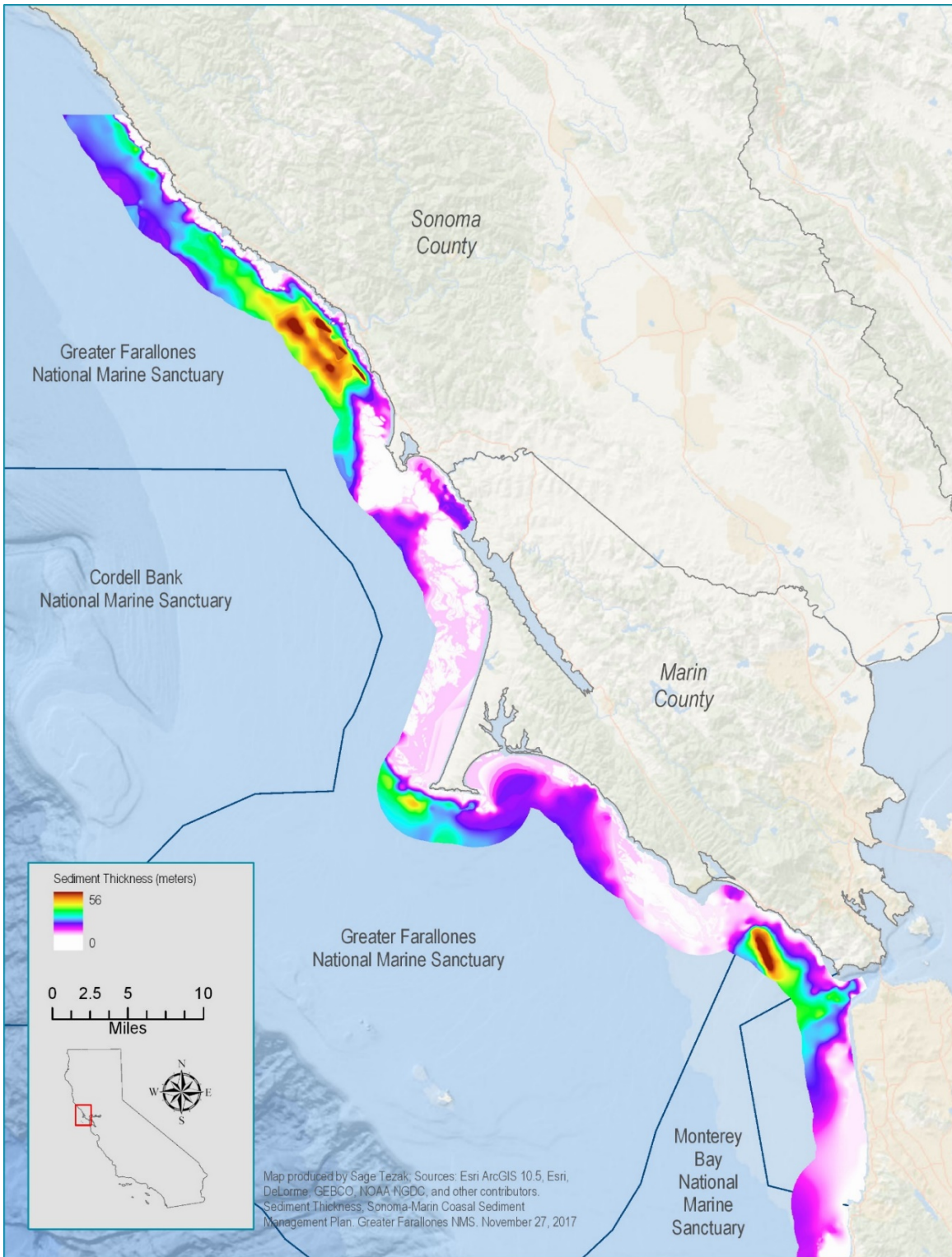


Figure 2-4 Sediment thickness (m) on the seafloor within the AOI. Hotter colors show thicker deposits and white indicates deposits close to 0. Data from the California Seafloor Mapping Program, USGS

## 2.5 Regional Sand Pathways/Budget

A sediment budget refers to the total amount of sediment added to and removed from a coastal system. Sediment comes from *sources*, such as rivers or cliff erosion, whereas sediment is removed by submarine canyons, bays, or offshore into *sinks*. The sediment budget details the balance between the sources and sinks and will indicate if accretion or erosion are expected in a particular location. All the sediment sources and sinks must be identified to accurately calculate the sediment budget for a coastal segment. Gaps in knowledge on either side of the budget will prevent reliable estimates about how much sediment is accreting or eroding from a beach each year.

### 2.5.1 Sediment Sources

Sediment sources to the study area are not well constrained because of widespread data gaps. Conceptually, the rivers, coastal watersheds, cliffs, and San Francisco Bay are the sources for beach-sized sand and cobble and marsh-forming mud. A literature review produced estimates for the largest individual sources (Russian River, Gualala River, and San Francisco Bay), some data on localized cliff erosion and a landslide but no information for the numerous coastal watersheds (Table 2-2). The Lone Tree Slide is located about 15 km north of San Francisco in Marin County. Its gradual movement was a problem for many years due to the disruption of Highway 1 and became severe following the Loma Prieta earthquake of October 17, 1989. Post-earthquake, a substantial amount of sediment was moved seaward off the cliffs as a singular deposit of sediment that has not been repeated. While this singular event was documented and monitored, a widespread coastal watershed analysis would greatly improve the understanding of input volumes to the regional sediment budget.

Table 2-2. Known quantified sediment sources for the study area.

<b>Location</b>	<b>Volume of sediment</b>	<b>Source</b>
Russian River	900,000 tons/yr	Milliman and Farnsworth, 2011
Gualala River	270,000 tons/yr	Milliman and Farnsworth, 2011
San Francisco Bay	1,200,00 tons/yr	Erikson et al., 2013
Cliffs	e.g., Bolinas bluffs: 5,100 tons/yr	Ritter, 1973
Slides	e.g., Lone Tree Slide: 1,800,000 tons	Komar, 1998



## 2.5.2 Sediment Sinks

Sediment sinks, or places where sediment is removed from the littoral system, are also not well understood in the study area. Bays, lagoons, harbors, submarine canyons, and the offshore shelf are traditionally considered sinks for material in transport. A literature review quantified the deposition rates in only three areas within the study area (Table 2-3).

Table 2-3. Estimated sediment sinks for the study area.

<b>Location</b>	<b>Volume of sediment</b>	<b>Source</b>
Tomales Bay	2,828 tons/yr	Rooney and Smith, 1999
Bolinas Lagoon	5,180 tons/yr	PWA, 2005
Bodega Harbor	6,300 tons/yr	Conner et al., 2006

The reduction of sediment inputs through impoundment of rivers and prevention of cliff erosion by coastal armoring can be thought of as a sediment sink. Two dams were erected on the Russian River in the 20th Century - Coyote Valley in 1958 and Warm Springs in 1982. According to an analysis by Willis and Griggs (2003), these dams trap a combined 96,600 tons/yr of beach-size sediment, which amounts to a 23-53 percent reduction of the total sediment delivery to the coast. Culverts under Highway 1 and county roads will also prevent the free flow of sediment to the coast, although the volume is a data gap at this time. The prevention of sediment entering the system by coastal armoring could be determined by a thorough analysis of existing California Coastal Commission sand mitigation fees as levied for compensation of building sea walls or placing revetments. Although armoring is not extensively used in the study area, this is a data gap that could be found to be substantially reducing sediment input.

## 2.5.3 Implications for Regional Sediment Management

Generally, the flow of sediment along the California coast is north to south with some local reversals from geomorphology of the shoreline. Given the gaps in knowledge to create a sediment budget, applying the traditional thinking about transport pathways is a prudent approach. Numerical modeling studies of the provenance of local beach sand (Barnard et al., 2013) indicate that sediment from San Francisco Bay can be identified as far north as Pt. Reyes and Russian River material can be found south of Pt. Reyes. Hence, taking a regional view instead of a small watershed perspective helps interpret the scant data available for sediment pathways.

## 2.6 Relevant Projects and Studies

The following section provides summaries of projects, studies, and tools relevant to the AOI and sediment management activities.

### 2.6.1 Farallones Sanctuary *Climate Action Plan*

The Climate Action Plan is the result of the 2-year “Climate-Smart Adaptation Project for the North-central California coast and ocean” to characterize climate impacts and vulnerabilities to the Farallones sanctuary. The Plan informs management priorities to enhance natural resource resilience to climate impacts. The Sanctuary Advisory Council led a planning process that resulted in the development of 78 adaptation strategy recommendations for the region’s management agencies to enhance coastal habitat resilience and decrease vulnerability to climate change. The Plan presents the adaptation strategies that the Farallones sanctuary expects to pursue.

### 2.6.2 Local Coastal Program (LCP) Updates

LCPs guide coastal zone development for local governments in partnership with the California Coastal Commission. LCPs provide guidance for protection of coastal resources and future development in all coastal cities and counties in California. Once approved by the local government, the LCP must be approved by the Coastal Commission in accordance with the Coastal Act.

#### 2.6.2.1 Sonoma County LCP

Sonoma County is in the [process](#) of updating its LCP (the last version was produced in 1982). The preliminary draft was made publicly available in June 2015. LCP documents and maps are currently being revised and will soon be available for public input before review by the Planning Commission, Board of Supervisors, and Coastal Commission.

#### 2.6.2.2 Marin County LCP

In 2016, Marin County Board of Supervisors approved [amendments](#) to the 1982 LCP. Currently, the plan is undergoing review and amendments by the Coastal Commission and the Board of Supervisors.

### 2.6.3 Collaboration: Sea Level Marin Adaptation Response Team (C-SMART)

Collaboration: Sea Level Marin Adaptation Response Team (C-SMART) is an effort led by the Marin County Community Development Agency to understand the potential impacts of sea level rise and work with communities to prepare for a resilient future. The project’s Stakeholder Advisory Committee is comprised of representatives from each of the West Marin communities - Muir Beach, Stinson Beach, Bolinas, Point Reyes Station, Inverness, Marshall and Dillon Beach. The Technical Advisory Committee is comprised of resource managers, utility providers,

conservation scientists and other local and regional experts. Members of the public joined the conversation through a series of community workshops, providing valuable input to the study process. Findings from the C-SMART project inform the Local Coastal Program.

#### 2.6.4 The Bolinas Lagoon Ecosystem Restoration Project

The Bolinas Lagoon Ecosystem Restoration Project protects and conserves a healthy lagoon ecosystem that can adapt to future changes through collaboration with managing partners, participation from community donors/volunteers, and implementing restoration work. Bolinas Lagoon is a designated United Nation's Wetlands of International Importance, State and National treasure, and an Audubon Important Bird Area. The program focuses on implementation of management strategies and restoration projects within the [\*Bolinas Lagoon Ecosystem Restoration Project: Recommendations for Restoration and Management\*](#), a community-supported document developed through the Sanctuary Advisory Council working group process in 2008. Since its release, the Farallones sanctuary and its partners have implemented several initiatives around Bolinas Lagoon including: road work improvements along Highway 1, invasive European green crab removal at Seadrift Lagoon, nonnative vegetation removal and habitat restoration at Kent Island in Bolinas Lagoon, and project concepts/design alternatives for sea level rise adaptation and wetland restoration measures at the north end of Bolinas Lagoon. Restoration projects at Bolinas Lagoon are led by Marin County Parks in partnership with NPS (GGNRA, PRNS) and the Farallones sanctuary whose jurisdictions overlap portions of the Bolinas Lagoon and its watershed. Projects incorporate nature-based solutions with inclusion of climate change adaptation measures.

#### 2.6.5 Our Coast, Our Future (OCOF)

[Our Coast, Our Future \(OCOF\)](#) is a collaborative, user-driven decision-support tool focused on providing coastal California resource managers and land use planners locally relevant, online maps and tools to help understand, visualize, and anticipate vulnerabilities to sea level rise and storms. Using the USGS Coastal Storm Modeling System (CoSMoS), the interactive flood map provides data on flood extent, depth, duration, wave heights, current velocity, minimum and maximum flood potential, as well as the option to compare scenarios. This information may be critical in the evaluation and design of project ideas proposed in this CRSMR.

#### 2.6.6 Hazard Exposure Reporting and Analytics (HERA)

The [Hazard Exposure Reporting and Analytics \(HERA\)](#) application was developed to provide users with insight on potential population, economic, land cover, and infrastructure vulnerability resulting from a given hazard. Interactive maps and graphics allow users to examine hazard exposure for individual communities, to compare the exposure of multiple communities, and to explore changes in community exposure given multiple hazard scenarios. HERA focuses on California coastal communities and their varying exposure to flooding related to coastal storm and sea level rise scenarios generated by the USGS Coastal Storm Modeling Systems (CoSMoS) project, and may provide critical economic information in the development of project ideas proposed in this CRSMR.

## 2.6.7 The Russian River Integrated Coastal Watershed Management Plan (RRICWMP)

The [Russian River Integrated Coastal Watershed Management Plan \(RRICWMP\)](#) is a watershed-specific, high-resolution planning document specific to the Russian River and contextualized within the *North Coast Integrated Regional Water Management Plan* framework. The Plan was developed by conducting research and analyzing current and historic scientific, socioeconomic, and policy data, and enlisting stakeholders and watershed experts to identify key management issues, and builds on previous efforts including the *Russian River Plan of Action*, and Russian River Watershed Baseline Assessment and Data Synthesis. A Technical Advisory Committee provided input into development of the RRICWMP and its goals, objectives and priorities. The plan identifies 7 goals and 60 objectives, many of which include specific recommendations for managing sediment in the watershed and estuary.

## 2.6.8 Integrating Coastal Vulnerability Modeling and Land Use Planning Strategies (InVEST)

The Center for Ocean Solutions (COS) has partnered with the Natural Capital Project and Stanford Law School on the project “Integrating Coastal Vulnerability Modeling and Land Use Planning Strategies”. This effort has engaged directly with city, county, regional, and state officials across California to co-develop policy-relevant information to aid in local-level climate adaptation planning. Consultations with planners and local government officials around the state have revealed existing knowledge gaps regarding coastal adaptation, particularly around strategy effectiveness and potential legal issues. To address these gaps, COS co-developed a set of coastal adaptation policy briefs, an online viewer, and a compilation of relevant data sets, all tailored to the feedback and needs of local communities.

## 2.6.9 Total Maximum Daily Loads

A total maximum daily load (TMDL) is a planning and management tool intended to identify, quantify, and control the sources of pollution within a given watershed such that water quality objectives are achieved and the beneficial uses of water are fully protected. TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. California State Water Boards use the TMDL process to develop a "pollution budget" designed to restore the health of a polluted or impaired body of water. The TMDL tool also provides a quantitative assessment of water quality problems, contributing sources of pollution, and the pollutant load reductions or control actions needed to restore and protect the beneficial uses of an individual waterbody impaired from loading of a particular pollutant. TMDLs are therefore linked more closely to fine sediment as compared to sand and gravel because pollutants are transported by mud. As part of their efforts to control sediment waste discharges and restore sediment impaired water bodies, the Regional Water Board adopted the Sediment TMDL Implementation Policy, which states that Regional Water Board staff shall control sediment pollution by using existing permitting and enforcement tools. The goals of the Policy are to control sediment waste discharges to impaired water bodies so that the TMDLs are met, sediment water quality objectives are attained, and beneficial uses are no longer adversely

affected by sediment. TMDL project locations include Gualala River, Russian River, Tomales Bay, Walker Creek and Muir Beach.

## 3 BIOLOGICAL RESOURCES

Sediment activities may result in beneficial impacts to biological resources in the region, and/or short to long-term detrimental impacts. Following is a summary of biological resources in the study region that may need to be considered when developing sediment management activities.

### 3.1 Habitats of the Region<sup>1</sup>

The study region of this CRSMR encompasses a complex array of habitats including exposed rocky headlands, protected sandy beaches, coastal strands and dunes, open bays, calm estuaries, creeks, sloughs and lagoons, rocky intertidal habitats, and productive mudflats.

#### 3.1.1 Sandy Beaches and Coastal Dunes

North-central California beaches exhibit classic beach structure: cliffs or dunes demarcate the upper boundary of the beach; the mean high tide line is generally indicated by a berm; and beach flats, troughs, or sand bars form the seaward side of the beach. Exposed sand beaches are harsh environments subjected to high wave action, wide temperature range, and periodic tidal exposure. Quiet-water beaches of estuaries and bays are protected environments subjected to less wave action. Species distributions within the sandy beach habitat are strongly influenced by physical factors on exposed sand beaches, whereas biological factors, e.g., competition and predation, influence species distributions on protected beaches of estuaries and bays. Exposed beaches of northern California show distinct patterns of biological zonation defined by the amount of tidal inundation to each region. The biological zones of the sandy beach habitat are: upper intertidal beach zone, mid-littoral beach zone, swash zone, low intertidal beach zone, and the surf zone.

The upper intertidal beach is submerged for a short time and exposed to the widest range of temperatures. It is often sparsely inhabited, because the food supply on sandy beaches is unpredictable. The major sources of food on the sandy beach include plankton, macroalgae, and occasional corpses of fishes, birds, and marine mammals that are washed ashore by waves. As a result, the upper intertidal is primarily dominated by scavengers on beach wrack, such as talitrid amphipods, flies, isopods, and Coleopteran beetles (Berzins, 1985). The pill bug, *Alloniscus perconvexus*, burrows into the sand just beneath the surface and emerges at night to feed on beach wrack. During the day, beach hoppers (genus *Megalorchestia*) are usually in shallow burrows or under piles of macroalgae. At night, the hoppers emerge to forage on algae and other detritus. The mid-littoral beach zone is characterized by a moderate inundation time, but is subject to many of the same rigors as the upper zone (e.g., temperature extremes and fresh water). The mid-littoral beach fauna is dominated by species with high mobility such as the cirolanid isopod, *Exciroloana*,

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<sup>1</sup> Content excerpted from 2014 GFNMS Management Plan: [https://farallones.noaa.gov/manage/management\\_plan.html](https://farallones.noaa.gov/manage/management_plan.html)

which are preyed upon by various shorebirds. The mid-littoral zone fauna must be highly mobile because this zone is subjected to rapid sediment removal during storms. The swash zone, where waves break on the beach, is characterized by the highest water movement and is submerged approximately twelve hours per day (Oakenen and Nybakken, 1977). Thus, the swash zone is not subjected to extreme temperatures and salinity characteristic of the high- and mid-littoral zones. The dominant species in the swash zone is the sand (mole) crab, *Emerita analoga*, an herbivorous species that forms the basis for much of the sandy intertidal food web. The low intertidal zone is subjected to nearly constant wave action and exposed only for short periods of time during the lowest tides. Most of the inhabitants of the low intertidal are either rapid burrowers or protected against injury. Numerous invertebrate species burrow into superficial sediments and flourish in wave-disturbed sand bottoms (Slattery, 1980). The surf zone is submerged continuously and experiences constant motion of waves breaking against the sea floor. Many studies suggest that sandy beach surf zones are low diversity environments, dominated by small planktivores and benthic feeding fishes and their predators (Gunter, 1958; McFarland, 1963; Edwards, 1973; Modde and Ross, 1981; Lasiak, 1983; McDermott, 1983). The trophic structure of surf zone fish communities appears to be controlled primarily by three factors: (1) primary production input to the surf zone; (2) water movement; and (3) geomorphology of the sandy beaches.

Over 180 bird species were observed on beaches between Bodega Head and the northern Santa Cruz County border during a six year period with Sanderlings, Western Gulls, and Brown Pelicans observed most frequently (Roletto et al., 2000). Most of the bird species that occur in coastal wetlands (especially Sanderlings, Willets and Marbled Godwits) also occur on outer sand beaches (Davis and Baldrige, 1980). Snowy Plovers, which have decreased significantly during the past two decades, nest in coastal dunes. Breeding populations of pinnipeds are also found on sand beaches off northern California. The species most commonly found along Northern California beaches, rocks and mudflats include California sea lions (*Zalophus californianus*) and harbor seals (*Phoca vitulina*).

Coastal dunes in the study region are the highly dynamic interface between ocean and land, affected by wave action, wind, tides, and trampling. Dunes develop where there is sufficient wind-blown sand to be trapped by pioneer species. Dunes provide protection from waves, improve water quality, and serve as habitat for a number of native and rare wildlife and plant species, including 11 federally listed species. Dunes are threatened by development and invasive species, including the European beachgrass and iceplant, which prevent natural dune migration and alter dune processes. Up to 70% of the dunes in Point Reyes National Seashore are infested with invasive species that cause decreased native species diversity, decreased nesting habitat for the Western Snowy Plover, and increases cover for predatory animals.

### 3.1.2 Coastal Rivers and Creeks

From north to south in the study region, Table 3-1 details the rivers and major creeks feed into the Pacific Ocean (excluding bays/lagoons and their inputs) that provide critical habitat for a number of salmonids and the endangered Tidewater Goby. As noted in Chapter 2, the sediment loads for most of these fluvial systems is not readily available.

Table 3-1. Coastal rivers and creeks in the study area.

Gualala River and its tributaries	Glennbrook Creek
Miller Creek	Santa Maria Creek
Warren Creek	Coast Creek
Wildcat Creek	Alamere Creek
Stockhoff Creek	Arroyo Hondo
Timber Cove Creek	Webb Creek
Fort Ross Creek	Lone Tree Creek
Russian River and its tributaries	Redwood Creek
Scotty Creek	Fern Creek
Salmon Creek	Tennessee Valley
Home Ranch Creek	

### 3.1.3 Estuaries, including bays and lagoons

Bays and estuaries are among the most productive natural systems. Their physical, chemical, and biological characteristics are critically important to sustaining living resources (Mann, 1982; Weinstein, 1979). Bays and estuaries are important nursery areas that provide food, refuge from predation and a variety of habitats. Major estuaries within the region include Gualala River, Russian River, Salmon Creek, Bodega Harbor, Tomales Bay, Estero Americano, Estero de San Antonio, Drakes Estero and Bolinas Lagoon.

Bodega Bay is located approximately 40 miles north of San Francisco and straddles the boundary between Sonoma and Marin Counties. Five miles across, the bay receives freshwater and tidal outflows from Bodega Harbor, Tomales Bay and both of the Esteros. Bodega Harbor is an important hub for navigation, recreation, and commercial and sport fishing including shellfish harvesting. Bodega Head protects the small harbor from north swells.

Many different habitat types are found in Estero Americano, Estero de San Antonio and adjacent uplands, including mudflats, marshes, rocky shore, coastal scrub, and grasslands. With the variety of habitats, the esteros support many species of plants, invertebrates, fishes, birds, and mammals. They provide essential feeding and resting areas for shore and sea birds. Some common fish species found in the esteros include Pacific Herring, Staghorn Sculpins and Starry Flounder. The endangered Tidewater Goby breeds in the shallow waters of Estero de San Antonio.

Tomales Bay is a fault-controlled valley along the San Andreas Fault, located between the mainland and the Point Reyes National Seashore (PRNS). Lagunitas Creek, which drains into Tomales Bay, supports a run of approximately 10 percent of California's current Coho Salmon population. The bay also supports seasonal populations of salmon, steelhead, sardines, and lingcod. The sandy bottom attracts a variety of bottom-dwelling fish including sole, halibut, skates and rays. Leopard Sharks are common in Tomales Bay and occasionally Blue Sharks are sighted. White Sharks, although not found in enclosed bays or estuaries, hunt for seals and sea lions that haul out on the sandy beaches and rocks near the mouth of Tomales Bay. More than 20,000 shorebirds and seabirds, including loons, grebes, geese, cormorants, and ducks, spend the winter in Tomales Bay.

Seagrass beds occur on the extensive mudflats in Tomales Bay, Bolinas Lagoon, Bodega Harbor, and within the Esteros. Seagrass supports a unique and diverse assemblage of invertebrates and fishes, including snails, shrimp, nudibranchs and sea hares. The structure of seagrass beds provides protection from predation, especially for juvenile invertebrates and fishes. Pacific Herring, invertebrates, and birds depend on seagrass beds in Tomales Bay to spawn and feed. The soft bottom habitats associated with estuarine environments support large concentrations of burrowing organisms, such as clams, snails, worms, and crabs. Benthic invertebrates in estuaries have a large effect on community structure. Willets and Marbled Godwits are among the most abundant large shorebirds in northern California estuaries whereas Sanderlings, Western Sandpipers, Least Sandpipers, Dowitchers, and Dunlins are the most abundant small shorebirds in wetlands and the outer coast beaches from Point Reyes to Manchester State Beach. There are some differences within estuaries in the abundances of shorebirds. Horned and Eared Grebes, American Coots, and numerous ducks (including Buffleheads, Goldeneyes, Pintail, Mallard, and Cinnamon Teal) dominate the coastal bird assemblage in shallow, tidal waters of local sloughs and estuaries while egrets and herons use brackish and salt marshes as roosting and feeding habitats during high tides (Davis and Baldrige, 1980). The time of migration and the routes of travel between breeding and wintering grounds seasonally affect the patterns in abundance of shorebird species in northern California (Ramer et al., 1991). Most species of wintering shorebirds move into California from August through March and leave wintering grounds for northern breeding grounds between late March and early May. Fish assemblages in estuaries of the Gulf of the Farallones and Point Arena regions exhibit similar trophic structure and taxonomic structure. The most abundant estuarine fish are juvenile planktivores or low-level carnivores on infaunal invertebrates (Yoklavich et al., 1991). Fish assemblages exhibit higher abundance and species richness during the summer with the invasion of young-of-the-year marine species (Allen and Horn, 1975; Hoff and Ibara, 1977; Allen, 1982; Onuf and Quammen, 1983; Yoklavich et al., 1991). Species richness (diversity of species) and the change in species composition decline with distance from the ocean interface (Loneragen et al., 1986; Blaber et al., 1989; Yoklavich et al., 1991). The mouths of bays and estuaries are strongly influenced by marine waters (Broenkow, 1977), and are therefore more accessible to coastal marine species.

### 3.1.4 Rocky Shores

In addition to sandy beaches (section 3.1.1) and sheltered estuary/lagoon habitat (section 3.1.3), rocky shores provide intertidal habitat between the low and high tides is biologically rich, supporting diverse assemblages of algae, plants and animals. It is characterized by extreme conditions caused by wind, waves, and the fluctuation of tides. Organisms living in the intertidal face many challenges that are unique to living at the edge of the ocean, including threat of desiccation, physical wave action, and limited space. Rocky shores are found throughout the region as the dominant shoreline. Four zones of rocky intertidal organisms are traditionally associated with different tidal heights with species distributions according to physiological tolerance along the thermal and moisture gradients. The splash zone is almost always exposed to air, and has relatively few species. The high intertidal zone is exposed to air for long periods twice a day. The mid-intertidal zone is exposed to air briefly once or twice a day. The low intertidal zone is exposed only during the lowest tides.



The periwinkle, *Littorina keenae*, and the barnacle, *Balanus glandula*, can be used as indicators of the splash zone. Microscopic algae are common in the splash zone in winter months when large waves produce consistent spray on the upper portions of the rocky shore. Black Oystercatchers and Black Turnstones are the common birds along the rocky shoreline off central and northern California. These birds are most abundant during fall and winter, and during this period, are accompanied by small numbers of Ruddy Turnstones, Surfbirds, and Wandering Tattlers. Black Oystercatchers nest along rocky coasts including the Farallon Islands (Sowls et al., 1980). A variety of species commonly considered land birds also feed along rocky shores, including Black Phoebe, American Crow, Brewer's Blackbird and European Starlings. Descending through the intertidal elevations are several zones dominated by (1) furoid and ceramial algae in the high intertidal; (2) a dense turf of erect coralline and gigartinal algae in the mid-intertidal; and (3) beds of *Postelsia palmaeformis* (sea palm), rhodymenials, and laminarials in the low intertidal zone. In northern California, the barnacle, *Balanus glandula*, and red algae, *Endocladia muricata* and *Mastocarpus papillatus*, are used as indicators of the high intertidal zone, but these species are also found in other areas of the rocky shore. At wave-exposed sites, the mussel, *Mytilus californianus*, can dominate the available attachment substratum in the mid-intertidal zone. Intertidal predators generally include whelks, sea stars, sea urchins, octopuses, fishes, and shore crabs. The low intertidal zone is subjected to nearly constant wave action and exposed only for short periods of time during the lowest tides. The presence of the seagrass, *Phyllospadix* spp., is a good indicator of the mean low water level.

### 3.1.5 Kelp Forest

The rocky nearshore environment of northern California is characterized by dense forests of kelp growing at depths from 6 feet to more than 60 feet. The bull kelp, *Nereocystis luetkeana*, is the dominant canopy-forming kelp north of Santa Cruz to the Aleutian Islands (Foster, 1982). The shallow areas inshore of kelp forests are often characterized by canopies of the feather boa kelp, *Egregia menziesii*, and other Laminarials (Foster and Schiel, 1985). Extensive kelp forests occur along the Sonoma and Mendocino County coasts and shelter the shoreline, allowing accretion on beaches. They alter turbulent flow patterns in the nearshore region through drag generated by their large size and frequently high densities (Duggins, 1988). The biological ramifications of this type of hydrodynamic influence are potentially very important to a wide range of nearshore organisms. Disruption of flow by kelp forests is likely to have significant effects on feeding and growth (particularly in suspension and deposit feeders), dispersal and recruitment (Duggins, 1988). Food and dispersal stages of many kelp forest organisms are passively dispersed, and their transport and settling characteristics will be determined largely by the movement of water in which they are suspended. Kelp beds may retain larvae released within the bed, and the strong deceleration of flow at the margins of the bed could facilitate settlement of larvae imported from outside the bed (Duggins, 1988). The concentration of zooplankton at the upcurrent edge of a kelp bed, and the corresponding higher densities and feeding rates of fish in that area, are probably results of alterations of current flow by kelp (Bray, 1981). Kelp forests harbor a large potential source of invertebrate and fish prey for birds (Foster and Schiel, 1985). Gulls, terns, Snowy Egrets, Great Blue Herons and cormorants are commonly associated with kelp forests (Foster and Schiel, 1985). Other species (e.g., phalaropes) feed on the plankton and fish larvae

associated with kelp. Harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) are common in and around kelp forests off northern and central California. Harbor seals feed on fishes in the kelp forest whereas California sea lions probably limit their use of the kelp forests to transitory feeding (Foster and Schiel, 1985). Gray whales (*Eschrichtius robustus*) have been observed entering kelp forests to feed on invertebrates such as mid-water crustacean swarms and to escape predation from killer whales (*Orcinus orca*). Kelp that breaks off can be transported onto beaches, providing a food subsidy for the sandy beach ecosystem (Liebowitz et al., 2016).

### 3.1.6 Continental Shelf and Nearshore Subtidal Communities

The continental shelf off central and northern California is generally quite gradual in slope, and the bottom substrate is a combination of varying amounts of sand, silt, and clay. Much of the mud and sand on the continental shelf was deposited by rivers that formed during the melting of the glaciers approximately 18,000 years ago (Eittrheim et al., 2000). At water depths between about 40 to 90 meters, the continental shelf off central California is covered by a nearly continuous blanket of mud. In areas of high wave energy, mud and sand may be resuspended and transported away from the shore. A zone of outcropping bedrock and sands is located seaward of the mud accumulation zone, on the far outer shelf where water depth exceeds 90 meters.

Although sandy sediments may appear less productive than rocky reefs and kelp forests, numerous organisms are adapted to the shifting environments on the sandy shelf. Some animals find shelter by living in tubes and burrows. Clams lie permanently buried with their siphons extended to the surface of the sediment. Some crustaceans and mollusks live beneath the sand, emerging at night to forage. Flatfishes are camouflaged on the sandy surface of the sea floor. Many species of flatfishes (Pleuronectidae and Bothidae) use the soft-bottom habitats along the continental shelf. English Sole (*Paraphrys vetulus*) are distributed from northwest Alaska to San Cristobal Bay, Baja California, in waters as deep as 1,800 feet. Spawning of English Sole generally occurs over sand and mud-sand bottoms at depths of 200 to 360 feet from September to April (Pearson et al., 2001). Dungeness crabs (*Cancer magister*) are commonly found in a variety of habitats, but populations are concentrated on sandy to sandy-mud bottoms from the intertidal to a depth of 300 feet. Dungeness crabs are opportunistic feeders, consuming clams, fish, isopods, and amphipods.

Along the northern California coast, rocky reefs support extensive macroalgal growth and associated abalones, sea urchins, and rockfishes. Rocky reefs occur in the nearshore and intertidal environments such as Duxbury Reef, as well as part of offshore, submarine banks and shoals. Juvenile red abalones settle as postlarvae on coralline algae in crevices between rocks (Haaker et al., 2001). Sea urchins are abundant subtidal herbivores that play an important ecological role in the structure of kelp forest communities. Red sea urchins (*Strongylocentrotus franciscanus*) are found on rocky shores of open coasts from the low-tide water line to 300 feet deep. Purple sea urchins (*S. purpuratus*) are found on rocky shores with moderately strong surf from the low-tide line to 525 feet deep. Fish commonly found in the rocky habitats of the continental shelf include surfperches, rockfish, and cabezon. The surfperches (Embiotocidae) are small abundant fishes found predominantly in temperate eastern North Pacific waters. Many species of rockfish can be

found at various depths on the rocky continental shelf. Bocaccio (*Sebastes paucispinis*), currently listed as an overfished species can be found in loose schools of 1 to 2 year fish in shallower waters, but then move to deeper more-rocky habitat when they increase in age. Cabezon (*Scorpaenichthys marmoratus*) are found on hard bottoms in shallow water from intertidal pools to depths of 250 feet. Cabezon are common in subtidal habitats in and around rocky reefs and kelp beds. These rocky habitats also include a wide variety of invertebrates such as deep-sea corals (*Antipathes dendrochristos*, *Chromoplexaura marki*, *Stylaster* spp., *Swiftia* spp., and *Paragorgia* spp.) and sponges (*Iophon piceus* var. *pacifica*, *Halichondria panacea*, *Heterochone calyx*, *Staurocalyptus fasciculatus*, *Xestospongia diprosopea*, and *Acanthascus fasciculatus*).

## 3.2 Managed Areas

In addition to the Greater Farallones National Marine Sanctuary, the managed areas within the AOI present a variety of protections for the coastal zone in Sonoma (

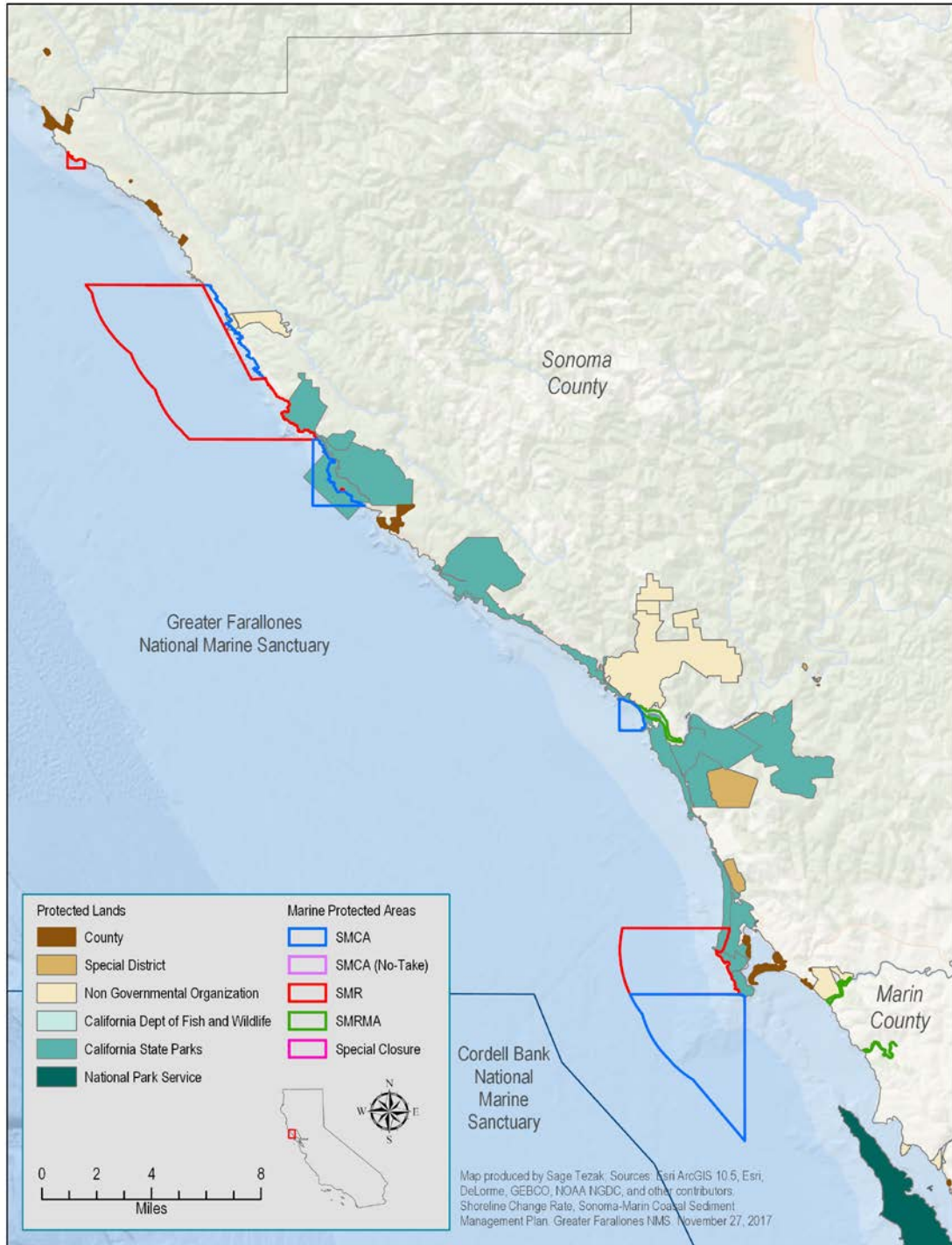


Figure 3-1) and Marin (

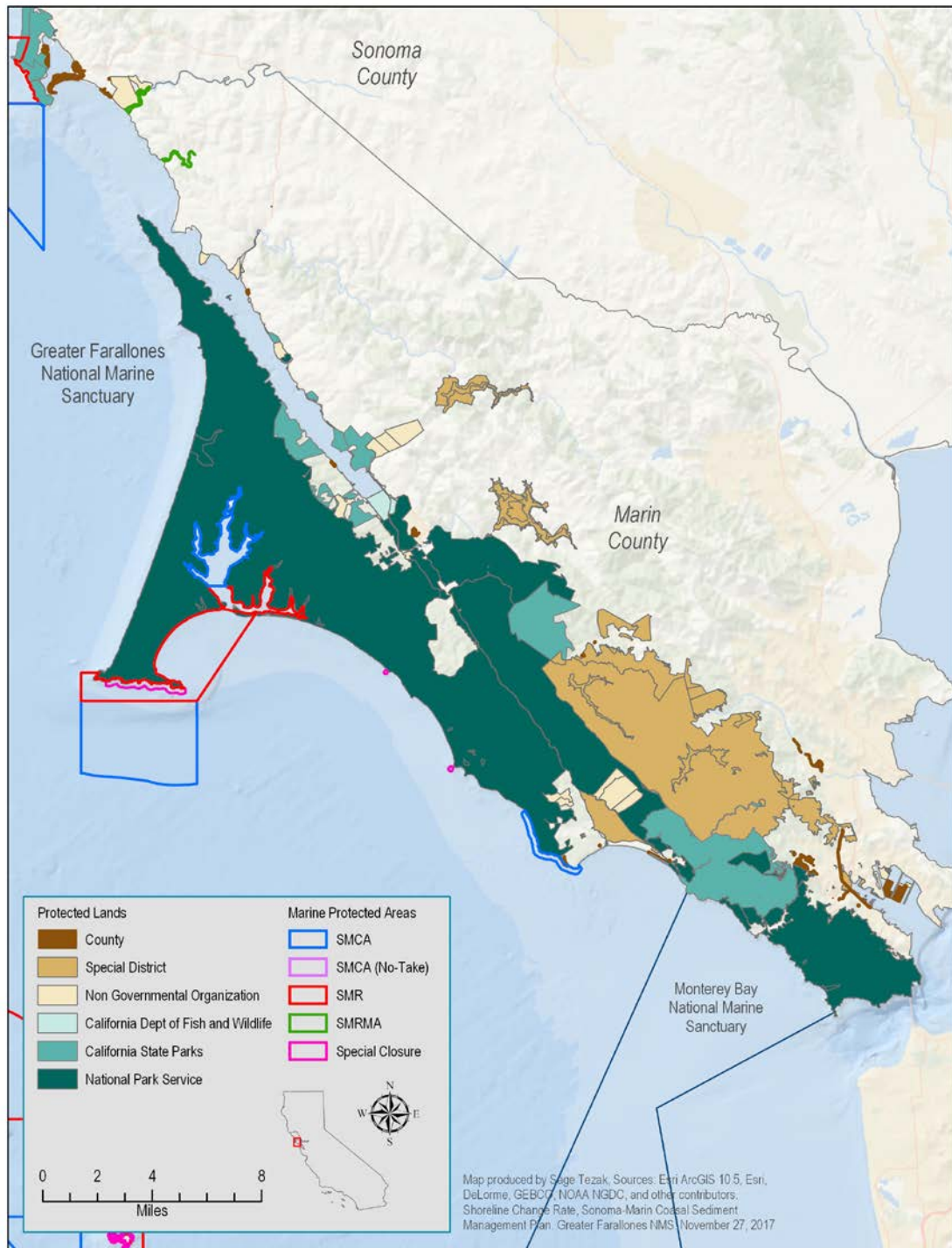


Figure 3-2). Sediment management activities conducted in any of these managed areas may require additional permits or approvals.

### 3.2.1 State Marine Conservation Areas and Reserves

There are 28 State designated Marine Protected Areas (MPAs) along the stretch of coastline in this AOI, including 9 State Marine Reserves (SMR: prohibits damage or take of all marine resources (living, geologic, or cultural) including recreational and commercial take), 11 State Marine Conservation Areas (SMCA: may allow some recreational and/or commercial take of marine resources), 3 State Marine Recreational Management Areas (SMRMA: limits recreational and commercial take of marine resources while allowing for legal waterfowl hunting to occur; provides subtidal protection equivalent to an MPA), and 5 Special Closures (designated by the Fish and Game Commission that prohibits access or restricts boating activities in waters adjacent to sea bird rookeries or marine mammal haul-out sites). The State MPAs in this region cover approximately 154 square miles, or about 20 percent of north central California state waters.

### 3.2.2 State Areas of Special Biological Significance

There are seven Area of Special Biological Significance (ASBS) monitored and maintained for water quality by the State Water Resources Control Board within the AOI. They support an unusual variety of aquatic life, and often host unique individual species. ASBS are basic building blocks for a sustainable, resilient coastal environment and economy. The following ASBS are within the AOI: Del Mar Landing, Gerstle Cove, Bodega Head, Bird Rock, Point Reyes Headlands, Double Point, and Duxbury Reef.

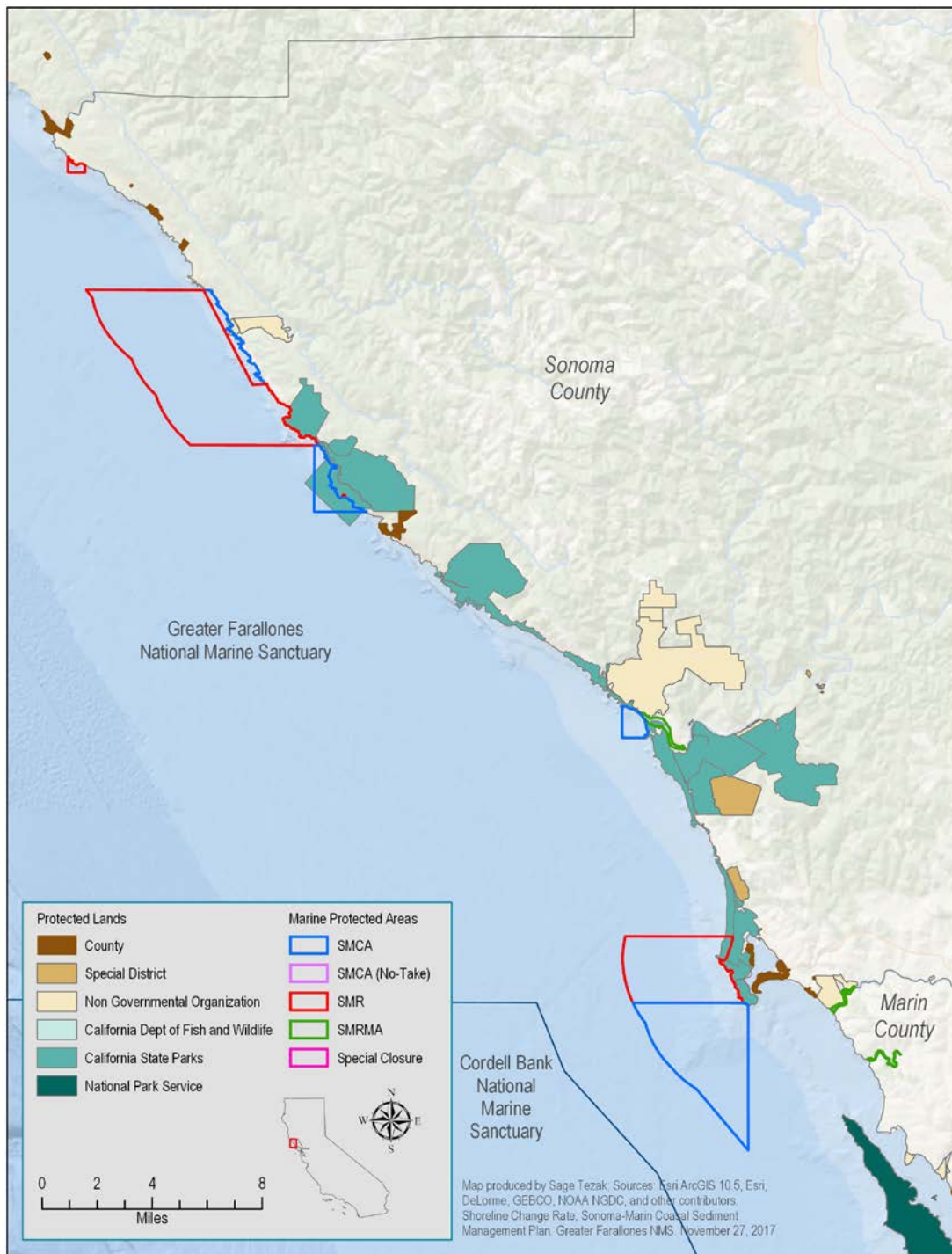


Figure 3-1 Managed areas along the coast in Sonoma County, including offshore (MPAs), and onshore (parks under Federal, State, or county management).

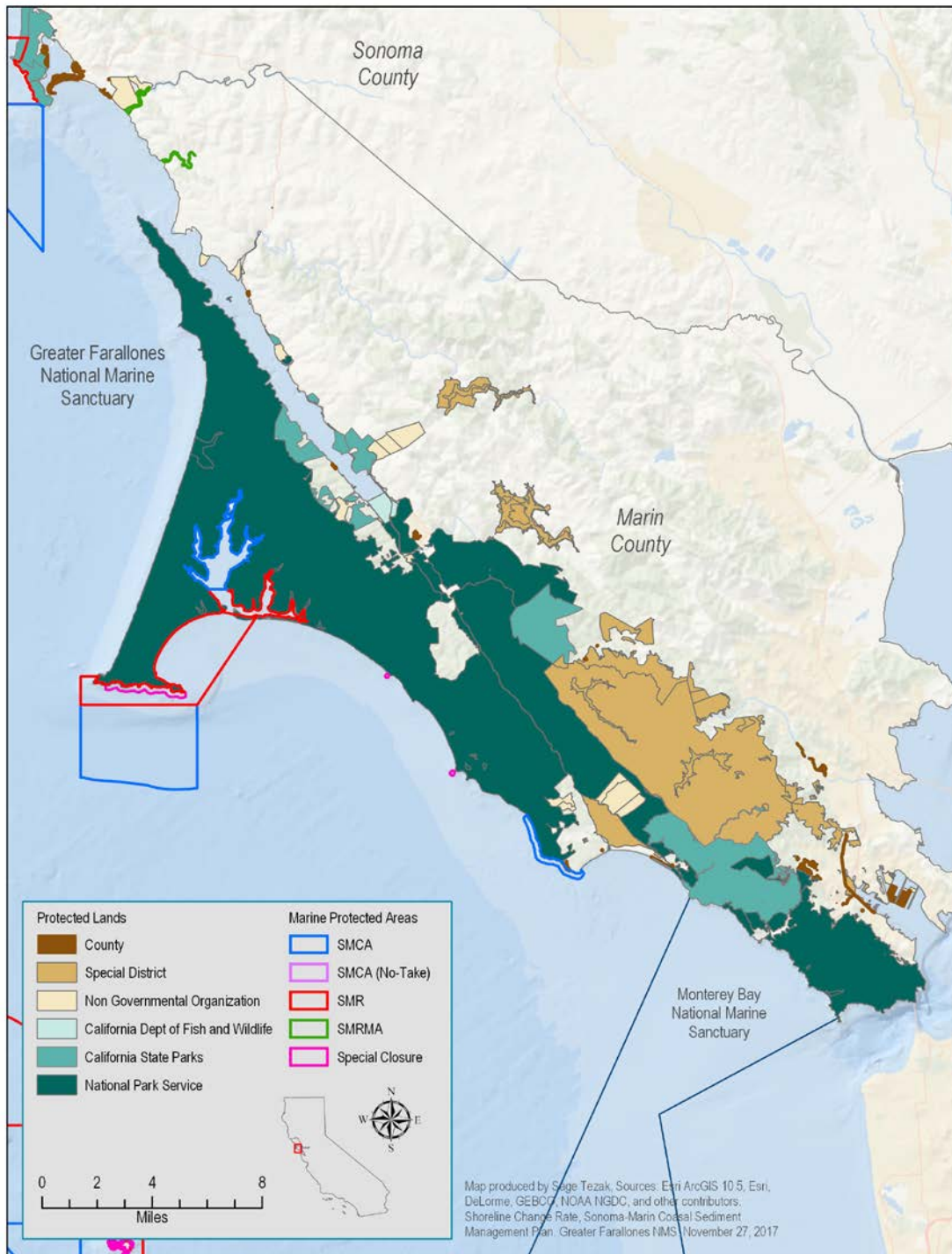


Figure 3-2 Managed areas along the coast in Marin County, including offshore (MPAs, ASBS), and onshore (parks under Federal, State, or county management).



### 3.2.3 State Department of Parks and Recreation

State Parks in the region include: Kruse Rhododendron State Natural Reserve, Salt Point State Park, Fort Ross State Historic Park, Sonoma Coast State Park, Marconi Conference Center State Historic Park, and Tomales Bay State Park. In general, state parks provide protection for natural and historical resources, while providing for outdoor recreation.

### 3.2.4 National Parks Service

National Parks in the region include Point Reyes National Seashore (PRNS) and the Golden Gate National Recreation Area (GGNRA). PRNS protects varied habitats and terrain, from sweeping beaches and dunes to forested ridges. PRNS also works to preserve the legacy of several cultures that persisted in the region for thousands of years. GGNRA protects 19 distinct ecosystems and over 2,000 species, with protected units scattered along the coastline from northern Marin County to San Mateo County, south of San Francisco.

### 3.2.5 US Fish and Wildlife Service Farallon Islands National Wildlife Refuge

The United States Fish and Wildlife Service Farallon Islands National Wildlife Refuge protects the remote and inaccessible Farallon Islands, 30 miles off the coast from San Francisco. These rocky islands contain the largest seabird nesting colony south of Alaska including the largest colony of western gulls in the world and half the world's population of Ashy storm-petrels.

### 3.2.6 Bureau of Land Management National Conservation Lands

The sole managed land by BML in the AOI is the California Coastal National Monument, which protects offshore rocks and islands exposed above mean high tide and within 12 miles of the coastline.

### 3.2.7 Bodega Marine Reserve

The Bodega Marine Reserve is a diverse research and teaching Reserve that surrounds the Bodega Marine Laboratory and is a unit of the University of California Natural Reserve System administered by the University of California, Davis. At 362 acres, these lands provide protection for research and education activities and serve as a living laboratory. The Bodega Marine Reserve extends 1000 feet into the ocean, which is now part of the Bodega State Marine Reserve.

### 3.2.8 Local (regional, county or city managed) Parks

The AOI contains numerous properties owned and managed by both Sonoma County Parks and Marin County Parks and Open Spaces (e.g. Doran Beach). These parks are not listed herein, but project planners should consult with appropriate regional or local governments to ensure all reviews and approvals are obtained prior to beginning a sediment management activity.

## 3.3 Fish and Wildlife of the Region

### 3.3.1 Marine and Coastal Birds

The Gulf of the Farallones supports the largest concentration of breeding seabirds in the contiguous U.S. These birds forage in the Gulf of the Farallones and are highly dependent on the productive waters in the region. Eleven of the sixteen species of seabirds known to breed along the U.S. Pacific coast have breeding colonies on the Farallon Islands and feed in the region. Breeding colonies include Ashy and Leach's Storm-Petrels; Brandt's, Pelagic, and Double-crested Cormorants; Western Gulls; Common Murres; Pigeon Guillemots; Tufted Puffins; and Cassin's and Rhinoceros Auklets. The region also provides foraging habitat for aquatic birds such as waterfowl, shorebirds, pelicans, loons, and grebes. These habitats are pristine compared to most coastal wetlands in California and provide habitat for thousands of migrating and wintering birds. More than 180 species of birds use the region for shelter, food, or as a migration corridor, including numerous federally protected species (see Appendix A for complete listing). Of these, over 50 species of birds are known to use the region during their breeding season. Critical breeding and nesting sites include, but are not limited to, Delmar Point, Horseshoe Cove, Russian River Rocks, Bodega Head, Dillon Beach Rocks, Tomales Point, and Double Point Rocks (see Appendix D for a more complete list of breeding and nesting sites).

### 3.3.2 Marine Mammals

Thirty-six species of marine mammals have been observed in the region, nine of which are federally protected. This includes six species of pinnipeds (seals and sea lions), twenty-eight species of cetaceans (whales, dolphins, and porpoises), and two species of otter (southern sea otter and river otter). Pinnipeds and cetaceans occur in large concentrations and are dependent on the productive and secluded habitats for breeding, pupping, hauling out, feeding, and/or resting during migration. Pinnipeds will haul-out at any available rocky bench or sandy beach, provided they are not accessible to humans, dogs or other predators. Critical haul-out locations in the region include, but are not limited to, Del Mar Landing (The Sea Ranch), Goat Rock Beach, Russian River Spit, Doran Beach, Dillon Beach, Tomales Bay and Point, Duxbury Reef, and Bolinas Lagoon (see Appendix D for a more complete list of pinniped haul-outs).

### 3.3.3 Fish

Fish resources are abundant over a wide portion of the study region. The region is vital to the health and existence of salmon (Chinook, Coho and Steelhead), northern anchovy, rockfish, and flatfish stocks. Eight federally protected species are found in the region (Appendix A). Common fish species of the major bays and estuaries include the Pacific Herring, smelts, Starry Flounder, surfperch, sharks and rays. The rocky intertidal zone supports a specialized group of fish adapted for life in tidepools, including Monkey Face Sticklebacks Rock Eels, Dwarf Surfperch, juvenile Cabezon, sculpins, and blennies. Many of these stocks are important as forage for shorebirds and seabirds. Subtidal habitats support large populations of juvenile finfish (e.g., flatfish, rockfish, etc.). Nearshore pelagic environs are habitat to large predatory finfish such as sharks, tunas, and mackerel. Northern Anchovies, Pacific Mackerel, and Market Squid are abundant and can be

commercially valuable. Pelagic fish resources in the study area generally parallel species living in the nearshore subtidal zone. At the mid-depth or meso-pelagic range over sand and mud bottoms, Bocaccio, Chilipepper, Widow Rockfish, and Pacific Hake are abundant. Kelp beds substantially increase the useable habitat for pelagic species and offer protection to juvenile finfish.

### 3.3.4 Terrestrial Flora

Coastal scrub and coastal strand plant communities dominate the shoreline in the study region and are able to tolerate abrasive conditions. These communities are composed primarily of Coyote Bush (*Baccharis pilularis*), Sand Verbena (*Abronia* spp.), Sand Bur (*Ambrosia chamissonis*), Low Saltbushes (*Atriplex* spp.), Rye Grass (*Elymus mollis*), Bush Lupines (*Lupinus arboreus* and *L. chamissonis*), Mock Heather (*Ericameria ericoides*), and Coastal Sagewort (*Artemisia pycnocephala*). Coastal scrub and strand plants provide important habitat and sediment stabilization.

### 3.3.5 Benthic Fauna

Benthic fauna communities refer to invertebrates living directly on or in the seafloor. Benthic fauna communities differ according to habitat type and exist in all habitats of the region (bays and estuaries, intertidal zones, nearshore, and offshore, see section 3.1 for detailed description). Generally, each habitat area supports differing benthic assemblages of most classes, e.g., worms, clams, or crabs. The most conspicuous species include abalone, crabs, and sea urchins. Hundreds of other species (including sea stars, clams, amphipods, and shrimp) are critical links in the food chains of fish, birds, and mammals.

## 4 ASSESSMENT OF COASTAL CHANGE AND CREATION OF PRIORITY ACTION AREAS

The priority areas for sediment management concerns were determined using community input and shoreline change analysis. This section explains the shoreline change analysis process of predicted hazard zones under two climate change scenarios, and features on land that may be at risk in the near-term (less than 10 years), mid-term (10-20 years) and long-term (up to 50 years). A summary of known data gaps is also provided.

### 4.1 Community Engagement

This CRSMR was prepared through a Farallones Sanctuary Advisory Council (SAC) formal working group process to provide sufficient community and agency engagement. The Advisory Council established the Sediment Management Working Group (SMWG) that included scientists, landowners, local stakeholders and agency representatives (Table 4-1). The SMWG reviewed

technical information and created recommendations for sediment management activities. The SMWG forwarded a set of recommendations to the Advisory Council after a 10-month-long science- and local knowledge-based process (see Appendix B for meeting summaries). Where scientific information was lacking, community input became more critical to develop an understanding of erosion and accretion. The Advisory Council reviewed and revised the recommendations and directed the formulation of the CRSMR. Concurrent with the SWMG process, the Farallones sanctuary convened a Technical Advisory Committee (TAC) consisting of Federal, State, and local agencies (Table 4-2) to provide regulatory and governance review of possible sediment management options. More than 60 community members contributed to the set of recommendations presented in Chapter 7.

Table 4-1. GFNMS Advisory Council Sediment Management Working Group Members

<p><b>Federal</b>  US Army Corps of Engineers*  National Park Service (Golden Gate National Recreation Area and Point Reyes National Seashore)</p> <p><b>State</b>  California Coastal Commission  California Geological Survey  Caltrans*  California State Parks  Natural Resources Agency</p> <p><b>Academic</b>  Bodega Marine Laboratory (UCD)  Romberg Tiburon Center (SFSU)</p>	<p><b>Local</b>  Sonoma County (Planning, Regional Parks, Water Agency*)  Marin County (Planning)</p> <p><b>Community</b>  Russian Riverkeeper  Wildlands Conservancy  Environmental Action Committee of West Marin  Bodega Bay Fishermen’s Association  Sonoma Coast Surfrider</p>
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\*- Initial participant, did not contribute to final SMWG recommendations

Table 4-2. GFNMS Technical Advisory Committee Members

<p><b>Federal</b>  US Army Corps of Engineers  Environmental Protection Agency  National Marine Fisheries Service  National Park Service (GGRNA and PRNS)  SF Bay Outer Coast Sentinel Site Cooperative</p> <p><b>Local</b>  Marin County</p>	<p><b>State</b>  Bay Conservation and Development Commission  California Coastal Commission  State Coastal Conservancy  Ocean Protection Council  California State Lands Commission  California State Parks  Water Resources Control Board</p>
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## 4.2 Identification of Sediment Challenged Areas

The combination of local knowledge and science-based analyses began with SMWG members identifying areas currently experiencing sediment issues for further evaluation. Shoreline change rates for Sonoma and Marin Counties were estimated to validate the suggested locations and detect areas that were not identified.

The first step to calculate shoreline change rates was to gather land surface elevations and identify the shoreline at different times. The following Light Detection and Ranging (LiDAR) elevation data were downloaded from the NOAA Data Access Viewer (Elevation) for the study area:

- a. 1997, Fall West Coast Pre-El Nino Lidar (CA, OR, WA)
- b. 2002, NASA/USGS Pacific Coast Shoreline Lidar (CA, OR, WA)
- c. 2010, USGS LiDAR San Francisco (CA)
- d. 2013, CA Merged Project

The data were contoured and the shoreline was selected from the resulting zero elevation contour after removal of any outlying features that were not part of the shoreline. Historical shorelines from prior work by the USGS were also included in the shoreline change analysis (Hapke et al., 2006; Hapke et al., 2007). The shorelines for Marin include 1853-1910, 1929-1942, 1945-1976 and for Sonoma 1854 -1880, 1928 -1936, 1952-1971.

Shoreline change was then determined by applying the Digital Shoreline Analysis System (DSAS), a free and open source computer software developed by the USGS that computes rate-of-change statistics from multiple historic shoreline positions (Thieler et al., 2017). Cross-shore transects were spaced every 100 m perpendicular to the coastline and changes between the various shoreline positions were determined where more than three shorelines were available (Figure 4-1 **Error! Reference source not found.**). This simplistic shoreline change approach works well for beaches but is not as robust for cliffs and bluffs. Rates of change showed the range of erosion and accretion as -1.3-2.1 m/yr throughout the study area with the mouths of the Russian River, Tomales Bay, and Drakes Estero particularly dynamic. Other highly active areas include near Gleason Beach, the west-facing beaches of PRNS, and Stinson Beach. Most of the highly active areas had been identified by the SMWG, which helped corroborate the findings.

The historical shoreline change rates were used to project future shorelines at three timeframes (near-term, mid-term, long-term). Following a method used in a pilot project by the Federal Emergency Management Agency (FEMA) along Ocean Beach, San Francisco, historical shoreline change rates (erosion or accretion) were assumed to be a combination of coastal processes and sea level rise (Baker AECOM, 2016). Under the FEMA method, coastal processes are assumed to remain constant but future sea level rise rates can be adjusted to include the expected acceleration of sea level rise rates. Based on the California Coastal Commission 2015 guidance, a mid- and high-rate of sea level rise rate were chosen (Figure 4-2 **Error! Reference source not found.**). The rate of sea level rise varies by climate change scenario (e.g., 1-, 2- or 3-ft SLR by 2050), so different acceleration factors were extracted from the FEMA study to adjust the sea level rise component of the shoreline change rates. Once the new position of the shoreline was calculated along each

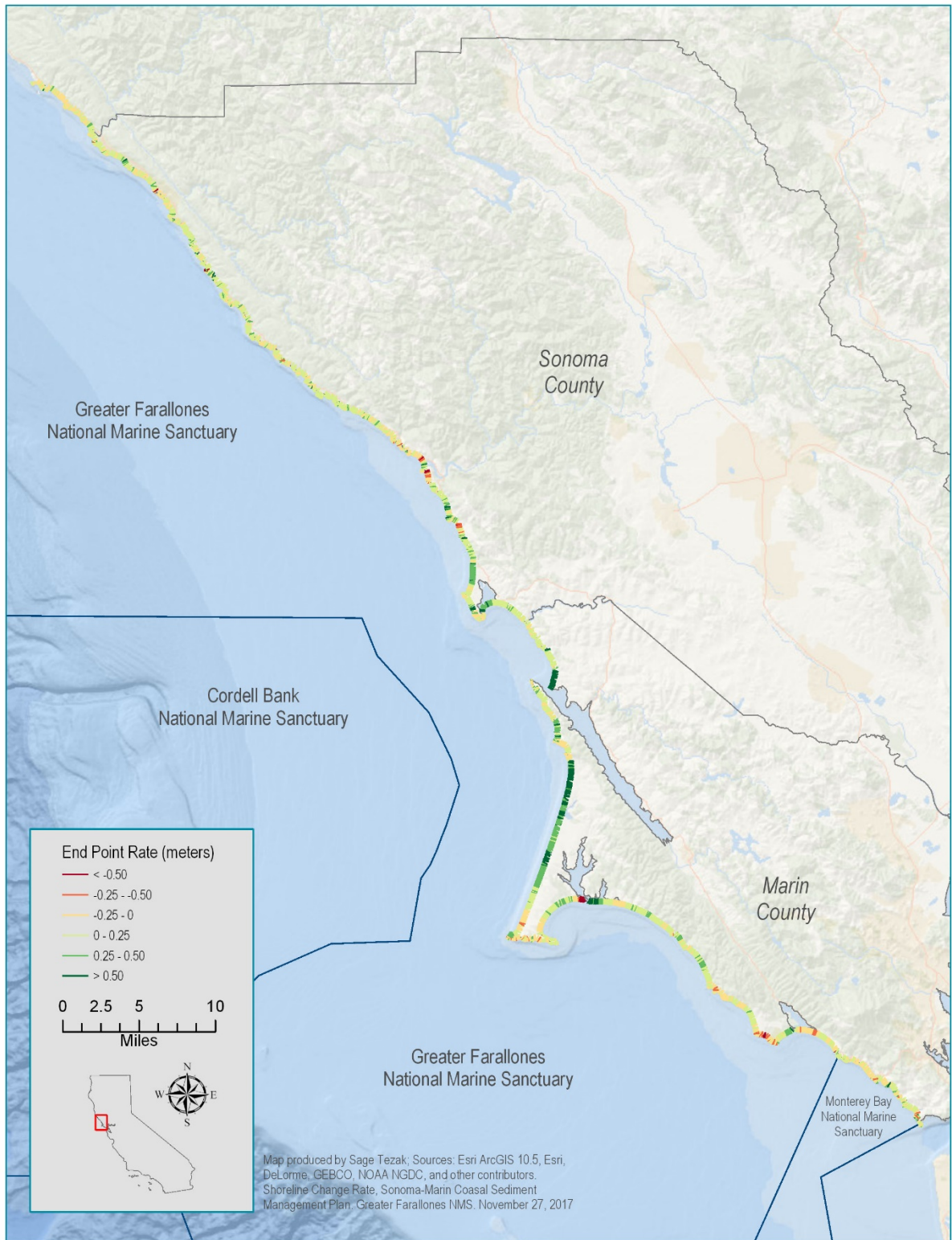


Figure 4-1 Shoreline change analysis within the AOI. Red indicates erosion and green shows accretion.

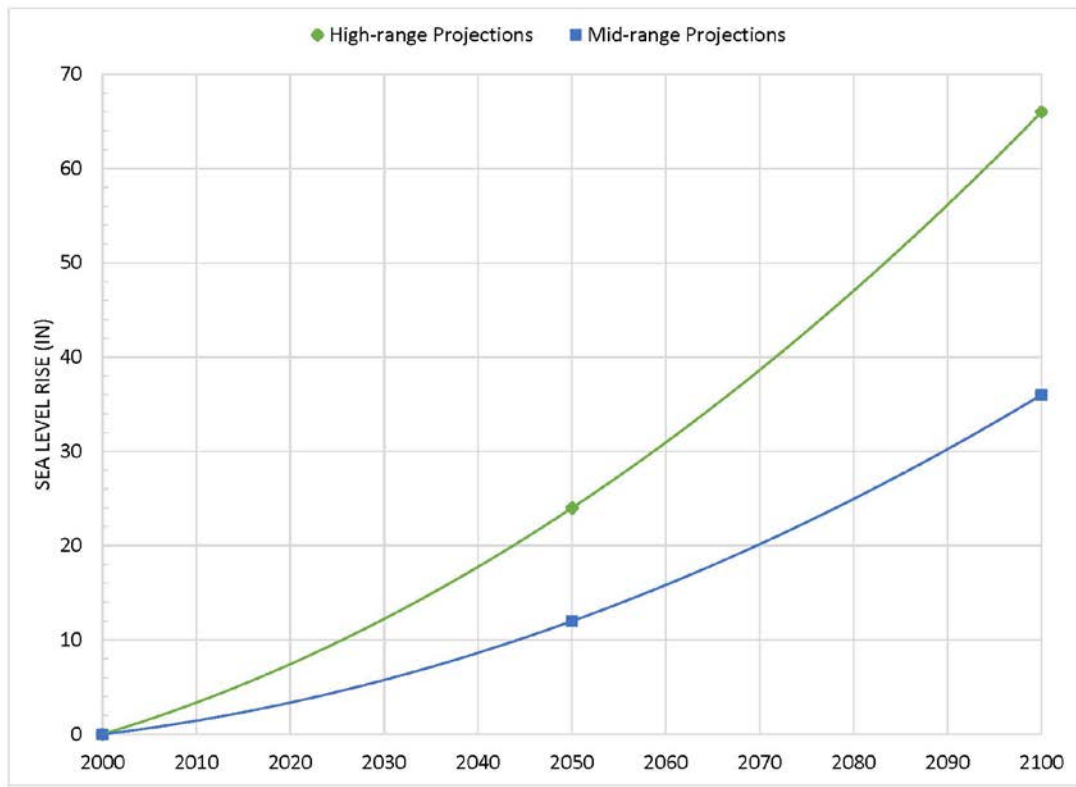


Figure 4-2 Sea level rise curves recommended by the California Coastal Commission (2015) for use in planning coastal activities. High-range projections correspond to a 24- and 66-in rise by 2050 and 2100 respectively. Mid-range projections are 12 and 24 inches for the identical timeframes.

transect, the points were connected to generate a predicted shoreline at the three timeframes for the two climate change scenarios.

Hazard zones were calculated as the area between the most recent shoreline (2013) and the projected shoreline. Features between those lines will likely be affected by sea level rise and potentially damaged, if not lost. A set of critical community features was developed by the SMWG to assess damages through time using geospatial data layers overlaid by the hazard zones (Table 4-3). As identified in the subsequent section, some data were not available for assessment and became data gaps that prevented a fuller understanding of potential damages.

Table 4-3. Community features used for potential damage assessment due to sea level rise

Mileage of roadways (highways & local)
Number of critical structures/functions
1. schools
2. hospitals
3. fire stations
4. water treatment
5. power stations (sub-stations)
Area of critical habitats (proxy for federal and state listed species)
Area of agricultural and open space land
Coastal/marine access points
1. beach access points
2. tidepool access points
3. harbors
4. boat ramps
5. trails
6. kayak launch sites
7. visual access points
Number of visitors annually
Tribal and historical resources
Underrepresented/vulnerable communities

Both sea level rise scenarios increased the number of features at risk in the two counties. The transportation network in Sonoma (Figure 4-3**Error! Reference source not found.**) and Marin (Figure 4-4**Error! Reference source not found.**) is expected to become more disrupted as mileage of damaged roads increases, especially Highway 1 in Sonoma. The acreage of at-risk critical habitat for special species, specifically California red-legged frog, Marbled Murrelet, tidewater goby, Western Snowy Plover, and Yellow Larkspur, increases with the majority of affected critical habitat in Marin, although marbled murrelet habitat is threatened near Salt Point State Park in Sonoma (Figure 4-5**Error! Reference source not found.**). The mileage of at-risk coastal trails is similar for Sonoma (Figure 4-6**Error! Reference source not found.**) and Marin (Figure 4-7**Error! Reference source not found.**) although fewer public access points in Sonoma (Figure 4-8**Error! Reference source not found.**) than Marin (Figure 4-9**Error! Reference source not found.**) are at risk of loss or damage.



The compilation of at-risk community features revealed several locations may be particularly challenged under either sea level rise scenario. Those locations were presented to the SMWG and cross-checked with local knowledge and anecdotal evidence. The scientific analysis and

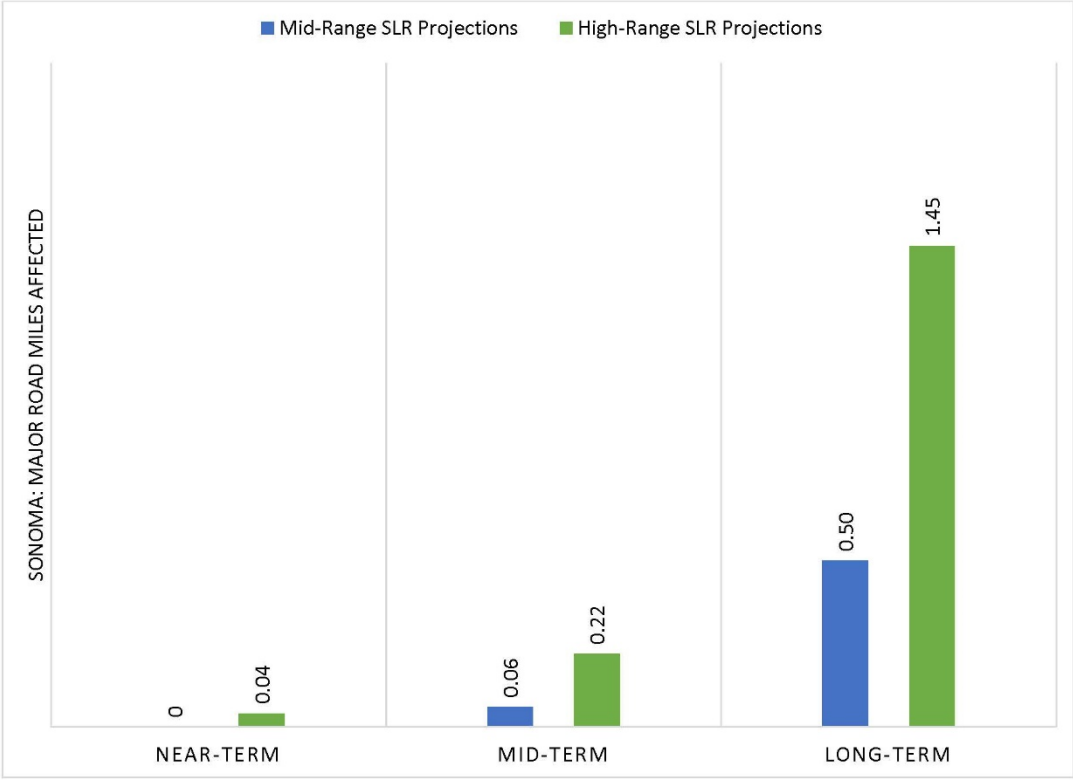


Figure 4-3 Miles of major roads (e.g., Highway 1) in Sonoma affected by sea level rise for the two projections.

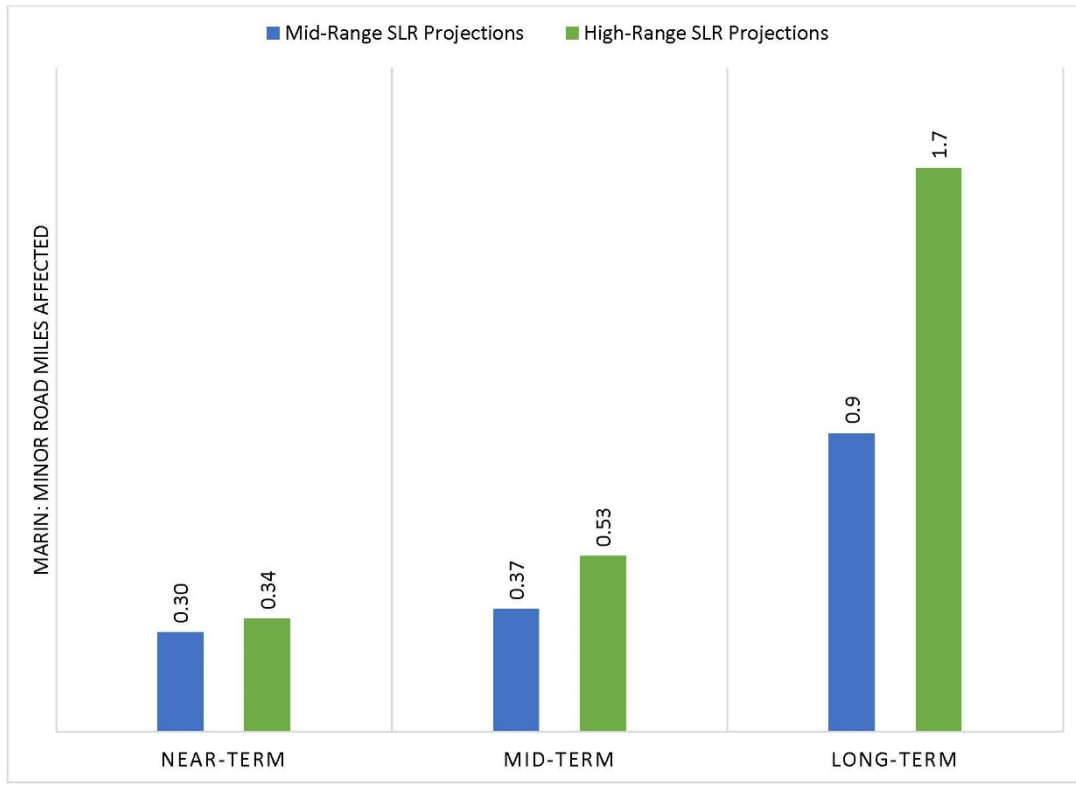


Figure 4-4 Miles of minor roads (e.g., not Highway 1) in Marin affected by sea level rise for the two projections.

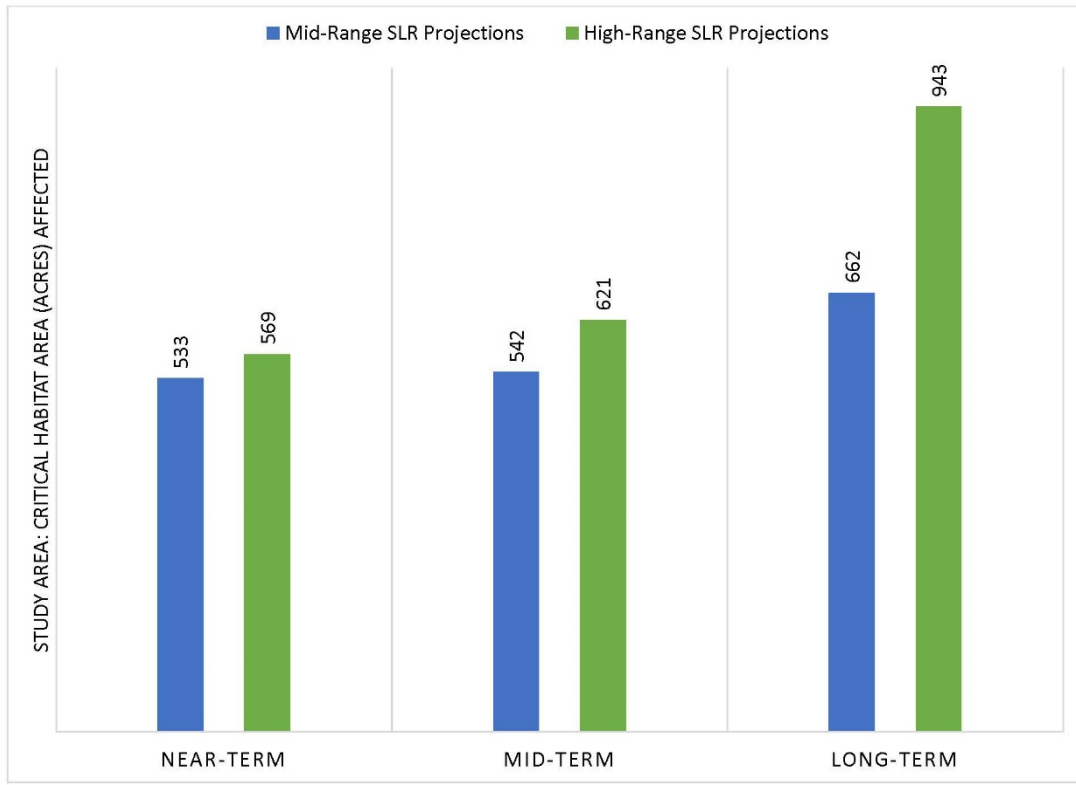


Figure 4-5 Acreage of critical habitat for California red-legged frog, Marbled Murrelet, tidewater goby, Western Snowy Plover, and Yellow Larkspur affected by sea level rise in study area for the two projections. The majority of critical habitat affected is in Marin County whereas Marbled Murrelet habitat is the primary one in Sonoma County near Salt Point State Park.

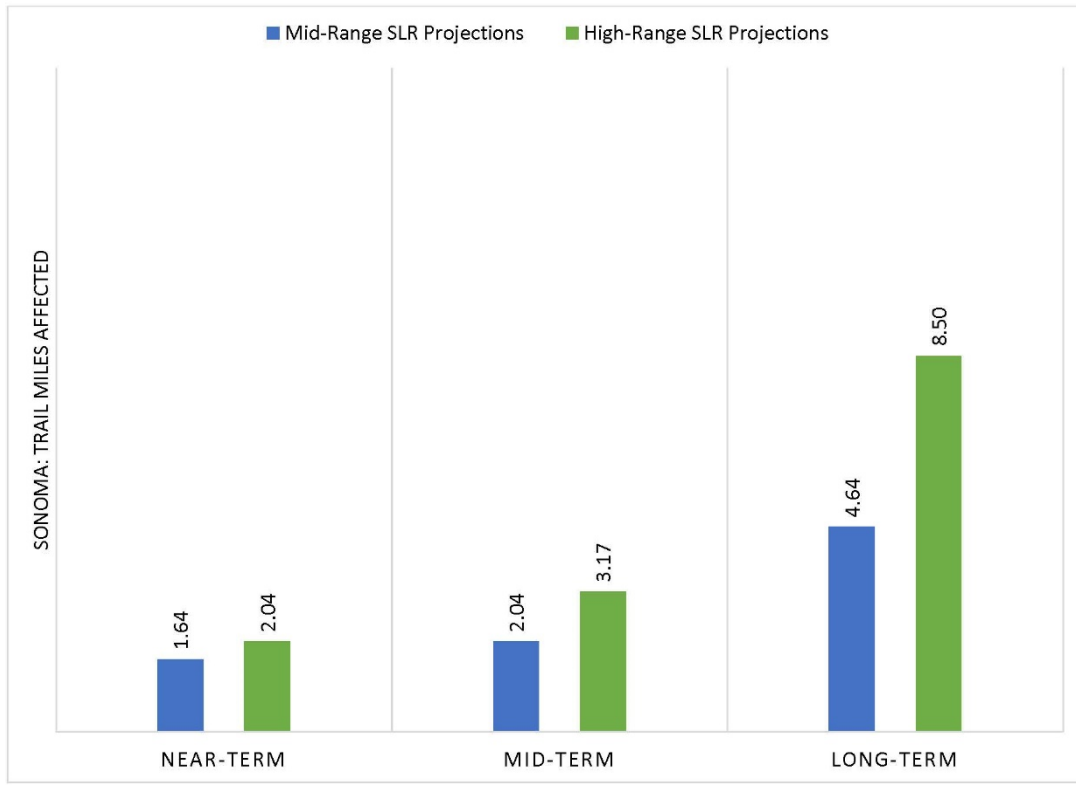


Figure 4-6 Miles of trails in Sonoma affected by sea level rise for the two projections.

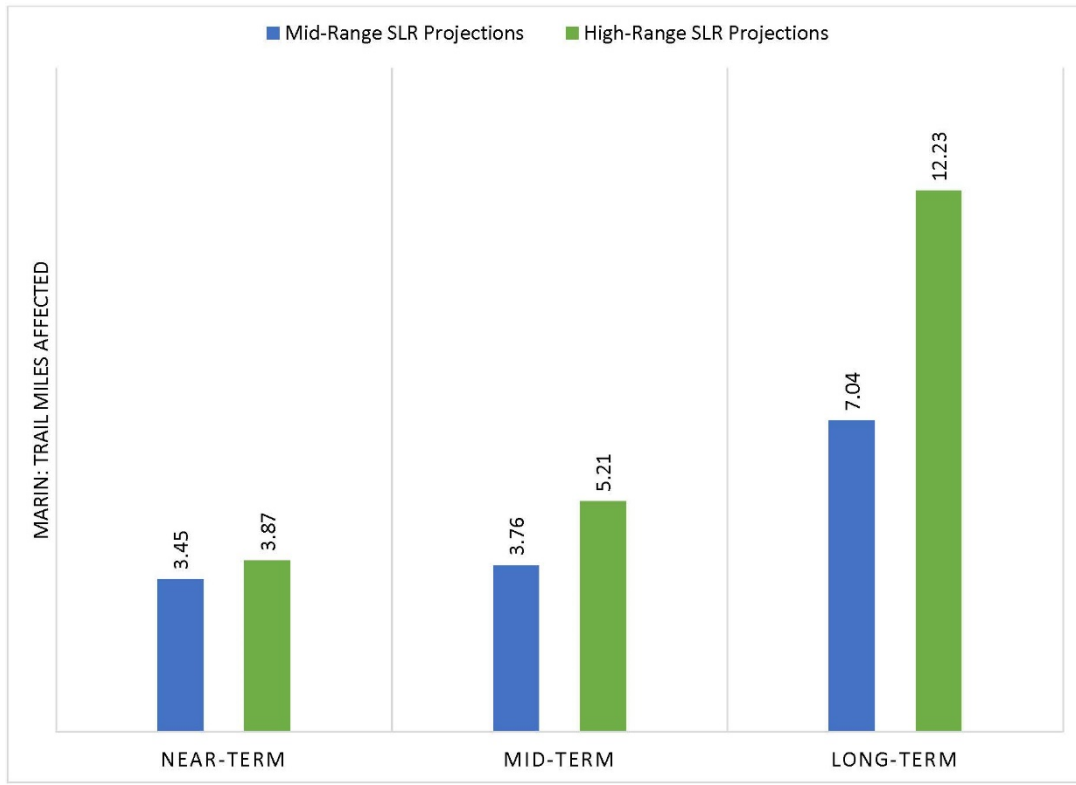


Figure 4-7 Miles of trails in Marin affected by sea level rise for the two projections.

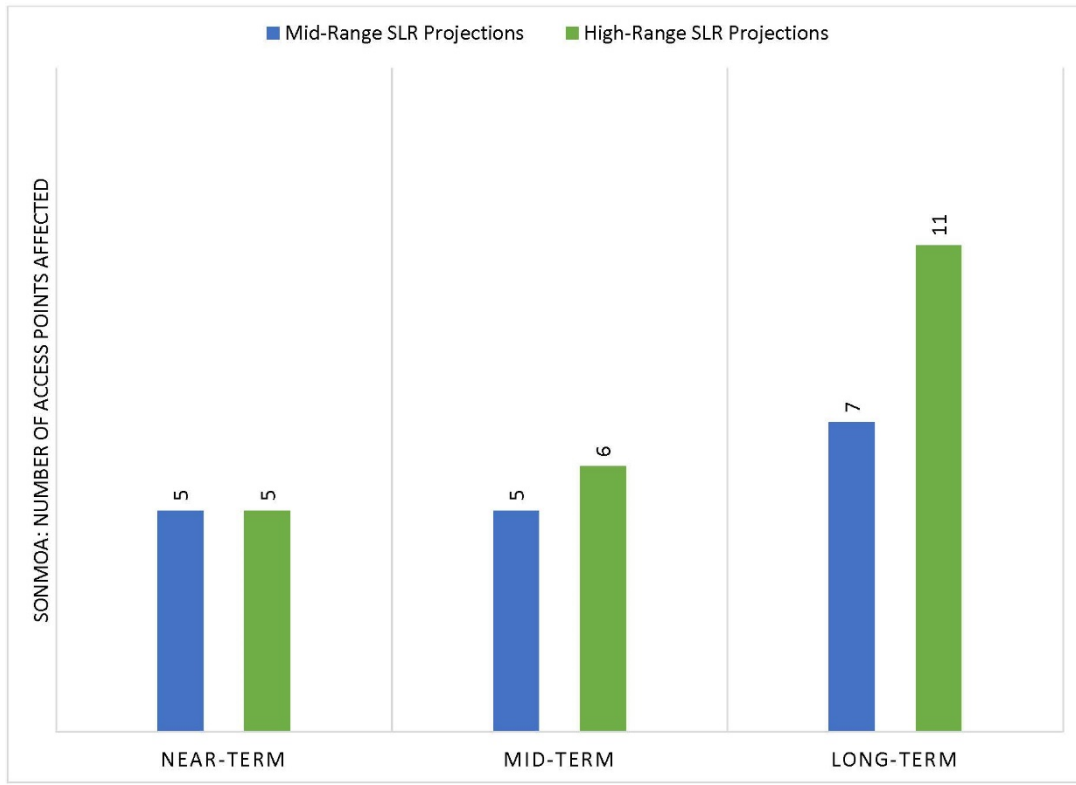


Figure 4-8 Number of public access points in Sonoma affected by sea level rise for the two projections. Access points are defined as those in the California Coastal Commission database.

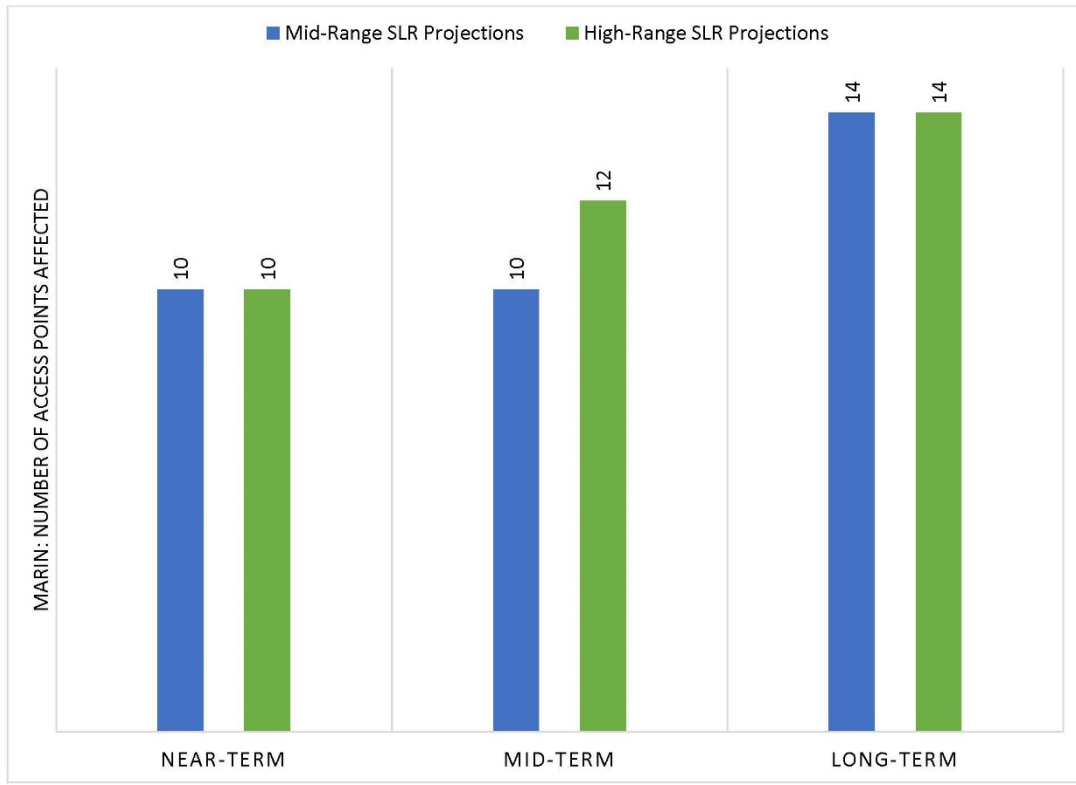


Figure 4-9 Number of public access points in Marin affected by sea level rise for the two projections. Access points are defined as those in the California Coastal Commission database.



community input were merged to produce a final set of sediment challenged locations in need of sediment management actions. Development of the recommendations occurred through multiple revisions of an initial set of ideas by the SMWG (see Appendix B).

### 4.3 Description of Data Gaps

As described in Chapter 2, substantial portions of the study area are missing essential information to perform analyses as part of this CRSMR. These data are grouped by physical, infrastructure and economic, and community features in Table 4-4.

Table 4-4. Data gaps identified through the CRSMR process.

<p><u>Physical</u></p> <p>Coastal watershed input of sediment</p> <p>Erosion rates of cliffs</p> <p>Alongshore transport pathways</p> <p>Vertical land motion</p> <p>Sedimentation rates along coast</p> <p>Characterization of sediment sources – grain size, volume, beach or wetland compatibility (e.g., Bolinas Graben)</p> <p><u>Infrastructure and Economic</u></p> <p>Highway 1 critical locations and planned actions by Caltrans</p> <p>Visitor counts to beaches</p> <p>Potential stockpile locations for sediment</p> <p><u>Community Features</u></p> <p>Geospatial data on tribal and historical resources</p> <p>Geospatial data on underrepresented/vulnerable communities</p>
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## 5 SEDIMENT MANAGEMENT MEASURES

### 5.1 Context for Formulation of Sediment Management Measures

Development of residential, commercial, and industrial zones in erosion-prone coastal regions over the previous century has increased the need for coastal protection measures. Traditionally, those measures have often been either engineered structures (seawalls, rock revetments, and groins) or placing sand in eroding areas. However, armoring or attempting to hold the shore in place through structures create a new set of problems, many of which are incompatible to

maintaining a natural beach system that supports the recreational and tourism economy and coastal ecosystem. Generally, on a natural shore, as the shore erodes, beach width is maintained. However, when structures are built on an eroding shore, passive erosion occurs in which the beach in front of the structure becomes drowned over time as the adjacent shore continues to erode. This results in the structure projecting like a peninsula into the ocean, which blocks lateral (alongshore) access. Identifying more sustainable approaches for preserving the beaches is a key objective of the CRSMR and an overall goal for the CSMW. Several newer mitigation alternatives have been proposed throughout the world that enhance or sustain coastal processes and, as a result, beaches and their associated coastal development. While some development will require engineered structures, providing a suite of options encourages preservation of beach environments wherever possible.

## 5.2 Description and Comparison of Sediment Management Measures

Measure	Definition	Opportunities	Constraints
Beach Nourishment	Placement of approved sediment-water slurry directly on the beach or beach face	Use sediment trapped behind dams, from harbor dredging, or road maintenance  Rebuild dune habitat	Transportation of sediment to receiver sites  Immediate short-term biological impacts  Habitat conversion over long-term
Living Shorelines	Blend of infrastructure and natural habitats; rely on development of natural habitat to protect shore and restore sediment paths	Restoration of natural shoreline cycles and habitats  Create new habitat  Increase sediment retention	Never been done in CA on scale required for northern CA conditions on open coast  Space required (e.g., horizontal levee)
Research and Education	Public engagement on coastal sediment imbalances; can be technical studies on systems or locations	Cross-agency partnerships  Incorporating local expertise and groups	Funding  “Perfect is the enemy of good”

Armor	Built structures with the specific goals of retaining sediment in place (seawalls) or blocking sediment transport (groins)	Increase sediment retention  Support infrastructure  Established engineering approaches	Damage to beach and nearshore environments  Permitting  Not resilient to climate change
Restoration (dunes)	Re-establish vertical and horizontal sand and vegetated mobile habitat	Native restored habitat and sediment reserve  Resilient to climate change and storm damages  Offers protection to development	Very site-specific  Require space that may be already developed
Restoration (wetlands)	Conversion of developed lands back to or into wetlands with connection to coastal processes	Restore native habitat  Increase sediment retention and local reserves  Resilient to climate change*	Physical space  Conflicting listed species  *May not keep pace with SLR if not enough sediment
Dredge	Mechanical movement of sediment deposits from a river, seabed, or other area of water	Supply sediment for other projects  Address multiple issues (navigation, flooding, restoration)	Perception of “cleanliness”  Funding  Storage of material
Managed Retreat	Systematic movement away from anticipated hazardous areas	Restoration of natural shoreline cycles and habitats  Removal/reduction of development in risk zones	Expense  Political will  Property rights  Existing armoring

In addition to the specific measures above, an additional category is “Indirect Sediment Management”, an action whose primary goal is not to directly manage sediment, but results in secondary benefits to sediment delivery, transport, or removal from a coastal location. The opportunities and constraints on this measure are expansive and depend on the activities associated with it. For example, altering a land use plan may be connected to agricultural production economics or soil conservation efforts by landowners and Resource Conservation Districts far outside of the coastal zone; the opportunities and constraints are not related to coastal management concerns.

## 5.3 Potential Sediment Sources

When a sediment management measure involves placement of sediment for beach nourishment or as part of restoration, local supplies are preferred for several reasons: cost, geological and mineralogical similarity, habitat and species connectivity, and visual aesthetics. The study area contains some potential sediment sources that would all require further investigation for compatibility and availability.

- Harbors and Navigation Channels
  - Bodega Harbor, the only harbor or port within the study area, is dredged on a 10-12 year cycle.
  - The USACE dredges the San Francisco Shipping Channel annually that produces 229,000 m<sup>3</sup> (300,000 yd<sup>3</sup>) on average. Currently, this sediment is placed near Ocean Beach, San Francisco.
  - Other regional harbors include those in Humboldt Bay and San Francisco Bay (i.e., Oakland, Richmond).
- Offshore Sand
  - Two known locations of sediment deposits are the Bolinas Graben and offshore of the Russian River.
- Oversaturated Locations
  - Northern Ocean Beach in San Francisco has been accreting extensively over the last decade causing the National Park Service and the City of San Francisco to truck sand from the north to the south of the beach. This sand is within the San Francisco Bay outflow zone and could be used on the Marin side of the Golden Gate.
  - Bolinas Lagoon could provide opportunities for multiple benefits to the ecosystem, including local recreational needs and infrastructure protection through use of accumulated sediment.
- Flood Risk Management Projects and Dams
  - Dredging and cleaning culverts for road asset integrity may provide sediment in localized situations.
- Major Construction Projects
  - Highway 1 stabilization may require large earthworks that could provide considerable volumes of sediment that may end up as landslides if left alone.

- Stockpile Sites
  - An important component of sediment management is identification of stockpile sites where sediment may be stored for use later (e.g., disconnect between dredging window and placement window) or until the volume is of adequate size for project needs and economic considerations.

## 6 REGULATORY AND POLICY CONSIDERATIONS

### 6.1 Section Overview

This chapter provides a general overview of potential laws, regulations, and agencies that would be involved in implementing recommendations. As part of the California Coastal Sediment Master Plan, a Beach Restoration Regulatory Guide (BRRG) (EIC, 2006) was developed to provide an analysis of relevant policies, procedures, and regulations and to assist coastal planners and managers in navigating the regulatory compliance process for beach restoration projects. The BRRG can be found online at: [http://dbw.ca.gov/csmw/PDF/BRRG\\_Final.pdf](http://dbw.ca.gov/csmw/PDF/BRRG_Final.pdf) and should be used in conjunction with the information provided in this section.

### 6.2 Overview of the Regulatory Compliance Process for Sediment Management Projects

Although the precise requirements and process would vary based on the specifics of each project, regulatory compliance can generally be broken down into two major components or processes: 1) Environmental Review and 2) Permitting. These processes along with the applicable laws, regulations, roles and responsibilities of various agencies are summarized. The BRRG (EIC, 2006) should be referred to for more specific guidance on the requirements and necessary steps in carrying out the environmental review and permitting processes for beach-restoration projects.

#### 6.2.1 Environmental Review Process

Environmental review consists primarily of compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA), but also with various other federal and state laws. Environmental review for proposed sediment management measures is typically completed or nearly completed prior to embarking on the permitting process, since the information developed during this phase will be used by permitting agencies in reviewing the project and making permit decisions. Environmental review and permitting should be viewed as an iterative process, and coordination between the permit applicant and regulatory agencies should begin early and reoccur often to ensure that the environmental review documentation will provide the information necessary to satisfy the needs of the permitting and review agencies.

Environmental review will require preparation of either NEPA and/or CEQA documentation. NEPA compliance is required by projects that are sponsored by a federal entity. Compliance with CEQA is required for all projects that necessitate approval or financing by the state or local government or participation by state government. NEPA and CEQA each require preparation of different documentation. Acceptable NEPA documentation could consist of an Environmental Assessment (EA) with a Finding of No Significant Impact (FONSI) or a more comprehensive Environmental Impact Statement (EIS). CEQA documentation would include a Negative Declaration (ND), a Mitigated Negative Declaration (MND), or an Environmental Impact Report (EIR). Compliance with CEQA and NEPA each entails undergoing a specific process and series of requirements (e.g., public notification) and steps to ultimately arrive at a determination of potential environmental impacts associated with a proposed project. A NEPA compliance process flowchart is provided in Figure 6-1 **Error! Reference source not found.** and a CEQA flowchart in Figure 6-2 **Error! Reference source not found.** Although NEPA and CEQA require different documentation, they can be conducted at the same time and combined into a joint NEPA/CEQA document. For additional information, both the NEPA and CEQA compliance processes are both discussed in detail in the BRRG (EIC, 2006). In certain cases environmental review would consist of compliance with both NEPA and CEQA. Although there are many similarities in the implementation of NEPA and CEQA, there are some key differences that are important to understand (Table 6-1).

## 6.2.2 Agencies and Local Jurisdictions Involved in Review and Permitting of RSM Measures

This section summarizes the relevant federal, state and local agencies and municipalities. Specific roles and responsibilities of these agencies, as they pertain to sediment management projects, are described in more detail in Sections 6.2.3 and 6.3. Numerous state and federal regulatory agencies would potentially be involved in reviewing the various sediment management measures identified in this Report although which regulations apply and what agencies are responsible for review or approval will vary from project to project.

Federal agencies primarily involved in conducting, reviewing or approving and permitting potential sediment management measures identified in this Report include: the U.S. Army Corps of Engineers (USACE), National Oceanic and Atmospheric Administration (NOAA) Office of National Marine Sanctuaries, National Parks Service (NPS) and the Bureau of Ocean Energy Management (BOEM). The U.S. Environmental Protection Agency (USEPA) and USACE are the two main federal agencies involved in regulating discharges of fill and dredged material. Numerous other federal agencies are also involved in the review of proposed projects involving the placement of fill in aquatic waters (e.g. for beach restoration or living shoreline projects) and must provide approval before permits can be issued. Any beach nourishment proposed within the boundaries of the Farallones sanctuary, which encompasses the majority of the Sonoma-Marin CRSMR AOI, will require sanctuary review and approval. Similarly, any sediment management projects within the boundaries of the NPS would require their review and approval.

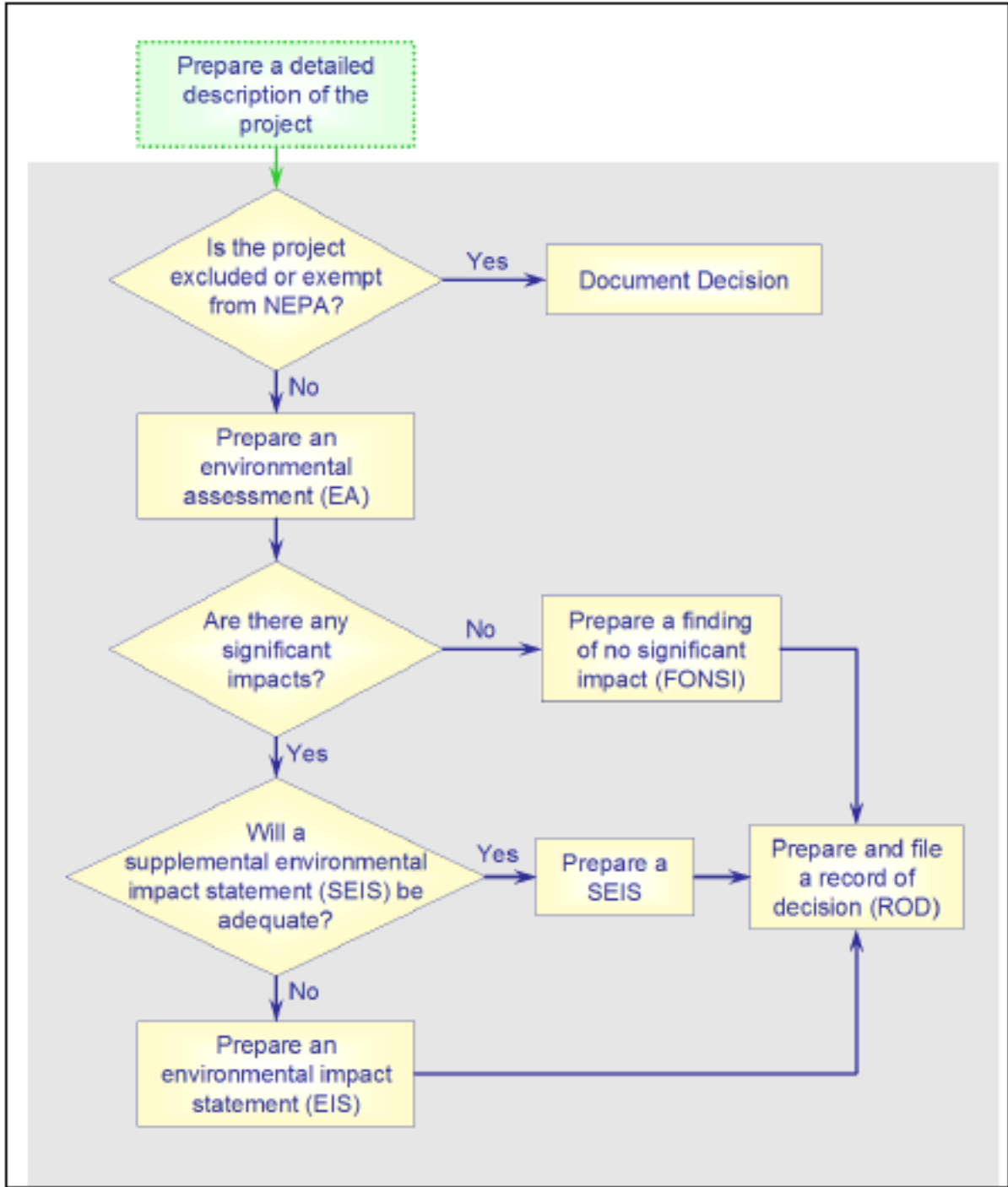


Figure 6-1 NEPA Compliance Flow Chart

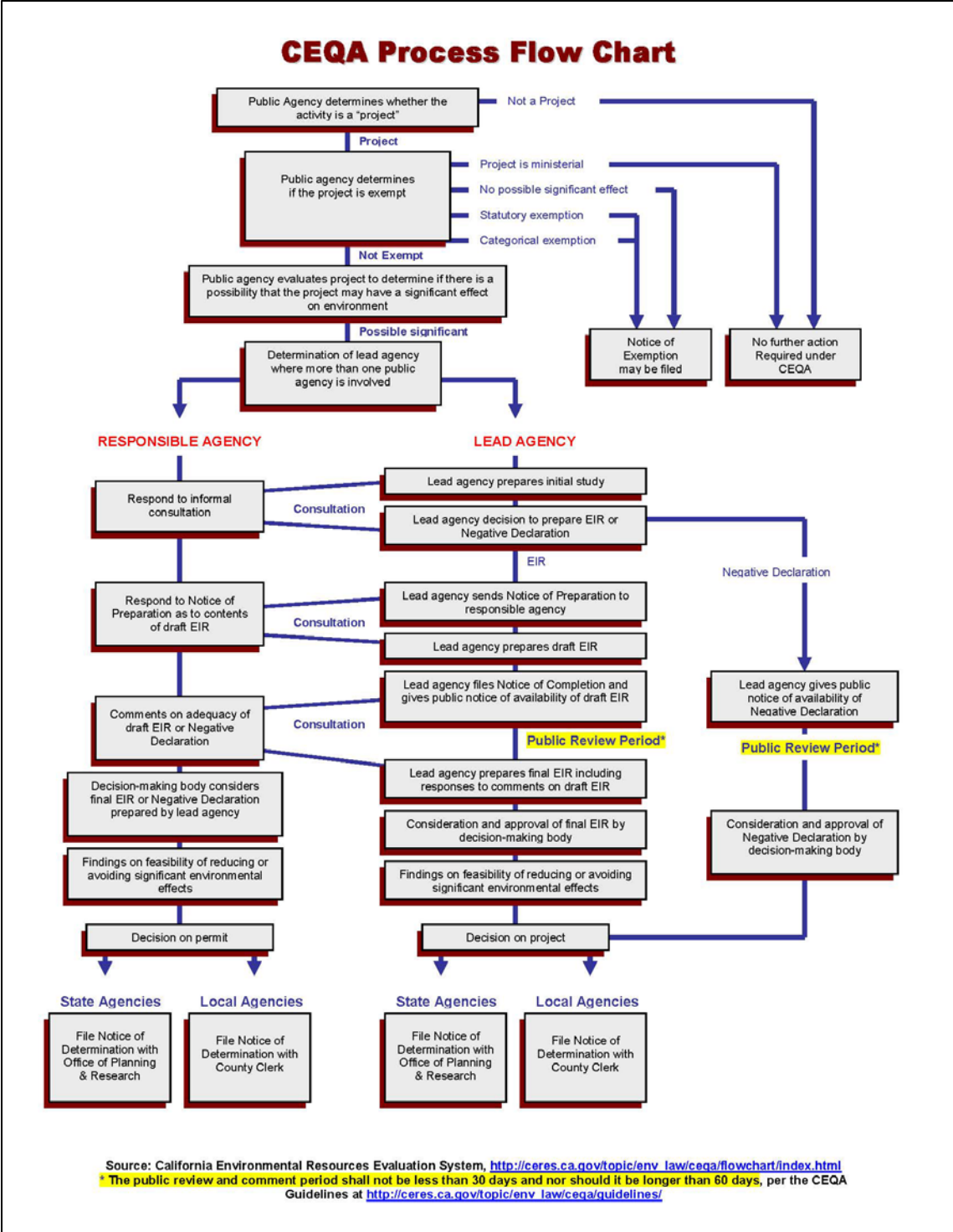


Figure 6-2 CEQA Process Flow Chart



Table 6-1 Key differences between NEPA and CEQA processes.

<b>NEPA</b>	<b>CEQA</b>
Agencies do not have to mitigate impacts	Agencies must mitigate impacts when feasible
Public noticing is not required for a FONSI	Public noticing required for negative declarations
Federal register notification required for draft EIS	Public noticing required for draft EIRs
Federal register notification required for final EIS	Public noticing not required for final EIRs
No time limits for preparation of environmental documents	Some statutes specify time limits for preparation of environmental documents
Record of decision (ROD) must address why the decision was made, and a ROD is not required for EA/FONSI	ROD must explain whether each impact has been mitigated and, if not, why not
Alternatives must be analyzed to a similar level of detail	Alternatives do not have to be analyzed to a similar level of detail as the proposed project
Environmental impact analyses must include an evaluation of reasonably foreseeable indirect and cumulative impacts	Environmental impact analyses do not have to include indirect and cumulative impacts
Document must include integration of other federal environmental laws	Document does not have to include integration of federal other environmental laws but should identify relevant state and local ordinances
<i>Source: Beach Restoration Regulatory Guide (EIC, 2006)</i>	

State agencies primarily involved in reviewing or approving potential sediment management projects recommended in this Report include: the California Coastal Commission (CCC), California State Lands Commission (CSLC), Regional Water Quality Control Board (RWQCB), California Geologic Society (CGS), Department of Parks and Recreation (DPR), and Division of Boating and Waterways (DBW). The RWQCB and the CCC would be the two main State agencies involved in regulating discharges of fill and dredged material. The State agencies with primary regulatory responsibility over shoreline protective structures are the CCC and CSLC. The State Coastal Conservancy and DBW are both involved with funding shoreline maintenance projects and generation of data; the DPR is involved as a land manager; and the CGS is the state agency with responsibility for identifying geologic hazards.

Local municipalities and agencies could also be involved in implementing sediment management measures as well as permitting and review of projects. The local jurisdictions existing within the boundaries of the Sonoma-Marine CRSMR AOI include: the Counties of Marin and Sonoma; Bodega Harbor, which is the only designated Pacific Ocean port for the two counties and is managed by a number of agencies including USACE (responsible for the federal channel), Sonoma County General Services Real Estate Division, Sonoma County Regional Parks, and other Sonoma County offices; and other local and regional agencies, special districts, and other relevant entities.

### 6.2.3 Relevant Laws and Regulations

Depending on the type of project being proposed, the location of the affected area, and the scale of the project, there is a wide range of federal, state and local laws and regulations that could apply to potential sediment management measures, such as beach nourishment or sand-retention structures (Table 6-2).

The primary federal laws to which sediment management projects must comply are the Clean Water Act (CWA), National Environmental Policy Act (NEPA), Coastal Zone Management Act (CZMA), Rivers and Harbors Act (RHA), federal Endangered Species Act (ESA), and Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). Any potential sediment management project in the Sonoma-Marine AOI that falls within the boundaries of the sanctuary must also comply with the National Marine Sanctuary Act (NMSA). Other federal laws may be applied depending on the project location, design, and scope.

The primary state laws and regulations include the California Environmental Quality Act (CEQA), the California Coastal Act (CCA), the California Endangered Species Act (CESA), the California Department of Fish and Wildlife Code, California Public Resources Code, and the Porter-Cologne Water Quality Control Act (PCWQCA). Other federal laws may be applied depending on the project location, design and scope.

## 6.3 Federal Agencies Involved in Reviewing, Approving and/or Implementing Sediment Management Projects

### 6.3.1 NOAA, Greater Farallones National Marine Sanctuary

The Office of National Marine Sanctuaries, a division of NOAA, administers the 13 national marine sanctuaries. A National Marine Sanctuary is a federally designated area within United States waters that protects areas of the marine environment with special conservation, recreational, ecological, historical, cultural, archeological, scientific, educational, or aesthetic qualities. There are two National Marine Sanctuary sites located within the Sonoma-Marine CRSMR AOI. Greater Farallones National Marine Sanctuary (GFNMS) and a small area of Monterey Bay National Marine Sanctuary (MBNMS) managed by GFNMS. GFNMS would be

Table 6-2. Relevant Laws and Regulations Affecting Sediment Management Projects

<b>POLICY/REGULATION</b>	<b>REQUIREMENT</b>	<b>PERMITTING/APPROVING AGENCY</b>
<i>Federal</i>		
NEPA	Compliance	Lead NEPA Agency
CZMA	Coastal Consistency Determination (CCD)	CCC
RHA	Section 10 Permit	USACE
CWA	Section 401 Certification or Waiver (401 Permit)	RWQCBs
CWA	Section 402 NPDES Permit	RWQCBs
CWA	Section 404 Permit (404 Permit)	USACE
ESA <sup>2</sup>	Section 7 Consultation	USFWS or NMFS
NMSA	Sanctuary Permit	GFNMS
MSFCMA <sup>2</sup>	Assessment of Impacts to EFH	NMFS
OCS	Lease Agreement for Utilization of Outer Continental Shelf Sand	BOEM
<i>State</i>		
CEQA	Compliance	Lead CEQA Agency
CCA	Coastal Development Permit (CDP)	CCC
PCWQCA	Compliance Permits under CWA Sections 401, 402, and 404	SWRCB and RWQCBs
California State Lands Public Resources Code	Lease Agreement for Utilization of Sovereign Lands	CSLC
California Public Resources Code	Streambed Alteration Agreement (SAA) (Section 1600)	CDFW
CESA	Section 2081(b) Incidental Take Permit (State); Section 2081.1 Consistency Determination (State and Federal)	CDFW
WQCPs, COP	Consistency Compliance	RWQCBs <sup>3</sup>

<sup>2</sup> Review and compliance is usually triggered through the initial CWA Section 404 permitting process by USACE

<sup>3</sup> The SWRCB has lead responsibility when a project involves jurisdiction by more than one RWQCB

involved in reviewing and permitting any sediment management projects for both sites in the AOI.

GFNMS and MBNMS were designated in accordance with the National Marine Sanctuaries Act (NMSA) (in 1981 and 1992, respectively) and are managed under the authority of the Act. Under the NMSA, GFNMS and MBNMS have the ability to grant permits for prohibited activities and enforce regulations, provided that the activities meet certain criteria such as having, at most, short-term and negligible adverse effects on sanctuary resources and qualities (15 CFR Part 922, Subpart H, Subpart M). The mission of the sanctuaries, to understand and protect the ecosystem and cultural resources of central California, is carried out through resource protection, research, education, and public use. As such, the Sanctuaries address a wide range of resource protection issues within their boundaries, and reduce or prevent detrimental human impacts on sanctuary resources through collaborative partner efforts, regulations and permits, emergency response, enforcement and education.

The Farallones sanctuary implements and enforces seventeen federal regulatory prohibitions within the GFNMS area and fourteen prohibitions within the northern MBNMS area designed to preserve and protect the natural and cultural resources and qualities of the ocean and estuarine areas within the boundaries of the sanctuaries. Depending upon the nature of the project, there are six of these prohibitions (which are the same for both GFNMS and MBNMS) that could pertain to potential RSM measures in the Sonoma-Marin CRSMR AOI, and thus trigger the need for GFNMS review and permitting. These are summarized below:

- 1) *Discharging or depositing, from within or into the Sanctuary, any material or other matter (with the exception of certain activities, such as fish parts from lawful fishing activities, treated vessel sewage, clean deck wash down, etc.)*<sup>4</sup>
- 2) *Discharging or depositing, from beyond the boundary of the Sanctuary, any material or other matter that subsequently enters the Sanctuary and injures a Sanctuary resource or quality (with the exception of several activities unlikely to be applicable to the measures evaluated in this Report).*
- 3) *Drilling into, dredging or otherwise altering the submerged lands of the Sanctuary; or constructing, placing, or abandoning any structure, material, or other matter on or in the submerged lands of the Sanctuary (with the exception of several activities, such as boat anchoring, lawful fishing, certain types of aquaculture activities, and harbor maintenance projects).*
- 4) *Taking or possessing (disturbing or injuring) any marine mammal, sea turtle, or bird within or above the Sanctuary, except as authorized by the Marine Mammal Protection Act, Endangered Species Act, or Migratory Bird Treaty Act (regardless of intent).*
- 5) *Possessing, moving, removing or injuring a Sanctuary historical resource, or attempting such actions.*
- 6) *Introducing or otherwise releasing from within or into the Sanctuary an introduced species (with the exception of striped bass and some shellfish species approved for aquaculture).*

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<sup>4</sup> In MBNMS, an additional discharge exception includes the disposal of dredged material at EPA-designated disposal sites that were created prior to January 1, 1993; this exception does not exist in the GFNMS regulations

In MBNMS, proposed RSM activities that do not meet the permit procedures and criteria described under Title 15 CFR 922.133, may qualify for separate regulatory approval to authorize any valid Federal, State, or local lease, permit, license, approval, or other authorization issued (15 CFR 922.49), known as an “authorization”. A request for an authorization may be approved under special circumstances for activities otherwise prohibited by Sanctuary regulations. There are several conditions that need to be met, including but not limited to: (1) The applicant notifying the Director (designated Superintendent) in writing within fifteen days of the date of filing of the application; (2) the Director notifying the applicant and authorizing agency that he or she does not object to issuance of the authorization (or amendment, renewal, or extension); and (3) the applicant complies with any terms and conditions the Director deems reasonably necessary to protect Sanctuary resources and qualities. For example, in cases where proposed projects require a California Coastal Commission Coastal Development Permit (or another relevant permit issued by a state or federal agency), but would otherwise be prohibited by MBNMS regulations and does not qualify as “permitted” activity, an application can be sent concurrently to NOAA requesting an authorization. If the Coastal Development Permit is issued, and the procedures required by NOAA under the authorization authority at 15 CFR 922.49 are followed, then the Director can “authorize” a prohibited activity, but may set additional terms and conditions for compliance by the applicant. It should be noted that the “authorization” authority is not applicable within GFNMS, meaning that any proposed RSM activity must comply with GFNMS permit procedures and criteria.

### 6.3.2 U.S. Army Corps of Engineers (USACE)

The USACE has regulatory authority over activities involving waters of the U.S. pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbor Act. This includes the regulation of any development or structure that may cause obstructions to U.S. navigable waters, or placement of fill or dredged material. Under Section 404 there are two types of applicable permits that are required: for larger-scale projects with the potential to cause significant impacts, an individual permit is typically required; for activities with minimal potential environmental impacts a general permit is usually required.

The USACE is the chief decision-making agency for beach nourishment projects (in consultation with the USEPA). For USACE to approve a project, the proponent must demonstrate that the proposed project is the “least environmentally damaging practicable alternative.” Additionally, under Section 404 permitting, either an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) is required for beach nourishment projects. The USACE disposal-related regulations are located at 33CFR 320-330 and 33 CFR 335-338. For more information on USACE policies, procedures, and regulations refer to the CSMW’s Beach Restoration Regulatory Guide (EIC, 2006).

### 6.3.3 U.S. Environmental Protection Agency (USEPA)

As noted above, the USEPA is one of the lead federal agencies involved in regulating discharges of fill and dredged material. The relevant USEPA regulations are included in 40 CFR Sections

220-229. The USEPA is responsible for developing and interpreting environmental criteria used to evaluate permit applications, identifying activities that are exempt from permitting, reviewing/commenting on individual permit applications, and enforcing Clean Water Act Section 404 provisions. The USEPA also has authority to veto USACE permit decisions.

The USEPA has developed reference documents (in coordination with the USACE) that contain more specific procedures for implementing the 404(b)(1) Guidelines. The most important reference document used in review of potential beach nourishment projects pursuant to Section 404 of the CWA is referred to as the Inland Testing Manual (ITM), which contains up-to-date procedures to complete the requirements in the CWA Section 404(b)(1) Guidelines for evaluation of potential contaminant-related impacts associated with the discharge of dredged material. CWA Section 404 provides for testing of dredged or fill material under certain circumstances, and the ITM provides suggested protocols to follow once it has been decided that testing is appropriate.

#### 6.3.4 NOAA National Marine Fisheries Service (NMFS)

NMFS is responsible for managing, protecting, and conserving living marine resources and their habitat throughout the Exclusive Economic Zone (typically, waters between 3 and 200 miles offshore). NMFS provides consultations on marine species pursuant to Sections 7 and 10 of the federal ESA, which governs potential impacts to species and habitats that are either federally listed or proposed for listing. NMFS also reviews project proposals for their potential impacts to Essential Fish Habitat (EFH) as designated under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (MSFMCA). Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is also responsible for protection of most marine mammal species found in the Sonoma-Marin CRSMR AOI, with the exception of the southern sea otter (*Enhydra lutris*), which is under the jurisdiction of the USFWS. With respect to the implementation of potential sediment management measures, the main activities that require NMFS review would be from construction or dredging activities that may impact fish, marine mammals, or fish habitat.

#### 6.3.5 U.S. Fish and Wildlife Service (USFWS)

Similar to NMFS, the USFWS plays a consultative role under Sections 7 and 10 of the federal Endangered Species Act (ESA), as well as the MMPA. Pursuant to the ESA, the lead agency responsible for environmental review of a proposed project is required to determine whether or not any species listed as either threatened or endangered under the ESA are present and to determine whether the project will cause any potentially significant impacts on that species.

The USFWS and NMFS are guided by the same set of regulations under the ESA; however each agency is exclusively responsible for different listed species. The USFWS has jurisdiction over terrestrial species, birds, and sea otters, and NMFS is responsible for all other marine mammals and marine species. If the lead agency responsible for the project were a federal agency, then a Section 7 consultation would occur. Otherwise the project proponent would need to complete a Habitat Conservation Plan (HCP) and submit it to the USFWS for review and approval.

### 6.3.6 U.S. Coast Guard (USCG)

The USCG is charged with ensuring safety and security along the U.S. coastline with respect to navigation, management of waterways, and protection of natural resources. The USCG typically is involved with reviewing proposals for structures to be located underwater to ensure that they do not interfere with navigation or present other hazards. Potential USCG involvement with shoreline restoration and protection projects would involve consulting with USACE as required under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act.

### 6.3.7 National Park Service (Golden Gate National Recreation Area (GGNRA) and Point Reyes National Seashore (PRNS))

The National Park Service (NPS) manages all national parks, many national monuments, and other conservation and historical properties with various title designations. The NPS was created by Congress through the National Park Service Organic Act and is an agency of the United States Department of the Interior. The NPS is charged with a dual role of preserving the ecological and historical integrity of the places entrusted to its management, while also making them available and accessible for public use and enjoyment.

There are two different national parks within the Sonoma-Marin CRSMR AOI: the Golden Gate National Recreation Area (GGNRA) and the Point Reyes National Seashore (PRNS). The GGNRA protects 332 km<sup>2</sup> (82,027 acres) of ecologically and historically significant landscapes surrounding the San Francisco Bay Area. Point Reyes National Seashore is a 287 km<sup>2</sup> (71,028-acre) park preserve located on the Point Reyes Peninsula in Marin County, California. Sediment management measures may require a NPS permit, such as a scientific research permit, collecting permit, or other approval, depending on the location, scope, and design of the project.

### 6.3.8 Bureau of Ocean Energy Management (BOEM)

The primary responsibility of BOEM is to manage the exploration and development of offshore energy and marine mineral resources on the U.S. Outer Continental Shelf (OCS). In addition to its offshore energy responsibilities, BOEM manages appropriate access to OCS marine minerals such as sand and gravel for coastal restoration projects.

BOEM may be involved in beach nourishment or restoration projects where the source of sand is located in federal waters on the OCS. State and local governments and other federal agencies negotiate directly with BOEM when OCS sand is needed for projects, such as beach nourishment, that benefit the public. As of the writing of this Report, BOEM has authorized more than 106 million m<sup>3</sup> (139 million yd<sup>3</sup>) of OCS material for 52 coastal restoration projects in eight states to restore more than 303 miles of the nation's coastline.

### 6.3.9 U.S. Forest Service (USFS)

The United States Forest Service (USFS) is an agency of the U.S. Department of Agriculture that administers the nation's 154 national forests and 20 national grasslands, which encompass 193

million acres. Major divisions of the agency include the National Forest System, State and Private Forestry, Business Operations, and the Research and Development branch. Managing approximately 25% of federal lands, it is the only major national land agency that is outside the U.S. Department of the Interior. There are nine regions in the USDA Forest Service. The region that falls within the Sonoma-Marín CRSMR AOI is the Pacific Southwest Region, region 5, which covers two states (California and Hawaii), eighteen National Forests and one Management Unit.

The agency's mission is to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations. The USFS provides leadership in the protection, management, and use of the nation's forest, rangeland, and aquatic ecosystems. Through implementation of land and resource management plans, the agency ensures sustainable ecosystems by restoring and maintaining species diversity and ecological productivity that helps provide recreation, water, timber, minerals, fish, wildlife, wilderness, and aesthetic values for current and future generations of people. The USFS also provides several landowner assistance programs and partnerships to assist private landowners and rural communities care for their forests, strengthen local economies, and maintain a high quality of life.

## 6.4 State Agencies Involved in Reviewing, Approving and/or Implementing Sediment Management Projects

### 6.4.1 California Coastal Commission (CCC)

The CCC, in collaboration with local counties and cities, is the primary state agency responsible for planning and regulating the use of land and water within California's Coastal Zone, in accordance with the specific policies of the CCA and consistent with the CZMA. Any proposed sediment management projects located within the coastal zone must be reviewed for consistency with the CCA and would require a Coastal Development Permit, which involves stringent review of the project by CCC staff. In addition to development within the state's coastal zone, the CCC also has jurisdiction over projects requiring federal permits or approval in federal waters.

The CCC was established to assist local governments in implementing local coastal planning and regulatory powers by adopting Local Coastal Programs (LCPs). An LCP consists of one or more Land Use Plans (LUP) with goals and regulatory policies as well as a set of Implementing Ordinances. The CCA requires local jurisdictions to prepare and submit an LCP; once the CCC approves the LCP, then that local jurisdiction has coastal permitting authority. As of the writing of this Report and within the project AOI, the counties of Marin and Sonoma both have approved LCPs and therefore permitting authority. The CCC, however, holds permitting authority over Sovereign Lands, which are submerged lands seaward of the Mean High Tide (MHT) line and those not in within the LCP area. Any projects located on sovereign lands below the MHT line are within CCC appeal jurisdiction (as are lands between the ocean and the first public road). Therefore in many cases, two permits may be necessary – one from the local jurisdiction with a certified LCP and one from the CCC. Most of the sediment management measures being



evaluated in this Report, including beach nourishment, would require CCC approval and a permit from the local jurisdiction with an approved LCP.

All structures in the coastal zone require CCC approval pursuant to CCA Section 30106, which regulates coastal development. The definition of development in the CCA is very broad and would encompass many potential coastal protection and restoration measures including beach nourishment, beach dewatering devices, submerged breakwaters, perched beaches, seawalls or revetments, groins, and emergent breakwaters.

The CCC is also mandated to protect views as well as to maintain public access and enhance recreational opportunities. Consequently, sediment management projects that have potentially significant visual impacts (e.g. groins or emergent breakwaters), or public safety or access issues would be reviewed subject to relevant policies of the CCA.

#### 6.4.2 California State Lands Commission (CSLC)

The CSLC was established in 1938 with authority detailed in Division 6 of the California Public Resources Code. It manages nearly 4 million acres of Sovereign Lands underlying California's navigable and tidal waterways, which include over 120 rivers, streams, and sloughs, tidal navigable bays and lagoons, and submerged lands along the entire coastline of the state between the MHT line and three nautical miles offshore.

Any proposed project with infrastructure that would encroach onto CSLC lands, such as a coastal protective structure, would require a General Lease from the CSLC. For beach nourishment borrow sites located on CSLC lands, a Mineral Extraction Lease may also be required.

#### 6.4.3 State Water Resources Control Board (SWRCB) and Regional Water Quality Control Board (RWQCB)

The SWRCB has jurisdiction throughout California. Created by the State Legislature in 1967, the Board protects water quality by setting statewide policy. Pursuant to the Porter-Cologne Act, there are nine regional water quality control boards that have primary responsibility for individual permitting, inspection, and enforcement actions within each of nine hydrologic regions. The SWRCB provides program guidance and oversight, allocates funds, and reviews RWQCB decisions. The North Coast Regional Water Quality Control Board (Region 1) would be the main office conducting permitting and review of potential sediment management projects in the Sonoma-Marine CRSMR AOI.

It is the responsibility of the RWQCBs to preserve and enhance the quality of the State's waters through the development of Water Quality Control Plans (Basin Plans) and the issuance of Waste Discharge Requirements (WDRs), which are required by the California Water Code. The WDRs issued by the RWQCBs, are subject to review by the SWRCB, but do not need the State Water Board's approval before becoming effective.

Any projects requiring a Clean Water Act Section 404 permit from USACE will require Section 401 Water Quality Certification by the RWQCB. Therefore, beach nourishment projects require the project sponsor to obtain a water quality certification from the corresponding RWQCB to be issued a permit. Additionally, the RWQCB requires all construction projects with the potential to disturb one or more acres of land to obtain a General Permit for Storm Water Discharges from Construction Activity. The Storm Water Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP identifies Best Management Practices (BMPs) for reducing or eliminating pollutants in runoff that discharges into waterways and storm drains.

#### 6.4.4 California Department of Fish and Wildlife (CDFW)

CDFW maintains the California list of threatened and endangered species. Under the California Endangered Species Act (CESA) it is illegal to take any species that are listed by the State as endangered and threatened. Take is defined roughly as any activity resulting in direct mortality, permanent or temporary loss of occupied habitat that would result in mortality, disruption in reproduction to one or more individuals of the species, or avoidance of the habitat resulting in the same as above. CDFW may evaluate a proposed sediment management project's potential to negatively affect species listed as either endangered or threatened in the state. In certain cases, an Incidental Take Permit may also be required. CDFW often becomes involved in proposed projects through reviewing and commenting on EIRs or EISs.

#### 6.4.5 Department of Parks and Recreation (DPR)

The DPR is responsible for the management and protection of natural and cultural resources and facilitating outdoor recreational opportunities within its numerous State Park units. State Park units in the Sonoma-Marine CRSMR AOI include Tomales Bay State Park, Sonoma Coast State Park (including Bodega Head, Salmon Creek Beach, Wright's Beach, Sonoma Coast State Beach, and Goat Rock Beach), Fort Ross State Historic Park, Salt Point State Park, Manchester Beach State Park, Schooner Gulch State Beach, Kruse Rhododendron State Nature Reserve, and Marconi Conference Center State Historic Park.

Any project located on or affecting state parkland would require approval by DPR in the form of an Encroachment Permit. In addition to the agency's permitting authority, DPR has several policies regarding coastal erosion and development that are relevant to the RSM recommendations in this Report. The following excerpt from the Policy on Coastal Erosion from the DPR Operations Manual, Chapter 3, Natural Resources, (updated September 2004) provides guidance regarding coastal erosion and development within parks:

*0307.3.2.1 Coastal Development Siting Policy*

*It is the policy of the Department that natural coastal processes (such as wave erosion, beach deposition, dune formation, lagoon formation, and sea cliff retreat) should be allowed to continue without interference. The Department shall not construct permanent new structures and coastal facilities in areas*

*subject to ocean wave erosion, sea cliff retreat, and unstable cliffs. New structures and facilities located in areas known to be subject to ocean wave erosion, sea cliff retreat, or unstable bluffs shall be expendable or movable. Structural protection and re-protection of existing developments is appropriate only when:*

*a. The cost of protection over time is commensurate with the value of the development to be protected, and*

*b. It can be shown that the protection will not negatively affect the beach or the near-shore environment.*

*Where existing developments must be protected in the short run to achieve park management objectives, including high-density visitor use, the Department should use the most natural-appearing method feasible, while minimizing impacts outside the threatened area. Any shoreline manipulation measures proposed to protect cultural resources may be approved only after an analysis of the significance of the cultural resource and the degree to which proposed measures would impact natural resources and processes, so that an informed decision can be made through an assessment of alternatives and long term costs.*

#### 6.4.6 Division of Boating and Waterways (DBW)

The DBW was established in 1957 upon enactment of legislation that established a state boating agency dedicated to all aspects of recreational boating and a special fund (Harbors and Watercraft Revolving Fund) to fund the division's activities. The DBW became part of DPR in 2015 and is responsible for planning, developing, and improving facilities on state-owned and state-managed properties, including those on State Parks and State Water Project properties. It also provides funding so that local agencies can renew deteriorated facilities or develop new public access. The DBW is heavily involved in furthering environmentally sound boating practices through its clean and green programs. In addition, it is involved in research on climate change and wave prediction as they relate to navigation and coastal protection.

The DBW is responsible for studying and reporting beach erosion issues in the state, and for developing measures to stabilize the shoreline pursuant to Article 2.5 of the Harbors and Navigation Code. Following the passage of the Public Beach Restoration Act (1999) is responsible for allocating funds for beach restoration projects.

The DBW reviews certain projects that have the potential to present a hazard to boaters, potentially including certain RSM and coastal protection recommendations in this plan. Although the DBW is not involved in projects from a regulatory standpoint, the agency plays the primary role in funding local projects and providing technical information.

#### 6.4.7 California Department of Forestry and Fire Protection

The California Department of Forestry and Fire Protection (Cal Fire) is a department of the California Natural Resources Agency. Cal Fire is responsible for fire protection and stewardship of over 125,000 km<sup>2</sup> (31 million acres) of California's privately owned wildlands. In addition,

Cal Fire provides emergency services in 36 of the State's 58 counties via contracts with local governments.

The primary job of Cal Fire is to provide fire protection for the State Responsibility Area (SRA). SRA lands are defined by the Public Resource Code of the state first, as, "covered wholly or in part by forests or by trees producing or capable of producing forest products." Second, they are "those covered wholly or in part by timber, brush, undergrowth, or grass, whether of commercial value or not, which protect the soil from excessive erosion, retard runoff of water or accelerate water percolation, if such lands are sources of water which is available for irrigation or for domestic or industrial use." Finally, they are "lands in areas which are principally used or useful for range or forage purposes, which are contiguous to" the lands described above. The State Board of Forestry and Fire Protection determines what lands are included in the SRA and their decisions have the force of law.

Cal Fire oversees enforcement of California's forest practice regulations, which guide timber harvesting on private lands. Department foresters review an average 500 to 1,400 Timber Harvesting Plans (THPs) and conduct over 6,500 site inspections each year. THPs are submitted by private landowners and logging companies who want to harvest their trees. The reviews and inspections ensure protection of watershed and wildlife, as well as renewal of timber resources. Cal Fire may be involved in coordinating, reviewing, and approving some recommendations in this Report.

## 6.5 County/Local level

### 6.5.1 Sonoma County

The Sonoma County Permit and Resource Management Department (PRMD) is the county office responsible for permits in Sonoma County. Any land development or construction that takes place in the unincorporated area of Sonoma County (outside the nine incorporated cities) is reviewed, permitted, and inspected by the Sonoma PRMD. The Planning Division of the PRMD is responsible for Zoning in unincorporated Sonoma County. It works to develop and implement the Sonoma County General Plan, Local Coastal Plan and other adopted Area Plans or Specific Plans. It evaluates the environmental impacts of private development proposals and public projects, such as bridges, roads, and airport projects. It reviews new development proposals for conformance with the County's General Plan and Zoning Code Regulations. Sonoma County has an LCP, which was originally certified in 1981, and any RSM projects within the coastal zone would likely require a Coastal Permit.

For certain indirect sediment management measures recommended by this Report, the Sonoma County Department of Agriculture, Weights and Measurements may be involved in reviewing and approving proposed activities to ensure they are consistent with the Sonoma County Vineyard and Orchard Site Development Ordinance, also known as VESCO, as well as Agricultural Grading and Drainage ordinances as established by the Sonoma County Code.

## 6.5.2 Marin County

The Marin County Community Development Agency (CDA) is the county agency tasked with regulating land use and reviewing development in Marin County. This agency also conducts project environmental review pursuant to state and federal law, and local regulations. The RSM recommendations in this Report may require review and approval by the Marin County CDA and a one or more permits, such as Design Reviews, Variances, Coastal Permits, Use Permits, and Subdivisions.

Marin County has a certified Local Coastal Plan (LCP), which was originally approved in 1982. Under the Marin County's LCP, the County assumes responsibility for reviewing and issuing Coastal Permits for development within its jurisdiction area. Thus, RSM projects in the coastal zone would likely require a Coastal Permit.

## 6.6 Resource Conservation Districts (RCDs)

RCDs are the entity created by the State of California (Division 9 of the California Public Resources Code) to help private landowners best manage their natural resources. RCDs were formed in the 1930s and currently provide non-regulatory confidential assistance to landowners with the goal of accomplishing voluntary stewardship of private lands. RCDs provide comprehensive services, including technical assistance to land owners and natural resource management professionals, outreach and education, planning, development, implementation of conservation projects, and permitting and permit coordination. RCDs may play a role in implementing the recommendations in this Report through facilitating agreements between private landowners and other public entities, securing funding, and partnering with stakeholders across the region on monitoring, education, and outreach efforts.

# 7 RECOMMENDATIONS FOR REGIONAL SEDIMENT MANAGEMENT

The recommendations for sediment management in the AOI are divided into regional and site-specific categories. The 17 regional recommendations span the entire study area and promote a comprehensive approach to sediment management. The 14 site-specific recommendations (Table 7-1) contain some locations with geographically linked sub-sites (Figure 7-1 **Error! Reference source not found.**).

Table 7-1. Locations of site-specific recommendations

<b>Site ID</b>	<b>Site Name</b>
1	Gualala River
2	The Sea Ranch
3	Salt Point State Park
4	Fort Ross Historic Park
5A	Russian River Zone – Driftwood Beach
5B	Russian River Zone – Jenner to Estuary
5C	Russian River Zone – Goat Rock
6	Wrights Beach
7	Gleason Beach
8A	Bodega Bay Zone – Salmon Creek Beach
8B	Bodega Bay Zone – Bodega Head
8C	Bodega Bay Zone – Bodega Harbor
8D	Bodega Bay Zone – Doran Park
9A	Esteros – Estero Americano
9B	Esteros – Estero de San Antonio
10A	Dillon Beach – North
10B	Dillon Beach – South
11A	Tomales Bay Zone – Marshall
11B	Tomales Bay Zone – Chicken Ranch Beach
11C	Tomales Bay Zone – Inverness
11D	Tomales Bay Zone – Pt Reyes Station - Bivalve
12A	Pt. Reyes National Seashore – Drakes Beach
12B	Pt. Reyes National Seashore – Schooner Bay
13A	Bolinas Zone – Duxbury Reef and Off-shore Area
13B	Bolinas Zone – Bolinas Cliffs
13C	Bolinas Zone – Bolinas Lagoon
13D	Bolinas Zone – Stinson Beach
14	Muir Beach

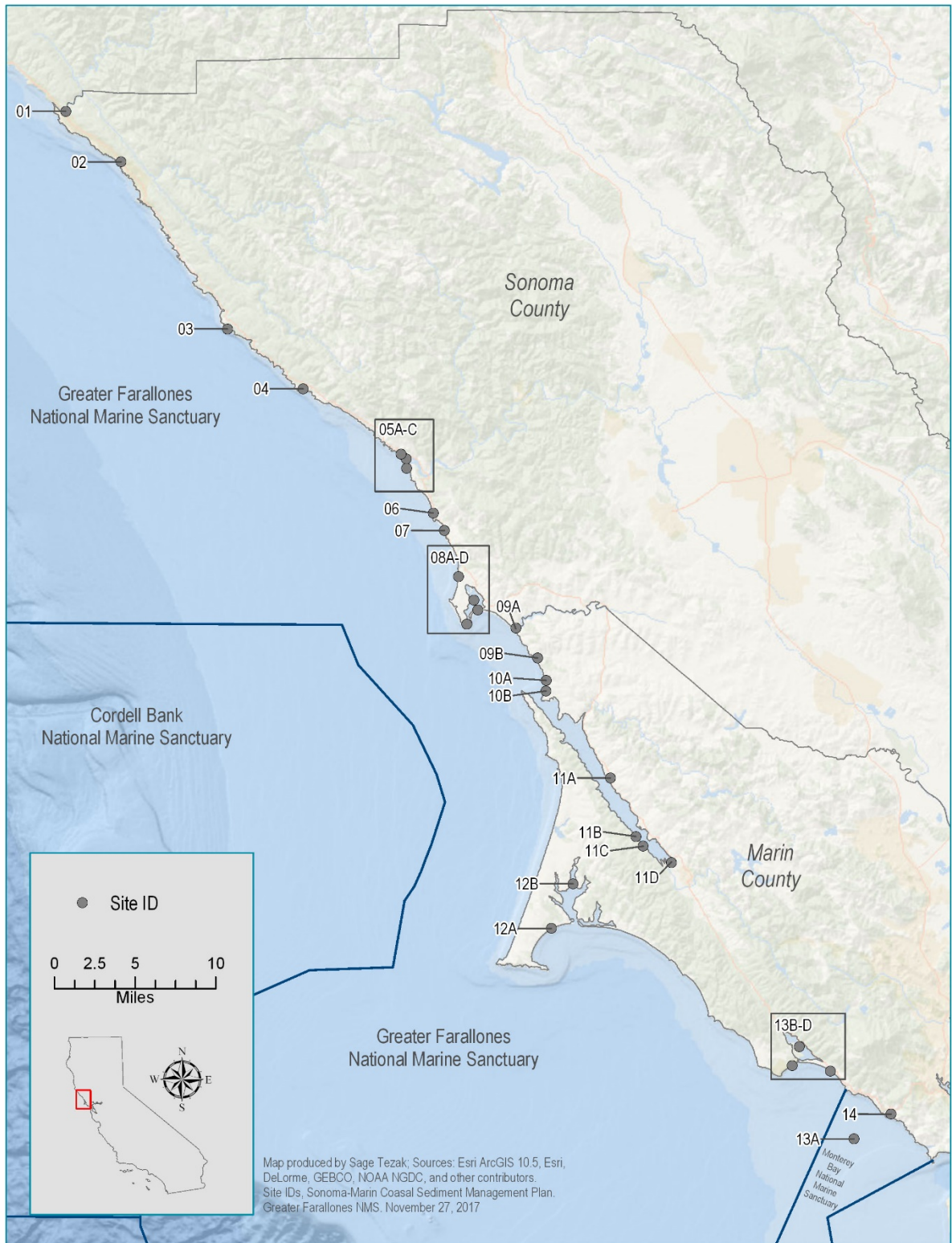


Figure 7-1 Locations of the 14 site-specific recommendations for sediment management activities.

## 7.1 Regional Recommendations

1. Develop a regional monitoring program using best available science, coordinated agency action, and community-based science including wave energy, water levels, shoreline change, bluff erosion, habitat evolution, water quality, sediment budget, and littoral transport. Coordinate efforts and data sharing amongst current regional monitoring programs (e.g. Russian River Regional Monitoring Program, San Francisco Bay Regional Monitoring Program) and develop sediment monitoring programs that connect the coast, coastal watersheds, and San Francisco Bay.
2. Take a holistic, watershed approach to understand sediment budgets and dynamics, and identifying areas of restoration to improve downstream water quality and encourage natural sediment transport.
3. Prioritize incentives and technical assistance to accomplish landscape level restoration of soil health and managed sedimentation through voluntary stewardship, consulting and seeking partnerships with local Resource Conservation Districts, Land Trusts, NGOs, property owner associations, and agricultural producers.
4. Develop a list of potential “receiver” and storage sites (upland and aquatic) to be pre-qualified for placement of reclaimed sediment. Develop a matrix similar to the SCOUP (Sand Compatibility Opportunistic Use Program) report to characterize sediment compatibility across the region and develop a process to implement sediment movement.
5. Referencing the SCOUP matrix (see recommendation #2), identify areas throughout the region where sediment delivery is interrupted by dams, culverts, etc. and consider beneficial use of the trapped sediment and options to prevent future impoundment of sediment.
6. Coastal bluffs and beach zones throughout the region are eroding, threatening key infrastructure and transportation assets. Long-term solutions at these locations may involve moving vulnerable infrastructure inland (managed retreat). Identify areas where managed retreat will allow for restoration of natural coastal processes, including the use of phased approaches. Look at applying sediment management actions to support and inform adaptation pathways with a clear definition of “adaptation pathways”.
7. There are impacts from coastal armoring which include interrupting sediment dynamics and coastal armoring should be limited to where necessary, appropriate, and allowable. Armoring should be considered a last resort option for coastal defense and should consider maintaining sediment processes.
8. Consider using sediment from landslides as a resource to support the coastal sediment management strategies outlined in this report.



9. Promote efficiency for sediment management activities (while preserving comprehensive environmental review) through means such as: creating memoranda of understanding, eliminating redundancies, consolidating permits, encouraging interagency collaboration (SF Bay Outer Coast and SF Bay Sediment Management Plans), creating a communication structure, and taking a programmatic approach where feasible. Some examples from which to draw lessons learned include the Dredge Material Management Office (DMMO), the Joint Aquatic Resource Permit Application (JARPA), the Marin Resource Conservation District (RCD) Permit Coordination Program, and the Department of Fish and Wildlife online interface for aquaculture applications.
10. With the Coastal Sediment Management Workgroup as a lead, convene a multi-stakeholder North-Central California Coast Sediment Taskforce to facilitate a holistic approach to sediment management in the region.
11. From the range of management strategies proposed here, identify those that have been successful in similar systems/habitats to transfer lessons learned.
12. Highway 1 is integral throughout the region and actions taken by Caltrans to address erosion, retreat, and sea level rise will impact sediment management decisions by others. Within 12 months of final submission of this report, request Caltrans 1) convene a task force of planners, managers, and relevant transportation entities to consider infrastructure impacts from sediment management; 2) review this CRSMR and identify overlap with their work; and, 3) incorporate the Report's recommendations into their work.
13. Solicit input on sediment management recommendations outlined in this report from the following agencies: US Fish and Wildlife Service, California Department of Fish and Wildlife, CalFire, and Sonoma County Planning Division.
14. Coordinate this CRSMR with other ongoing sediment management work in the region (e.g. Tomales Bay, Russian River, Bolinas North-End Restoration Project). Coastal agencies and San Francisco Bay agencies working on sediment activities (e.g., sand mining or dredging) should coordinate to maintain connectivity of programs and research through the Golden Gate region.
15. Educate agencies and communities about the value of sediment as a resource and natural component of the coastal environment in many areas.
16. Engage communities and relevant agencies throughout the region, by developing and implementing education and outreach programs about the importance of sediment to coastal regions, providing platforms to convey results and opportunities to join in sediment management efforts and monitoring; and, encouraging community-based science opportunities.

17. Complete a sediment management plan for Mendocino County coastline.

## 7.2 Site-specific Recommendations

The succeeding series of figures and tables present site-specific characterizations and recommendations following the terminology in Table 7-2, with the data sources and geological unit key preceding the location-by-location information. Hazard zones in the aerial imagery were identified as potential coastal regions at risk from sea level rise and erosion conditions (methods described in Section 4.2). As noted above, the coastal shoreline change method is applicable to beach environments solely.

Table 7-2. Terminology used in Sediment Management Recommendations

<p><b>Column Headers:</b></p> <p><i>County:</i> Sonoma or Marin</p> <p><i>Location:</i> the specific site within the county targeted by the recommendation.</p> <p><i>Concerns and Issues:</i> brief description or statement describing the concerns and issues identified by Working Group members at this site. Recommendations seek to address these issues.</p> <p><i>Management Goal:</i> the Working Group members described the overall goal of sediment management actions at the location.</p> <p><i>Timeframe:</i> Recommendations were considered for 3 timeframes (near-, mid-, and long-term) based on erosion data and timing of projected impacts. These timeframes are not prescriptive and should not be seen as hard deadlines, rather guidelines based on urgency.</p> <p><i>Sediment Management Strategy:</i> All recommendations were binned into categories for internal analysis and assessment.</p> <p><i>Strategy Detail:</i> The specific recommendations being made.</p> <p><i>Governance feasibility:</i> Recommendations were analyzed by Working Group members using a flowchart to determine governance feasibility, including permitting, regulations, statutes, and policies, but not including design, cost, or engineering feasibility:</p> <ul style="list-style-type: none"><li><i>Feasible:</i> this action can be taken with relative regulatory ease, with existing policies or regulations. Note that the Working Group does not necessarily endorse this strategy or prioritize it over others.</li><li><i>Potentially feasible:</i> this action can be taken, potentially with changes to current policies or regulations</li><li><i>Infeasible:</i> this action likely cannot be taken, even with changes to current policies or regulations or based on other reasons (cost, engineering considerations, property ownership issues, etc.)</li></ul> <p><i>Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting):</i> agencies that would need to issue a permit or approval for the proposed recommended projects (e.g. regulatory agencies, other management agencies, or agencies with land ownership) or agencies that would be directly involved in implementation of a project.</p> <p><i>Likely Agencies Involved in Project Review and Consultation:</i> agencies that would need to be consulted on proposed recommended projects; resource agencies includes NOAA Fisheries, US Fish and Wildlife Service, and/or California Department of Fish and Wildlife.</p> <p><b>Management Strategy Categories:</b></p> <p><i>Beach Nourishment:</i> Placement of approved sediment-water slurry directly on the beach or beach face.</p> <p><i>Living Shorelines:</i> Blend of infrastructure and natural habitats; rely on development of natural habitat to protect shore and restore sediment paths.</p> <p><i>Research and Education:</i> Public engagement on coastal sediment imbalances; can be technical studies on systems or locations.</p> <p><i>Armor:</i> Built structures with the specific goals of retaining sediment in place (walls) or blocking sediment transport (groins).</p>
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*Indirect Sediment Management:* An action whose primary goal is not to manage sediment but causes secondary benefits to sediment delivery, transport, or removal from a coastal location.

*Restoration:* Re-establish vertical and horizontal sand and vegetated mobile habitat (dunes) or conversion of developed lands back to or into wetlands with connection to coastal processes (wetlands).

*Dredge:* Mechanical movement of sediment deposits from a river, seabed, or other area of water.

*Managed Retreat:* Systematic movement away from anticipated hazardous areas.

**Other terms:**

**Dredged Material:** Any material that is excavated or dredged from waters of the United States (40 CFR 232.2).

**Beneficial Reuse (of Dredged Material):** The use of any dredged material as a sediment resource is referred to as “beneficial reuse”, which recognizes sediment as an essential piece of the ecosystem. Material that is determined to be suitable for beneficial reuse is considered “fill” and evaluated under the Clean Water Act (CWA) whereas material that is to be thrown away (i.e. not reused) is evaluated under the Marine Protection, Research, and Sanctuaries Act (aka the Ocean Dumping Act).

**Total Maximum Daily Load (TMDL):** A TMDL is defined as the sum of the individual waste load allocations for point sources, load allocations for non-point sources, and natural background such that the capacity of the water body to assimilate pollutant loading (the loading capacity) is not exceeded (40 CFR §130.2). In other words, a TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards.

**Resource Agencies:** state and federal agencies involved in consultations on potential impacts to wildlife and/or habitat such as, NOAA Fisheries, CA Department of Fish and Wildlife, and U.S. Fish and Wildlife Service.

**Data Sources for Site Characterizations**

<b>General Geology and Shoreline Types</b>	<b>Shoreline Change (m/yr)</b>	<b>Primary Landowners</b>	<b>Critical Habitats</b>	<b>Public Access and Trails</b>	<b>Infrastructure</b>	<b>Historical Resources</b>
<p><i>Geology:</i> Geologic Map of Sonoma County, USGS Scientific Investigations Map 2918, 2006</p> <p>Geologic Map of Marin County, USGS Scientific Investigations Map 2918, 2006</p> <p>Offshore and onshore geology and geomorphology, Offshore of Bolinas map area, California, Sheet 10, 2015</p> <p><i>Shoreline Types:</i> Environmental Sensitivity Index, 2008</p>	<p>Analysis conducted by GFNMS for CRSM Report. Method only applicable to beach environments and, where noted, results are not accurate for cliff and bluff erosion rates.</p>	<p>California Protected Area Database, 2016</p>	<p>U.S. Fish &amp; Wildlife Service - ECOS Environmental Conservation Online System; Environmental Response Management Application (ERMA) - California Coastal Chinook Critical Habitat (NMFS, 2005); State of California Department of Fish and Wildlife, Marine Region GIS Lab; State Water Resources Control Board</p>	<p><i>Public Access:</i> California Coastal Commission, 2016</p> <p><i>Trails:</i> California Coastal Trail, 2015; Sonoma County Regional Parks Trails, 2017; Marin County Trails, 2017</p>	<p><i>Roads:</i> TIGER, 2013; Sonoma County, 2017; Marin County, 2017</p> <p><i>Culverts:</i> Caltrans, 2017</p> <p><i>Armor:</i> Coastal Erosion Armoring, California Coastal Commission, 2014</p>	<p>Historical Resources at Risk, NOAA, 2016</p>

**Abbreviation Keys:**

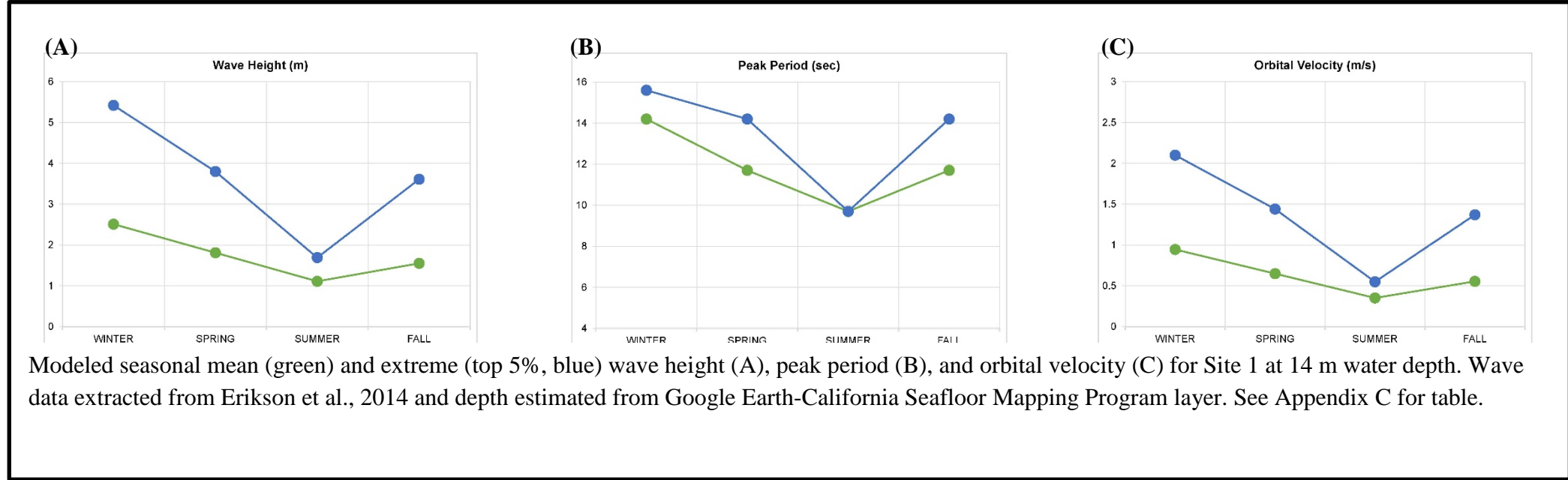
<b>Geological Unit</b>	<b>Description</b>	<b>Material Classification</b>
af	Artificial fill	Surficial Sediment
Qha	Alluvium (Holocene)	Surficial Sediment
Qs	Beach and dune sand (Quaternary)	Surficial Sediment
Qsl	Hillslope deposits (Quaternary)	Surficial Sediment
Qpa	Alluvium (Pleistocene)	Surficial Sediment
Qt	Marine terrace deposits (Pleistocene)	Surficial Sediment
Qoa	Alluvium (early Pleistocene)	Surficial Sediment
Qms	Marine nearshore and shelf deposits (late Holocene)	Surficial Sediment
Qmss	Marine shelf scour depressions (late Holocene)	Surficial Sediment
QTs	Sediments (early Pleistocene and (or) Pliocene)	Overlying Rock
Tpms	Sedimentary rocks (Pliocene and early Miocene))	Overlying Rock
Tms	Sedimentary rocks (Miocene)	Overlying Rock
Tepas	Sedimentary rocks (Eocene and (or) Paleocene)	Overlying Rock
fsr	Franciscan Complex mélangé (Eocene, Paleocene, and (or) Late Cretaceous)	Basement Complex Rock
Kfs	Franciscan Complex sedimentary rocks (Cretaceous)	Basement Complex Rock
Kgr	Salinian complex plutonic (granite) rocks (Cretaceous)	Basement Complex Rock
KJs	Great Valley complex sedimentary rocks (Early Cretaceous and (or) Late Jurassic)	Basement Complex Rock
KJfs	Franciscan Complex sedimentary rocks (Early Cretaceous and (or) Late Jurassic)	Basement Complex Rock
KJfm	Franciscan Complex metamorphic rocks (Early Cretaceous and (or) Late Jurassic)	Basement Complex Rock
MzPzm	Salinian complex metamorphic rocks (Mesozoic and (or) Paleozoic)	Basement Complex Rock

<b>Marine Protected Area (Critical Habitat)</b>	<b>Definition</b>
SMCA	State Marine Conservation Area
SMR	State Marine Reserve
SMRMA	State Marine Recreational Management Area

**Site 0: All State Parks in Sonoma and Marin CRSMR AOI (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
0	All State Parks	Erosion threatening managed coastal access points and significant park resources.	Respond and prepare for coastal erosion to protect designated access and resources (natural, cultural, and infrastructure)	Near-term	Managed Retreat	Planning for access and trail alignment. System trail repair and/or reroutes.	Feasible	State Parks; County; CCC	GFNMS; Water Board; Resource Agencies	Vertical access (e.g., stairways or trails) is important to facilities, pocket beaches, and bluff-top trails.
					Research/Education	Engage park stakeholders to explore alternatives to managed retreat.	Feasible	State Parks; County; CCC	GFNMS; EPA; Water Board	
				Mid- and Long-term	Managed Retreat	Implement as needed	Potentially feasible	State Parks; County; CCC; Water Board	GFNMS; USACE; EPA; Resource Agencies	

Site 1: Gualala River (Site Characterization)

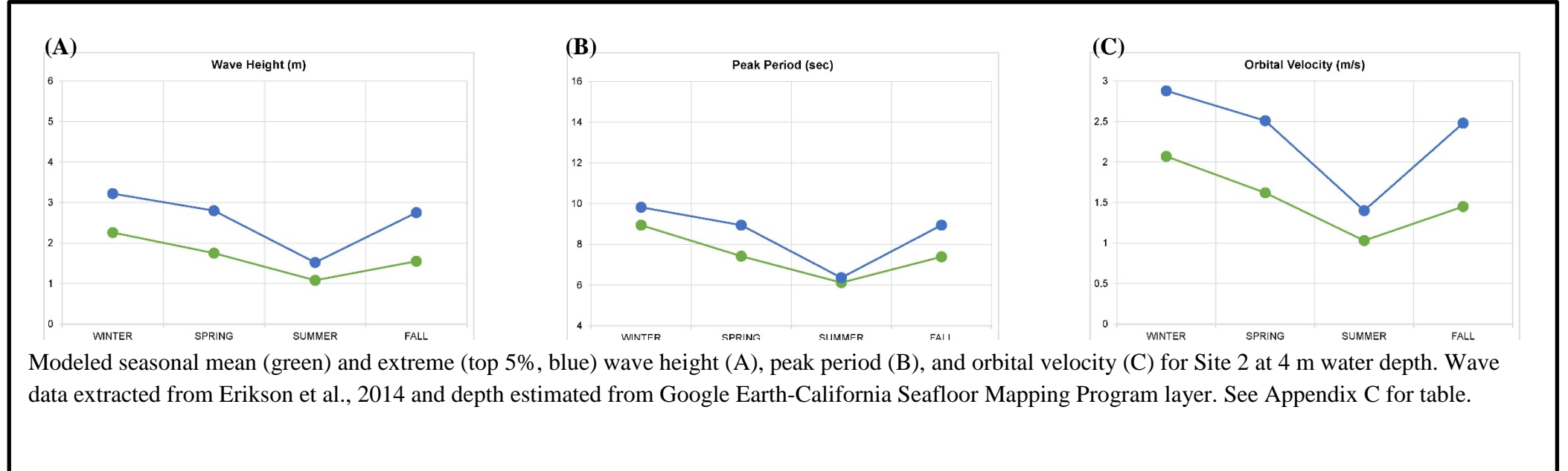


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qs, Tepas, Qha, Qt</p> <p><i>Shoreline Types:</i> Coastal Marsh, Beaches, Rocky Shore</p>	<p>Average: <math>0.12 \pm 0.126</math></p> <p>Maximum: 0.29</p> <p>Minimum: -0.11</p>	Sonoma County Regional Parks Department	None	<p>6 Access Points: 3 Beach Access, 2 Visual Access, 1 City/Town</p> <p>~2 km of coastal trail, including California Coastal Trail</p>	<p><i>Roads:</i> Hwy 1 and ~2 km of local roads</p> <p><i>Culverts:</i> none</p> <p><i>Aarmor:</i> none</p>	None

**Site 1: Gualala River (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
1	Gualala River	Density of roads, specifically legacy logging roads, is causing hillside erosion	Restore natural sediment pathways and delivery timeframe	Near-term	Indirect Sediment Management	Implement best management practices on forest roads	Potentially feasible	CCC; Water Board; County	Resource Agencies; CalFire; Regional Parks	Water Council is engaged through fundraising for road decommissioning and projects.
		Logging the floodplain could remove stabilizing vegetation	Restore natural sediment pathways and delivery timeframe	Long-term	Indirect Sediment Management	Acquire from willing sellers the riparian forest to remove logging from floodplain	Feasible	CCC; Water Board; Regional Parks; County	Resource Agencies	
		Gravel mining is removing essential salmon habitat from the system	Restore natural sediment pathways and delivery timeframe	Long-term	Indirect Sediment Management	Monitor gravel mining and use adaptive management process to ensure habitat goals are being achieved and adverse effects are being avoided and minimized.	Infeasible	CCC; Water Board; County; USACE	Resource Agencies	Current gravel mining could benefit from engagement with downstream coastal community. Permit renewal could be an opportunity to help them adapt, use education and outreach to promote adaptation direction.
		Sediment loads may increase from intensified agricultural development.	Reduce sedimentation from agricultural lands	Mid-term	Indirect Sediment Management	Implement BMPs for agricultural producers	Feasible	CCC; Water Board; County; USDA; RCD	Resource Agencies	Sonoma RCD would be a key partner.

Site 2: The Sea Ranch – north (Site Characterization)

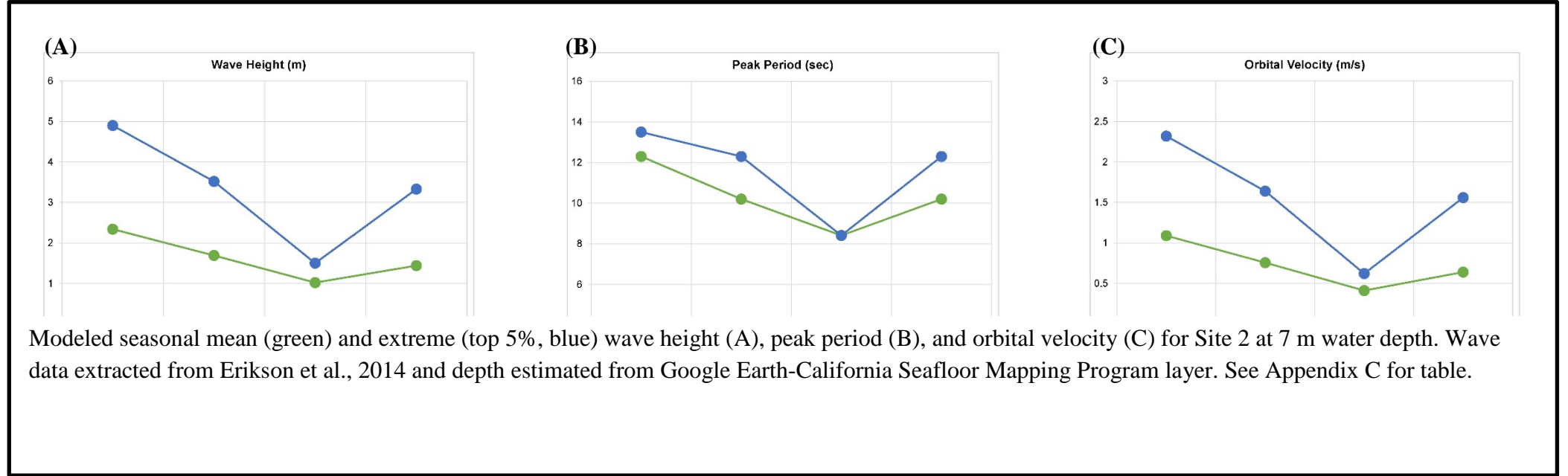


Modeled seasonal mean (green) and extreme (top 5%, blue) wave height (A), peak period (B), and orbital velocity (C) for Site 2 at 4 m water depth. Wave data extracted from Erikson et al., 2014 and depth estimated from Google Earth-California Seafloor Mapping Program layer. See Appendix C for table.

General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qt, Qs</p> <p><i>Shoreline Types:</i> Beaches, Rocky Shore</p>	Results not accurate for cliff and bluff environments.	Private	None	<p>4 Access Points: 4 Beach Access</p> <p>~6 km of coastal trail, including California Coastal Trail</p>	<p><i>Roads:</i> ~19 km of local roads</p> <p><i>Culverts:</i> 27</p> <p><i>Aarmor:</i> none</p>	None



Site 2: The Sea Ranch – south (Site Characterization)

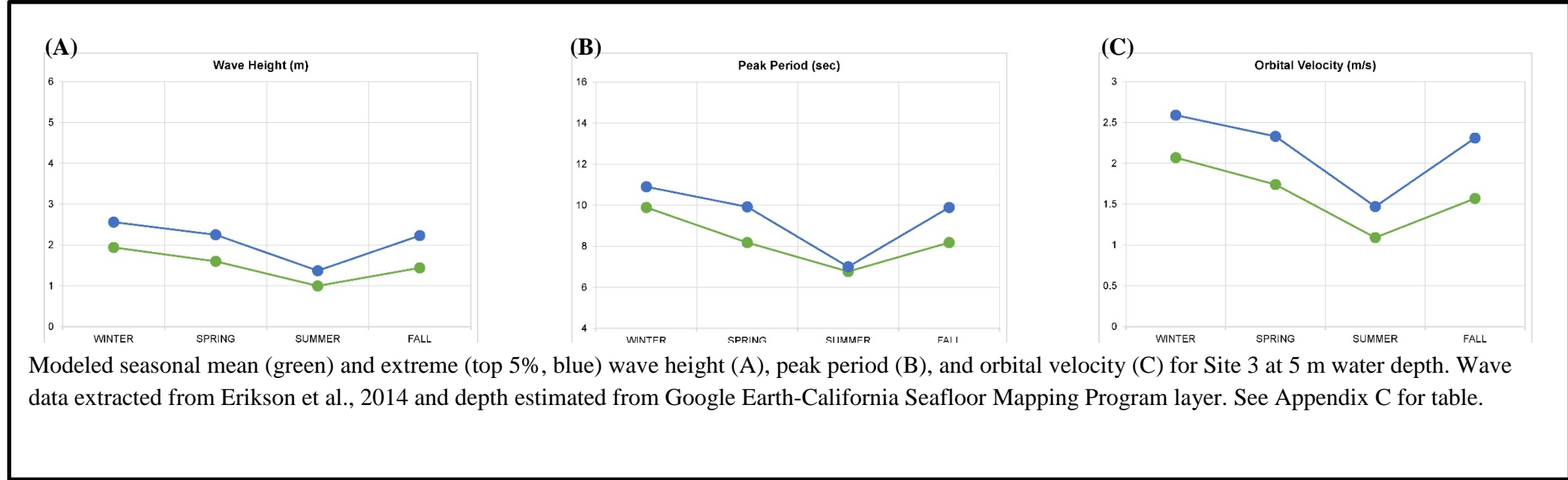
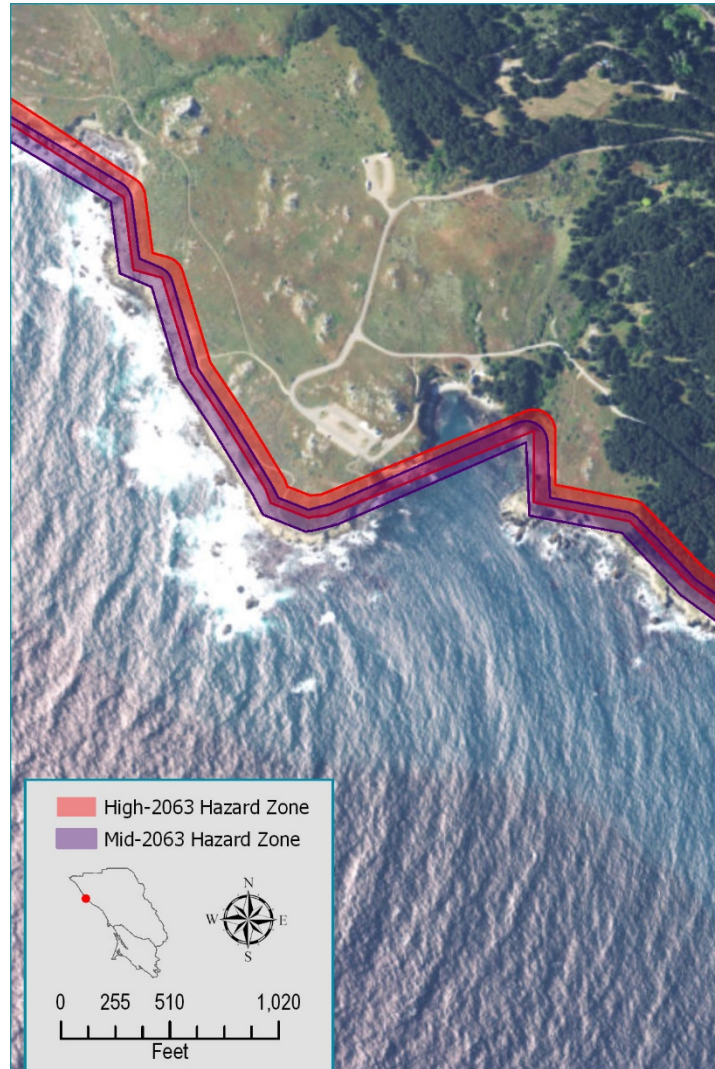


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qt, Qs</p> <p><i>Shoreline Types:</i> Coastal Marsh, Beaches, Rocky Shore</p>	Results not accurate for cliff and bluff environments.	Private, Sonoma County Regional Parks Department	None	<p>4 Access Points: 4 Beach Access</p> <p>~13 km of coastal trail, including 11 km of California Coastal Trail</p>	<p><i>Roads:</i> Hwy 1 and ~21 km of local roads</p> <p><i>Culverts:</i> 50</p> <p><i>Aarmor:</i> none</p>	None

**Site 2: The Sea Ranch (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
2	The Sea Ranch and Del Mar Pt	Erosion threatening homes and coastal access points	Respond and prepare for coastal erosion to protect access and property	Near-term	Managed Retreat	Plan for access and trail alignment	Feasible	County; CCC	GFNMS; Water Board; Resource Agencies	Vertical access (e.g., stairways or trails) is important to facilities, pocket beaches, and bluff-top trails. Requires additional consultation with property owners. SCC would be a potential partner.
					Research/Education	Consult with Sea Ranch community to explore alternatives to managed retreat.	Feasible	County; CCC	GFNMS; EPA; Water Board	SCC would be a potential partner.
				Mid- and Long-term	Managed Retreat	Implement as needed	Potentially feasible	County; CCC; Water Board	GFNMS; USACE; EPA; Resource Agencies	Create a buffer zone for public access, incentivize

Site 3: Salt Point State Park (Site Characterization)

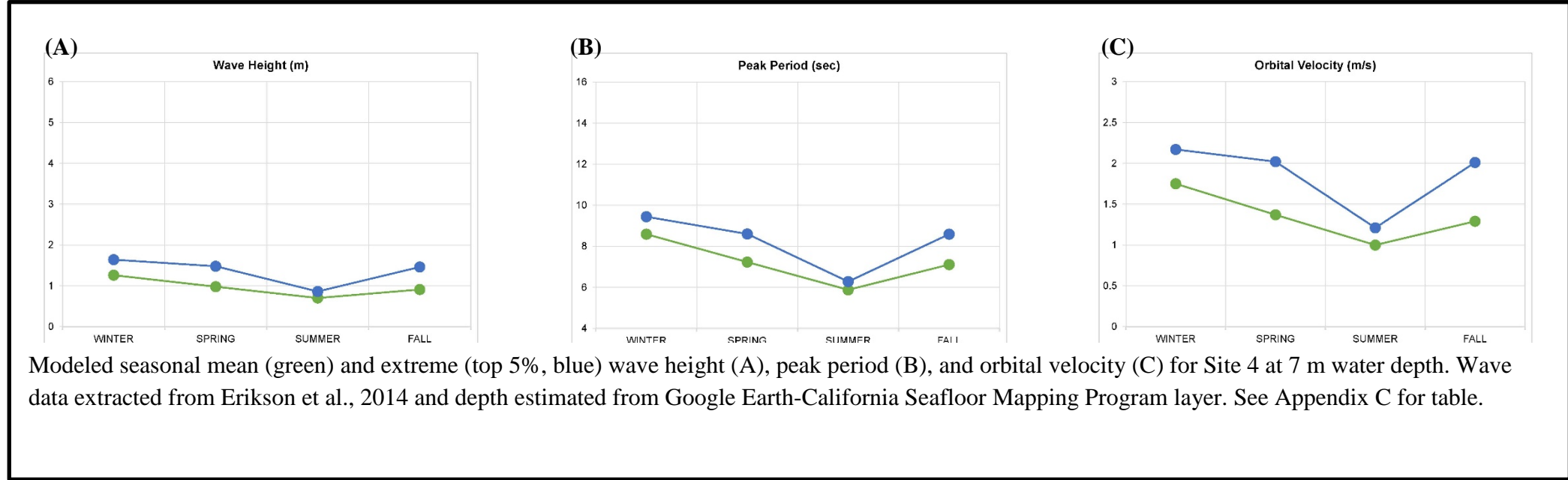


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Tepas, Qt</p> <p><i>Shoreline Types:</i> Rocky Shore, Beaches</p>	Results not accurate for cliff and bluff environments.	California Department of State Parks and Recreation	<p>Marbled murrelet</p> <p>Salt Point SMCA Gerstle Cove SMR Gerstle Cove ASBS</p>	<p>2 Access Points: 2 Beach Access</p> <p>California Coastal Trail</p>	<p><i>Roads:</i> none</p> <p><i>Culverts:</i> none</p> <p><i>Aarmor:</i> none</p>	Doghole Port

**Site 3: Salt Point State Park (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
3	Salt Point State Park	Bluff erosion in potentially cultural and historical sensitive area.	Protect recreation and access, cultural and historical resources	Near-term	Research/Education	Through consultation internally and externally with tribes, study options to improve, remove, or relocate recreational access and facilities	Feasible	State Historic Preservation Office (SHPO); State Parks; CCC; Water Board	GFNMS; Resource Agencies	Native American resources, doghole ports and historical quarry sites may be impacted. Conduct a cultural resources study for preferred relocation sites. Vertical access to site features is more threatened than horizontal erosion negatively affecting access points (see Site 0).

Site 4: Fort Ross State Historic Park (Site Characterization)

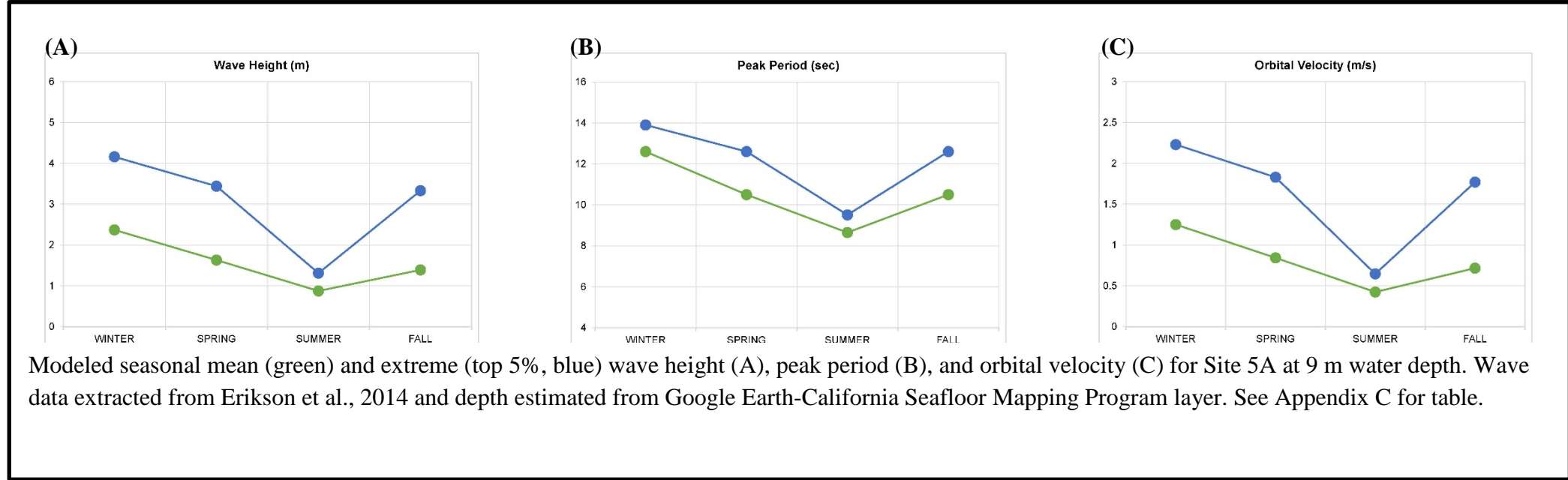
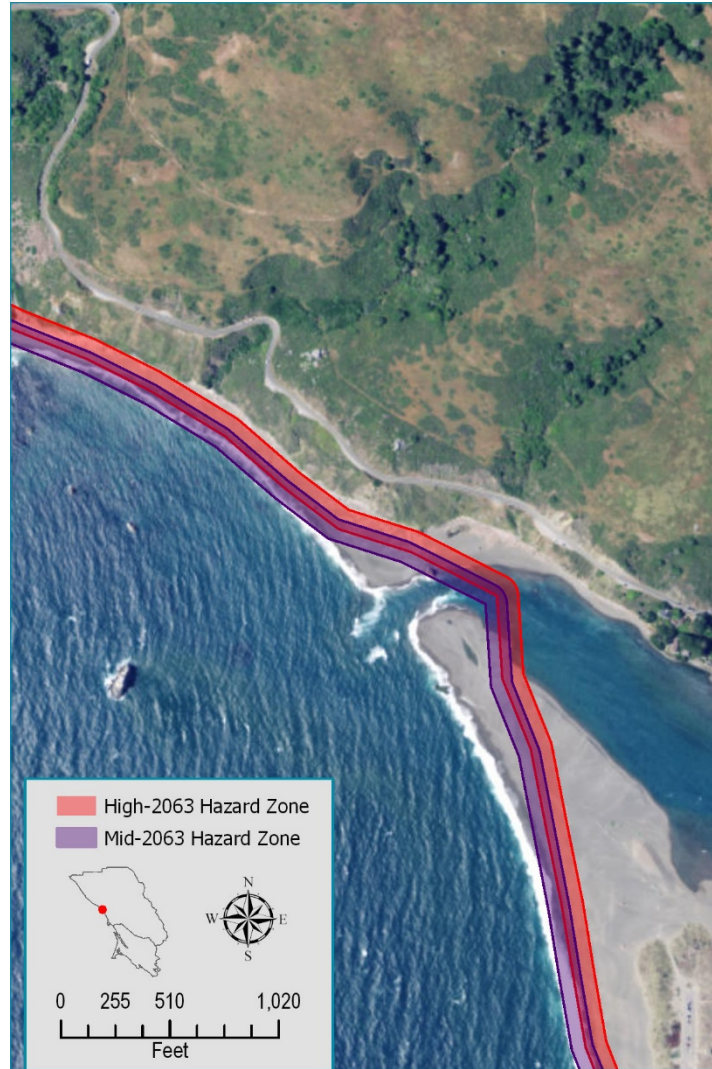


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Tepas, Qt, Tms</p> <p><i>Shoreline Types:</i> Rocky Shore, Beaches</p>	Results not accurate for cliff and bluff environments.	California Department of State Parks and Recreation	None	<p>2 Access Points: 1 Beach Access, 1 Campground</p> <p>California Coastal Trail</p>	<p><i>Roads:</i> none</p> <p><i>Culverts:</i> 2</p> <p><i>Aarmor:</i> none</p>	Doghole Port

**Site 4: Fort Ross State Historic Park (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
4	Fort Ross State Historic Park (SHP)	Bluff erosion	Protect cultural resource & recreation/visitation of historic facilities	Near-term	Managed Retreat	Relocate historic buildings	Infeasible	State Parks; State Historic Preservation Office (SHPO); CCC; Water Board	GFNMS; USACE; EPA; Resource Agencies	Native American resources (Kashia coordination on their sites), doghole ports and historical quarry sites may be impacted. Conduct a cultural resources study for preferred relocation sites. Vertical access to site features is more threatened than horizontal erosion negatively affecting access points (see Site 0).
				Long-term	Managed Retreat	Relocate Sandy Cove facilities	Potentially feasible	State Parks; State Historic Preservation Office (SHPO); CCC; Water Board	GFNMS; USACE; EPA; Resource Agencies	Other strategies may need to be considered following consultation with tribes and State Parks.

Site 5A: Russian River Mouth Zone – Driftwood Beach (Site Characterization)



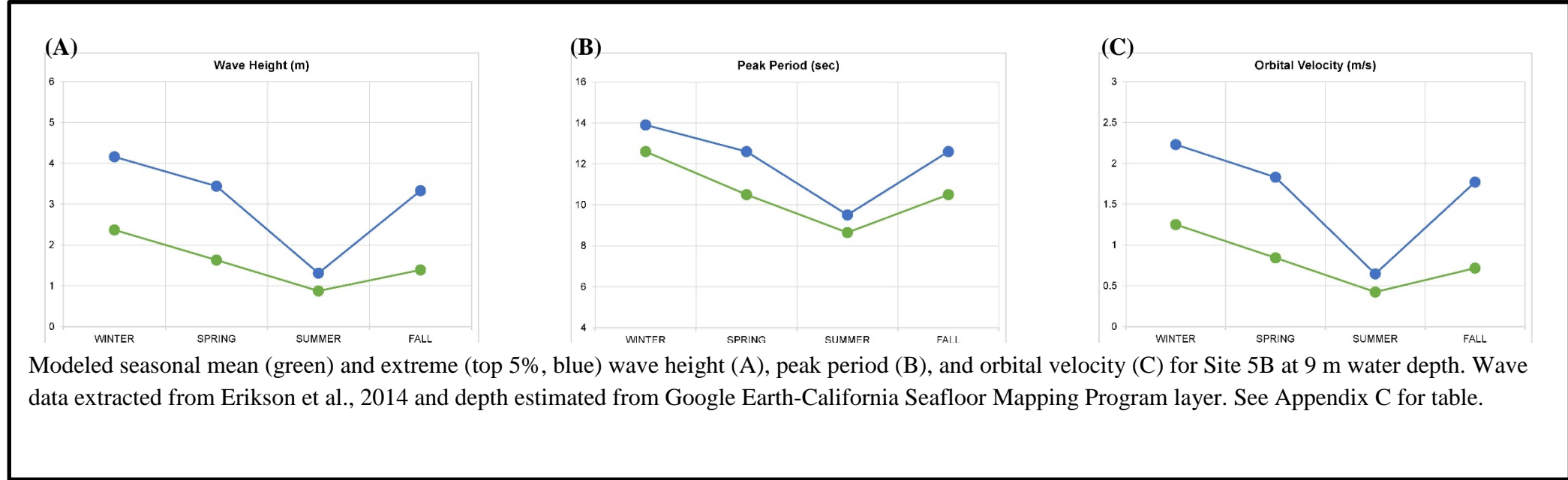
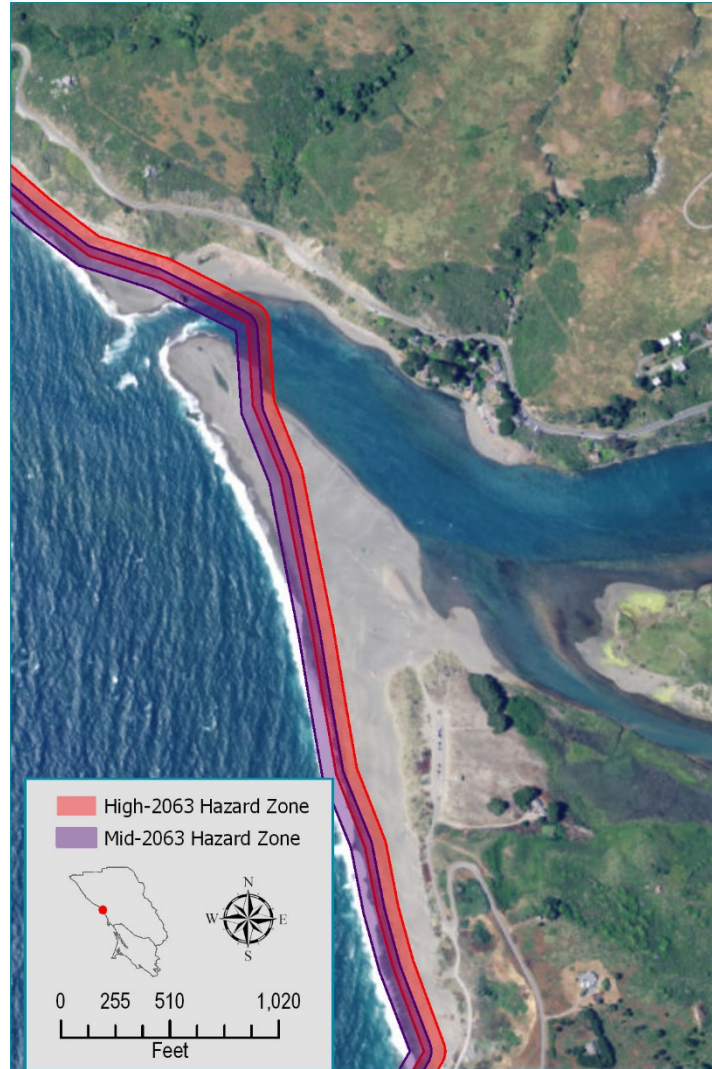
General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qt, Qha, KJfs</p> <p><i>Shoreline Types:</i> Beaches</p>	<p>Average: <math>-0.14 \pm 0.15</math></p> <p>Maximum: - 0.05</p> <p>Minimum: -0.49</p>	California Department of State Parks and Recreation	<p>None</p> <p>Russian River SMRMA</p> <p>Russian River SMCA</p>	<p>1 Access Points: 1 Beach Access</p> <p>&lt; 1 km of California Coastal Trail</p>	<p><i>Roads:</i> &lt; 1 km Hwy 1</p> <p><i>Culverts:</i> 6</p> <p><i>Armor:</i> Retaining Wall, 25 m long</p>	None

**Site 5A: Russian River Mouth Zone – Driftwood Beach (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
5A	Driftwood Beach-north side of Russian River Mouth	Erosion of Highway 1 and trail to beach. Trail to beach significantly eroded within last year and no longer provides safe passage to beach-needs to be repaired and maintained for beach access.	Maintain coastal access via road and trail	Near-term	Indirect Sediment Management	Factors leading to erosion need to be studied and resolved. Further erosion of Highway 1 should be prevented. Agencies involved should coordinate efforts to rebuild "Main Trail" aka "Kat Trail" to Driftwood Beach or if not feasible, repair adjacent Surfers trail to join with lower portion of main trail to provide continued and needed access.	Feasible	State Parks; CCC; Caltrans; Water Board	County; Resource Agencies	Important to maintain access to remove accumulated marine debris deposited in this area by Russian River flow and ocean currents. Determine the landowner where there are trails and identify permits required for maintenance.



Site 5B: Russian River Mouth Zone – Jenner to Estuary (Site Characterization)

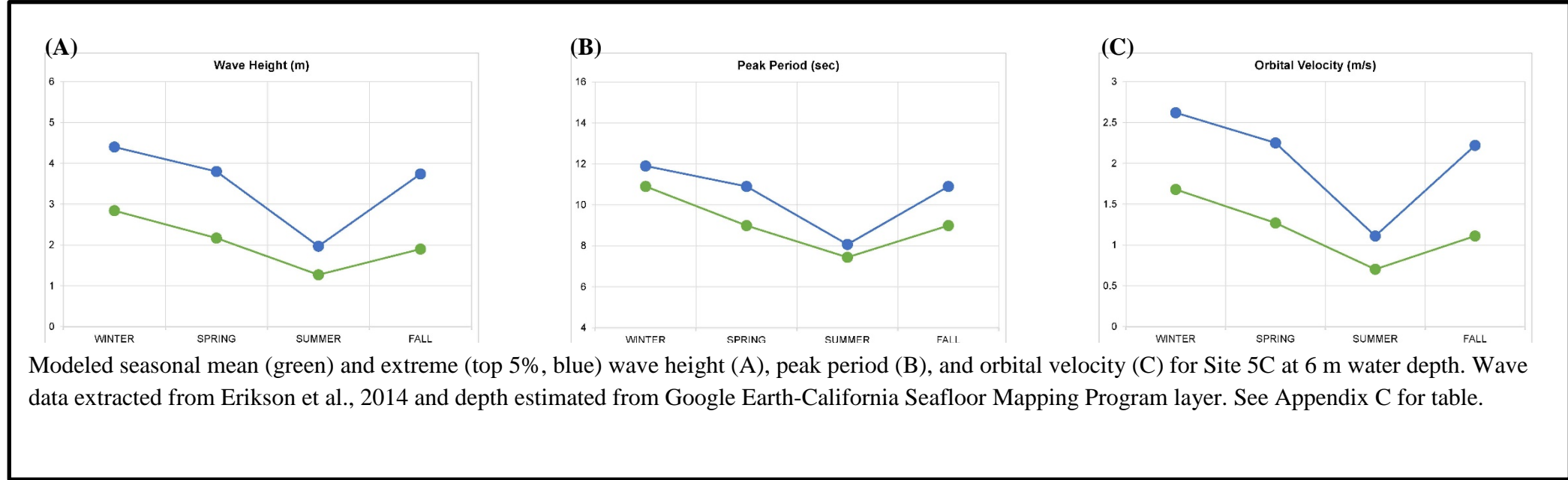
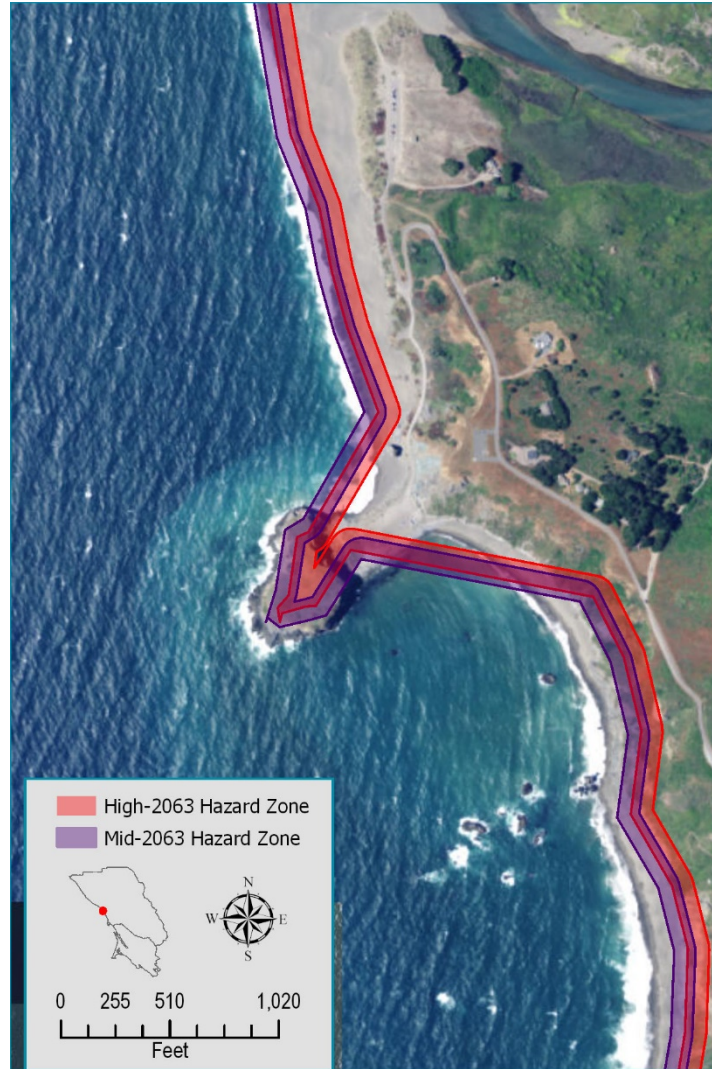


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qs, Qha, KJs</p> <p><i>Shoreline Types:</i> Beaches, Rocky Shores, Hardened Shores</p>	<p>Average: <math>0.01 \pm 0.328</math></p> <p>Maximum: 0.53</p> <p>Minimum: -0.83</p>	<p>California Department of State Parks and Recreation, The Wildlands Conservancy</p>	<p>Chinook</p> <p>Russian River SMRMA</p> <p>Russian River SMCA</p>	<p>3 Access Points: 1 Beach Access, 1 City/Town, 1 Visual</p> <p>California Coastal Trail</p>	<p><i>Roads:</i> Hwy 1</p> <p><i>Culverts:</i> 13 (on Jenner side)</p> <p><i>Armor:</i> Retaining Wall, 25 m long</p>	<p>None</p>

**Site 5B: Russian River Mouth Zone – Jenner to Estuary (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes	
5B	Russian River (mouth, jetty and estuary); Jenner	Need more complete understanding of sediment dynamics at river mouth and jetty. Need to reduce impacts of flooding to natural habitats, private property, and public assets.	Holistic watershed management	Near-term	Indirect Sediment Management	Support existing efforts to manage upstream inputs of sediment(see notes).	Potentially Feasible	County; CCC; Caltrans; Water Board; SWCA	USACE; EPA; Resource Agencies	Vineyards, agriculture, logging, watershed specific planning efforts upstream to reduce anthropogenic sediment load/discharges; maximize natural sediment erosion processes. Identify partner agencies and successful programs. Reach out to landowners. Capture potential TMDL overlap. Consider restoration for estuary. Refer to the Habitat Blueprint ongoing work.	
					Dredge	Sediment dredging from dams on Russian River for placement within littoral cell.	Infeasible	USACE; EPA; Water Board; CCC; Sonoma County Water Agency (SCWA); County	Resource Agencies		
					Research/Education	Conduct stakeholder meetings in order to devise a shared management plan. Commence studies of dam removals.	Feasible	SCWA; County; CCC	EPA; Water Board; Resource Agencies		Sonoma County Water Agency is lead agency for mouth management.
					Managed Retreat	Investigate relocation of housing, roadways and US Post Office.	Potentially Feasible	SCWA; County; CCC; Caltrans; Water Board	USACE; EPA; Resource Agencies		
				Mid-term	Indirect Sediment Management	Monitor upstream inputs of sediment. Continue ongoing upstream sediment management.	Feasible	SCWA; County; CCC; Caltrans; Water Board	USACE; EPA; Resource Agencies		
					Managed Retreat	Floodplain restoration. Managed retreat at Jenner. Re-alignment and elevation of Hwy 1.	Potentially Feasible	SCWA; County; CCC; Water Board; Caltrans	USACE; EPA; Resource Agencies	Drainage maintenance and best management practices (10 year), potentially armoring (20 years). Managed retreat as a continuous strategy.	
				Long-term	Indirect Sediment Management	Long-term management of upstream sediment input.	Feasible	SCWA; County; CCC; Water Board; Caltrans	USACE; EPA; Resource Agencies	Remove the dams as appropriate.	
					Managed Retreat	Ongoing monitoring and management of previous actions.	Potentially Feasible	SCWA; County; CCC; Water Board; Caltrans	USACE; EPA; Resource Agencies		

Site 5C: Russian River Mouth Zone – Goat Rock (Site Characterization)

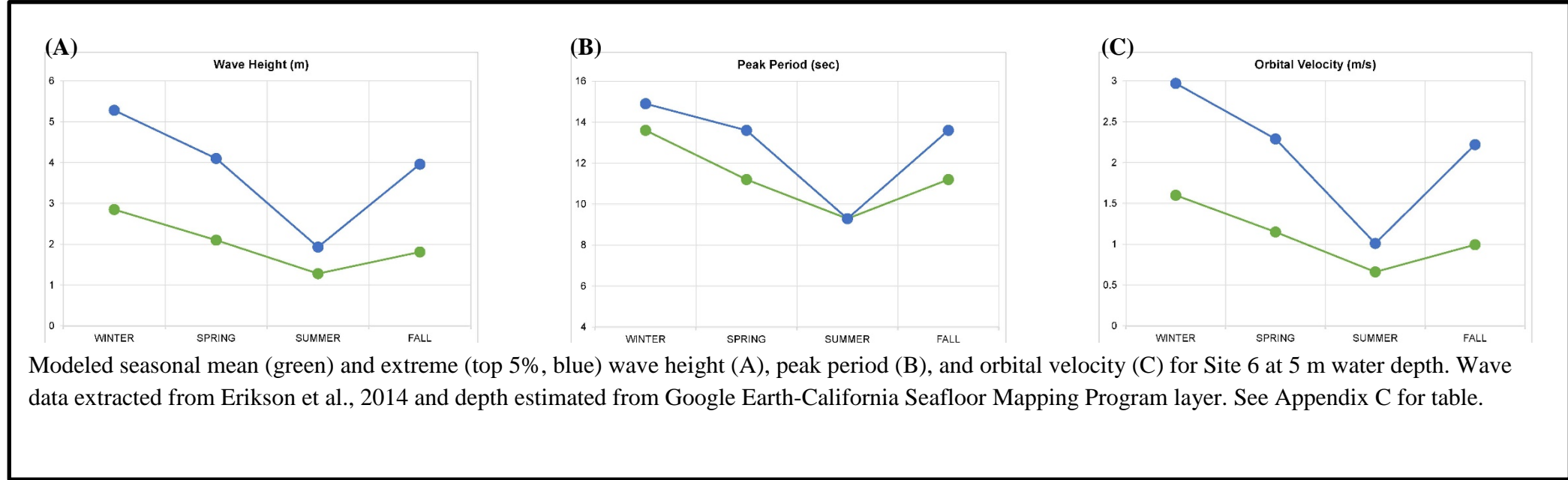
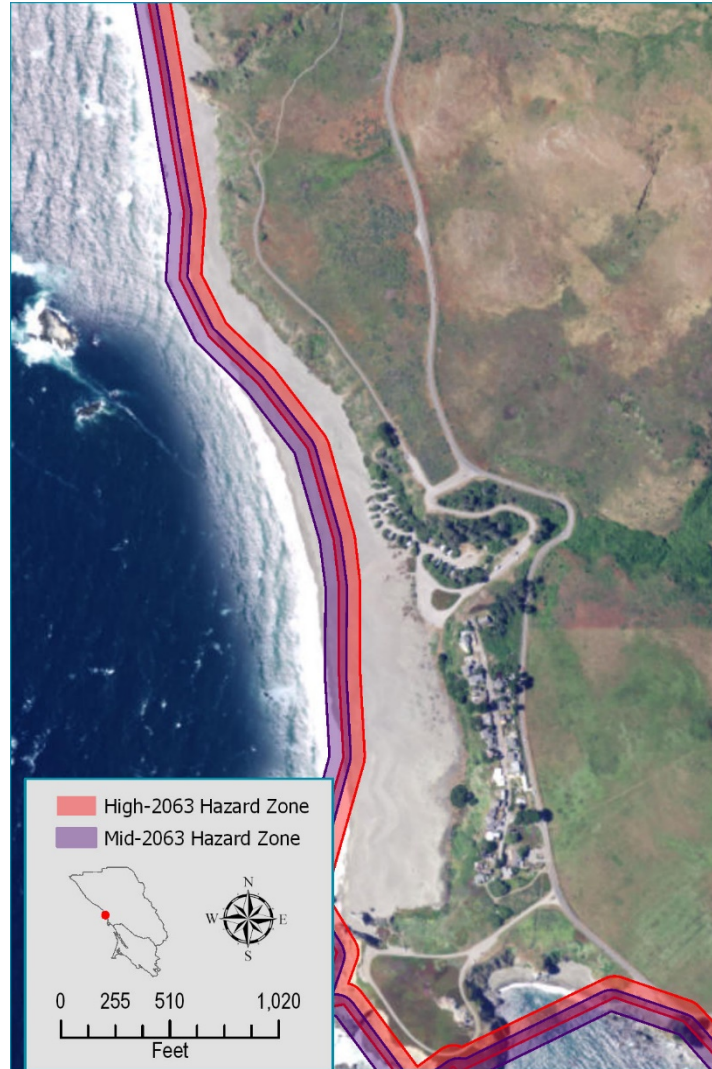


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> KJfm, Qs</p> <p><i>Shoreline Types:</i> Beaches, Rocky Shores, Hardened Shores</p>	<p>Average: <math>-0.03 \pm 0.41</math></p> <p>Maximum: 0.40</p> <p>Minimum: -0.59</p>	California Department of State Parks and Recreation	<p>None</p> <p>Russian River SMRMA</p> <p>Russian River SMCA</p>	<p>1 Access Point: 1 Beach Access</p> <p>~2 km of California Coastal Trail</p>	<p><i>Roads:</i> 0.8 km</p> <p><i>Culverts:</i> none</p> <p><i>Armor:</i> 2 Revetments (290 m long)</p>	None

**Site 5C: Russian River Mouth Zone – Goat Rock (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
5C	Goat Rock (Sonoma Coast State Park)	Sediment imbalance caused by infrastructure	Restore natural processes and maintain coastal access	Near-term	Indirect Sediment Management	Upgrade drainage, culverts, maintain road system	Potentially Feasible	State Parks; CCC; Water Board	GFNMS; USACE; EPA; Resource Agencies	Strategies are linked to proposal for management plan of Russian River estuary and north Goat Rock parking area.
				Mid-term	Managed Retreat	Develop managed retreat plan	Potentially Feasible	State Parks; CCC; Water Board	GFNMS; USACE; EPA; Resource Agencies	Strategies are linked to proposal for management plan of Russian River estuary and north Goat Rock parking area.
				Long-term	Managed Retreat	Managed retreat of parking lot. Remove armoring to allow movement of sediment from the north.	Potentially Feasible	State Parks; CCC; Water Board	GFNMS; USACE; EPA; Resource Agencies	Strategies are linked to proposal for management plan of Russian River estuary and north Goat Rock parking area.

**Site 6: Wright's Beach (Site Characterization)**



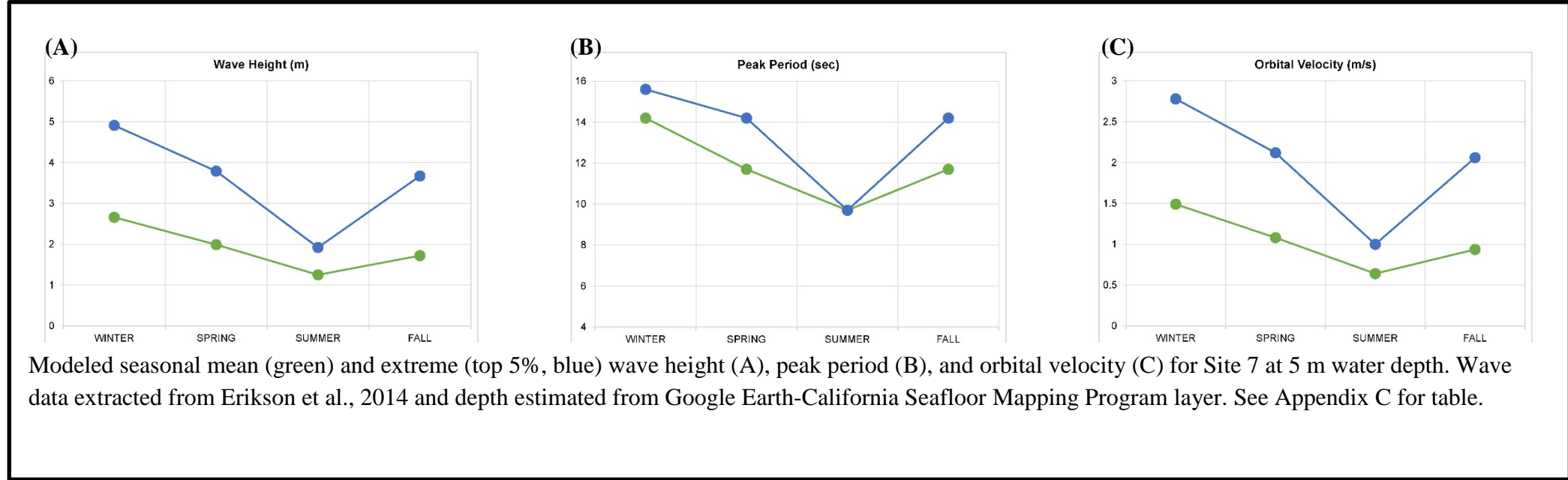
Modeled seasonal mean (green) and extreme (top 5%, blue) wave height (A), peak period (B), and orbital velocity (C) for Site 6 at 5 m water depth. Wave data extracted from Erikson et al., 2014 and depth estimated from Google Earth-California Seafloor Mapping Program layer. See Appendix C for table.

General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qs</p> <p><i>Shoreline Types:</i> Beaches</p>	<p>Average: 0.23 ± 0.21</p> <p>Maximum: 0.62</p> <p>Minimum: -0.05</p>	California Department of State Parks and Recreation, Private	None	<p>3 Access Points: 3 Beach Access</p> <p>~1.5 km of California Coastal Trail</p>	<p><i>Roads:</i> Hwy 1 and ~2 km of local roads</p> <p><i>Culverts:</i> 2</p> <p><i>Aarmor:</i> none</p>	None

**Site 6: Wright's Beach (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
6	Wright's Beach (Sonoma Coast State Park)	Flooding and erosion of the trail	Address inundation; Protect public access	Near-term	Restoration/Indirect Sediment Management	Prepare and implement a stream restoration plan	Potentially feasible	State Parks; CCC; Water Board; County	Resource Agencies	Campground with inundation issues, storm surge, evacuate the sites. Vertical and lateral access issues (see Site 0).
				Long-term	Managed Retreat	Prepare and implement a managed retreat plan including rerouting of vulnerable trail segments and maintenance of trails where feasible	Potentially feasible	State Parks; CCC; Water Board; County	Resource Agencies	Campground with inundation issues, storm surge, evacuate the sites. Vertical and lateral access issues (see Site 0).

**Site 7: Gleason Beach (Site Characterization)**



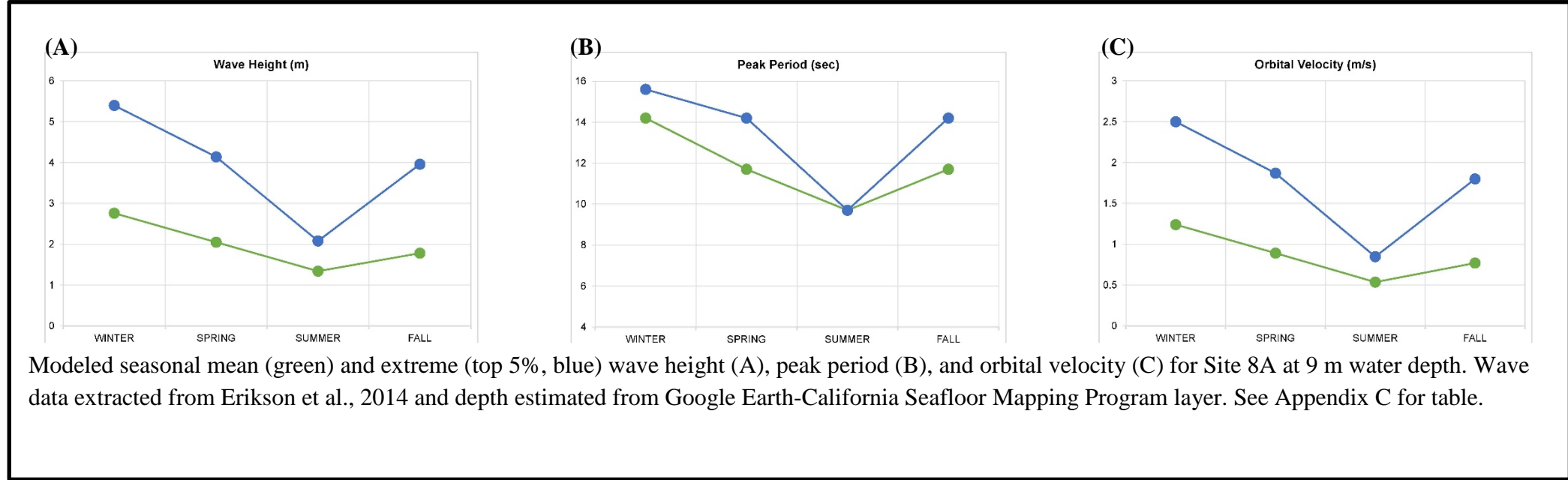
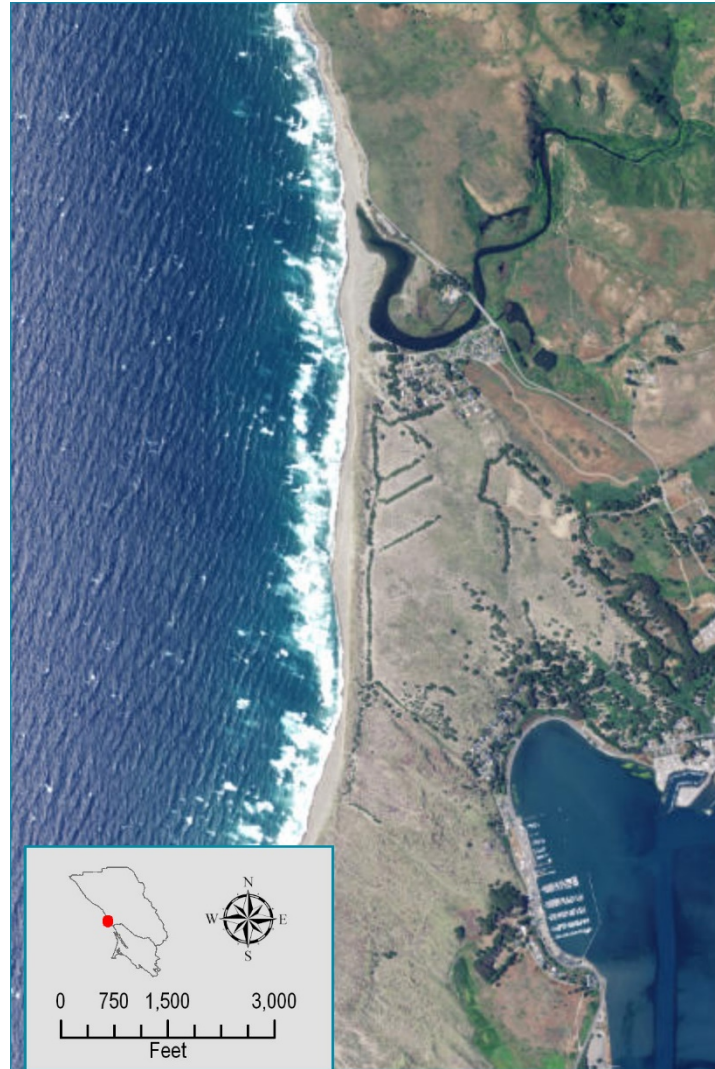
General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> KJfs</p> <p><i>Shoreline Types:</i> Beaches, Rocky Shores</p>	<p>Average: <math>-0.02 \pm 0.21</math></p> <p>Maximum: 0.15</p> <p>Minimum: -0.33</p>	Private	None	<p>0 Access Points identified by CCC</p> <p>California Coastal Trail</p>	<p><i>Roads:</i> Hwy 1</p> <p><i>Culverts:</i> 1</p> <p><i>Armor:</i> Seawalls, Retaining Walls (233 m total)</p>	None

**Site 7: Gleason Beach (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
7	Gleason Beach	Severe erosion threatening homes and Hwy 1; Interest from CalTrans to move Hwy 1; Restoration of Scotty Creek to allow sediment connectivity to coast; Grazing practices in Scotty Creek watershed and gullying are causing erosion	Restore beach and coastal bluff habitats. Retain coastal access. Relocate Highway 1 to a suitable area.	Near-term	Restoration	Remove culvert from Scotty Creek to restore flow to ocean. Monitor and manage flow and water quality.	Feasible	USACE; Caltrans; CCC; SLC; Water Board; County	GFNMS; EPA; Resource Agencies	Part of the Highway 1 realignment project. There may be opportunities to collaborate with the SCC.
					Restoration	Remove old seawalls and derelict homes. Remove shoreline protection and debris in order to restore beach and bluffs.	Feasible	Caltrans; CCC; SLC; Water Board; County	GFNMS; EPA; Resource Agencies	Part of the Highway 1 realignment project. There may be opportunities to collaborate with the SCC.
					Managed Retreat	Move Highway 1 inland; remove houses or access roads built to remaining houses; realign Highway 1/bridge	Feasible	Caltrans; CCC; Water Board; County	GFNMS; EPA; Resource Agencies	Part of the Highway 1 realignment project. There may be opportunities to collaborate with the SCC.
					Indirect Sediment Management	Create coastal trail from abandoned roadway	Feasible	Caltrans; CCC; Water Board; County	GFNMS; Resource Agencies	Part of the Highway 1 realignment project. There may be opportunities to collaborate with the SCC.
				Mid-term	Restoration	Monitor previous actions. Restore vegetation and widen banks of Scotty Creek.	Feasible	Caltrans; CCC; SLC; Water Board; County	GFNMS; EPA; Resource Agencies	
					Restoration	Remove existing bluff armoring. Develop drainage plans.	Potentially feasible	Caltrans; CCC; SLC; Water Board; County	GFNMS; EPA; Resource Agencies	
					Managed Retreat	Remove abandoned infrastructure	Feasible	Caltrans; CCC; Water Board; County	GFNMS; EPA; Resource Agencies	
					Indirect Sediment Management	Pedestrian bridge across Scotty Creek	Feasible	Caltrans; CCC; Water Board; County	Resource Agencies	
				Long-term	Restoration	Manage and monitor previous actions.	Feasible	Caltrans; CCC; SLC; Water Board; County	GFNMS; EPA; Resource Agencies	
					Managed Retreat	Monitor, maintain, and manage previous actions.	Feasible	Caltrans; CCC; Water Board; County	GFNMS; EPA; Resource Agencies	
					Indirect Sediment Management	Maintain trail; rolling easement	Feasible	Caltrans; CCC; Water Board; County	Resource Agencies	



Site 8A: Bodega Bay Zone - Salmon Creek Beach (Site Characterization)

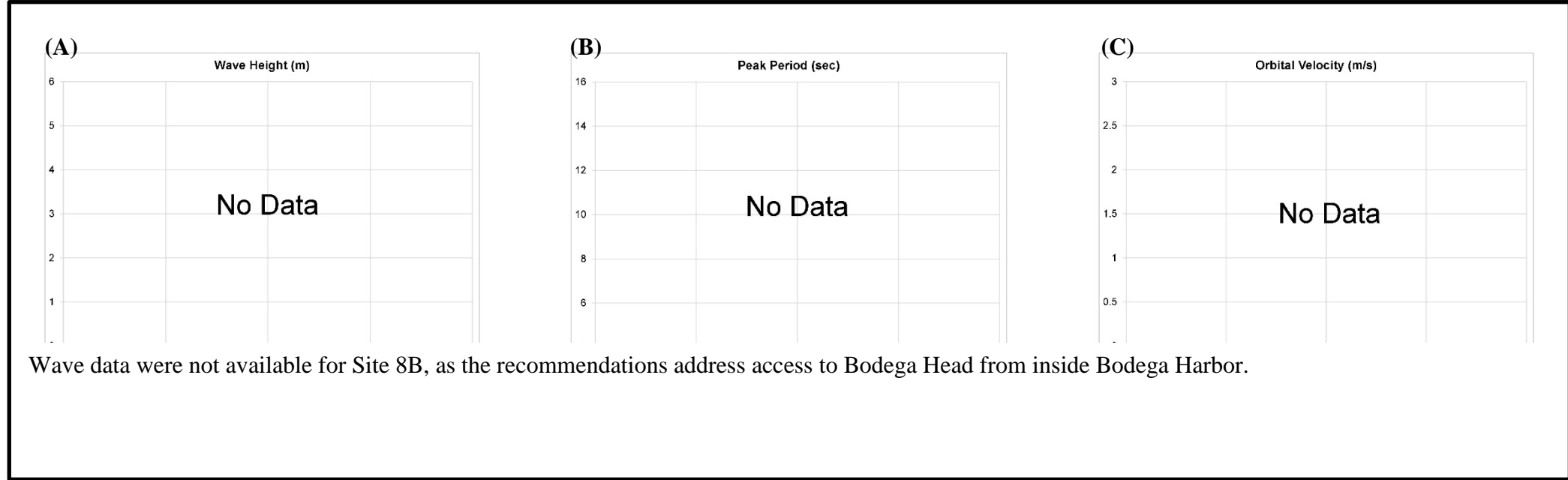
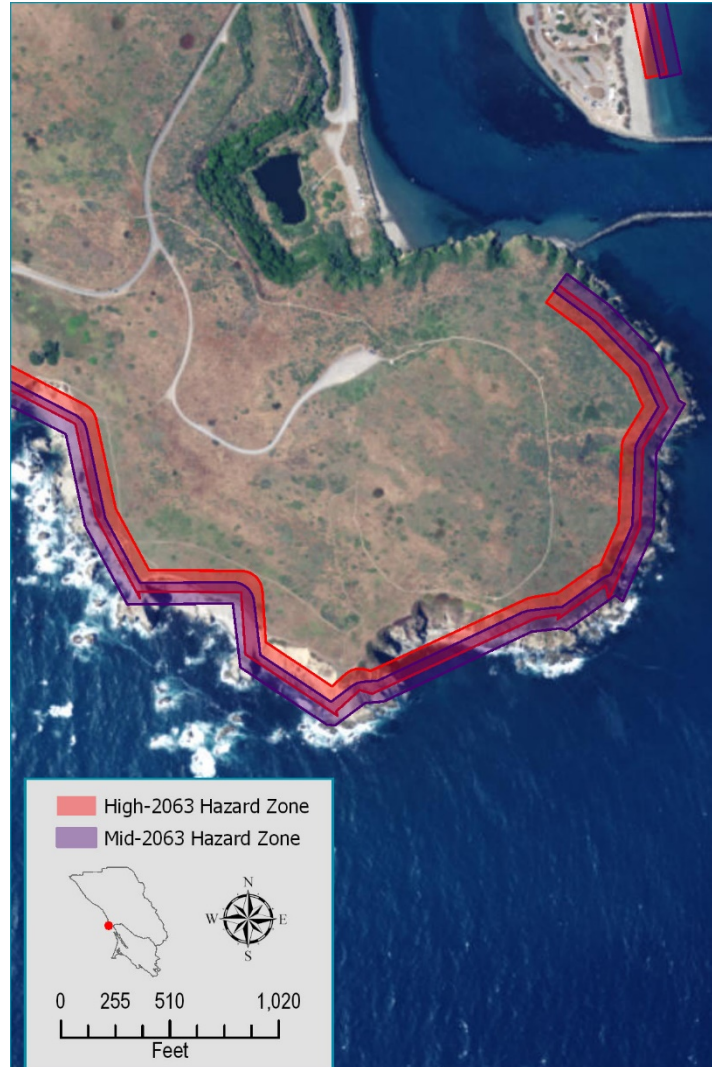


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qs</p> <p><i>Shoreline Types:</i> Beaches</p>	<p>Average: <math>0.24 \pm 0.24</math></p> <p>Maximum: 0.64</p> <p>Minimum: -0.17</p>	California Department of State Parks and Recreation	<p>Tidewater goby</p> <p>Bodega Head SMCA</p>	<p>2 Access Points: 2 Beach Access</p> <p>~2.5 km of California Coastal Trail</p>	<p><i>Roads:</i> ~4 km local roads</p> <p><i>Culverts:</i> 1</p> <p><i>Aarmor:</i> none</p>	None

**Site 8A: Bodega Bay Zone – Salmon Creek Beach (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
8A	Salmon Creek Beach/Northern Bodega Bay Dunes (Sonoma Coast State Park)	Properties along inland area and the creek shoreline have significant flooding and are threatened by dune migration	Protect recreational access. Dune protection & restoration. Reduce/address inundation of public & private property.	Near-term	Research/Education	Investigate options to address inundation such as managed retreat, restoration of riparian and saltmarsh habitat, and living shorelines.	Feasible	GFNMS; USACE; EPA; CCC; SLC; Water Board; State Parks; County	Resource Agencies	
					Research/Education	Public outreach on dune dynamics.	Feasible	CCC; State Parks; County	GFNMS; Resource Agencies	
					Restoration	Remove Ammophila and restore native plants. This strategy is dependent upon community support, as the local community planted Ammophila to stabilize the dunes that were blowing into Bodega Harbor. Also will need to explore ordinances due to former use as military site.	Infeasible	CCC; State Parks; County	Resource Agencies	

**Site 8B: Bodega Bay Zone – Bodega Head (Site Characterization)**

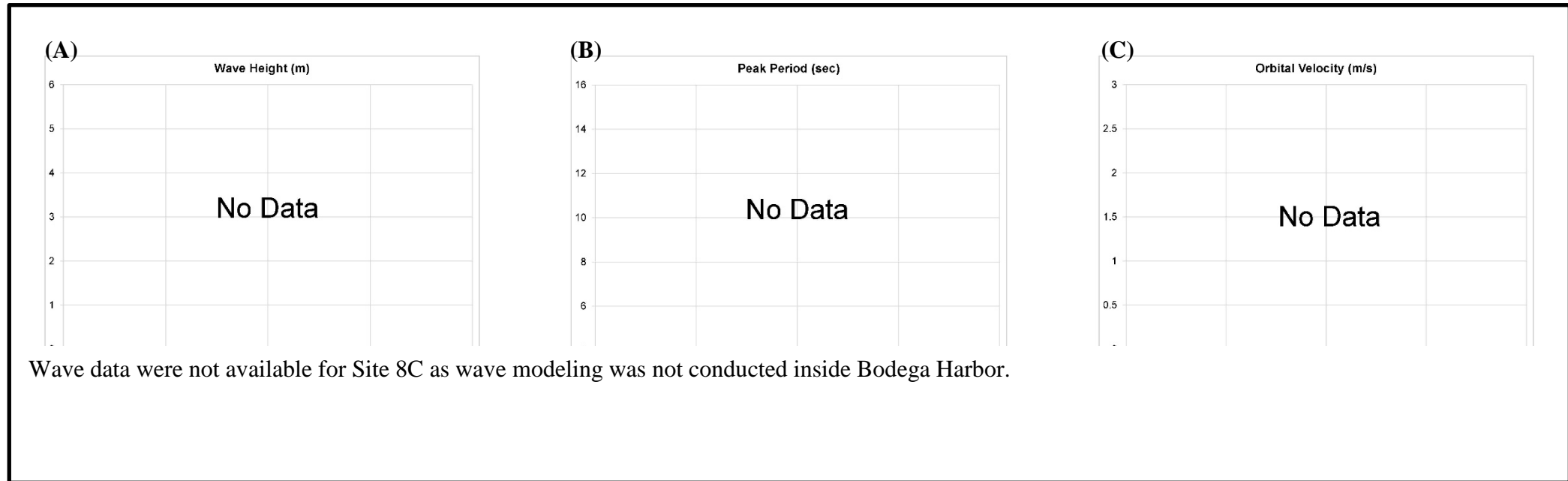


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Kgr</p> <p><i>Shoreline Types:</i> Rocky Shores, Beaches, Hardened Shores</p>	Results not accurate for cliff and bluff environments and no data available for inside Bodega Harbor.	California Department of State Parks and Recreation	Tidewater goby	<p>2 Access Points: 2 Beach Access</p> <p>~4 km of California Coastal Trail</p>	<p><i>Roads:</i> ~7 km local roads</p> <p><i>Culverts:</i> 1</p> <p><i>Aarmor:</i> none</p>	None

**Site 8B: Bodega Bay Zone – Bodega Head (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
8B	Bodega Head	Erosion is threatening coastal access.	Reduce runoff from parking lots. Reduce cliff erosion. Protect access to roads, parking lot.	Near-term	Research/Education	Conduct a road protection feasibility study.	Feasible	Caltrans; State Parks; County	Water Board; Resource Agencies	
					Research/Education	To protect Bay Flat Rd and Westside Rd, investigate options to relocate road, and create living shoreline.	Potentially feasible	Caltrans; State Parks; County	Water Board; Resource Agencies	
					Indirect Sediment Management	Implement storm water best management practices.	Feasible	CCC; State Parks; Water Board; County	Resource Agencies	
				Mid-term	Managed Retreat	Relocate roadway where feasible and improve, relocate, or remove vehicle-dependent facilities.	Potentially feasible	State Parks; Water Board	Resource Agencies	
				Long-term	Managed Retreat	Adaptively manage to relocate trail access/road and facilities.	Potentially feasible	State Parks; Water Board	Resource Agencies	

Site 8C: Bodega Bay Zone – Bodega Harbor (Site Characterization)



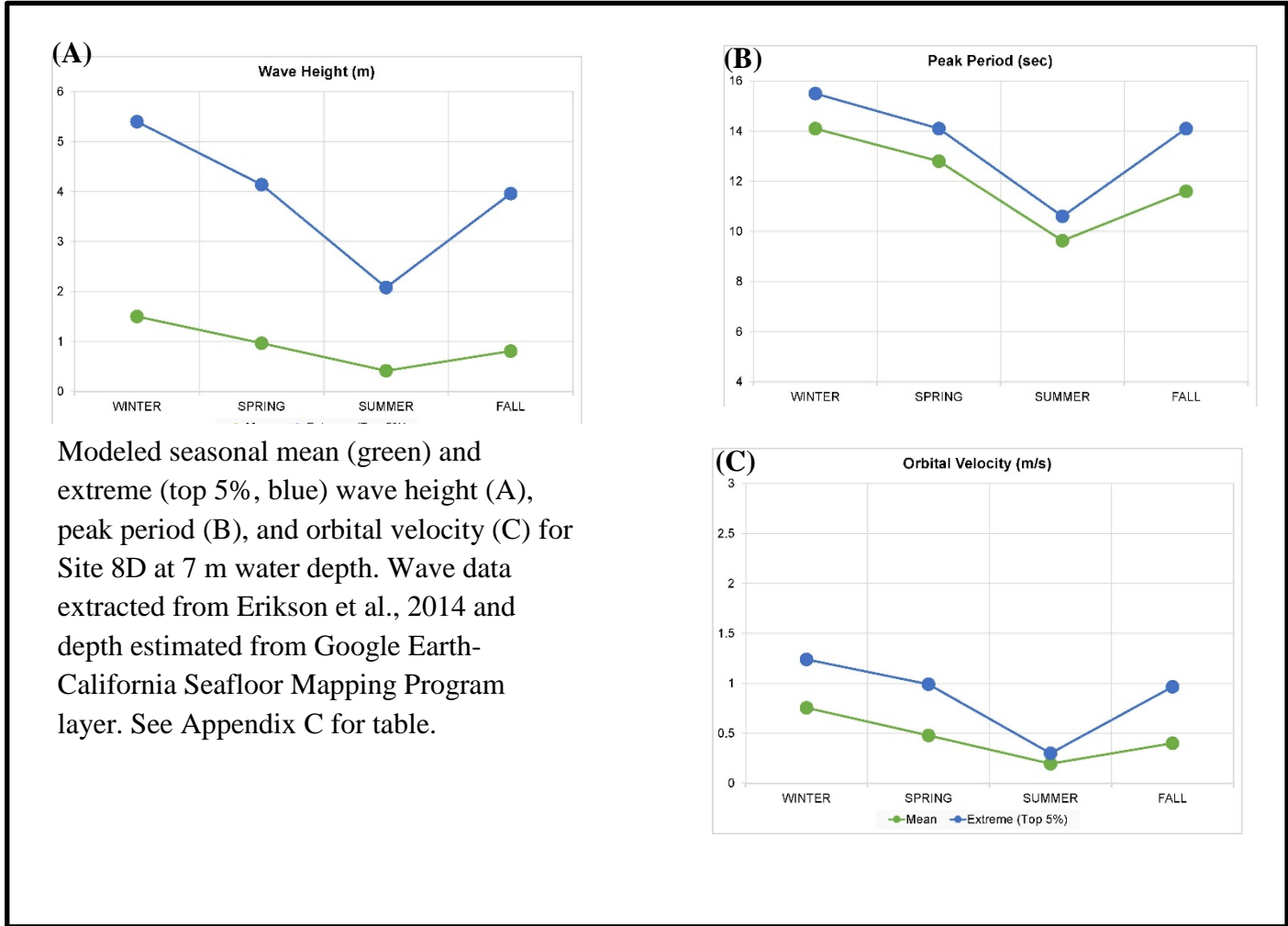
Wave data were not available for Site 8C as wave modeling was not conducted inside Bodega Harbor.

General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qha, Kgr, af, Kfs</p> <p><i>Shoreline Types:</i> Tidal Flats, Beaches, Hardened Shores, Coastal Marsh</p>	<p>Note: No data available for inside Bodega Harbor</p>	<p>California Department of State Parks and Recreation, Sonoma County Regional Parks Department, University of California, Private</p>	<p>Yellow larkspur</p>	<p>9 Access Points: 2 Visual, 2 Beach Access, 3 Boat Access, 1 Campground, 1 City/Town</p> <p>~4 km of trails, including California Coastal Trail</p>	<p><i>Roads:</i> Hwy 1 and ~20 km local roads</p> <p><i>Culverts:</i> 22</p> <p><i>Aarmor:</i> none</p>	<p>None</p>

**Site 8C: Bodega Bay Zone – Bodega Harbor (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
8C	Bodega Harbor	Lack of plan to use decadal dredge material. Bodega Bay Harbor has seen many changes in the bottom of the bay.	Maintain and protect an active waterfront and develop a plan for dredge material management. Maintain and protect recreational access, including roadway flooding.	Near-term	Dredge	Research opportunities for dredge material placement in the Bodega Bay zone. Continue and analyze ongoing dredging. Study morphology of bay and harbor and sediment transport.	Feasible/Potentially feasible	GFNMS; USACE; EPA; CCC; SLC; Water Board; State Parks; County	Resource Agencies	In the past, dredged materials from Bodega Harbor have been relocated to Doran Park. Follow guidelines regarding reuse of sediments and avoid potential source of invasive species.
					Living Shoreline	Manage flooding of roadway. Potentially create a natural shoreline	Potentially feasible	GFNMS; USACE; EPA; CCC; SLC; Water Board; State Parks; County	Resource Agencies	
					Research/Education	Develop a plan to elevate infrastructure at Spud Point and Porto Bodega Marinas to support an active waterfront/harbor.	Feasible	County; USACE; CCC	Water Board; Resource Agencies	
				Mid-term	Dredge	Placement of dredged material at eroded beaches.	Feasible/Potentially feasible	GFNMS; USACE; EPA; CCC; SLC; Water Board; State Parks; County	Resource Agencies	
					Managed Retreat	Elevate roadway. Build causeway. Limit vehicle access.	Infeasible	Caltrans; State Parks; Water Board; County	Resource Agencies	Considered infeasible because likely cost-prohibitive
					Managed Retreat	Elevate/retreat active harbor easements.	Infeasible	Caltrans; State Parks; Water Board; County	Resource Agencies	
				Long-term	Dredge	Maintain and monitor previous actions.	Feasible	GFNMS; USACE; EPA; CCC; SLC; Water Board; State Parks; County	Resource Agencies	
					Managed Retreat	Move roadway where needed.	Feasible	Caltrans; State Parks; Water Board; County	Resource Agencies	
					Managed Retreat	Monitor, maintain, and adapt previous actions.	Feasible	Caltrans; State Parks; Water Board; County	Resource Agencies	

Site 8D: Bodega Bay Zone – Doran Park (Site Characterization)



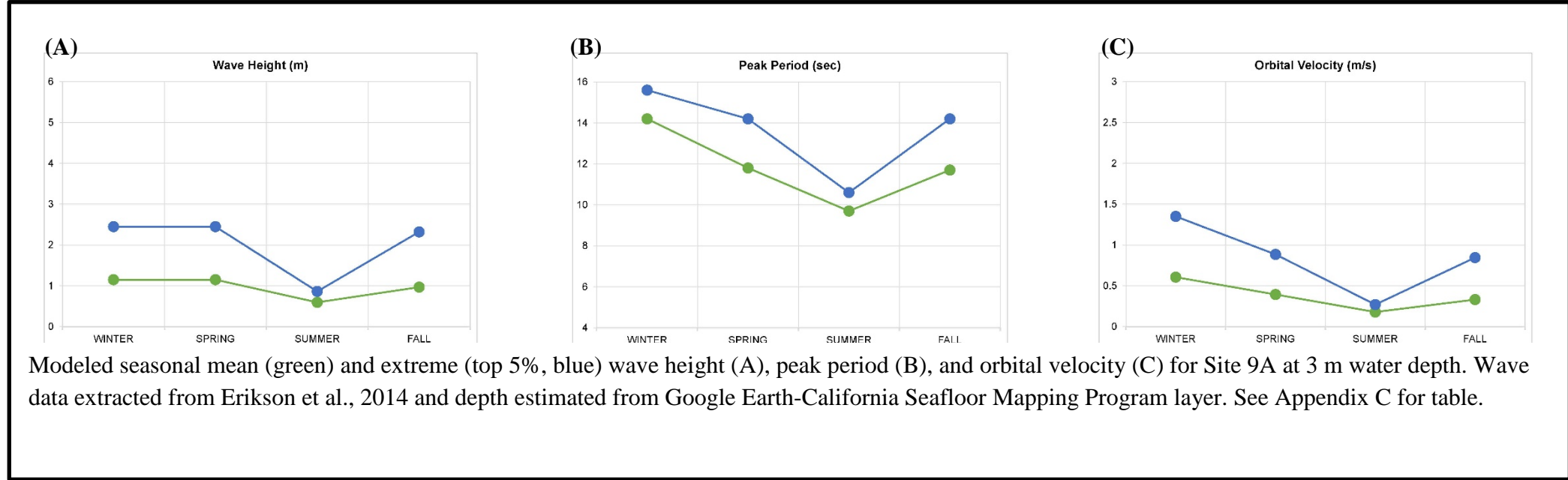
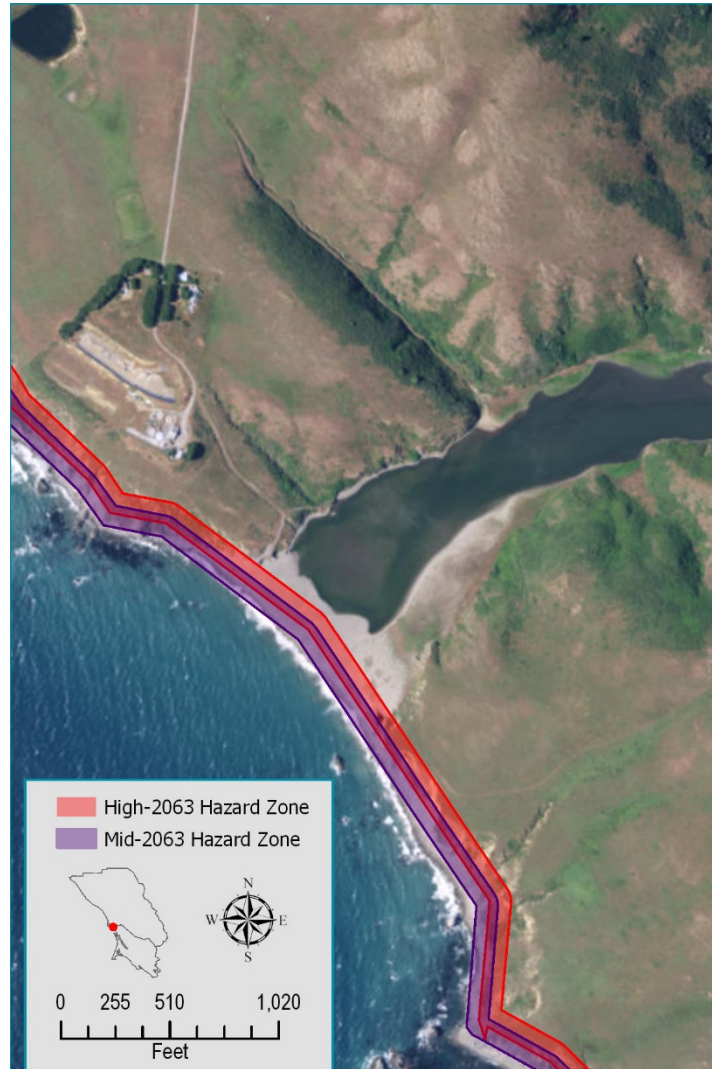
General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qs</p> <p><i>Shoreline Types:</i> Beaches</p>	<p>Average: <math>0.39 \pm 0.31</math></p> <p>Maximum: 1.42</p> <p>Minimum: 0.1</p>	<p>Sonoma County Regional Parks Department, Private</p>	<p>None</p>	<p>1 Access Points: 1 Beach Access</p> <p>~3 km of California Coastal Trail</p>	<p><i>Roads:</i> ~4 km local roads</p> <p><i>Culverts:</i> none</p> <p><i>Armor:</i> Revetment (100 m)</p>	<p>None</p>

**Site 8D: Bodega Bay Zone – Doran Park (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
8D	Doran Park	Access (parking and other park facilities) is threatened by flooding	Ensure continued access for recreation by reducing inundation.	Near-term	Beach Nourishment	Beach nourishment with Bodega Harbor or Russian River dredge materials.	Potentially feasible	GFNMS; USACE; EPA; CCC; SLC; Water Board; State Parks; County	Resource Agencies	Lots of public attention; will take agency collaboration
					Living Shoreline	Create a living shoreline	Feasible	GFNMS; USACE; EPA; CCC; SLC; Water Board; State Parks; County	Resource Agencies	
					Managed Retreat	Relocate United States Coast Guard station	Infeasible	USCG; Caltrans; State Parks; Water Board; County	Resource Agencies	Will need to engage with many agencies to address this issue
					Restoration	Remove Ammophila and restore natural dune processes	Potentially feasible	CCC; State Parks; County	USACE; GFNMS; Resource Agencies	
				Mid-term	Living Shoreline	Create a living shoreline	Feasible	GFNMS; USACE; EPA; CCC; SLC; Water Board; State Parks; County	Resource Agencies	
					Managed Retreat	Raise roadway or other improvements to maintain access	Potentially feasible	Caltrans; State Parks; Water Board; County	Resource Agencies	
				Long-term	Managed Retreat	Raise roadway or other improvements to maintain access	Potentially feasible	Caltrans; State Parks; Water Board; County	Resource Agencies	
					Living Shoreline	Maintain and monitor	Feasible	GFNMS; USACE; EPA; CCC; SLC; Water Board; State Parks; County	Resource Agencies	



Site 9A: Estero Americano (Site Characterization)

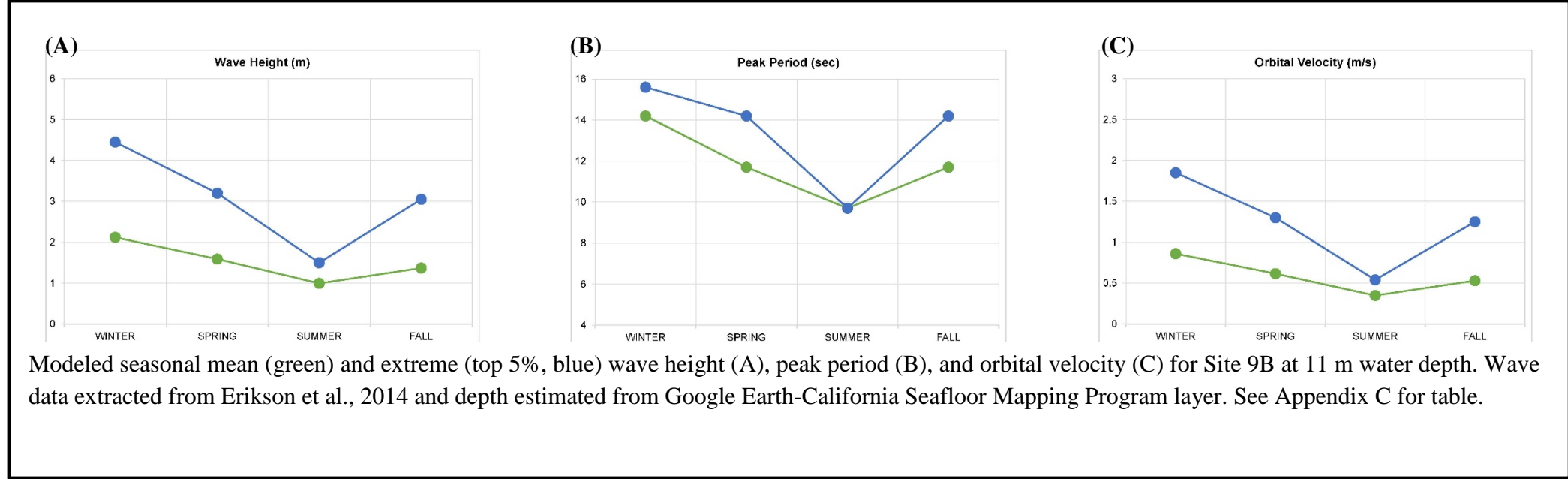
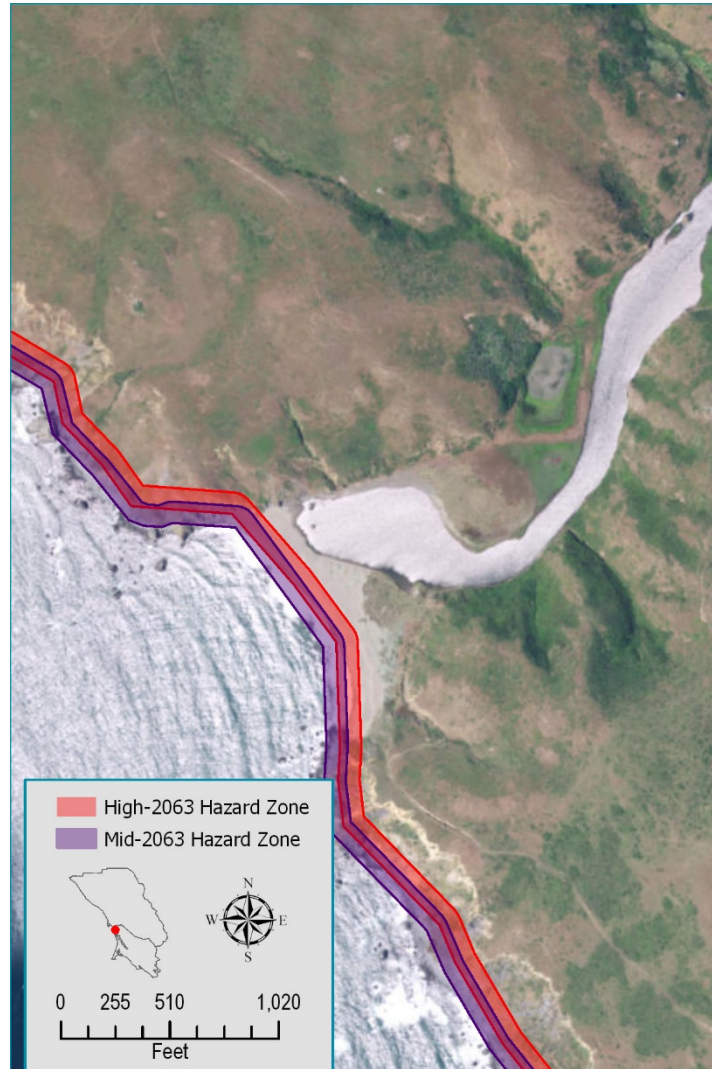


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qs, Qpa, Qt, KJfs</p> <p><i>Shoreline Types:</i> Beaches, Coastal Marsh, Rocky Shores</p>	<p>Average: <math>0.11 \pm 0.01</math></p> <p>Maximum: 0.12</p> <p>Minimum: 0.10</p>	<p>Wildlands Conservancy, Private</p>	<p>Tidewater goby, Red-legged frog, Yellow larkspur</p> <p>Estero Americano SMRMA</p>	<p>No Access Points</p> <p>&lt;1 km of California Coastal Trail</p>	<p><i>Roads:</i> &lt;1 km local roads</p> <p><i>Culverts:</i> none</p> <p><i>Aarmor:</i> none</p>	<p>None</p>

**Site 9A: Estero Americano (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
9A	Estero Americano	Sediment accumulation has changed habitats; 1 million cubic yards of sediment have entered Estero Americano; Historically channel was open with eelgrass beds; Entire ecosystem has been altered. Presence of protected species.	Reduce Sediment. Improve Habitat. Increase monitoring of water quality.	Near-term	Indirect Sediment Management	Upgrade roads to improve drainage.	Feasible	Water Board; Caltrans; County	Resource Agencies	There may be opportunities to collaborate with the local RCDs and the Wildlands Conservancy
					Dredge	Remove excess sediment and assess sediment quality for beneficial reuse.	Feasible	GFNMS; EPA; USACE; CCC; SLC; Water Board; County	Resource Agencies	There may be opportunities to collaborate with the local RCDs and the Wildlands Conservancy
				Mid-term	Research/Education	Develop a framework to further understand ecosystem and best path for restoration projects. Study sediment dynamics, including system change, species impacts, inland flooding and salinity changes; Characterize quality and type of sediment and identify locations for placement. Survey for eelgrass habitat and compare with historic eelgrass extent. Engage with local landowners.	Feasible	GFNMS; EPA; USACE; Water Board; County	NMFS	There may be opportunities to collaborate with the local RCDs and the Wildlands Conservancy
					Indirect Sediment Management	Preserve current eelgrass beds.	Feasible	Water Board; Caltrans; County	Resource Agencies	
			Mid-term	Research/Education	Work with community to manage land to prevent further sedimentation so dredging does not have to be repetitive.	Feasible	GFNMS; Water Board; County	Resource Agencies		
				Restoration	Restore eelgrass beds. Restore habitat to decrease sediment inputs into estero.	Feasible	GFNMS; EPA; USACE; CCC; SLC; Water Board; County	Resource Agencies		
				Research/Education	Evaluate multiple benefits, including wetland creation, flood protection and sediment movement for benefit of species and living shorelines.	Feasible	GFNMS; USACE; EPA; CCC; Water Board; County	Resource Agencies	Ecosystem restoration in esteros based on results from studies recommended in the near-term.	

Site 9B: Estero de San Antonio (Site Characterization)



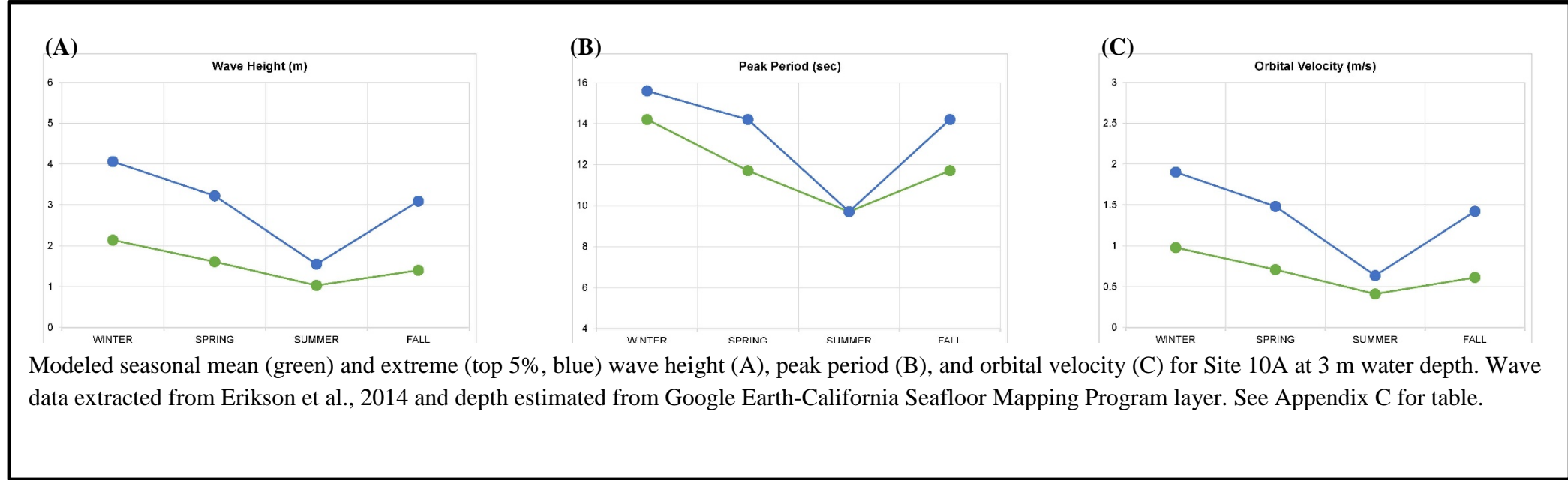
Modeled seasonal mean (green) and extreme (top 5%, blue) wave height (A), peak period (B), and orbital velocity (C) for Site 9B at 11 m water depth. Wave data extracted from Erikson et al., 2014 and depth estimated from Google Earth-California Seafloor Mapping Program layer. See Appendix C for table.

General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qha, KJfs</p> <p><i>Shoreline Types:</i> Beaches, Rocky Shores, Tidal Flats</p>	<p>Average: <math>0.42 \pm 0.15</math></p> <p>Maximum: 0.59</p> <p>Minimum: 0.22</p>	Private	<p>Tidewater goby, Red-legged frog, Yellow larkspur</p> <p>Estero de San Antonio SMRMA</p>	<p>No Access Points</p> <p>No trail</p>	<p><i>Roads:</i> &lt;1 km local roads</p> <p><i>Culverts:</i> none</p> <p><i>Aarmor:</i> none</p>	None

**Site 9B: Estero de San Antonio (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
9B	Estero de San Antonio	Need to evaluate sediment issues. Assess the potential for loss of wetlands with rising sea level (open land may be available to acquire from a willing seller to allow for wetland migration). Presence of protected species (e.g. tidewater goby).	Develop relationships with private landowners surrounding the estero. Develop research program to better understand sediment dynamics.	Near-term	Research/Education	Develop partnerships with private land owners bordering the estero	Feasible	GFNMS; Water Board; County	Resource Agencies	May be opportunities to collaborate with the Marin RCD
					Research/Education	Develop a framework to further understand ecosystem and best path for restoration projects. Study sediment dynamics, including system change, species impacts, inland flooding and salinity changes; Characterize quality and type of sediment and identify locations for placement. Survey for eelgrass habitat and compare with historic eelgrass extent. Engage with local landowners.	Feasible	GFNMS; Water Board; County	Resource Agencies	May be opportunities to collaborate with the Marin RCD

**Site 10A: Dillon Beach - north (Site Characterization)**



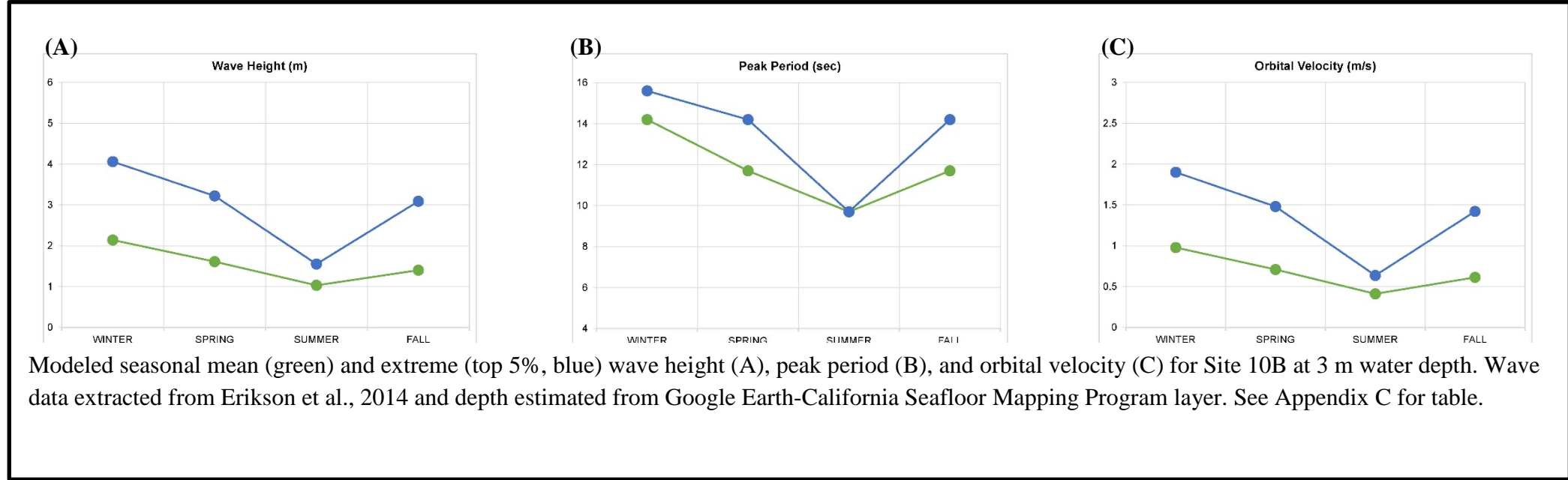
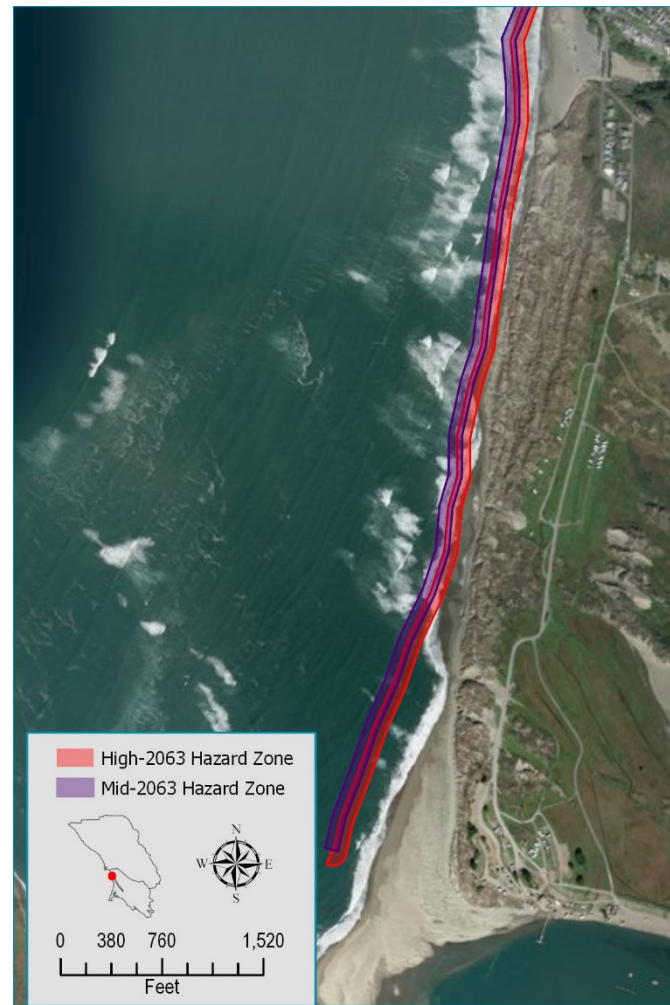
Modeled seasonal mean (green) and extreme (top 5%, blue) wave height (A), peak period (B), and orbital velocity (C) for Site 10A at 3 m water depth. Wave data extracted from Erikson et al., 2014 and depth estimated from Google Earth-California Seafloor Mapping Program layer. See Appendix C for table.

General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qs, Qha, KJfs, Qt, fsr</p> <p><i>Shoreline Types:</i> Rocky Shores, Beaches</p>	Results not accurate for cliff and bluff environments.	Private	None	<p>No Access Points</p> <p>No trails</p>	<p><i>Roads:</i> &lt;1 km local roads</p> <p><i>Culverts:</i> none</p> <p><i>Aarmor:</i> Revetment (26 m), Retaining Wall (7 m)</p>	None

**Site 10A: Dillon Beach - north (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
10A	Dillon Beach (parking area and bluff-top homes)	Sediment movement interfering with public access (especially the excess sand accumulation in parking lot).	Preserve public access and refer to CSMART Conceptual Adaptation Options	Near-term	Indirect Sediment Management	Reduce top of bluff erosion through "softer" erosion control measures, including reducing water flow and runoff and replacing iceplant with native vegetation.	Feasible	CCC; Water Board; County	Resource Agencies	Look at approach to link both areas (parking lot and residential zone).
					Research/Education	Identify homes at risk from erosion along bluff-top and discuss trigger points and solutions, including erosion control measures and managed retreat.	Feasible	CCC; County	Water Board; Resource Agencies	
						Evaluate current sand management practices on the beach and impact to public access. Consider alternatives to preserve parking availability for public access.	Feasible	CCC; County	Water Board; Resource Agencies	
				Long-term	Managed Retreat	Managed retreat where it would help replenish beach.	Potentially feasible	CCC; Water Board; County	Resource Agencies	Politically problematic
					Armor	Only if necessary following strategies for bluff-top erosion control	Potentially feasible	GFNMS; USACE; EPA; CCC; Water Board; SLC; County	Resource Agencies	Politically problematic

Site 10B: Dillon Beach - south (Site Characterization)



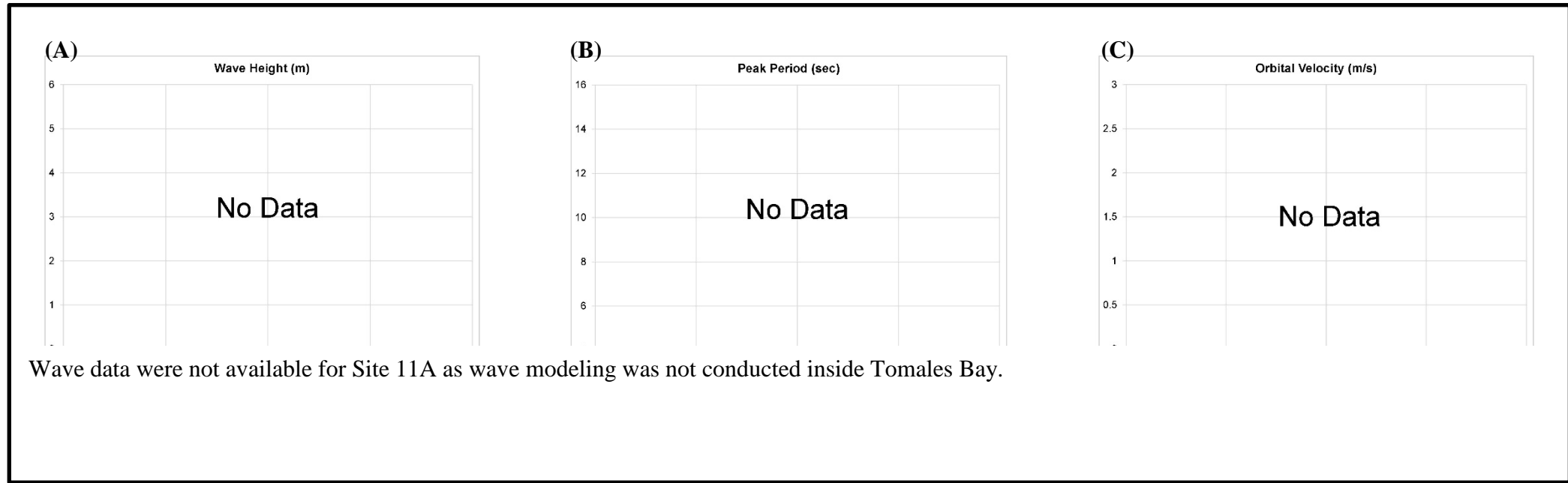
General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qs</p> <p><i>Shoreline Types:</i> Beaches</p>	<p>Average: 1.01 ± 0.23</p> <p>Maximum: 1.39</p> <p>Minimum: 0.69</p>	Private	Snowy plover	<p>2 Access Points: 2 Beach Access</p> <p>2 km of local trail</p>	<p><i>Roads:</i> 2.5 km local roads</p> <p><i>Culverts:</i> none</p> <p><i>Aarmor:</i> none</p>	None

**Site 10B: Dillon Beach - south (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
10B	Dillon Beach (south of Bay street, including Lawson's Landing)	Dune erosion is threatening coastal access, habitat, and existing infrastructure.	Preserve public access and refer to CSMART Conceptual Adaptation Options	Near-term	Restoration	Promote ongoing study/implementation of dune restoration at Lawson's Landing (Center for Ocean Solutions adaptation strategies/study).	Feasible	USACE; EPA; CCC; County	Water Board; Resource Agencies; SLC	Local group actively interested in pursuing dune restoration; COS found that dunes play a significant role in reducing vulnerability exposure here more than other areas; great case study to inform the state on effective strategies if monitoring is incorporated.



**Site 11A: Tomales Bay Zone – Marshall (Site Characterization)**

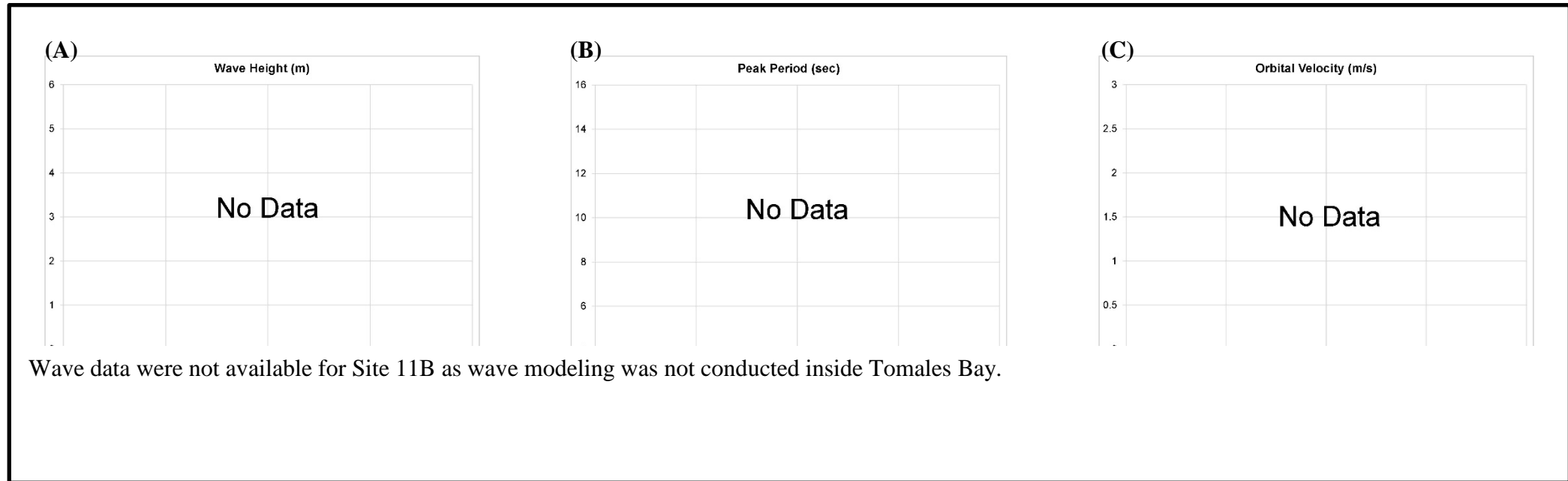
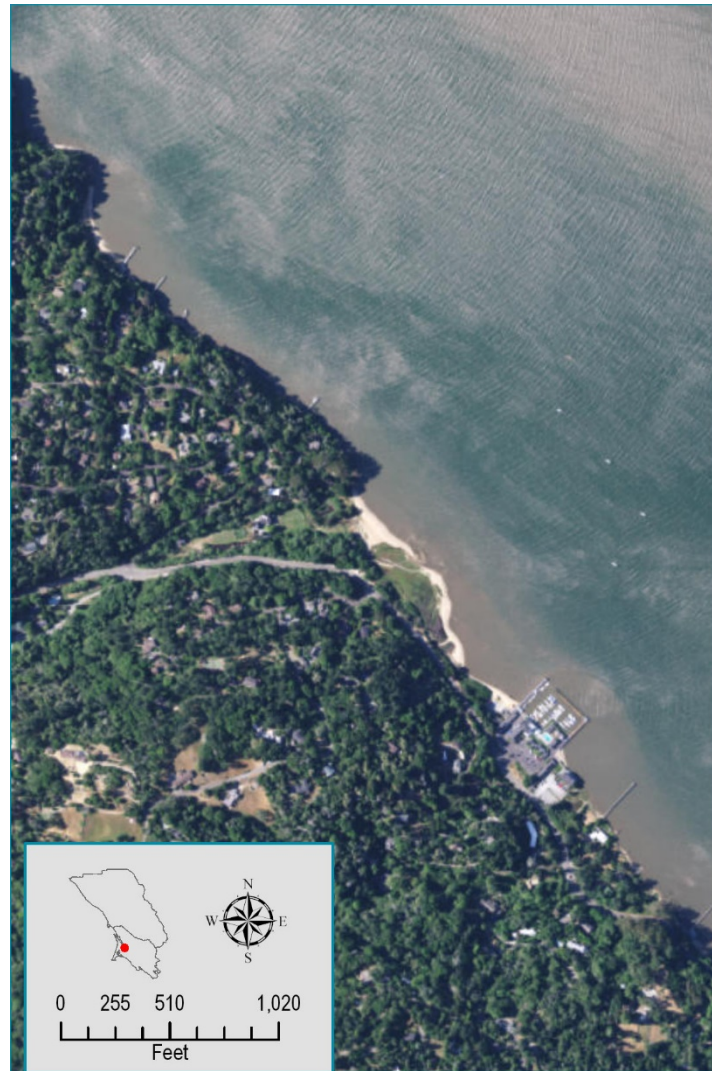


<b>General Geology and Shoreline Types</b>	<b>Shoreline Change (m/yr)</b>	<b>Primary Landowners</b>	<b>Critical Habitats</b>	<b>Public Access and Trails</b>	<b>Infrastructure</b>	<b>Historical Resources</b>
<i>Geology:</i> Qt, fsr  <i>Shoreline Types:</i> Tidal Marsh, Beaches, Coastal Marsh, Hardened Shores	No data available	Audubon Canyon Ranch, National Park Service (GGNRA)	None	1 Access Points: 1 City/Town  No trails	<i>Roads:</i> <1 km local roads  <i>Culverts:</i> 8  <i>Armor:</i> none	None

**Site 11A: Tomales Bay Zone – Marshall (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
11A	Marshall	Scouring of mudflats and increased erosion - losing habitat (mudflats) and their protective capacity	Erosion reduction, habitat preservation	Near-term	Living Shoreline	Explore pilot project for living shoreline using native oyster shells to reduce wave impacts.	Potentially feasible	GFNMS; USACE; EPA; CCC; SLC; Water Board	Resource Agencies; State Parks; County	See C-SMART Marshall Conceptual Adaptation Options from Marin County
					Research	Investigate additional solutions for reducing erosion	Feasible	GFNMS; USACE; EPA; CCC	Water Board; Resource Agencies; SLC; State Parks; County	

Site 11B: Tomales Bay Zone – Chicken Ranch Beach (Site Characterization)

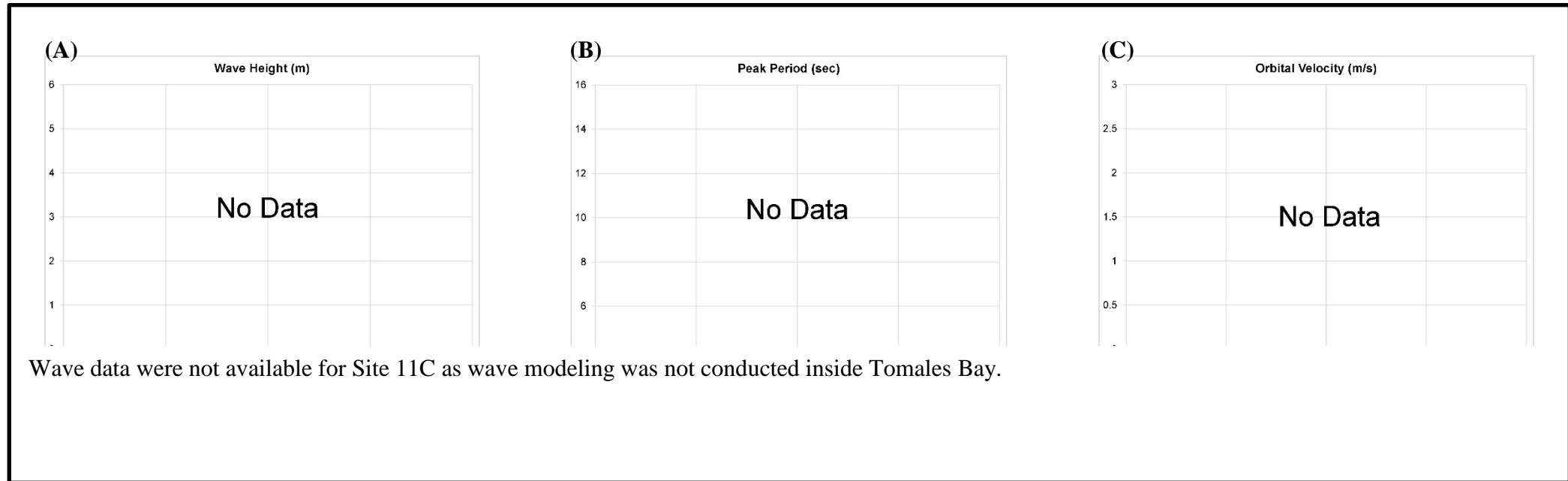
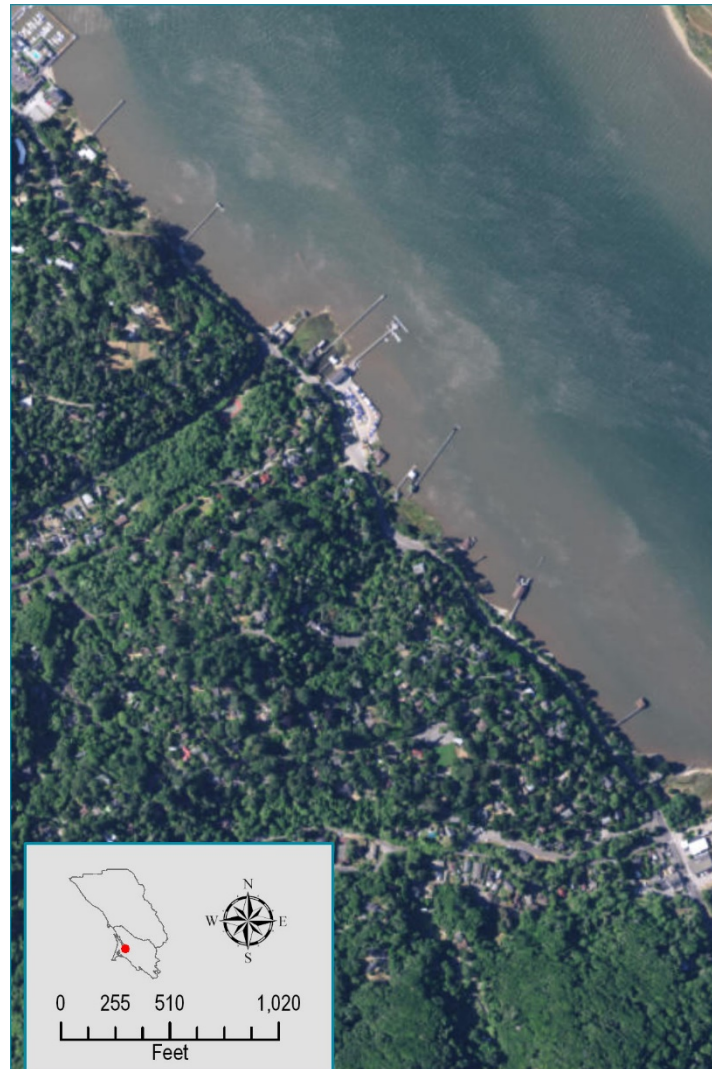


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qt, fsr</p> <p><i>Shoreline Types:</i> Beaches, Coastal Marsh, Rocky Shores</p>	No data available	California Department Parks and Recreation, Marin County Parks Department, Private	None	<p>3 Access Points: 2 Beach Access, 1 Boat Access</p> <p>No trails</p>	<p><i>Roads:</i> &gt;1 km local roads</p> <p><i>Culverts:</i> none</p> <p><i>Aarmor:</i> none</p>	None

**Site 11B: Tomales Bay Zone – Chicken Ranch Beach (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
11B	Chicken Ranch Beach	Sediment is migrating to the south (losing beach on north end); water quality issues.	Preservation of beach access	Near-term	Research	Better understand sediment movement at Chicken Ranch Beach; potentially move sand from south end of beach to north end (back-passing) once this concern is confirmed.	Feasible	GFNMS; USACE; EPA; CCC	Water Board; Resource Agencies; SLC; County	
		Excess sediment is being delivered to Tomales Bay.	Reduction of excess sedimentation in Tomales Bay, primarily from Third Valley Creek watershed	Near-term	Restoration	Restoration to improve sediment storage and reduce sediment impacts. Restoration could improve natural floodplain water and sediment storage. There may be available sediment for use elsewhere (including sediment dredge material on the beach). See Restoration Feasibility and Conceptual Design Report Third Valley Creek and Chicken Ranch Beach Inverness, California, February 2013.	Feasible	GFNMS; USACE; EPA; CCC; SLC; Water Board	Resource Agencies; State Parks; County	Environmental Action Committee, Tomales Bay Watershed Council and Inverness Association are considering a potential restoration project. The proposed project is focused mainly on improving the water quality of Channel B at Chicken Ranch Beach, but depending on funding it could also be expanded to include sediment management improvements as originally proposed. Chicken Ranch Beach is 303d listed as impaired for indicator bacteria.

Site 11C: Tomales Bay Zone – Inverness (Site Characterization)

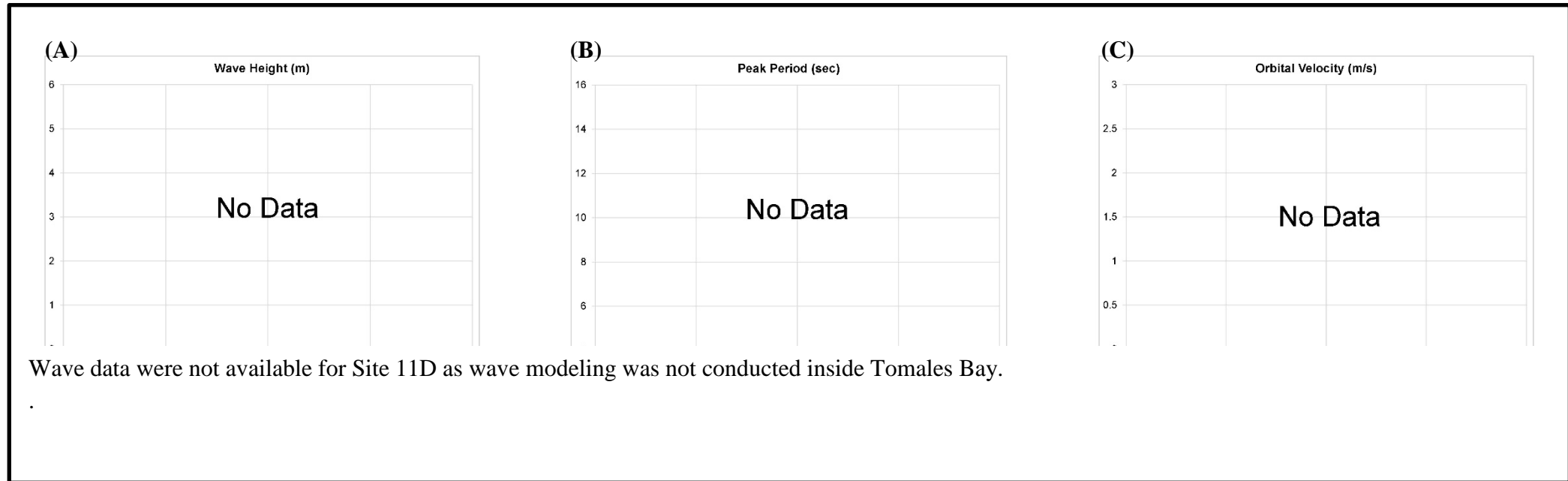


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qt, fsr</p> <p><i>Shoreline Types:</i> Coastal Marsh, Beaches</p>	No data available	Audubon Canyon Ranch, National Park Service (GGNRA), Private	None	<p>2 Access Points: 1 Beach, 1 City/Town</p> <p>No trails</p>	<p><i>Roads:</i> &lt;1 km local roads</p> <p><i>Culverts:</i> none</p> <p><i>Aarmor:</i> none</p>	None

**Site 11C: Tomales Bay Zone – Inverness (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
11C	Inverness	Sediment deficit, wetlands may be submerged due to sea level rise. Road is currently impacted, with slumping and flooding.	Protection of wetland resources	Near-term	Living Shoreline	Explore pilot project for horizontal levee off bulkhead protecting the road to maintain wetland habitat.	Potentially feasible	GFNMS; USACE; EPA; CCC; SLC; Water Board	Resource Agencies; State Parks; County	
					Indirect Sediment Management	Elevate homes and businesses.	Feasible/Potentially feasible	County; Caltrans; CCC; Water Board; County	Resource Agencies	Depends on specifications. See C-SMART Inverness Conceptual Adaptation Options from Marin County.
				Long-term	Managed Retreat	Relocate impacted homes and businesses.	Potentially feasible	County; Caltrans; CCC; Water Board; County	Resource Agencies	

Site 11D: Tomales Bay Zone – Pt. Reyes Station/Bivalve (Site Characterization)



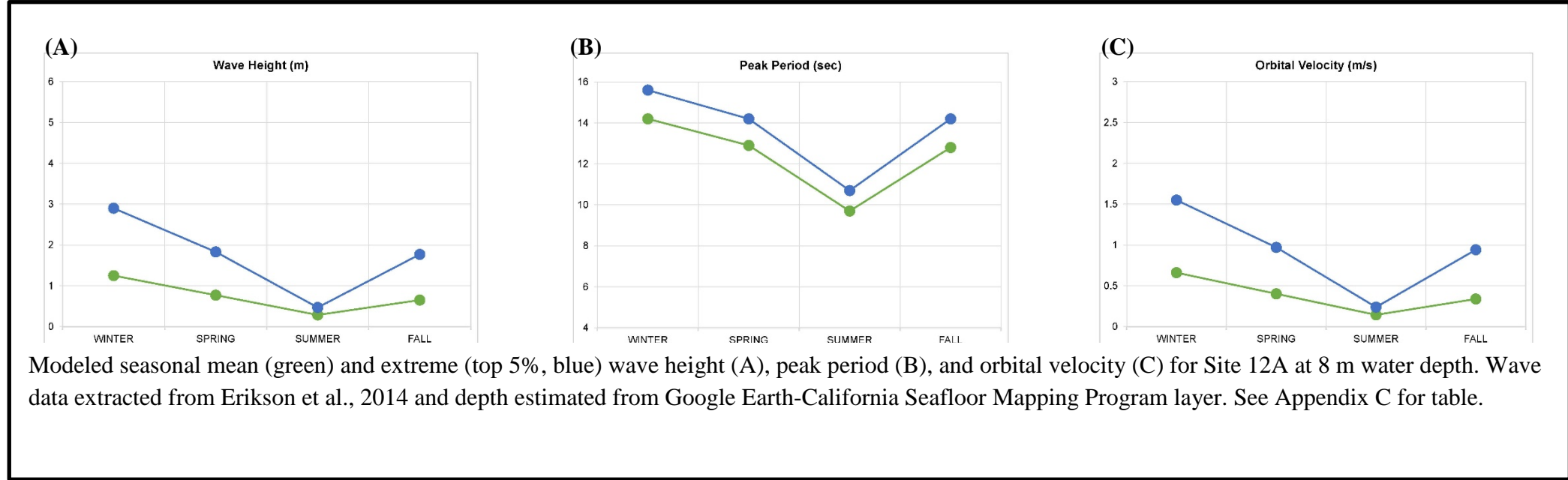
General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qt, fsr</p> <p><i>Shoreline Types:</i> Tidal Marsh, Coastal Marsh</p>	No data available	Audubon Canyon Ranch, National Park Service (GGNRA), California Department of Fish and Wildlife	Tidewater goby, Red-legged frog	<p>1 Access Points: 1 Visual Access</p> <p>No trails</p>	<p><i>Roads:</i> no roads</p> <p><i>Culverts:</i> none</p> <p><i>Aarmor:</i> none</p>	None

**Site 11D: Tomales Bay Zone – Pt. Reyes Station/Bivalve (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
11D	Pt Reyes Station (including Bivalve, east shore of Tomales Bay, and areas behind railroad levees).	The engineered railroad levees have been in place along much of the east shore of Tomales Bay since the 1870s and have altered marsh performance.	Enhance wetland habitat	Near-term	Research	Understand impacts of historic railroad levees and options for restoration or inland wetland migration for continued wetland existence (removal of development)	Feasible	GFNMS; NPS; County; USACE; CCC; State Parks	Water Board; SLC; Resource Agencies	The potential pros and cons of any action at these sites should be evaluated in the context of Tomales Bay limiting habitats. The SCC may be interested in collaborating on potential projects at these sites. Many of the levees have created habitat that protected species now use (e.g., Tricolored Blackbird).
				Mid-term	Restoration	Implement based on what was learned in feasibility study	Potentially feasible	GFNMS; USACE; EPA; NPS; CCC; SLC; Water Board	Resource Agencies; State Parks; County	



Site 12A: Point Reyes National Seashore - Drakes Beach/Visitor Center (Site Characterization)

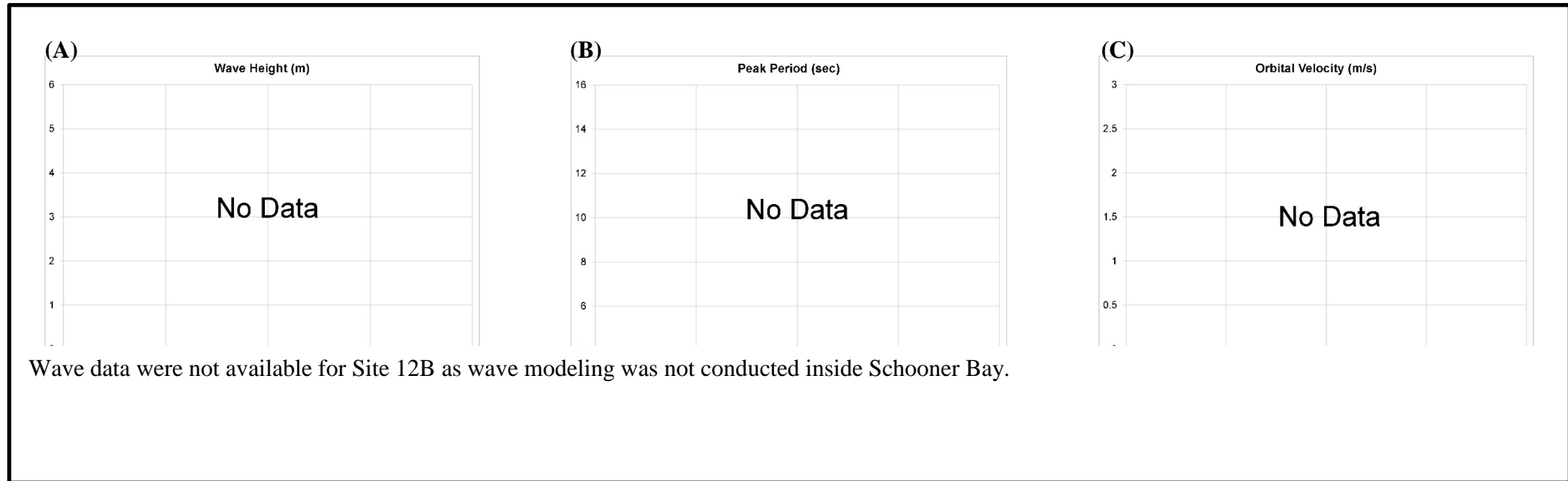


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qs, Tpms, Qha</p> <p><i>Shoreline Types:</i> Beaches</p>	<p>Average: <math>0.24 \pm 0.11</math></p> <p>Maximum: 0.44</p> <p>Minimum: 0.04</p>	National Park Service (PRNS)	<p>Red-legged frog</p> <p>Pt Reyes SMR</p>	<p>1 Access Points: 1 Beach Access</p> <p>~2.5 km of trails</p>	<p><i>Roads:</i> &lt;3 km local roads</p> <p><i>Culverts:</i> none</p> <p><i>Aarmor:</i> none</p>	None

**Site 12A: Point Reyes National Seashore - Drakes Beach/Visitor Center (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
12A	Point Reyes National Seashore - Drakes Beach/Visitor Center	Wetlands are not connected to system and federally listed species are impacted.	Restoration and retain public access	Near term	Research/Education	In light of the current proposal to restore wetland connectivity and reduce the parking lot area, evaluate opportunities to enhance habitat as part of restoration improvements.	Potentially feasible	USACE; NPS; CCC; Water Board	Resource Agencies	

Site 12B: Point Reyes National Seashore - Schooner Bay (Site Characterization)

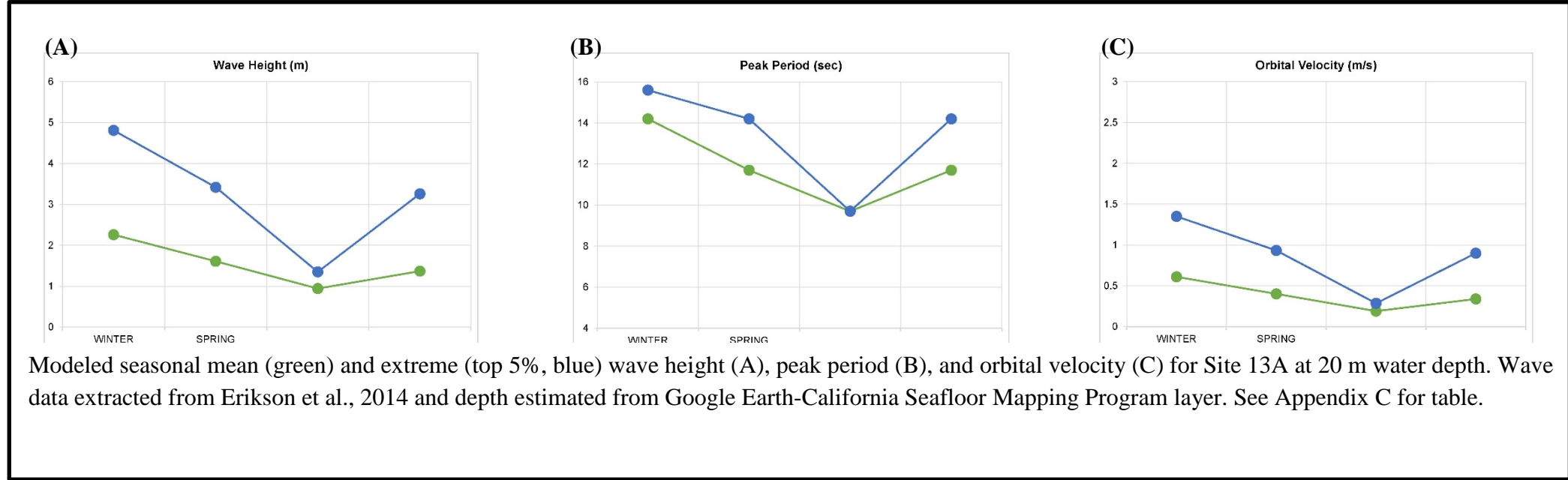
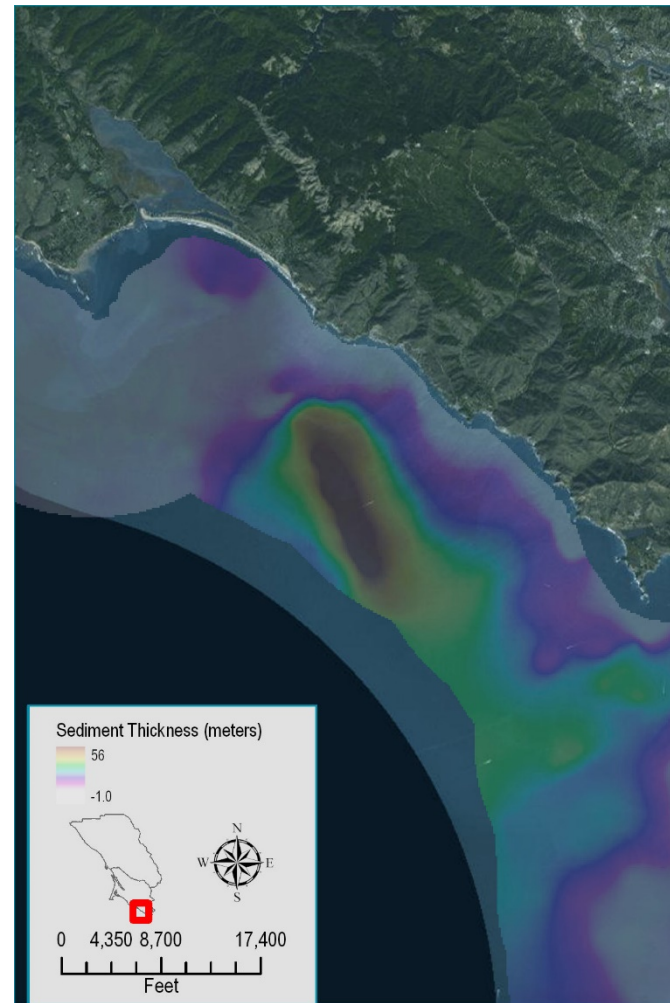


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Tpms, Tms, Qha</p> <p><i>Shoreline Types:</i> Beaches, Coastal Marsh, Tidal Flats</p>	No data available	National Park Service (PRNS)	<p>Red-legged frog</p> <p>Drakes Estero SMCA</p>	<p>1 Access Points: 1 Beach Access</p> <p>12 km of trail</p>	<p><i>Roads:</i> 8 km local roads</p> <p><i>Culverts:</i> 1</p> <p><i>Aarmor:</i> none</p>	None

**Site 12B: Point Reyes National Seashore - Schooner Bay (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
12B	Point Reyes National Seashore - Schooner Bay	Riparian, stream, and estuarine habitat along East Schooner Creek and Schooner Bay are not connected to overall system and federally listed species are impacted.	Restoration and retain public access	Near term	Restoration	Evaluate opportunities to enhance habitat as part of road and trail improvements. Develop trail plan for sea level rise. Reroute trails when triggers are met.	Potentially feasible	USACE; NPS; CCC; Water Board	Resource Agencies	The Sir Francis Drake Road Federal Land Access Program (FLAP) through the County of Marin and Federal Highways Administration will result in substantial improvements to 12 miles of SFDB. This work will realign the road to protect riparian and marsh habitat. Installation of a bridge will enhance estuary habitat at Schooner Bay.

Site 13A: Bolinas Zone - Duxbury Reef and Offshore Area (Site Characterization)

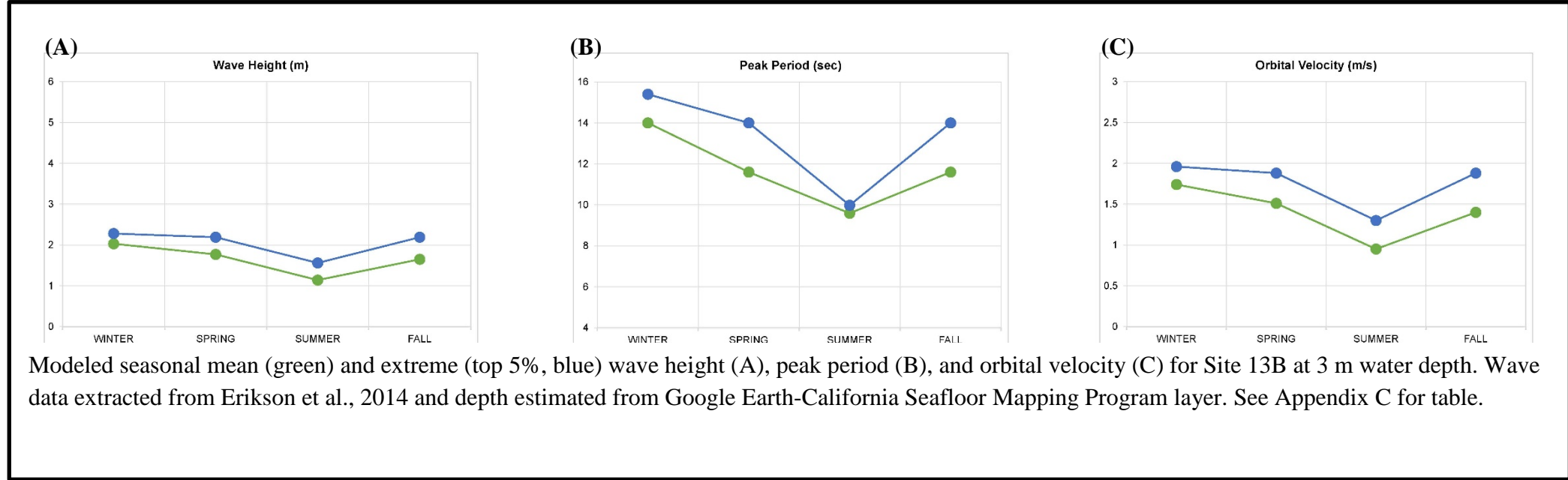


General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qms, Qmss</p> <p><i>Shoreline Types:</i> N/A</p>	<p>Average: N/A</p> <p>Maximum: N/A</p> <p>Minimum: N/A</p>	<p>Monterey Bay National Marine Sanctuary, State Lands Commission</p>	<p>MBNMS</p>	<p>N/A</p>	<p>N/A</p>	<p>N/A</p>

**Site 13A: Bolinas Zone - Duxbury Reef and Offshore Area (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
13A	Duxbury Reef and Off-shore Area	Graben of deep sediment for beach nourishment is an opportunity; however, accessibility may be problematic.	Identify graben material and pathways for use	Near-term	Research/Education	Characterize "sand resource" and where it can be used (depth/extent). Identify potential areas for sand placement based on environmental considerations and overlapping regulations (MPAs). Investigate regulatory opportunities to access graben material.	Feasible	GFNMS; USACE; EPA; CCC; Water Board; SLC	Resource Agencies	Need to be certain protection of kelp beds even if kelp is not there, need to be certain will not impact the rocky substrate

Site 13B: Bolinas Zone – Bolinas Cliffs (Site Characterization)



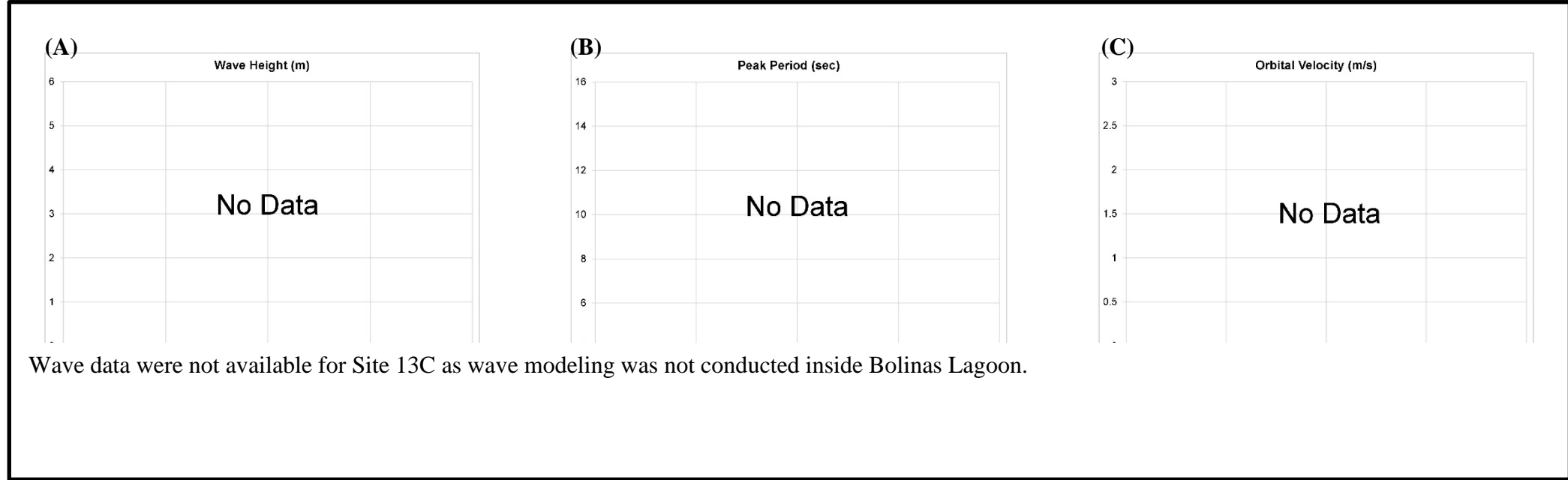
General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Tms, Qt, Qsl, QTs</p> <p><i>Shoreline Types:</i> Rocky Shores, Beaches</p>	Results not accurate for cliff and bluff environments.	Private	None	<p>2 Access Points: 1 Beach Access, 1 Visual Access</p> <p>No trails</p>	<p><i>Roads:</i> ~3 km local roads</p> <p><i>Culverts:</i> none</p> <p><i>Aarmor:</i> Revetment (107 m), Seawall (351 m)</p>	None

**Site 13B: Bolinas Zone – Bolinas Cliffs (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
13B	Bolinas Cliffs/ Beach (between Duxbury & Lagoon)	Armoring along the base and cliff-side; Homes are highly vulnerable if armoring removed but armoring impacts sediment supply. 30% of sediment input to the lagoon is from these cliffs.	Ensure access and protect habitats	Near-term	Restoration	Allow natural beach replenishment. Encourage bluff-top erosion control.	Feasible	GFNMS; USACE; EPA; CCC; Water Board; SLC	Resource Agencies	Bluff erosion provides sediment for beach. Potential removal of armoring if erosion becomes too severe - armoring is considered temporary and to be removed eventually. All parties would have to be on board.
					Managed Retreat/Armor	Relocate homes and remove armor where possible when homes are red-tagged. Armor above mean high water line to protect existing homes.	Feasible	EPA; CCC; Water Board; County		
				Long-term	Managed Retreat	Planned retreat for cliff-side houses within hazard zone.	Feasible	EPA; CCC; Water Board; County	GFNMS; USACE; Resource Agencies	



Site 13C: Bolinas Zone – Bolinas Lagoon (Site Characterization)



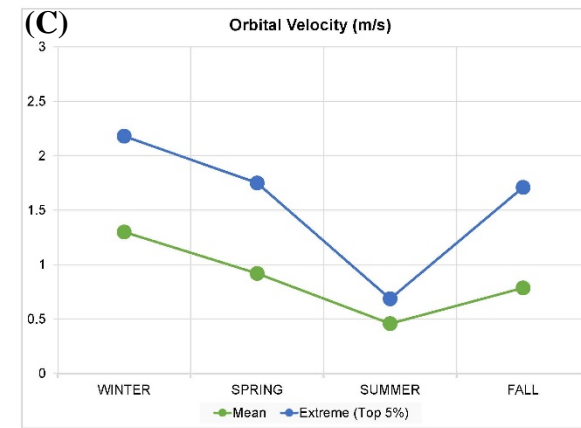
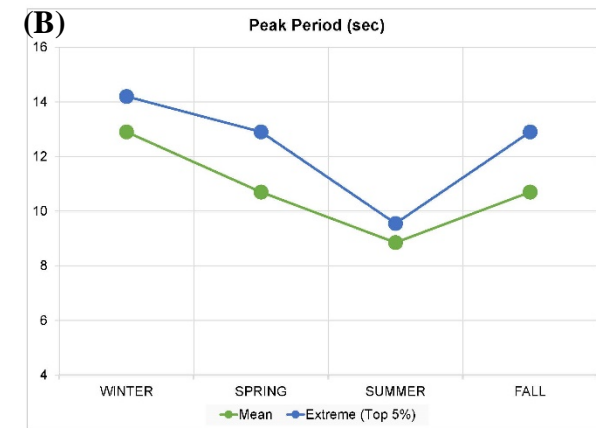
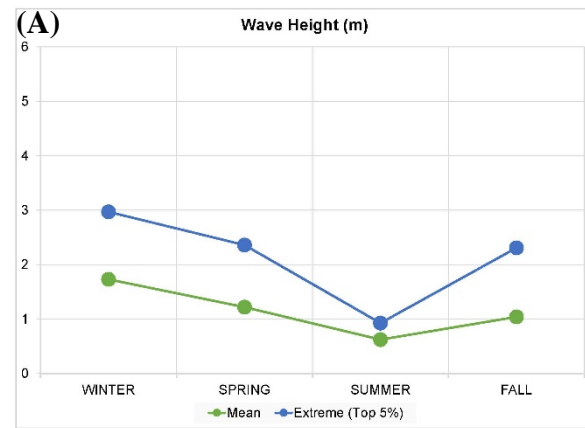
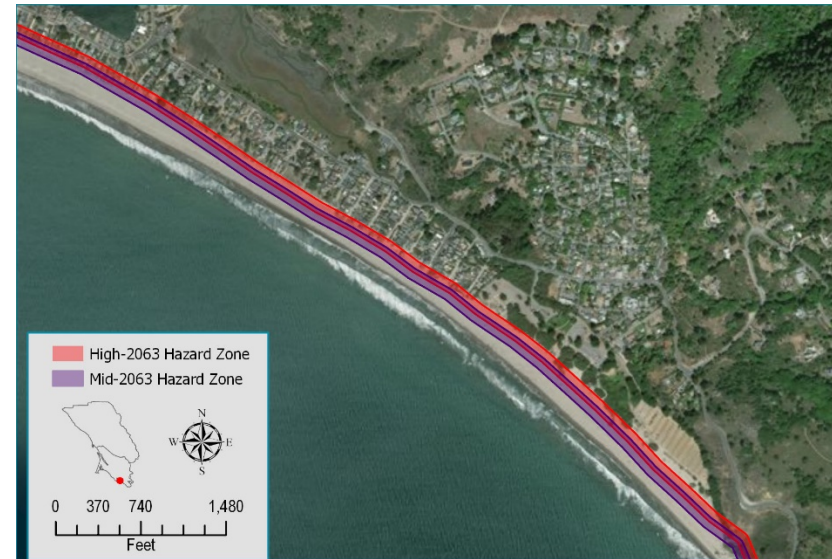
Wave data were not available for Site 13C as wave modeling was not conducted inside Bolinas Lagoon.

General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qs, Tms, QTs, af, Qha, Qoa, fsr, Kfs</p> <p><i>Shoreline Types:</i> Coastal Marsh, Tidal Flats</p>	No data available	National Park Service (GGNRA), Audubon Canyon Ranch, Marin County Open Space District, Private	Tidewater goby	<p>3 Access Points: 1 Beach Access, 1 City/town, 1 Historical/Cultural Site</p> <p>~10 km of trail</p>	<p><i>Roads:</i> Hwy 1 and ~10 km local roads</p> <p><i>Culverts:</i> ~60</p> <p><i>Aarmor:</i> none</p>	None

**Site 13C: Bolinas Zone – Bolinas Lagoon (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
13C	Bolinas Lagoon	Sedimentation in lagoon is degrading the ecosystem.	Ensure access and protect habitats	Near-term	Research/Education	Gather long-term trends and work on communications with the community to help facilitate sediment management decisions.	Feasible	GFNMS; NPS; CCC; SLC; County	Resource Agencies	See Bolinas North End project and Kent Island Restoration Project
				Mid-term	Research/Education	Consider alternatives to protect the roadway including create a living shoreline or horizontal levee or elevating Highway 1 (bypass). Understand changes in depths of water level and road and habitat impacts.	Feasible	GFNMS; NPS; CCC; SLC; County	Resource Agencies	Refer to general recommendation regarding CalTrans task force

Site 13D: Bolinas Zone – Stinson Beach (Site Characterization)



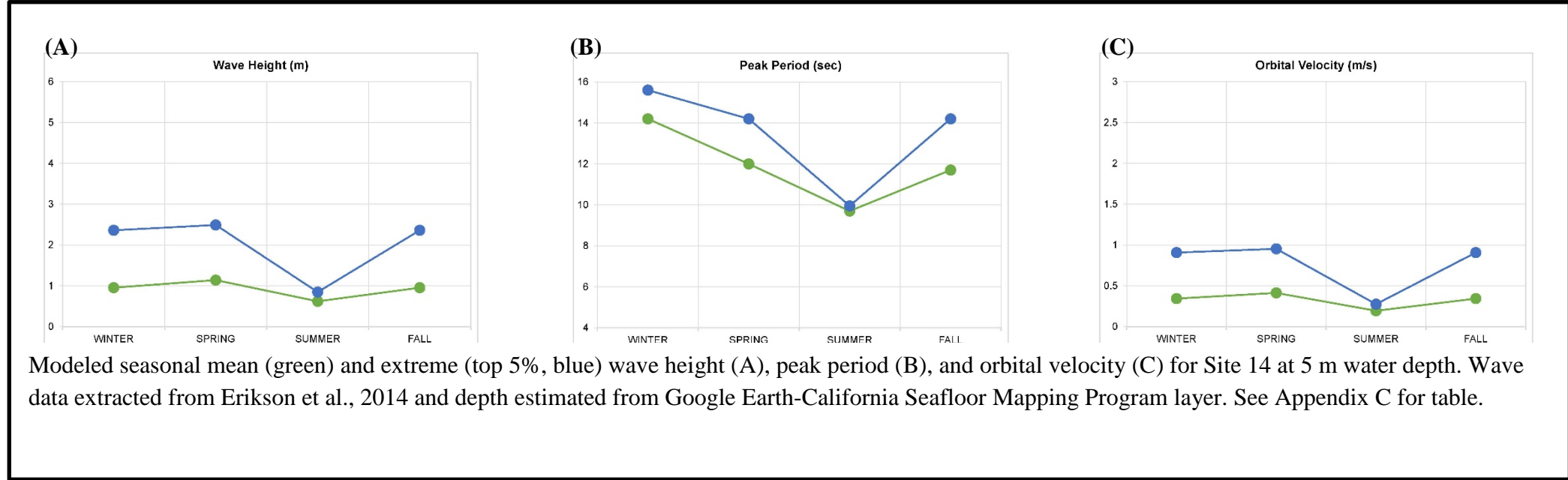
Modeled seasonal mean (green) and extreme (top 5%, blue) wave height (A), peak period (B), and orbital velocity (C) for Site 13D at 3 m water depth. Wave data extracted from Erikson et al., 2014 and depth estimated from Google Earth-California Seafloor Mapping Program layer. See Appendix C for table.

General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> Qs, af, Qha, fsr</p> <p><i>Shoreline Types:</i> Beaches</p>	<p>Average: <math>-0.08 \pm 0.14</math></p> <p>Maximum: 0.16</p> <p>Minimum: -0.32</p>	<p>Marin County Parks Department, Department of Parks and Recreation, National Park Service (GGNRA), Private</p>	<p>None</p>	<p>4 Access Points: 3 Beach Access, 1 City/Town</p> <p>~4 km beach trail</p>	<p><i>Roads:</i> ~5 km local roads</p> <p><i>Culverts:</i> none</p> <p><i>Armor:</i> Revetment (2800 m), Seawall (105 m)</p>	<p>None</p>

**Site 13D: Bolinas Zone – Stinson Beach (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
13D	Stinson Beach	Wave attack and sea level rise are threatening recreational beach, community and beach/dune habitats	Preserve beach recreation and community and protect habitat	Near-term	Beach Nourishment	Identify funding and source materials for nourishment activities	Feasible	GFNMS; NPS; USACE; EPA; CCC; Water Board; SLC	Resource Agencies: NMFS	NPS is starting to monitor beach profiles. Difficult to implement due to access and funding, particularly in locations with infrastructure. Potential for natural recovery. May nourish after erosive events.
					Managed Retreat	Consider options for managed retreat including strategies such as no shoreline protective devices for vacant lots, property acquisition, infrastructure relocation, etc.	Potentially feasible	NPS; CCC; Water Board; County	GFNMS; USACE; EPA; Resource Agencies	Complicated by interaction with adjacent property protections.
					Research/Education	Monitor rate of change of beach and offshore sediment transport pathways.	Feasible	GFNMS; NPS; USACE; USGS; CCC; SLC; County	Resource Agencies	
					Research/Education	Help the community accomplish dune restoration efforts. Emphasize small restoration projects with native species.	Feasible	NPS; CCC; Water Board; County	USACE; EPA; Resource Agencies	
					Restoration	Evaluate areas with inland migration and managed retreat. Evaluate extending the dune system. Protect/enhance the existing dunes. Encourage more planting of native vegetation.	Feasible	NPS; CCC; Water Board; County	USACE; EPA; Resource Agencies	
				Mid-term	Restoration	Increase overflow capacity of Easkoot Creek for flood control and to create habitat.	Feasible	NPS; CCC; Water Board; County	Resource Agencies	Already proposed by flood control district and rejected by slim margin; needs extensive NEPA process and National Park Service (GGNRA) involvement
					Restoration	Protect/acquire open areas where dunes can migrate	Feasible	NPS; County	Resource Agencies	
				Long-term	Managed Retreat	Relocate first line of houses.	Potentially feasible	NPS; CCC; Water Board; County	GFNMS; USACE; EPA; Resource Agencies	
					Restoration	Removal of homes and paths and extend the dune system in front of the Calles.	Feasible	NPS; CCC; Water Board; County	USACE; EPA; Resource Agencies	

Site 14: Muir Beach (Site Characterization)



General Geology and Shoreline Types	Shoreline Change (m/yr)	Primary Landowners	Critical Habitats	Public Access and Trails	Infrastructure	Historical Resources
<p><i>Geology:</i> fsr, Qha, Qsl</p> <p><i>Shoreline Types:</i> Beaches, Rocky Shores</p>	<p>Average: 0.05 ± 0.08</p> <p>Maximum: 0.19</p> <p>Minimum: -0.05</p>	National Park Service (GGNRA), Private, The Nature Conservancy	None	<p>1 Access Points: 1 Beach Access</p> <p>~1 km of California Coastal Trail</p>	<p><i>Roads:</i> &lt;1 km local roads</p> <p><i>Culverts:</i> 3</p> <p><i>Aarmor:</i> Revetment (46 m), Retaining Wall (15 m)</p>	None

**Site 14: Muir Beach (Sediment Management Recommendations)**

Site ID	Location	Concerns and Issues	Management Goal	Timeframe	Management Strategy	Strategy Detail	Governance Feasibility	Likely Agencies with Direct Regulatory and/or Policy Oversight (Including Permitting)	Likely Agencies Involved in Project Review and Consultation	Notes
14	Muir Beach	Potential erosion of hillside and intermittent erosion up the hillside puts homes at risk and potential loss of north county beach. Federally listed species are present and impacted.	Ensure coastal access and protect habitats	Near-term	Research/Education	Evaluate offshore fortification/reefs to reduce erosion, maintain beach and enhance habitat.	Infeasible	GFNMS;NPS; USACE; EPA; CCC; Water Board; SLC	Resource Agencies	
					Research/Education	Research the dune and beach processes.	Feasible	NPS; GFNMS; CCC	Resource Agencies	NPS is doing monitoring
				Mid- and long-term	Managed Retreat	To minimize armoring, develop and implement a managed retreat plan.	Feasible	EPA; NPS; CCC; Water Board; County	GFNMS; USACE; Resource Agencies	

# 8 IMPLEMENTATION AND GOVERNANCE STRUCTURE OPTIONS

## 8.1 Overview of Implementation Process for Sonoma-Marín CRSMR Recommendations

This Report provides a framework to regional stakeholders for using RSM to address sediment imbalances within the Sonoma-Marín CRSMR AOI. This section provides an implementation process, including a preliminary list of next steps, to initiate potential short-term, long-term, and ongoing actions as well as examples of how other CSMW-sponsored RSM Plans have approached implementation.

Implementing the recommendations in this Report would involve a coordinated effort among stakeholders to establish and maintain a RSM program. It would require coordination among numerous overlapping jurisdictions as well as close collaboration among state and federal agencies, local jurisdictions, and a variety of other stakeholders. One of the first steps necessary for initial implementation is to connect the relevant stakeholders, including agencies and local municipalities, to begin collaborative discussions on options for long-term implementation.

Although RSM implementation is unique and tailored to a specific region and set of circumstances, they typically have the following elements in common:

- a governance structure for RSM plan implementation;
- a process for RSM stakeholder coordination;
- an outreach and education program;
- a dedicated funding source; and
- a streamlined permitting program.

## 8.2 Development of a Governance Structure

To effectively implement an RSM program in the Sonoma-Marín CRSMR AOI, a governance structure that meets the specific needs of the region should be developed and adopted by agencies, local governments and stakeholders. Development of an RSM governance structure typically entails the establishment of a coordinated CRSMP implementation process led by an entity that has appropriate jurisdictional authorities. Such entity would need the ability to enter into contracts, oversee staffing resources, and facilitate a process for input and collaboration with local stakeholders as well as federal, state, regional, and local entities. Each of the previous CRSMPs makes recommendations for a governance structure to implement RSM within their planning regions. In some cases, such as the San Diego and Santa Barbara/Ventura County CRSMPs, lead RSM coordinating agencies and active sediment management programs were in existence prior to the development of those plans. In other cases, such as the Orange County CRSMP, the recommendation was to establish a new entity to oversee implementation and coordinate RSM activities. Examples are provided in 8.2.3 of how some of the other regions have addressed governance structure in their CRSMPs.

In certain cases, initial implementation involves formal adoption of a CRSMP by a lead planning and coordinating agency with appropriate jurisdictional authorities. In the Sonoma-Marín RSM AOI this may not be possible because of the large number of jurisdictions potentially involved and the lack of an obvious candidate for the RSM coordinating agency. Nonetheless, several feasible options are available for potential governance structure models and lead agencies to implement RSM in the region. It is recommended, during the early phases of plan implementation, to engage in a coordinated stakeholder effort to further evaluate the range of available options and reach consensus in determining the most effective governance structure for the region.

Once a decision has been made on a governance structure and implementation model to pursue, the next steps would be:

1. Adopt the Report as the basis for a regional plan (CRSMP);
2. Establish a coordination mechanism and an agreement among the participating stakeholders that clearly states roles and responsibilities and formalizes the process for making RSM decisions and implementing regional plan recommendations;
3. Establish a means to administer and seek funding and enter into contracts to conduct studies and collaborative planning efforts; and
4. Establish and oversee RSM implementation actions.

### 8.2.1 Staffing Needs and Options for RSM Implementation

Other regions of California have concluded that implementation requires, at a minimum, a dedicated program manager to oversee implementation. The program manager coordinates projects, studies, and management and funding strategies among stakeholders. In addition to a program manager, several plans recommend additional support staff and technical specialists.

Near-term staffing is needed to coordinate initial stakeholder outreach efforts, assess funding needs and potential sources, oversee the process to develop and adopt a governance structure, establish an implementation committee or stakeholder advisory group, and begin work on a Strategic Implementation Plan (SIP). Over the longer-term staff responsibilities could include: establishing and facilitating a decision-making process and coordinating an advisory group to make recommendations to decision makers; coordinating, scheduling, and facilitating meetings; administering grants; overseeing studies and contracts; coordinating with local municipalities and pulling together specific project needs from each party; seeking funds for plan implementation; and developing a coordinated regional permitting process.

Ideally, new positions would be established and overseen by a lead RSM coordinating agency with governance structure responsibilities. Other options include creating one or more new RSM-focused staff positions within an existing entity or among several different entities or include RSM coordination responsibilities in the job descriptions of existing staff.



## 8.2.2 Other Governance Structure Responsibilities and Requirements

An effective governance structure should also include a system for periodic evaluation of the effectiveness of the RSM program and its individual projects. This makes it possible to determine whether or not the RSM goals are being met and allows for adjustments to be made to improve the effectiveness of the program based on monitoring results. As an adaptive management plan and living document, a CRSMP should be updated periodically, as new information becomes available, to allow flexibility for the Plan to be responsive to emerging issues and adapt to changing circumstances. A collaborative stakeholder process should be put into place to ensure that the Plan is updated as needed to add or modify data, information, processes, and recommended activities.

## 8.2.3 Examples of Governance Structures from Completed Coastal RSM Plans

As of the writing of this Plan, ten CRSMPs have been either drafted or finalized for the various regions along the coast of California: the Southern Monterey Bay CRSMP (completed in 2008), the Santa Barbara and Ventura Counties CRSMP (completed in 2009), the San Diego Region County CRSMP (completed in 2009), the Los Angeles County CRSMP (completed in 2012), the Orange County CRSMP (completed in 2013), the Santa Cruz Littoral Cell CRSMP (completed in September 2015), San Luis Obispo County CRSMP (completed in May 2016), San Francisco Outer Coast Littoral Cell CRSMP (drafted in 2016), San Francisco Central Bay CRSMP (draft released in 2017), and Eureka Littoral Cell CRSMP (completed in August 2017).

Many of these plans were developed and adopted by a regional partner such as an existing Joint Powers Authority (JPA) or municipality. In most cases, some form of governance structure and an active beach-restoration program were in existence prior to the development of the CRSMP. For example, the Southern Monterey Bay CRSMP recommended that the Association of Monterey Bay Area Governments (AMBAG), which is an existing JPA, take on governance structure responsibilities and act as the lead planning and coordinating agency to adopt the CRSMP, seek funding, administering grants and studies, and assist with implementation of recommended project and activities. The Santa Barbara CRSMP also recommended utilizing an existing JPA, a regional beach-restoration program called BEACON, to implement their CRSMP. BEACON was previously established for the limited purposes of dealing with coastal erosion, beach nourishment, and beach problems in Ventura and Santa Barbara Counties and, thus, a logical choice for selecting as the governance lead to coordinate the implementation of the CRSMP for the region. Similarly, the San Luis Obispo CRSMP recommended that an existing JPA in their region, the San Luis Obispo Council of Governments (SLOCOG), serve as the coordinated CRSMP implementation body to enter into contracts, oversee staffing resources, and facilitate a process for input and collaboration with local stakeholders as well as federal, state, regional, and local entities.

In the case of the Sonoma-Marin CRSMP AOI, there is no existing JPA to work through and thus a new entity would need to be established. Three of the previous CRSMPs for Santa Cruz, Orange County, and Eureka may be useful as references. These three regions lacked any sort of JPA or regional body with jurisdictional authority that could be recommended to take the lead on RSM and, therefore, recommended establishing a new JPA for the region. The Orange County recommendation focused on using BEACON as a model for a new JPA that would act as the lead planning and coordinating agency that adopts the

CRSMP, seeks funds, administers grants and studies, assists with implementation activities as deemed necessary by the local implementing agencies, facilitates collaboration on coastal issues, works to fill data gaps, and maintains and updates the CRSMP. Consistent with the recommendations of other CRSMPs, the JPA would receive funds, complete environmental documentation, acquire regional permits as appropriate, and plan coastal projects. Local land-use decision-making and implementation would remain with the local agencies, however. The Eureka region suggested that the Humboldt Bay Harbor, Recreation and Conservation District and the County of Humboldt might take the lead and create a Joint RSM Committee (JRSMC) amongst all the agencies and stakeholders that participated in the development of the CRSMP. The JRSMC would either adopt the CRSMP or set the stage for preparing the appropriate programmatic document to facilitate adoption and a stakeholder advisory team that would direct CRSMP activities could be established to oversee such an adoption. The Santa Cruz CRSMP, rather than recommending a specific governance model, identifies and describes a range of potential scenarios and encourages local jurisdictions, agencies, and other stakeholders to engage in a collaborative effort to further evaluate the options and make an informed decision on the most appropriate governance structure for the region.

One common conclusion of all the previous CRSMPs is that the designation of a JPA or implementation governance entity is essential for the successful implement RSM in each region. Thus, to fully implement this Report, a governance structure that meets the specific needs of the Sonoma-Marine AOI must be developed and adopted by local governments and stakeholders. Development of an RSM governance structure typically entails the establishment of a coordinated CRSMP implementation process led by an entity that has appropriate jurisdictional authorities. Such entity would need the ability to enter into contracts, oversee staffing resources, and facilitate a process for input and collaboration with local stakeholders as well as federal, state, regional, and local entities.

### 8.3 Establish a Process for RSM Stakeholder Coordination

Successful implementation of RSM strategies is not possible without the direct cooperation and participation from the local municipalities, regulatory agencies, and numerous other potential stakeholders that are responsible for addressing sediment issues or involved in planning or implementing RSM projects. The CSMW considers the cooperation and coordination of RSM stakeholders within each region to be a fundamental component for a successful RSM program and requires that each CRSMP include a stakeholder outreach program.

There are many potential options available for a process to ensure stakeholder coordination and involvement in the implementation of RSM. These options would vary depending on the financial and staffing resources available and the level of local commitment and participation by stakeholders. Examples of mechanisms to achieve successful coordination include: establishing a stakeholder advisory group (SAG) convened to solicit expertise and provide recommendations to decision makers, implementing cooperative agreements among agencies and municipalities to formalize the RSM program, creating mechanisms for cooperative funding and cost-sharing for studies and projects, holding public meetings and workshops to educate and solicit input from stakeholders, and developing a coordinated permitting program to increase efficiency and better address agency concerns. These potential stakeholder coordination processes are described in more detail throughout this section.

Near-term and ongoing implementation would also require convening and facilitating meetings of a SAG and potentially a decision-making body such as an implementation committee to bring together the numerous stakeholders and experts in the region to solicit input and guidance on RSM matters. Below is an initial list of potential stakeholders and partners with a description of the roles each may play in implementing RSM.

It is recommended that the options for stakeholder coordination mechanisms be further evaluated as part of the process to develop an RSM governance structure. Following the evaluation process the local jurisdictions involved in implementation should then agree upon and pursue an individualized stakeholder program. The stakeholders identified below should be contacted individually to discuss potential opportunities for collaboration and to assess their interest in participation. In addition to connecting individually with each party, the Farallones sanctuary TAC, established for development of this Report, can be reconvened to assist with implementation. The TAC, however, is agency-only and meetings are not public. It may also be necessary to establish a decision-making committee comprised of local jurisdictions and agencies. Finally, as a means of reaching out to the general public, local residents, and property owners, the lead RSM agency may want to partner with CSMW to host at least two public workshops, one in Marin County and another in Sonoma County, to present the recommendations and obtain input on initial implementation. Based on the needed functions for the lead RSM agency, some possible candidate agencies include the Farallones sanctuary, the National Park Service, or State Parks and Recreation. At a minimum, these three land and ocean management agencies should be involved with the lead RSM agency.

### 8.3.1 California Coastal Sediment Management Workgroup

The CSMW sponsored and supported the development of this Report and should also serve as a key partner in its implementation. It is recommended the RSM lead for Marin and Sonoma Counties coordinate with CSMW on all aspects of implementation and stakeholder outreach strategies and to establish a list of prioritized next steps for the early stages of implementation. This aligns with Regional Recommendation 10 (RR-10).

### 8.3.2 State and Federal Agencies

State and federal agencies, including regulatory, non-regulatory, and natural resource agencies, would play a range of potential roles, all of which are essential to fully implement the recommendations. Potential agency roles and responsibilities include: project planning, permitting, environmental review, management of natural resources and public lands, protection of coastal infrastructure and roads, funding of planning for and construction of RSM projects, and conducting necessary scientific research and studies.

Federal agencies with potential involvement in implementation should be contacted during initial outreach efforts. These include the Farallones sanctuary, USACE, USEPA, and the USGS. State agencies include the CCC, CSLC, SCC, CGS, DPR, DBW, and the California Department of Transportation

(CalTrans). More detailed information on the specific roles and regulatory and statutory authorities of these agencies is included in Section 6 of this Plan. This aligns with Regional Recommendation 13 (RR-13).

### 8.3.3 Local Jurisdictions

Coordination with and among local jurisdictions is essential for successful implementation of the recommendations, because RSM measures are typically planned and carried out at the local level and all of the recommended actions would require local engagement and collaboration. Included among local jurisdictions are municipalities (counties and cities/towns), local agencies, special utility districts, Geologic Hazard Abatement Districts (GHADs), Resource Conservation Districts, and harbors. Each of these entities would play a specific role in the implementation process. Some are involved in project planning, review, and permitting, whereas others may be responsible for protecting coastal properties or infrastructure, managing public lands, or actual construction and implementation of RSM measures. Municipalities are involved in planning and permitting (planning or community development departments) and project implementation (public works departments). It is recommended that the initial list of local jurisdictions to be contacted during the initial outreach process include the counties of Sonoma and Marin and Resource Conservation Districts (Sonoma, Gold Ridge, and Marin).

### 8.3.4 Non-Governmental Organizations (NGOs)

There are numerous environmentally focused NGOs that are active within the region and several of these organizations have provided input on the development of this Report. Each individual organization would play a unique role in implementation based on its unique set of objectives and focus on addressing specific issues and concerns. Many NGOs could be involved in commenting on local coastal planning processes and proposed coastal development projects and in reviewing coastal CEQA and NEPA documents, whereas others could provide resources and support to local jurisdictions.

These NGOs should be contacted early in the implementation process to inform them of the Report's availability and provide opportunities for involvement and input. NGOs should also be engaged in the planning and implementation of specific RSM measures that are proposed. An initial list of active NGOs in the area includes the Environmental Action Committee of West Marin, Sonoma Land Trust, Marin Agricultural Land Trust, Wildlands Conservancy, Sonoma Coast Surfrider, Sierra Club, the Nature Conservancy, Russian Riverkeeper, and the Bodega Bay Fishermen's Association.

### 8.3.5 Other Stakeholders

Other stakeholders should be engaged in the implementation process including local researchers and academic institutions, coastal engineers and consultants, private landowners, resource conservation districts, and local residents. Local researchers and academic institutions can provide scientific expertise and complete studies that support planning for and implementation of the recommendations. Coastal engineers and consultants involved in local coastal protection and beach restoration projects can provide

relevant expertise and project-specific information. The involvement from local residents and recreational beach users can provide site-specific information and a different perspective from agencies and local jurisdiction.

## 8.4 Develop and Implement a Stakeholder Engagement Program

Stakeholder engagement is a crucial component of implementation that usually consists of a program to inform stakeholders of emerging issues, proposed RSM measures, and opportunities for involvement. It also should include a system for distributing newly available scientific information pertaining to the Sonoma-Marine AOI. The first step should be focused outreach efforts on the Report, including why it was developed, and how the recommendations would be implemented. This could include public workshops, presentations to local governmental organizations, and individual meetings with stakeholders. This Report recommends that the CSMW (with support from the Farallones sanctuary and/or other RSM partner agencies) are involved in initial stakeholder engagement efforts including holding at least two public workshops and individual meetings with key stakeholders and decision makers. This aligns with Regional Recommendations 15 and 16 (RR-15, RR-16).

In addition to the initial outreach efforts, it is also recommended to assess options for and to establish a long-term ongoing outreach and education program to ensure stakeholder coordination and input. Determining which options for education and outreach are feasible depends on the degree of available funding and staffing resources. For example, at the very basic end of the scale, there could be a modest effort that involves maintaining a stakeholder outreach list and distributing new information as it becomes available (e.g., new reports and studies and announcements for opportunities for public involvement). At the more involved end of the scale, there could be a staffed program that includes a process for convening stakeholder meetings and workshops and developing and distributing an array of outreach products (e.g., fact sheets and brochures).

As is the case with the other recommended activities, stakeholder engagement will require funding and staffing resources that are currently not available. As part of the process to develop a governance structure, funding and staffing requirements should be evaluated for a variety of different stakeholder engagement options.

## 8.5 Establish and Maintain a Dedicated Funding Source

Funding can be obtained from local, regional, state, federal, or private sources. Because state and federally funded projects will almost always require local matching funds from the project proponent, developing a local funding source for implementation is critical to leveraging these state and federal resources.

Local governments in the Sonoma-Marine AOI currently do not budget for significant RSM projects and programs. Therefore, any level of implementation will require a dedicated source of funding to carry out its recommended activities. Near-term funding would need to be acquired for initial implementation, including stakeholder outreach efforts and coordinating with local municipalities on developing a

governance structure. Funding would also be required on an ongoing basis for staffing resources, conducting feasibility and engineering studies, environmental review and permitting costs, outreach and stakeholder coordination, and the actual construction of RSM projects.

A recommendation in this Report is that the regional RSM lead(s) work with local jurisdictions to identify and assess funding options for RSM activities. Once options have been evaluated and prioritized, it is also recommended to collaboratively pursue those sources that are most promising and establish a dedicated fund and administrative process. This would include local sources for matching funds and for demonstration and other beneficial use projects including those with environmental, recreational, flood control, and economic and commercial benefits. Improved communication and long-range planning between Federal, State, and local agencies and project proponents could support more coordinated project efforts (e.g., beneficial-use alternatives or shared funding opportunities). Dedicated non-federal funding sources would help to ensure that the local funds are available when needed.

There are USACE policies and programs that may allow for some incremental costs to be borne by the federal government including Section 1135 of the Water Resources Development Act (WRDA) of 1986, Section 204 of WRDA 1992 as modified, and Section 207 of WRDA 1996. Potential sources of state funds include the State Coastal Conservancy, and State Parks, Division of Boating and Waterways.

### 8.5.1 Federal Funding Sources

The USACE is the primary federal agency constructing shoreline protection projects. Funds are available for a wide array of projects such as beach nourishment, large-scale structural alternatives, and managed retreat projects. Funding mechanisms within USACE consist of two major programs. One is the Continuing Authorities Program (CAP), which allows USACE to study and construct projects without additional authorization from Congress. Project costs are generally capped at \$5-10 million federal expenditure. The other is the General Investigation (GI) Study, whereby USACE conducts a feasibility study that may recommend a larger project for authorization (i.e., a project costing more than CAP program funding limits). All projects constructed by USACE will require a non-federal sponsor, a feasibility study prior to implementation (unless directed by a member of Congress to move ahead with the project), and the required NEPA environmental documentation.

The USFWS is another potential federal funding source. It administers a variety of natural resource assistance grants to governmental, public and private organizations, groups, and individuals. One possible source of funding assistance for projects that restore wildlife habitat (e.g., beach restoration) is the Cooperative Conservation Initiative. This program provides funding for projects that restore natural resources and establish or expand wildlife habitat. A 50% match is required of the project sponsor. Another potential source is the Cooperative Endangered Species Conservation Fund, which provides funding for implementation of conservation projects or acquisition of habitat that will benefit federally listed threatened or endangered species. The required match by the local sponsor for this program is 25% of estimated project cost (in-kind contributions are accepted).

The USEPA is another potential funding source for RSM projects related to wetlands through the Wetland Program Development Grants (WPDG) program. WPDGs provide eligible applicants an

opportunity to conduct projects that promote the coordination and acceleration of research, investigations, experiments, training, demonstrations, surveys and studies relating to the causes, effects, extent, prevention, reduction and elimination of water pollution. WPDGs assist state, tribal, local government agencies and interstate/intertribal entities in building programs to protect, manage and restore wetlands. States, tribes, local governments, interstate associations, and intertribal consortia are eligible to apply for the Regional WPDG whereas nonprofits, interstate associations and intertribal consortia are eligible to apply for the National WPDG.

## 8.5.2 State Funding Sources

Most state funding for beach restoration projects comes from DBW, which is the agency in California with principal responsibility for protecting public coastal infrastructure and restoration of eroded beaches. When state funding is available, DBW issues grants under two programs: Public Beach Restoration (PBR) and Beach Erosion Control (BEC). The program allows for 100% funding of project construction costs for beach nourishment at state parks and state beaches and up to 85 percent for projects at non-state beaches (local sponsor provides 15% match, either money or in-kind services). The BEC Program focuses more on structural solutions such as groins or breakwaters, but the newer PBR focuses more on restoration projects. The PBR program can fund beach restoration and nourishment projects, or feasibility or research studies. Grant amounts entirely depend on fund availability at the state level. A local match is usually required and can be either cash or in-kind services. CEQA documentation must be submitted with grant applications, and public beach access must be adequately addressed by the project.

The State Coastal Conservancy (SCC) is a state agency that uses entrepreneurial techniques to purchase, protect, restore, and enhance coastal resources, and to provide access to the shore. The SCC works in partnership with local governments, other public agencies, nonprofit organizations, and private landowners. It has carried out more than 1,000 projects along the California coastline and in San Francisco Bay. The SCC funds shoreline protection projects that are consistent with the goals of California's Coastal Act. Similar to DBW grants, the availability of SCC grant money depends entirely on the availability of funds (i.e., recent bond measures). The SCC can fund pre-project feasibility studies, property acquisition, planning (for large areas or specific sites), environmental review, construction, monitoring, and maintenance – in limited cases. Funding from SCC grants ranges from \$10,000 to several million dollars depending upon fund availability and the “need, significance, and urgency of the project.” Potentially relevant funding programs include: Urban Waterfronts, Wetlands, Site Reservation, Resource Enhancement, and Case Studies. One example of SCC funding for CRSMP implementation includes providing BEACON with a \$200,000 grant to complete engineering feasibility studies, site reconnaissance, permitting, and related administrative tasks, of a beach restoration project in Goleta Beach.

The Ocean Protection Council (OPC) is another state agency that may provide funding for RSM projects, primarily for planning and feasibility studies. The OPC ensures that California maintains healthy, resilient, and productive ocean and coastal ecosystems for the benefit of current and future generations. The OPC is committed to basing its decisions and actions on the best available science, and to promoting

the use of science among all entities involved in the management of ocean resources. Similar to SCC, OPC funding is related to bond initiatives and proposals must align with the strategic plan of the agency.

### 8.5.3 Local Funding Sources

Securing state and federal funding for RSM implementation may require a local source of matching funds. Some of the previous CRSMPs suggest a range of options to pursue local funding source including:

*Cost sharing among project beneficiaries:* In this strategy, the local share of the cost of a project is distributed among the various entities that benefit from that project. The cost could be divided in proportion to the total benefits attributed to each group (e.g., by the value of the property and the risk being averted). For example, for a project in the Sonoma-Marine AOI, the local costs may be borne by a town, a county, the private landowners, and other potentially affected parties (e.g., DPR, Caltrans, etc.).

*Ad Valorem Taxes:* These are taxes levied on the price of a good or service that are equal to a certain percentage of the price. These taxes are typically assessed on real estate such as with Real Estate Transfer taxes when a property exchanges hands. Ad Valorem taxes are commonly used in the State of Florida.

*Special Assessments:* The local government would place assessments on properties that would receive a higher proportion of the benefits derived from the project. For example, private property at high-risk of erosion damage would be required to pay a special fee that would not be required of other properties that are not at risk and proportionally higher than those that are at moderate or low risk. In Florida, for example, the state assesses a tax based upon the distance of the structure from the beach.

*City or County General Revenue Funds:* Funds may also be available from the general funds of the local jurisdictions or counties.

*Transient Occupancy Taxes:* TOTs are hotel taxes that are levied on visitors. These taxes in fact are the primary source of local funding in several East Coast states that have well-established beach nourishment programs (e.g., Florida and New Jersey), and have recently been implemented by some municipalities in Southern California.

*User Fees:* Many local municipalities on the East Coast and in Southern California have turned to user fees as a source of funding for beach restoration projects. This can include parking or beach use fees, which are often levied on visitors but not required of local residents. For example, the City of Del Mar charges for parking in most areas near the beach.

*Regional Sales Tax:* A regional sales tax could be used to provide a potential funding source to meet the regional sediment management needs in the AOI. A regional sales tax would generate the greatest amount of flexibility and stability as the revenues would be controlled regionally and such funds would be better protected against inflation. The regional tax could be tied directly to regional sediment management needs (e.g., beach restoration) and/or regional needs.

*Parking Fees:* A fee could be levied on beach parking to provide funding for regional sediment management activities. This fee could be levied as an increase in existing parking fees where such fees exist, or as new parking fees in areas where no such fees exist. Implementing parking fees at city and state beaches would be difficult due to concerns about negative impacts on public access. Consequently, it



might be better to levy parking fees only in non-beach areas (such as downtown or redevelopment districts) within coastal city jurisdictions.

*Development Impact Fees:* Development Impact Fees on residential, commercial, and industrial development could be considered to help fund regional sediment management needs. Studies could be prepared to demonstrate the impact new development has on sediment transport through coastal watersheds to the beaches in order to determine an appropriate cost sharing distribution.

#### 8.5.4 Private Funding Sources

In addition to government funding there are opportunities for private sources of funding. A number of private foundations may provide funding for CRSMP planning efforts and shoreline restoration projects. An initial list of potential private non-profit funding sources includes: the Resources Legacy Fund (RLF), Packard Foundation, Alfred P. Sloan Foundation, Kresge Foundation, Moore Foundation, and the William and Flora Hewlett Foundation. These, and other private sources, should be investigated as a source of funding for initial Plan implementation and outreach as well as ongoing RSM projects and coordinated planning efforts. Homeowners Associations (HOAs) are a type of private property owner organization that could be involved in planning and funding of local RSM projects that protect private property under their sphere of influence. HOAs are organizations comprised of local property owners within a designated planned unit development, neighborhood, or other self-designated entity, which have been chartered as an organization subject to certain bylaws and mandatory membership.

### 8.6 Investigate and Pursue Options for a Streamlined Permitting Program

The permitting system for RSM projects can be lengthy and complex, involving numerous federal and state agencies that issue permits or other legal approvals. This Report recommends developing a strategy with USACE, the Farallones sanctuary, CCC, local jurisdictions, and other regulatory agencies to identify options for and pursue a regional streamlined permitting program. Such a program would benefit parties that are seeking permits for proposed RSM projects as well as the permitting and resource agencies that are reviewing these projects and making permitting decisions. It would minimize duplication of effort and allow agencies to better address their concerns and develop mitigation measures to ensure that projects do not result in significant impacts. This aligns with Regional Recommendation 9 (RR-9).

Developing a streamlined permitting program has been a common recommendation in each of the completed CRSMPs. As such, many of the corresponding regions have implemented or are in the process of developing such a program. For example, the San Diego CRSMP recommended pursuing General Permits for all agencies and has since adopted a pilot Sand Compatibility and Opportunistic Use Program (SCOUP) for the region. The Southern Monterey Bay CRSMP also recommended developing a SCOUP for the region.

Because of the large size of the Sonoma-Marin AOI and the overlapping of multiple geopolitical boundaries and jurisdictions, developing a streamlined permitting program is no easy task. Developing such a program would involve clarifying roles and level of involvement of each agency in projects and

planning and developing review thresholds, identifying consistent permit conditions and authorization criteria, preparing the appropriate studies and environmental documentation, and obtaining needed agreements and permits from each agency. A variety of different mechanisms for permitting coordination could potentially be pursued for the region and the costs and benefits of these should be further explored. Options include developing a SCOUP, and pursuing a USACE Regional General Permit or a regional permit from the CCC.

To develop a streamlined RSM permitting program for the Sonoma-Marine AOI it is recommended, during the initial plan implementation phase, to meet individually with each of the permitting and resource agencies described in this Report. The purpose of these initial meetings would be to identify and further assess the mandates, resource protection concerns, and permitting requirements of each agency and discuss opportunities for permitting collaboration. This information would be used to develop a detailed permitting roadmap for the various potential RSM measures being recommended in this Report. To facilitate this collaborative process, regional jurisdictions should consider establishing a committee made up of the permitting and resource agencies and local jurisdictions to assess options, define roles, and agree upon and pursue a regional permitting program that meets the specific needs of the region. An example of a tool that could emerge from this effort is the Agency Involvement Matrix (AIM) produced as part of this Report in Figure 8-1.

The regional permitting program should also address performance monitoring and program evaluation to determine the effectiveness of individual RSM projects and the RSM program as a whole. Pre- and post-implementation project monitoring would help to determine whether any adverse impacts have occurred as a result of the project. Those findings could then be used to help guide future project planning and permitting decisions.

As part of the permitting streamlining efforts, this Report also recommends collaborating with the Farallones sanctuary, CCC, and other state and federal resource agencies to develop science-based resource protection guidelines aimed at avoiding and mitigating potential environmental impacts of sediment management projects in the region. Through the regional permitting program, these guidelines could be applied to projects in the region as permit conditions to avoid environmental impacts. The guidelines would address site evaluations including sediment grain sizes, sand transport patterns, and potential impacts that may result from beach nourishment and other RSM measures. As part of an adaptive management approach, these guidelines would be updated as needed based on new scientific data, operational practices, and monitoring results from local RSM projects implemented as part of this Plan.

**Agency Involvement Matrix (AIM)**

●	Direct regulatory and/or policy engagement, including permitting responsibility
◐	Not a lead agency for strategy but have some responsibility for resource protection or regulatory authority if impacts occur as a result of implementing the strategy
○	No direct regulatory responsibility but would like to be informed
	Role undetermined but agency involved at some level

Sediment Management Strategy	GFNMS	EPA	NMFS	NPS - GGNRA	NPS - PRNS	SF Bay Outer Coast Sentinel Site Cooperative	USACE	BCDC	CCC	CDFW	OPC	SCC	SLC	State Parks	Water Board	Sonoma County	Main County
Beach Nourishment	●	●	●	●	○	○	●	●	●		○	○	●	●	●		●
Living Shorelines	●	●	●	◐	◐	○	●	●	●		○	○	●	●	●		●
Reefs	●	●	●	◐	●	○	●	●	◐		○	○	●	●	●		○
Education/Research	●	○	●	●	●	○	◐	●	●		○	○	●	●	○		●
Armor (land; e.g., seawall)	◐	●	○	●	●	○	●	●	●		○	○	○	●	●		●
Armor (sea; e.g., groin)	●	●	●	●	●	○	●	●	●		○	○	●	●	●		◐
Restoration of Wetlands	●	●	●	●	●	○	●	●	●		○	○	◐	●	●		●
Restoration of Dunes	○	◐	●	●	●	○	◐	●	●		○	○	◐	●	◐		●
Dredging	●	●	●	●	●	○	●	●	●		○	○	●	●	●		○
Managed Retreat	◐	◐	●	●	●	○	◐	●	●		○	○	●	●	●		●

Figure 8-1 Agency Involvement Matrix developed by the Technical Advisory Committee to indicate the degree of agency engagement for the different sediment management strategies. “Reefs” was separated from “Living Shorelines” for this table specifically although they are normally considered part of a living shoreline project.

## 8.7 Recommended Next Steps

The following next steps are recommended in order to implement effective RSM in the Sonoma-Marín region:

1. Use this report as the basis for implementing a Coastal Regional Sediment Management Plan (CRSMP).
2. Begin an evaluation of options for governance structure, including considerations for potential lead agencies and partners, and processes for decision-making and information sharing.
3. Develop a comprehensive list of potential RSM partners and stakeholders and identify their possible roles in CRSMR implementation.
4. Connect with the relevant stakeholders, including agencies and local municipalities, to provide information about the CRSMR, discuss potential opportunities for collaboration, and assess their interest in participation.
5. Reconvene the Technical Advisory Committee (TAC) that was formed for the development of this CRSMR to: present the final CRSMR, initiate discussions on RSM options, solicit recommendations on the initial implementation of a CRSMP, and discuss the possibility of the TAC playing a permanent role in ongoing implementation of the CRSMP.
6. Seek near-term funding to establish a new staff position within an existing agency, municipality, or other organization to coordinate initial plan implementation.
7. Work with the TAC, local jurisdictions, and other stakeholders to identify and assess funding options for RSM activities; once options have been evaluated and prioritized, collaboratively pursue those sources that are most promising and establish a dedicated fund and administrative process.
8. Develop a strategic implementation plan (SIP) for this CRSMR.
9. Initiate focused outreach efforts by providing presentations to local governmental organizations, and holding individual meetings with stakeholders and public workshops. Provide an explanation of what this CRSMR consists of, why it was developed, and how it could be carried out.
10. Establish a list of prioritized initial stakeholder engagement actions and identify existing CSMW outreach products and tools that could be used to support initial implementation of the CRSMP.
11. Begin to develop a detailed permitting roadmap and explore options for a streamlined regional RSM permitting program.

The CSMW sponsored and supported the development of this Report and should also serve as a key partner in implementing its recommendations. It is recommended the RSM lead for Marin and Sonoma Counties coordinate with CSMW on all aspects of implementation and stakeholder outreach strategies and to establish a list of prioritized next steps for the early stages of implementation.

## 8.8 Benefits of Regional Sediment Management (RSM)

The CSMW developed the Coastal RSM Plan program to provide local stakeholders with a means to formulate and implement strategies for RSM policy and guidance that will help in:

- restoring, preserving, and maintaining coastal beaches and other critical areas of sediment deficit;
- sustaining recreation and tourism, enhancing public safety and access, restoring coastal sandy habitats; and
- identifying cost-effective solutions for restoration of areas affected by excess sediment.

At a minimum, this Report can benefit agencies, local jurisdictions, and other stakeholders as a technical reference that contains the best-available and most-recent scientific information regarding the geology, geomorphology, physical and biological processes, coastal erosion threats, and RSM issues. The Report can be referred to as a reliable source of information while making planning and permitting decisions at the local, state, and federal levels. For example, the Southern Monterey Bay CRSMP (PWA, 2008) is a widely used source of technical information that is often cited as a reference for planning and permitting decisions. With a better understanding of the geological, physical, and biological processes and the specific threats from coastal erosion and sediment impairment issues in the region, coastal decision makers can make informed sediment management decisions and develop more effective policies and practices.

In addition to being a useful technical reference, this Report can serve as a valuable planning resource providing local jurisdictions and agencies with a framework for using RSM to address sediment imbalance issues within the Sonoma-Marine AOI. It provides an inventory and assessment of sediment issues and coastal erosion threats, both general and specific recommendations for RSM measures and stakeholder processes, and tangible next steps for initial implementation. Thus, it provides a framework that will allow local stakeholders to further evaluate, prioritize, and pursue specific projects on a cooperative basis. Moreover, the availability of information in the Report will provide the opportunity for sediment management issues to be addressed proactively and comprehensively rather than on an emergency, reactive basis, which could allow for more effective solutions with fewer environmental impacts.

Another key benefit of implementation is improved agency and institutional collaboration, resulting in increased efficiency and effectiveness in addressing RSM issues. Such collaboration can provide new opportunities for information sharing and leveraging financial and staffing resources in data collection and analysis, tool development, and project implementation. The development of partnerships among permitting agencies, municipalities, researchers, and other stakeholders can lead to potential benefits including reduced study costs, enhanced protection of environmental resources, and the streamlining of regulatory processes.

Having an active RSM program in the region would increase the likelihood of receiving funding from a variety of sources. A clear benefit of adopting the Report in the region is that it provides new opportunities to cooperatively apply for grants and other funding from various state, federal, and private sources. It demonstrates to potential funders that there is a serious regional commitment to pursue RSM along with a high level of stakeholder collaboration. Such commitment is anticipated to favorably incline funders who prioritize limited available funds.

Most importantly implementation of the recommendations provide a comprehensive, forward-thinking, regional approach to managing activities along the Sonoma-Marine Counties coastline. These projects could provide direct benefits to the region including: mitigating shoreline erosion and coastal storm

damage, allowing for habitat restoration and protection, increasing natural sediment supply to the coast, providing public safety, access and recreational benefits through beach restoration, and preparing the coast for the impacts of climate change.

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# Appendix A: Special Status Species

To identify species that may be of special concern and/or interest when evaluating and designing potential sediment management projects, this special status species list was created from the following documents:

1. [Ecological Linkages](#): Marine and Estuarine Ecosystems of Central and Northern California (2003)
2. Gulf of the Farallones National Marine Sanctuary [Condition Report](#) (2010)
3. Federally listed species: endangered (E) and threatened (T)
4. [Ocean Climate Indicators](#): A Monitoring Inventory and Plan for Tracking Climate Change in the North-central California Coast and Ocean Region (2013)
5. [Northern and Central California Biogeographic Assessment - Marine Fishes, Birds and Mammals](#) (2003)
6. [Climate Change Vulnerability Assessment for the North-central Coast and Ocean](#) (2014)

In this list, (E) indicates Endangered and (T) indicates Threatened status.

<b>Plants/Algae</b>	American Dune Grass
	Beach Layia (E)
	Bull Kelp
	Coralline Algae
	Cordgrass
	Eelgrass
	Endocladia
	Northcoast Sand Verbena
	Pickleweed
	Sea Palm
	Surfgrass
	Tidestrom's Lupine (E)
<b>Invertebrates</b>	Black Abalone
	California Mussel
	Common Little Neck Clam

	Copepod
	Deepsea corals
	Dungeness Crab
	<i>Euphasia pacifica</i>
	Gaper Clam
	Giant Green Anemone
	Gooseneck Barnacle
	Horseneck Clam
	Myrtle's Silverspot butterfly (E)
	Ochre Seastar
	Olympia Oyster
	Pteropod
	Red Abalone
	Red Sea Urchin
	Red Sponge
	Sand Crab
	Sandy Beach Tiger Beetle
	Strawberry Anemone
	Sunburst Anemone
	<i>Thynsanoessa spinifera</i>
<b>Fish</b>	Blue Rockfish
	Bluefin Tuna
	Boccacio
	CA Halibut

Cabazon
Canary Rockfish
Chinook Salmon (E)
Chum Salmon (T)
Coho Salmon (E)
Cowcod
Gopher Rockfish
Green Sturgeon (T)
Lingcod
Longfin Smelt
Northern Anchovy
Pacific Herring
Pacific Lamprey
Pacific Sardine
Rosy Rockfish
Shiner Surfperch
Shortbelly Rockfish
Staghorn Sculpin
Starry Rockfish
Steelhead/Rainbow Trout (T)
Swordfish
Threespine Stickleback (E)
Tidewater Goby (E)
White Shark

	White Sturgeon
	Widow Rockfish
	Yelloweye rockfish (T)
	Yellowtail Rockfish
<b>Sea Turtles</b>	Green Sea Turtle (T)
	Leatherback Sea Turtle (E)
	Loggerhead Sea Turtle (T)
	Ridley Sea Turtle (T)
<b>Birds</b>	Aleutian Canada Goose
	American Bittern (T)
	Ashy Storm-Petrel
	Bald Eagle
	Black Oystercatcher
	Black Rail
	Black Storm-Petrel
	Black Tern
	Black-footed Albatross
	Brandt's Cormorant
	Bristle-thighed Curlew
	Brown Pelican
	California Least Tern (E)
	Cassin' Auklet
	Clapper Rail
Common Murre	

	Dark-rumped Petrel (T)
	Elegant Tern
	Fork-tailed Storm-Petrel
	Harlequin Duck
	Marbled Murrelet (T)
	Peregrine Falcon
	Pigeon Guillemot
	Rhinoceros Auklet
	Saltmarsh Common Yellowthroat
	Scripps Murrelet
	Short-tailed Albatross (E)
	Sooty Shearwater
	Tufted Puffin
	Western Snowy Plover (T)
	White Faced Ibis
<b>Mammals</b>	Blue Whale (E)
	Fin Whale (E)
	Gray Whale
	Guadalupe Fur Seal (T)
	Harbor Porpoise
	Harbor Seal
	Humpback Whale (E)
	Killer Whale, southern resident (E)
	Minke Whale



	Northern Fur Seal
	Northern Elephant Seal
	Northern Right Whale (E)
	Pacific white-sided dolphin
	Sei Whale (E)
	Southern Sea Otter (T)
	Sperm Whale (E)
	Steller Sea Lion

# Appendix B: Working Group Meeting Summaries

Four in-person and one webinar Working Group Meetings were held through 2017 to engage stakeholders, community members, and agencies. This appendix summarizes each meeting.

## Working Group Meeting 1 Summary

March 9, 2017 9:30 am – 3:30 pm

Red Barn Classroom, Point Reyes

Welcome by Cea Higgins, Working Group Chair and Sanctuary Advisory Council Sonoma/Mendocino Primary member (slides 1-2) *\*Linked text provides access to the meeting’s PowerPoint presentation*

Thank you for making the journey out to join us and we thank you for the service you are providing to help shape the vision for the future of our coast. The goal of the Sonoma/Marin Sediment Management Working Group is to develop sediment management recommendations for specific, prioritized locations experiencing sediment issues along the Sonoma and Marin County coastline, and determine governance structure for select projects. These recommendations will be presented to the Sanctuary Advisory Council in November 2017 for discussion and approval before being forwarded to the Sanctuary for consideration and inclusion in a final Regional Sediment Management Plan.

We have 120 miles of coastline, and it is an ambitious goal, but it is a feasible goal. We have great existing data. There have been approximately 10 RSM plans developed for the California Coastline of which Sonoma/Marin is the last so there are models available for guidance. The knowledge represented by all of you makes it a goal we can accomplish.

### Staff introductions and roles

Sara Hutto: Ocean Climate Program Coordinator, primary contact for the working group

Doug George: Coastal Oceanographer, project technical lead

Sage Tezak: GIS Analyst, sharing and showing data

Jenn Gamurot: Sanctuary Advisory Council Coordinator, coordinating working group logistics

### Working Group member introductions (slide 3)

<i>Name</i>	<i>Affiliation</i>	<i>Priority location or area of concern</i>
Neil Lassettre	Sonoma County Water Agency	Geomorphology
Brannon Ketcham	National Park Service, Point Reyes National Seashore	Marine, hydrologic, and geomorphic issues.
Stefan Galvez	Caltrans	Entirety of Highway 1 along the coast
Dick Ogg	Fisherman’s Association	Bodega Bay Harbor has seen lots of changes in the bottom of the bay.
Brook Edwards	Wildlands Conservancy	Bodega Harbor and Estero Americano. 1 million cubic yards of sediment have emptied into the Americano. Used to be open channel with eelgrass beds. Whole ecosystem has changed a lot.

Kristin Ward	National Park Service, Golden Gate National Recreation Area	Stinson Beach due to dune erosion - would like to understand a bit better how to manage this area.
Jon Campo	Marin County Parks.	The Marin Roads and Trails Plan; managing sediment and erosion is a big part of that.
Mary Nicholl	Sonoma County Planning	Jenner - has seen sediment from Russian River contribute to flooding of low-lying areas.
Ashley Eagle- Gibbs	Environmental Action Committee of West Marin	Chicken Ranch Beach in Tomales Bay.
Stephanie Rexing	California Coastal Commission.	Maintaining publicly accessible beaches and sediment transport.
Melanie Parker	Sonoma County Regional Parks	Salmon Creek, Russian River, Bodega Bay Harbor.
Jack Liebster	County of Marin Planning Department	Manages adaptation program for outer coast of Marin County; concerned about finding sources of sand for Stinson and Muir Beaches; interested in looking at possibilities to keep up with sea level rise for wetlands.
James Zoulas	US Army Corps of Engineers	
Abby Mohan	GFNMS Advisory Council Maritime/Recreation Alternate seat, graduate student at Romberg Tiburon Center	
Leslie Ewing	California Coastal Commission	
Jeannine Manna	California Coastal Commission	Unincorporated areas of Marin and San Mateo Counties
Shannon Fiala	California Coastal Commission	Transportation around the state; interested in Highway 1 in Marin/Sonoma
John Largier	Oceanographer at UC Davis Bodega Marine Lab, Sanctuary Advisory Council chair	Open coast beaches such as inlet at Russian River, Tomales, Bolinas, San Francisco Bay, channels, marshes, sea level rise

Meeting Guidelines ([slides](#) 4-6)

*Cell phones and timeliness:* Working Group (WG) agreed to arrive to meetings on time and silence

cell phones during meeting.

*Respect:* WG agreed that they are participating and promoting a consensus driven working group where they will exercise mutual respect and **whenever possible** offer solutions or alternatives when identifying problems. WG also agreed the goal is to create an environment that fosters participation so that participants can make comments and ask questions. There was also agreement that due to the size of the group; individuals wanting to comment would wait to be acknowledged by the WG Chair before speaking.

*Commitment:* WG agreed to commit to attend meetings regularly and come prepared to discuss issues. If a conflict exists, WG participants agree to send an alternate, make sure the alternate is up to speed, and to notify the chair in advance that an alternate will be attending. The WG chair with support of staff committed to providing the WG with the necessary materials in a timely manner and if not possible notifying the WG. The Chair also committed to whatever can be reasonably done to keep the WG informed and to facilitating a consensus driven outcome.

*Meeting operations:* The WG agreed that meetings will be closed (not advertised or open to uninvited guests). The WG can agree at any time in the process to open up a meeting to the public or take public comment if they would find it beneficial to get public input. The WG agreed to vet ideas with their respective constituents and keep the WG informed of any feedback as well as any discussions from others that informs or impacts the WG.

#### Meeting Objectives ([slides 7-9](#))

- Review project scope, goal, and working group objectives
- Learn about regional sediment plans in general
- Review and understand existing data and information that will inform the working group's recommendations
- Provide feedback on priority locations for recommendations, additional data needed to inform recommendations, and criteria for priority location selection
- Confirm future meeting schedule and locations

#### Working Group Process ([slides 10-12](#))

- WG reviews information and makes recommendations to Sanctuary Advisory Council.
- Advisory Council reviews working group recommendations and advises Sanctuary.
- Sanctuary Superintendent reviews recommendations and responds in writing with rationale to all recommendations that will not be acted upon.

Technical Advisory Committee (TAC) will provide regulatory and governance review of recommendations. TAC will be engaged in summertime between meetings 2 and 3.

If this WG identifies that they need additional expertise, they can inform the WG Chair and invite someone who is not in the room.

#### Proposed timeline ([slides 13-14](#))

Meeting 1: Setting the Stage and Reviewing Information  
Today, Point Reyes Station

Meeting 2: Making the Recommendations  
May 17: location TBD

- Presenting maps, reviewing adaptation options that have been suggested through plans. Main goal is to develop range of recommendations.

Meeting 3: Determining Governance for Selected Projects  
August 29, location TBD

Meeting 4: Approving the Final Plan  
October 2, location TBD

Sanctuary Advisory Council Meeting to Approve Plan  
November 29, San Francisco

- Working Group Chair will present recommendations to the advisory council for discussion and approval. The Chair, working with Sanctuary staff, will then incorporate any final input before producing the final Plan.

Sanctuary Review of final Plan: December – January  
Final Plan Due to Coastal Sediment Management Workgroup: February 1, 2018

Questions/Comments:

- Jack Liebster asked what kinds of recommendations are expected and what the scope is. Doug George responded that the recommendations could range from hard structures to softer, as part of a larger suite of options. This is a plan to develop recommendations; for example, developing shoreline monitoring programs.
- Brook Edwards asked about the timeline for the entire process (from planning to environmental review to implementation). Sara Hutto responded that this immediate planning process will be complete by February 2018, and review/implementation will be completely dependent on funding, staff capacity, etc.
- Stefan Galvez asked if there will be a similar working group from San Mateo/San Francisco. Doug responded that there is one that started in 2012. With this project, we are looking at sediment throughout the entire coastline. The smaller projects will be merged into a larger cohesive plan. This part of the coast needed to be finished before bringing them together.
- It was suggested to create a Google folder for the working group for members to access meeting resources such as presentations and meeting notes; Sara Hutto will set this up.

Regional Sediment Management 101: California Coastal Sediment Overview (slides 15-35)

Lot of sediment is being pumped out along our coastline due to storms. A north to south pattern is the generally accepted flow for sand due to currents and waves. Mud plumes are spread out across the shelf, and reworked by the waves. Mud and sand have different behavior; we are focusing more on sand. We also have fine sand and gravel, so we have the full spectrum of sediment.

Littoral cells are a geographic area that includes a complete cycle of sedimentation including sources, transport paths, and sinks. Historically used; headlands, river mouth, submarine canyon. Our area of interest includes Russian River, Bodega Bay, Point Reyes, Bolinas, and San Francisco beaches.

Seasonal cycles: summer is widest, low wave energy moves sand onshore. Winter is most eroded: high waves energy pulls sand off to bars.

How should we address sediment imbalance issues? How will climate change affect our sediment management approach? We are looking at both ends of the spectrum- sediment accumulation and loss/erosion.

Existing sediment management demonstrates that sediment is trapped behind dams, and disrupted by harbor structures and coastal armoring. Regional sediment management re-establishes natural pathways, supports beaches and wetlands and a return to dynamic states, seeks to free up sediment from behind reservoirs, encourage mitigation to compensate, and use funds in other ways to support sediment movement.

#### *Regional Sediment Management Goals*

- Identifying sediment-related problems
  - o beach erosion, wetland erosion/sedimentation, habitat loss, and water quality impairment
- Defining the causes of sediment-related problems
- Providing a solid scientific framework and database regarding technical issues within the coastal environment.
- Providing a framework, through collaboration with federal, state, regional, and local governments, to address the sediment-related problems on a regional scale, such as littoral cells and/or watersheds.
- Developing and exporting new and existing analytical tools to assist in managing coastal resources.
- Providing a programmatic road map to plan, prioritize, and program future coastal resources projects.
- Fostering a collaborative approach among agencies to provide a consistent framework for project proponents.
- Establishing a streamlined process for coastal resources related project approvals.

Coastal Sediment Management Workgroup (CSMW) is a work group co-chaired by USACE and CA Natural Resources Agency. It was developed to help understand sediment in California in context for management issues.

Federal perspectives: USGS, NOAA/NMFS, NPS, EPA

State perspectives: Coastal Commission and BCDC, Coastal Conservancy, State Lands

Commission, Water Boards, CDFW, State Parks/Boating and Waterways

Stakeholders, landowners, resource agencies, and public

The long-term goal is to make a big plan for the entire state. Regional issues can be dealt with regionally. If there is too much sediment, it can be moved to another place. If we can develop that approach, everyone can benefit.

Present ideas for local projects: Policy & governance → economics and infrastructure → ecology → geology/morphology → physical processes. These plans are the beginning of thinking big for the coastline, and will lead to projects that will lead to actions.

#### *The Big Questions of a CRSMP*

- Where are the sediment challenged areas?
  - o Erosion (e.g., coastal highway segments)
  - o Sedimentation (e.g., Bolinas Lagoon)
- What's at risk?
  - o Human Needs: Infrastructure, Development
  - o Nature's Needs: Habitats
  - o Both: Resilience to Climate Change/SLR
- How bad is that risk?
- What can be done to minimize risk?

### *Sediment Management Tools*

#### A Short List

- Harder (Gray) Infrastructure
  - o Jetties/groins
  - o Seawalls
  - o Breakwaters/reefs
- Softer approaches
  - o Beach nourishment
  - o Living shorelines
- Overarching
  - o Managed retreat
  - o Restoration of natural processes

#### *Constraints on solutions*

- Technical (physical/ecological)
- Sediment sources for beach nourishment, nearshore dynamics. Land shifts- tectonics, vertical land migration.
- Economic: funding, timing and amount.
- Political: governance structures, constituent groups.
- Regulatory/policy: CEQA/NEPA, mandates from agencies.

Completed projects: Santa Barbara, Ventura counties, managed retreat in Surfers' Point.

Reconfigured area, made more publicly accessible. Encouraged natural processes in the areas. Artificial reef has been an idea, but not gone anywhere. San Diego County has done beach nourishment and borrowed sand from sites. Longevity of placements changes depending on environment.

#### A mini-CRSMP in San Francisco

- City of SF and NPS (GGNRA) Ocean Beach has a sediment imbalance – Moving sediment from one part of the beach to another
  - o Sand trucking from North to South Ocean Beach in 2012, 2014, 2016
- USACE
  - o Single placement of 300,000 cubic yards
    - Dredged sediment pumped onshore at Sloat and to 4000' south
  - o Designation of OBDS as permanent site
- Ocean Beach Master Plan
  - o 2 million cubic yards of sand placed every 10 years

#### A mini-CRSMP in Bolinas Lagoon

- Sediment management objectives
  - o Restore natural processes for resilience and sustainability
- Kent Island Restoration
- Bolinas "Y" at Lewis and Wilkins Gulch creeks

#### A mini-CRSMP in Half Moon Bay

- Pilot project at Surfer's beach
- Move 140K-150K of harbor sand to revetment along Hwy 1
- Expected to last only 6 years
  - o Design is meant to buy time for realignment of Hwy 1

Recommendations can be temporary while we work towards larger, targeted, long term goals.

GFNMS specific: Why is the Sanctuary interested in this project?

- The acquisition of extensive coastline with northern expansion.
- Sonoma State Beach is third in attendance for all state beaches.
- We have 85-125 of coastal highway in Marin, Sonoma, Mendocino counties
- Estero and beach habitats
- Existing projects: Bolinas Lagoon, Tomales Bay, Marin County
- Climate action plan

## **BREAK**

Available Data and Information ([slides](#) 36-63)

### *Project Coastal Geography*

- “G to G” – Gualala to the Golden Gate
- Approximately 340 miles (including bays)
- 5 littoral cells plus adjacent San Francisco cell and undetermined zones
- 15 Marine Protected Areas
- 7 Areas of Special Biological Significance
- GFNMS jurisdiction below high tide line

### *Land ownership*

Sonoma: State (Parks, UC at Bodega Marine Reserve), Nonprofit, Private, County

Marin: Federal (GGNRA, PRNS), Private, State, Non-Profit

### *Sediment basics*

- Sediment sources: Russian, Gualala, SF Bay, cliffs, slides, Northern rivers-
- Sediment sinks: Tomales Bay, Bolinas Lagoon, Bodega Harbor, offshore shelf? Bodega submarine canyon?
- Pathways—headlands disrupt and redirect flow. Regional studies, (USGS modeling), local projects (PWA Bolinas work)
- All based on last 10-15 years of work, and sometimes baseline studies can be conflicting. We are looking at the questions in a different way. This has been a hole in the state in terms of knowledge and studies. We are hoping that any information that people have can help inform fellow members and staff about the region.
- Provenance: Origin of sediment. Patrick Barnard’s work suggests that sediment goes around the Point Reyes headlands. Push and pull in terms of this region.
- There is a substantial flow of muddy suspended sediment that moves to the north, such as sand coming into Crissy Field beach.
- An example of this is the Bolinas inlet. Cliff erosion on the western side, sediment is sucked into the lagoon, deposited within the lagoon. The thickness of sediment on the seafloor tells us where sediment is available and accumulates.

### *GIS Demo*

Erosion Rates, Coastal Exposure, Sea Level Rise and Storms (OCOF scenarios) Coastal Armor, Infrastructure (Roads, Dams, Culverts/Fish Passage Barriers, Trails)

- Long-term rates of erosion: there are many data gaps in Sonoma. More data is available in Marin, but there are still gaps. Please start making lists of information you have if any.
- Coastal exposure: Info from Center for Ocean Solutions for Sonoma County. None available for Marin. Know how dynamic the coast is and what is causing that.



- Sea level rise - Info from OCOF (Our Coast, Our Future). Counties are doing their own sea level rise info assessments. Do we want to change our scenarios? Map shows inundation and flooding for each county.
- Coastal armor - Info from Coastal Commission – purple, blue, fairly small in coverage. If you know of any other coastal armoring that is not represented please let us know.
- Infrastructure:
  - o Info from CSMW - Roads, dams, culverts, fish passage barriers, trails (Marin only) for both Sonoma and Marin counties
  - o Culverts disrupt sediment natural pathways.
  - o Satisfying recreational aspects.
  - o Don't have trails for Sonoma. Pull that information together so we can have consistent info for both counties.

Questions/Comments:

- Cross reference with Caltrans data layers and information
- Brannon Ketchum noted that sediment depths reflect the San Andreas Fault. The whole peninsula is uplifting fast. That activity is driving local sediment transport. Regulatory actions are contributing to unintended consequences.
- Doug noted that this is a vision of ~50 years. Projects may not last longer than that due to funding sources. Since we do have episodic occurrences, we can only plan for tolerance.
- Leslie asked about the timeline; are we planning for the long term. The average rate will bring the episodic periods in the picture. However, within the next 5 years, you need different data. What are your tolerances for short-term erosion? What issues are of greatest concern? We should think in decadal processes, so that things would get phased in to ensure continuity. We should think about how we identify the problem, and then identify the solution.
- Jack – is there a way to characterize how much fluvial sediment is entering system?

*Planning at all levels of government* – highlighted 3 main projects that are most relevant:

1. Local Coastal Programs:
  - a. Marin's "Collaboration: Sea-level Marin Adaptation Response Team" (C-SMART) project: vulnerability assessment, adaptation strategies (temporal and spatial – all available on website – Bolinas, Stinson, Pt Reyes Station, Inverness, Marshall, East Shore), LCP amendment all on SLR – can inform working group on priority locations, and as a guide for future projects
  - b. Sonoma LCP update: public access, SLR, biotic resources, geo hazards, water quality; GIS data layers that we can include in our work
2. Caltrans –identified priority locations for highway realignments, revetment work, etc.
  - a. Example – Gleason Beach has significant erosion, proposal to move road into a causeway – up and out of the way
  - b. Other road issues: just north of Russian River, Salmon Creek Beach, Bolinas Lagoon roads
3. Sanctuary:
  - a. Bolinas Lagoon Restoration Project
  - b. Climate Action Plan

*Take home from the LCP updates work:*

Lots of planning is underway; CRSMP can benefit from the existing work, there are ways to integrate recommendations into LCP Amendments for policy consistency; opportunities to complement each other and emphasize regional approach

*Take home from Caltrans and other roads:*

Lots of planning is underway; CRSMP can benefit from the existing work by informing actions such as freeing sediment clogged culverts/floodplains, landslide abatement, and by integrating recommendations into transportation planning; opportunities to complement each other and emphasize regional approach

Questions/Comments:

- Is there any possibility that Hwy 1 wouldn't be maintained up and down the coast? Stefan from Caltrans noted that due to economic well-being of communities along the coastal highway, issues would need to be managed on a local level, as there is no state-wide plan for Highway 1, and they are just focusing on specific areas
- Is there anything in Caltrans that addresses sea level rise scenarios? Stefan answered that CalTrans HQ does have an office that is looking at sediment vulnerability assessments. In many cases, counties are ahead of the state, so looking to incorporate county work into Caltrans assessments. More information will be available in the next couple months.
- Lesley Ewing noted that not all structures are the same – a tide gate is a small structure but impacts a significant area, and it would be good to highlight those types of structures. The coastal trail is wonderful, but lots of other access pts are very important (Coastal Commission can share that info); local hazard mitigation plans (get from counties); are we thinking that littoral cell boundaries are sacrosanct or are we looking at sediment movement between them? Doug responded that with such a large region, there is no need to be constrained by boundaries.
- Are Caltrans maps online? Stefan responded that draft maps are, but are internal only and need to be updated

**LUNCH** ([slide](#) 64)

Over the lunch break, WG members identified data needs, geospatial data and planning resources, as well as preliminary areas of concern for the basis of management recommendations. Flipcharts and large printed regional maps were available throughout the meeting room for collecting input, and are available [here](#) and summarized below.

Data Needs:

- Better understanding of overlapping regulatory limitations
- Local Hazard Mitigation Plans
- Marsh and mudflat monitoring information and studies (eelgrass)
- Temporal component to beach nourishment projects already occurring along the coast
- Seasonal, annual, and long-term shoreline change at Stinson and Muir Beaches
- List of restoration projects

Resources Available:

- Data collected from the Marine Life Protection Act Initiative
- CA coastal commission may have trail data (will follow up)
- Sonoma County LCP public access element
- US Army Corps of Engineers has coastal LIDAR (2010, 2014, 2016)
- Erosion rate data from shoreline protective device permits (CCC)
- Russian River jetty study and Am Plan, Sonoma County Water Agency (sedimentation rates)
- Point Reyes Coastal Bluff Study
- Mid-2000s USGS sea level rise risk evaluation for Pt Reyes National Seashore and Golden Gate National Recreation Area
- Ct (?) to check projects erosion rates (Gleason), culverts, armoring data

Areas of concern (from maps, north to south):

- Gualala: sediment inputs related to timber production, logging (historical and current)
- Del Mar Point: bluff erosion
- Russian River jetty and estuary
- Willow Creek: legacy road issues, grazing
- Gleason Beach: erosion from drainage vs. wave action (?), restoration of Scotty Creek, grazing practices and gullying
- Bodega Harbor: maintain active waterfront, dredging issues
- Bodega Head: access
- Doran Park: access, parking, park facilities
- Estero Americano: sediment accumulation has changed habitats – should it be restored?
- Estero de San Antonio: sediment issues here?
- Walter Creek: Highway 1 and coastal access
- Chicken Ranch: sediment issues
- Point Reyes: planned culvert replacement as part of SFD work (2018/2019) just north of point; dams have been removed south of point
- Bolinas Lagoon: source of sand to save Stinson Beach?
- Alamere Creek: natural cliff/waterfed
- Duxbury Reef
- Off Duxbury Point: graven of deep sediment for beach nourishment
- Stinson Beach: preservation of beach and dune system

Review/Discussion of lunchtime activities:

- Stefan- Caltrans highlighted a way to capture restoration projects that may be affected in the future due to sedimentation, including transportation changes. Example is removing the culvert at Gleason Beach. That may affect sediment rates, so we can expect changes. The plan is to capture existing data and see changes.
- Doug asked if there are any hydrology studies to understand the watershed? Is there anything that could help us project what might be coming down? Stefan said that yes, we have done some studies. However, the restoration project should be discussed, so it is morphing a bit. We don't have a final plan. That may be an area where we do some monitoring.
- Doug asked if Caltrans is required to do any monitoring of water quality at the culverts. Stefan responded that studies show that regular maintenance activities do monitor the water quality, but this doesn't impact the highway. When we go through projects, we go through CCC, but it varies.
- Leslie noted that there are two needs to address: fine sand and beach type. What we see in the future will change. What might have to yield to natural conditions when you get abrupt changes in the coast? The key is to identify what is so critical and how these areas are maintained.
- Brannon noted that wildlife habitats should be considered. How do we create transitional habitat? By creating cliff retreats, we lose all habitat. By creating culverts, we do create transitional habitat. This is important to consider when developing monitoring. If we can identify sediment, gravel, sand, as a beneficial use, how do we identify in the regulatory sense that it is in fact beneficial? There should be a regional understanding that sediment is a resource and we should identify that as a beneficial resource instead of a negative.
- Melanie asked how this process plays out with large river systems. Should these guidelines go up to the headwaters? What are our jurisdictional boundaries with this project? Cea responded that we may have some opportunities here to look at upland issues. Doug responded that in past CRSMPs, the jurisdictional boundaries vary. The sanctuary boundaries don't go inside the river, however, even if the boundary doesn't go in, most of the sediment management is actually land-based problems, not ocean problems. It is hard to take actions but we can make suggestions. We

should be careful not to manage all the way up the Russian River watershed, but important to be aware of what goes on within the watershed. We may be limited since we are only trying to solve a coastal problem, not the whole watershed.

- Jack said there seems like a win-win gain we've created for ourselves. We ought to think about how we can create mitigation projects that would be publicly funded that would be possible for public implementation.
- Leslie asked what the scales of sediment would need to be and the mitigation that would be part of that.
- Jack said that it is a matter of cumulative supply of sediment. Utilize sources (e.g. Oakland Harbor) that have to truck sediment to the landfill and pay to dispose.

#### Small group activity: Developing Priority Area Selection Criteria (slides 65-71)

Goal: Develop selection criteria and metrics to prioritize areas of concern

1. In small groups, review and revise:

- Proposed criteria to prioritize location selection (categories and factors)
  - Definitions for prioritization ranking 1 (high) – 5 (low)
2. Select group speaker to report-out to larger group

Location Selection Process:

1. Working Group establishes criteria and metrics (today!)
2. Staff applies criteria to geospatial dataset (March-April)
3. Working Group assesses results and makes any changes (Meeting 2)
4. Working Group develops draft recommendations (Meeting 2)
5. Staff investigates and refines draft recommendations (May-July)
6. Working Group assesses recommendations and makes any changes (Meeting 3)
7. Staff finalizes recommendations and connects to governance process
8. Working Group approves recommendations and governance nexus (Meeting 4)

#### Questions/Comments:

- Jack - relative to other places, does this particular criteria apply to this area? Relatively, how does these criteria relate to one another? What a 1-5 scale would mean for each of these areas?
- Leslie noted that we should be looking heavily at human impact.
- Doug asked the group to consider what they think is important when applying the plan and not connected to the geography.
- Brannon asked what criteria was used in other places, and if there is a need to develop new criteria for this region since we are the last region. Doug answered that typically Hwy 1 has been a problem with a commercial and residential sense. Habitats have not been as valued in other areas, but this area is unique since we have lots of agricultural land and open space. We are in uncharted territory with this region and different concerns that this group can look at. Cea noted that the existing plans are solely models. We aren't limited to what's been established in those models. We have the opportunity to build on them. Sara added that this group can take ownership of the sediment management plan. We want to get this group's perspectives of what's important, which is why we did not solely rely on previous plans.
- Doug asked the group if we were going to apply all listed criteria to all areas within the study area? Stephanie said that they won't all be applicable; they would be condensed.
- Sara suggested that all the factors be considered when determining a score for each category as a way to simplify the process.
- Jack suggested to give a rationale as to why you are rating something some specific way, to provide a qualitative description for why something got ranked
- It was suggested to tease out more urgent/immediate concerns vs "inconvenience".

- Melanie suggested that we should give each main category a 1, as a binary system to determine presence or absence of criteria. 1 is the least critical, 5 most critical?

*Cumulative list of criteria identified by staff and small groups:*

Infrastructure

- Mileage of roadway threatened at different time frames
  - o Functionality of roadways – Is there another way to move residents/visitors around key transportation corridors? Can we identify roads that are critical to public access, such as private roads?
  - o Public benefits of roads – What critical access ways are disrupted? Consider perspective of connecting communities
- Mileage of power and communication lines - multiple functions along road corridors
- Public safety (natural disasters – evac routes, functionality of roadways)
- Number and locations of critical community functions – Prioritize these with at-risk and vulnerable sections of coast, identify alternative paths to provide these functions that are not adjacent to high risk areas of coast
- Number of structures impacted
- Public vs. private use
- Number of water treatment conveyance facilities – utilities as a public resource
- Cost of the impact
- Critical public service vs. non-critical use
- Number of impacted individuals
- Availability of alternatives – adaptability of impacted area

Ecological/Biological Resources

- Area of threatened permanent habitats for listed resident species through erosion (removal) or deposition (smothering)
- Area of threatened seasonal habitats for listed transient species through erosion (removal) or deposition (smothering)
- Multiple use habitats
- Expand definition to include agricultural lands and open space
- Prioritize harbors as both public access (infrastructure) and habitat conservation
- Look at areas of coastal erosion to allow habitat to maintain with sea level rise – plan for a natural balance and sea level rise to keep up with sedimentation
- Break down areas into types of habitat (rocky shore/wetland/beach) – Look at areas of natural overlap to preserve different types of habitat and the functions they provide
- Mobility of impacted species – valuable or listed?
- Habitat function
- Ecosystem services
- Introduced species – how will this change the ecosystem?
- Water quality within the context of habitat restoration (adjacency to agriculture runoff)
- Sediment quality (legacy contaminants) to match up quality of sediments, quality of water, use/function of habitat. Looking at matchup of these resources to find areas of highest overlap.

Commercial

- Impacts to valuable species

Real Estate

- Number of parcels threatened at different time frames
- Type of parcels threatened (private vs public)
- Adaptability of impacted parcel (primary vs secondary residence, redundancy)
- Stinson Beach, Bolinas, Sea Ranch as large private areas with infrastructure to protect
- FEMA floodplain models (in context of sea level rise for relocation, managed retreat, etc.) for

low-lying areas and bluffs as areas we need to prioritize

#### Public Access

- Consider public recreation facilities, campgrounds (Doran campground), marinas, boat ramps, kayak areas, trails
- Consider historic access points and the potential scenarios if we lose access – Does road re-routing allow access to the same beach or is this beach cut off?
- Maintain areas of access to the ocean (harbors, boat ramps, access to respond to marine habitats and incidents such as whale entanglement, oil spill, fishing communities)

#### Recreation

- Consider visual resources and protecting aesthetics
- Ecotourism function
- Nature appreciation,
- Coastal dependent or not
- Density or frequency of use
- Available alternatives

#### Environmental Justice:

- Sustenance fishing
- Tribal, historical resources – Ensure locations are accounted for in management (economic impact of oyster/crab). Values need to align with historic structures/use and make judgement calls
- Impact under-represented communities?
- Adaptive capacity of impacted community

#### Regulatory burden:

- Level of protection applied to the area
- Difficulty or consistency of compliance with existing regulations

#### Environmental hazards:

- Multiple hazards present
- Will they manifest over short term or long term?

#### Other considerations:

- An opportunity to re-envision the story of the California coast. Are we clinging to the same “status quo” of access? Perhaps there is a space to re-envision the story. Can we be more dynamic? Address functionality, while also allowing for natural processes.

#### Wrap-up and Next Steps ([slide 72](#))

##### Future meetings:

May 17<sup>th</sup>: Meeting 2

August 29<sup>th</sup> : Meeting 3

October 2<sup>nd</sup>: Meeting 4

(A location poll will be distributed to determine future meeting locations.)

##### Meeting follow-ups:

- Data sharing/transfer – please contact staff with any data or resources you would like to make available to the group
- Review draft/criteria scoring methods – within the next month
- Google folder with meeting materials – Sara will create
- Online database to display data layers for WG use – Sage will create

## **Working Group Meeting 2 Summary**

Wednesday May 17, 2017, 9:30am – 4:00pm  
Finley Community Center, Santa Rosa

To access the slide presentation from the May 17<sup>th</sup> meeting click [here](#). Reference to slides #s for each presentation are noted in parenthesis.

*Meeting begins 9:30am*

Welcome by Cea Higgins, Working Group Chair

### **Introduction of new working group members:**

*Bob Legge, Russian Riverkeeper* – Concerned with quality of sediment, nutrient loading, biggest concern is floodplain connectivity, need good sediment supply and off ramps, riparian corridors are top priority, how sediment transport works in the larger scale, areas are heavily laden with mercury chemicals such as mercury, phosphorus.

*Luke Farmer, Wildlands Conservancy* (alternate for Brook Edwards) – Priority is Estero Americano, Russian River, interested restoring and enhancing those areas.

*Brendan O’Neil, California State Parks* – Priority is locations of mix of infrastructure, natural and cultural resources, including mouth of the Russian River.

*Clif Davenport, Coastal Sediment Management Workgroup* – Glad to be involved so close to home. Fits into statewide effort the Coastal Sediment Management Workgroup (CSMW) is trying to do.

*Liza Sternik, EAC intern* – Focus area is West Marin, Drakes Estero, Bolinas Lagoon.

### **A recap of March 9<sup>th</sup> SMWG meeting accomplishments presented: (slide 2)**

- Working Group project overview (Objectives & Timeline)
- Discussed roles and responsibilities of staff and members
- Agreed to meeting guidelines
  - o mutual respect
  - o propose solutions when identifying problems
  - o holding closed meetings unless group opens
  - o timeliness with cell phones silenced
- Regional Sediment Management plan basics (RSMP 101)
- Reviewed existing & available data
- Pooled knowledge of WG members on establishing priority areas of concern along the Sonoma & Marin Coastlines, and
- Listed criteria to be considered when selecting critical areas

### **Motion to approve March 9<sup>th</sup> meeting minutes:**

WG given opportunity to make any final corrections to minutes-no corrections offered so motion to approve March Meeting minutes passed unanimously.

### **Accomplishments from March to May presented: (slide 3)**

- Compiled the information gathered
  - o Created Areas of Concern map and table
- Integrated comments of partners

- Met with Caltrans
- Discussed sediment management plans in MBNMS
- Reconciled issues raised when identifying and ranking selection criteria to determine priority areas
- Analyzed coastal shoreline change for study area
- Created maps & tables presenting priority areas that were identified and located within areas of existing or predicted shoreline change for 2 climate change scenarios over 3 projected timelines

Chair let the WG know that information formulated since last meeting would be presented to WG during the meeting for their review and approval.

**Meeting Agenda introduced & reviewed: (slides 4 & 5)**

<i>Time</i>	<i>Item</i>
9:15	<i>Sign-in and Coffee</i>
9:30	<i>Welcome and Working Group Business Cea Higgins, Working Group Chair</i>
9:45	<i>Sanctuary Regulations 101 Max Delaney, GFNMS</i>
10:15	<i>Priority Area Selection and Process with Data Projection Doug George and Sage Tezak, GFNMS</i>
10:45	<i>Priority Areas Map Exploration (including break)</i>
11:45	<i>Recommendation Guidance and Climate Action Plan Doug George, GFNMS</i>
12:05	<i>Game of Floods primer Jack Liebster, County of Marin</i>
12:10	<i>Lunch (30 min) and Game of Floods interactive session (30 min)</i>
1:15	<i>Small Group Activity: Make the Recommendations</i>
3:45	<i>Conclusion and Wrap-up</i>
4:00	<i>Meeting End</i>

**Meeting 2 Meeting Objectives: (slide 5):**

- Learn about relevant Sanctuary regulations that may impact working group recommendations
- Learn about the process used to select priority areas for the development of recommendations
- Finalize priority areas to address coastal sediment issues
- Learn about adaptation planning through relevant strategies recommended via the Sanctuary’s Climate Action Plan and hands-on interaction with Game of Floods
- Develop sediment management recommendations in small, site-specific planning groups for



priority areas

**Sanctuary Regulations Presentation: (slides 8-23)**

Max Delaney gave a presentation on Sanctuary regulations. A critical component of the CRSMP process will be to identify and discuss all relevant local, state, and federal agency regulations and policies that may be applicable to implementing sediment management projects and recommendations. [This document](#) provides a starting point for the governance component of the plan by providing an overview of the sanctuary's regulatory program.

**WG Comments on Presentation:**

*Jack Liebster* asked if monitoring using citizen science something that the sanctuary could come into with support? It could be a suggestion for the plan. Would we also look more specifically at some issues that may lead to a framework for permits that would be rigorous down the line, give substance for future permit review by the sanctuary? One of the things they would like to look at is artificial dunes. Does that come under the same rigor as an artificial seawall? Can the sanctuary tease that out with this process?

*Mary Nichols* noted that “abandoning infrastructure” is one of the prohibitions, and it would be nice to have framework for decommissioning the roads.

*Jeannine Manna* asked if the sanctuary has considered the implications of sea level rise with the expansion with more of the coast becoming inundated and how this might affect sanctuary boundaries and or regulations/permitting. *Doug George* responded that it was not something explicitly explored yet. The timeframe is pretty far out; NOAA may re-designate the shoreline, which may expand the boundary in the far future.

*Jeannine* also asked what kind of activities fall under salvage and recovery. *Max Delaney* responded that these permits for the removal of items that get abandoned in the sanctuary, such as containers or ships, and that GFNMS gets involved to ensure no injury to the sanctuary.

*Shannon Fiala* asked about property owners in relations to permits. The relationships between sanctuary boundaries and this project, and where do we want the recommendations to go? *Max* responded that we can make recommendations beyond the sanctuary boundaries even though they may fall outside of sanctuary jurisdiction/other agency boundaries.

*Doug* added that the Climate Action Plan does have recommendations for outside of boundaries, and we can take that approach in this plan as well.

*Jack* had a question for *Clif Davenport*. Are there any parameters for this plan, does it get approved by the state, and does it become the official state plan? *Clif* responded that the State works with regional entities and locals to come up with the plan that works on a regional level with a hope that the plan would be adopted by said regional entity and incorporated into their activities. It is not intended to be prescriptive at a state level. The only connection at the state level is to take various plans to become one master document. The state wants to help the regions come up with strategies for the plan that work for them.

*Lesley Ewing* said that the California Coastal Commission serves as a guidance and does not override regulations. She asked how the Sanctuary deals with the mean high water line? *Max* responded that he will find out and get back to them. They are set by NOAA and may get re-set by 2022.

*Shannon* asked if there are examples of beach nourishment in sanctuary. *Max* responded that

within the Farallones site, he has no direct knowledge of any previous nourishment projects. In MBNMS, all prior beach nourishment projects have been conducted by placing material above the mean high water line (i.e. outside the sanctuary boundaries).

*Abby Mohan* asked if there is conversation between Greater Farallones and Monterey Bay National Marine Sanctuaries with permitting [in relation to Northern Management Area (NMA)]. *Max* responded that the GFNMS staff handles day to day permit decision in the NMA. He added that when reviewing a permit application in each of the 2 sites, we have to apply the regulations for the sanctuary in which the project is happening. *Max* also noted if a project triggers larger policy issues, we do consult the MBNMS staff prior to making management or permit decisions in the NMA.

*Brendan O'Neil* asked what the plans were for north of the Gualala. *Doug* responded that the scope of work was determined by the state, and this project had funding for the two counties of Marin and Sonoma, and we are not addressing the gap on the Mendocino coastline. *Clif* confirmed that there are no current plans.

*Cea Higgins* added that the project was based on littoral cells, and it could be in our recommendations that the north coast is looked at in the future.

*Clif* added that they did look at Crescent City, but it was not happening for this plan. There are still several places along the coastline, though they are on rocky coast with not a lot of beaches, so they did not get high priority for this. The master plan is “sunsetting”. They are looking to continue program into the implementation phase, depending on funding.

### **Priority Area Selection and Process with Data Projection: (slides 25-52)**

*Doug* presented on the process for identifying areas of concern.

The priority areas for sediment management concerns are being determined using both working group input and shoreline change analysis. [This document](#) explains the shoreline change analysis process, creation of projected hazard zones under two climate change scenarios, and the features on land that may be at risk in 10, 20, and 50 years. Example graphics of the erosion rates and a shoreline hazard zone are also provided.

In preparing for the first Working Group meeting, staff consulted with outside agencies and organizations that began identifying areas for further evaluation. Additionally, during the first Working Group meeting, members were asked to identify areas currently experiencing sediment issues, in need of attention in regards to sediment management. These primary focal areas are identified as year 0 (present day) areas of concern. Staff then developed a multi-step process to estimate shoreline change rates for Sonoma and Marin Counties to validate the suggested locations and detect areas that have not been identified.

### **WG Comments on Process for Identifying Areas of Concern:**

*Brendan* asked about the difference of access points. *Sage Tezak* clarified that it is all coastal access points, which includes trailheads. The data does not include the actual trail an individual may travel, which *Brendan* is calling vertical coastal access.

### **Master list of Proposed Areas of Concern presented: (slide 54)**

<b>SONOMA</b>
Highway 1
Gualala
Del Mar Point
The Sea Ranch
Gerstle Cove
Fort Ross
Russian River (mouth, jetty and estuary); Jenner
Willow Creek
Gleason Beach
Salmon Creek Beach/Northern Bodega Bay Dunes
Bodega Dunes
Bodega Head
Bodega Harbor
Doran Park
<b>MARIN</b>
Highway 1
Estero Americano
Estero de San Antonio
Dillon Beach (at mouth of Tomales Bay)
Marshall
Walker Creek
Chicken Ranch Beach
Inverness
Point Reyes
Pt Reyes Station
Alamere Creek
Duxbury Reef and Off-shore Area
Bolinas Cliffs (between Duxbury & Lagoon)
Bolinas Lagoon
Stinson Beach
Seadrift
Muir Beach

The ranking system that was proposed at the March 9 meeting was deemed too subjective to use by the WG (subjectivity) so a new approach was developed that used shoreline change analysis to identify areas of concern within hazard areas in three time periods under two climate change scenarios.

**Map Exploration Exercise:**

– Working group members move around the room and explore large wall maps

Doug asked the working group to look at the list of priority areas and determine if this list is what the group wants to move forward with.

**WG Comments on Priority Area maps:**

*Brendan* asked what these designations would mean for his agency as a land manager. *Doug* responded that the way we have thought of using these plans was to present them to a funding agency, and let them know we are looking to implement a pilot study with lots of community input, and having this plan gives us a boost once we ask for funding. *Mary Nichols* noted that this meeting has the regulators at the table. It makes the permitting processes a lot easier, and is a benefit to the process later on.

*Lesley Ewing* noted that we may want to do a first screening to vet out the areas we are more interested in, for example, we do not see sediment as a direct opportunity to fix Highway 1, and may eliminate some of these because they don't have sediment tied opportunities.

*Stephanie Rexing* asked if we are going to be designating threats as well. *Doug* answered that we tried to capture some of the issues with the initial locations with the table. It can be useful to look at the problems and if it is this something that could be addressed with the sediment management measures.

*Mary* asked that since the Russian River is outside Sanctuary boundaries but is a known sediment issue, whether we should we make sure we apply the same criteria to all areas. *Cea* responded that in the recommendation process, we can write down if something cannot be addressed and the justification as to why not to show that we looked at all possible areas.

*Stephanie* suggested removing the general approach and instead identifying hotspots. This was done with prioritizing the locations.

*Jack* asked if beach nourishment be a possible approach to slowing erosion of a cliff where we have erosion. *Doug* said that it is difficult to answer whether we can buffer a cliff erosion process, as there could be various processes, and undercutting by waves may be one of many processes. It is a tool to consider to slow down that particular element, but may not address the whole issue. *Clif* noted that steeper vertical cliffs usually indicate lots of wave action compared to less steep cliffs indicating more terrestrial processes. With dunes and bluffs, sand is more likely to stick around. *Lesley* noted that on the steep cliffs on Highway 1, most of the erosion is happening at the upper portion of bluff.

*Ashley Eagle-Gibbs* asked if the criteria have been applied to this Master List. The hazard zones were overlaid with the features within the areas of concern. For example, Dillon Beach may have different strategies for different parts of the beach. For this project we are assessing whether or not something can be done; this will be done in the smaller afternoon groups. Groups can rank within themselves, provide direct input, and discuss at a smaller scale. *Clif* noted that we need a vast suite of options.

(Group was not ready to finalize Priority Areas at this time).

*Cea* suggested that the group look at the recommendations process with examples presented, and then revisit the locations in the afternoon to see if the recommendations process could be utilized to finalize priority areas.

WG agreement to this suggestion

**Making the Recommendations:** (In Packet Information provided to WG during meeting)

*Liza Sternik* asked about the cost of the strategies for these projects. *Cea* said that this will be revisited during recommendation worksheet activity.

**Recommendation Guidance: (slides 56-74)**

**Terminology:**

***Site management goal:*** What the working group hopes to accomplish at the site through the recommended sediment management strategies.

***Recommendations:*** Includes the sediment management strategies, as well as the timeframe for implementation, and governance for implementation. Final recommendations will be presented to the Sanctuary Advisory Council for approval, and considered by the Sanctuary for incorporation in the final Sediment Management Plan.

***Sediment management strategies:*** The specific actions that the working group recommends the governing agency take to alleviate sediment issues at a specific location.

***Governance:*** The agency with the jurisdiction and authority to implement the strategy. Governance will be discussed at the 3<sup>rd</sup> working group meeting, and informed by the Technical Advisory Committee.

***Timeframe:*** From the last available shoreline erosion data (2013), strategies should be recommended for the following timeframes:  
10 years (2023); 20 years (2033); 50 years (2063)

### **Strategies:**

- *Blending different strategies to achieve goals of sediment management, habitat protection/enhancement, public recreation opportunities*
- *In relation to Climate Action Plan*
  - *Implement Living Shorelines*
  - *Promote Education*
  - *Protect and Restore Habitat*
  - *Limit Human Disturbance*
  - *Address Invasive Species*
  - *Invest in Science Needs*
  - *\*\*most strategies call for the identification of locations based on a number of factors; this project will help inform the CAP by providing spatial component for strategies\*\**
  - *Priority Locations preliminarily identified for some strategies*

### **Recommendations Examples:**

#### **1. Climate Action Plan**

- *Implement Living Shorelines:*
  - *LS-1: Identify potential demonstration sites for nature-based infrastructure projects*
  - *LS-2: Reduce or modify armoring that exacerbates erosion.*
  - *LS-3: Remove/redesign roads in locations that act as barriers to natural expansion of coastal habitats.*
- *Protect and Restore Habitat:*
  - *H-1: Remove or modify structures that disrupt the delivery of sediment via long-shore sediment transport and coastal and near-shore structures that contribute to erosion.*
  - *H-8: Let go of pocket beaches that can't retreat, and do not intervene with management actions.*

These recommendations were vetted by the Sanctuary Advisory Council on the Climate Action Working Group. The Monterey Bay National Marine Sanctuary (MBNMS) Action Plan has two action plans with focus on improving sediment management reuse. The Coastal Armoring Action Plan has several activities that relate to beach nourishment, opportunistic use of dredged material, and identifying alternatives to coastal armoring structures.

#### **2. MBNMS Action Plans:**

- Coastal Armoring Action Plan
- Harbors & Dredge Disposal Action Plan

#### **3. Marin County C-SMART:**

Four posters talk in detail about strategies that Marin County used. Locations were identified where these strategies could be employed. There is also a poster zoomed in to six locations; time and space were considered in terms of Accommodate, Protect, or Retreat.

**WG Comments on Recommendations:**

*Cea* suggested using “Informing factors” as a term.

*Clif* noted that sediment management plans traditionally look at impacts, but also identify source areas. One of the best sources is the basin off Duxbury Reef. USGS has identified that it is beach quality sand. It is going to take time and effort on whether we can actually get that sand. He suggests that the group thinks about ways to determine if and how we can get that sand (dredge, etc). It would take a long time so it should be considered sooner rather than later.

*Cea* asked if there are other spots to identify. *Clif* said it was important to identify all sources and if they are viable. It is good to know the quality, politics, etc. involved in the beginning.

*Doug* showed “Offshore deposits” slide from first meeting. California Seafloor Mapping Program shows thickness of sediment on seafloor; this tells us where sediment is available and accumulates.

*Jeannine* asked if it is in a Marine Protected Area, and take of sediment may not be allowed regardless.

*Jack* asked if there is more information on the littoral cells available. *Doug* responded that research shows that there is transit between littoral cells, blurs lines, and there are connections between the Russian River and deposits near the Golden Gate. It may be difficult to nail down littoral cells from a sediment transport perspective. Looking at coastal watersheds, we should consider how much sediment is being delivered from it. Some members are looking at is using existing work in Gualala, how to scale for other watersheds along the coast, so we can see what is expected to come in.

*Clif* noted that the San Francisco bar has all sand coming out of Golden Gate and ends up there. It circles up, some goes to Marin, etc. dredge, pile sand up on San Francisco Channel Bar Disposal Site (SF-8). There is a big pile of sand that has been moving onto the beach. The USGS has done studies to see if sand could be placed near Ocean Beach, and have the waves push it onto shore. It has been put further offshore than ideal, and it is unclear if it is effective yet. In terms of getting the sand, funding is a constraint. *Cea* noted that the Bodega Bay dredged material is going to SF 8 now. It has been land deposited in past, but now it depends on quality.

**Game of Floods Presentation:**

*Jack* presented the “Game of Floods”: A game developed in cooperation with Marin County and Marin Public Works. It involves the public, decision makers to confront issues related to climate change adaptation. Experience tradeoffs, costs, etc. accommodated, protection (engineered, natural), retreat. Examples include elevate buildings (accommodate), floodproof buildings (accommodate), elevate/new road (accommodate/retreat), coastal armoring (protect-engineered), tidal gate (protect-engineered), living shorelines (protect-natural), offshore structures, managed retreat, and hybrid strategies that integrate different approaches.

**LUNCH** (included opportunity for WG members to interact with Game of Floods)

*Afternoon Session*

**Recommendations:**

The Working Group was divided into four groups, two representing each county. Staff facilitated the

discussions for the groups based on the geospatial data provided, which included layered PDFs of each location showing critical features and projected shorelines for 10, 20, and 50 years. Each group assessed the data moving north or south along the coastline within their assigned county, and used the recommendation worksheets to record their discussion and draft preliminary recommendations. The worksheets included listing the priority site, group members, group facilitator, site management goal, and strategies for sediment management for three time frames of 10, 20, and 50 years using 2013 as a baseline. The groups were given 1 hour 45 minutes to discuss, and were asked to report back to the group the following points:

- 1) Briefly list the recommendations you made for your priority sites
- 2) What did you learn from this process?
- 3) What were the challenges?
- 4) What Factors informed your decision
  - Economic feasibility/Funding availability
  - Visual/aesthetic considerations
  - Regulatory guidelines
  - Environmental impacts
  - Impacts to Vulnerable Communities
  - Education or public outreach opportunities
- 5) What did you accomplish, and what is left to do?

*Below is a brief summary of group findings. A more detailed summary will be compiled by staff and posted to shared WG folder as soon as possible for review and comments.*

### **Groups**

**Marin 1:** (South to North): Abby Mohan, Lesley Ewing, Kristin Ward, Liza Sternik  
Two sites: Muir Beach & Stinson Beach/Seadrift

Recommendations for Stinson Beach included educating the community about dune farming, restoration, natural dune enhancement, managed retreat, converting to a houseboat community. Recommendations for Muir Beach included using the current armorment to create an access wall on top to continue to allow public access rather than having to do beach nourishment. The site management goals included habitat protection and recreation. Big points are educating the community and working with locals to inform them of strategies Things learned are that sites are unique but managed retreat and community education came up a lot. Cliff houses may infringe upon habitat. Balancing habitat and human encroachment. What is left to do: some sites needed more understanding, look at regulatory and jurisdictional areas to understand feasibility of strategies for specific sites.

**Marin 2:** (North to South): Jack Liebster, Jeannine Mana, Clif Davenport, Ashley Eagle-Gibbs  
Two sites: Estero Americano, Estero San Antonio

With sediment accumulation, assess in 10 years how the system is changing. Increase in inland flooding, potential impacts to ab land, land managers/owners. Recommended to study type of sediment/quality, etc. and identify locations to place. In 20 years, suggested ecosystem restoration, flood protection, depth changes in sediment for species, living shorelines Duxbury Reef: focusing on research and categorize type of sand for beneficial reuse, environmental consideration of regulations, in marine protected areas. Learned that there are a lot of problems, and lots to be done. Sometimes not sure of issues at the site, would be nice to identify those. Unsure of what to propose for strategy since there is more research to be done. All the knowledge and GIS layers were helpful, visuals around the room. Created some preliminary



recommendations but still more to be done.  
Both Marin sites dropped Alamere Creek.

**Sonoma 1:** (South to North): Shannon Fiala, Luke Farmer, Neil Lassette, Brendan O'Neil  
Two sites: Doran Park and Russian River

Doran Park is an important park in Sonoma county, protecting public recreation and against inundation, consider beach nourishment using Bodega harbor dredged material or Russian River bank offshore sand. Protect road to facility through road infrastructure improvement. Dune restoration, removal of non-native beach grass. Height of dune reduces overtopping.

Russian River mouth- Jenner is flood prone. Construction of the jetty, Goat Rock, allowed sand to flow, but sand starved in south. Impacts the frequency of breaching of river mouth. Low-lying community in Jenner. Over long term, relocating parking lot at beach. Would restore natural process of sand flow. Potential to change/remove the jetty. Relocation of structures in Jenner. Significant resources to be protected there. Economic feasibility and regulations may be a challenge. It was difficult to identify the problems at these sites, but great to think outside the box in terms of strategies.

**Sonoma 2:** (North to South): Melanie Parker, Mary Nichol, Bob Legge, Stephanie Rexing  
Three sites: Russian River, Gleason Beach, Bodega Harbor

At the Russian River, there are many agencies and issues intersecting at Jenner. Called for large collaborative watershed restoration plan to tackle all issues at the same time. Have Jenner be an international awareness and raise its profile to be a model.

For Gleason Beach, managed retreat was suggested. Converting it back to public lands, may suggest not having homes on cliff.

For Bodega Harbor, relocating and/or elevating road, rethinking access points. Dredging was suggested, and to reuse the dredged material in beneficial ways, but got stuck on technical aspects such as cleaning, etc.

It was difficult to not have all perspectives in group.

They all had different priorities – identify things that are high priority for putting resources. More time was spent on factors of environmental impacts, community, education/outreach opportunities. The group did not drop any sites but had lower priority ones.

**Next Steps: (slides 53-54)**

Meeting follow-ups:

- Review of recommendations (will make available in shared folder)
- Integration of regulatory and permitting into the recommendations
- Begin interagency outreach for governance structure
- Technical Advisory Committee Meeting #1: mid-summer

Upcoming Working Group Meetings

**Meeting 3: Determining Governance for Selected Projects**

Tuesday, August 29th, Bodega Bay Grange

Finalize Recommendations

Present Draft Governance Structure

**Meeting 4: Approving the Final Plan**

Monday, October 2nd, Marin Health and Wellness Campus

**Meeting End 4:00pm**

## **Working Group Meeting 3 Summary**

Tuesday August 29, 2017, 9:30am – 4:00pm

Bodega Bay Grange, Bodega Bay

To access the slide presentation from the August 29th meeting click [here](#). Reference to slides #s for each presentation are noted in parenthesis.

Meeting begins 9:30am

Welcome by Cea Higgins, Working Group Chair

Working group members in attendance: Bob Legge, Ashley Eagle-Gibbs, Brendan O’Neil, Jack Liebster, Luke Farmer, Dick Ogg, Brannon Ketcham, Jeannine Manna, Stephanie Rexing, Mary Nicholl, Hattie Brown, Abby Mohan, Clif Davenport, John Largier, Cea Higgins

Staff in attendance: Doug George, Max Delaney, Jenn Gamurot, Sara Hutto

### **Welcome and Working Group Business**

Cea reviewed the working group process and timeline, where the group stands now, and what was accomplished since the group’s last meeting in May. Meeting minutes from the May 17 meeting were approved. Cea reviewed the agenda for today’s meeting.

#### Coastal Watershed Analysis

Doug shared information on the Coastal Watershed Analysis, being conducted by Neil Lassetre of Sonoma County Water Agency that will assist informing the overall plan. Staff will report out on this information at the next working group meeting.

*Jack Liebster* asked if there is any way to ground truth the estimates; Doug responded that hopefully that will be possible, and Neil can explain the process. Gualala is one we have known information on. We have a known relationship between geological and vegetation layers and delivery, and can scale to other locations. Clif also has some information on the Russian River basin. Tomales Bay there are studies done already. Clif mentioned the North Coast Watershed Assessment Program - a multi agency program from early to mid 2000; partners included the California Geological Survey, California Fish and Wildlife, State Water Board, Calfire, to assess sediment impacts in specific rivers including Gualala and Mad River. Clif will assist in getting this information.

### **Storymap Demonstration**

#### Recommendations and Categories

The previous meetings were very informative. There were a wide variety of ideas and staff presented and sorted them into eight categories: beach nourishment, living shoreline, education and research, armoring, indirect sediment management, restoration, dredging, managed retreat.

#### Flowchart to Incorporate TAC Regulatory Input

Doug showed how staff filtered the recommendations using the first step of a flowchart: “Is recommendation a sediment management measure or climate change adaptation?” If it was a climate

change adaptation it was set aside to be considered for inclusion to the Sanctuary Climate Action Plan. The remainder of the flow chart was discussed later in the meeting.

### Storymap discussion

Staff utilized an Esri StoryMap to organize, analyze and illustrate the suite of sediment management recommendations developed by the working group. Doug and Jenn introduced the storymap to the working group, demonstrating how the strategies and associated information are displayed and organized. Staff emphasized that this is a draft tool for use by the working group at this meeting to better visualize their recommendations, and will later be finalized and made public as part of the Sediment Management Plan.

Comments/questions:

*Abby Mohan* asked about how to think regionally and connect all of these issues up and down the coast (which will be covered later in the meeting). Would be great to integrate these opportunities for connectivity into the map (e.g. dredged material from location x can be used for beach nourishment in location y).

*Jack Liebster* emphasized that the focus of this group's efforts should be much more regional in focus and that there has not been enough data on sediment in this process to support this group making direct sediment management recommendations (especially for the future). Cea responded that this group's task was to look at site-specific issues; Doug responded that the final plan will have much more of this science information and will use the working group's recommendations to make those more regional connections. *Clif Davenport* explained that all the other regional sediment management plans convened similar stakeholder groups to identify problem locations, incorporated into the final plan. He confirmed that this project is on track with previous projects and the use of the storymap has taken the typical planning process to the next level. Clif asked about recommendations that are currently difficult due to existing regulations (e.g. getting at the sand in the graben off Duxbury Reef) and the ability to discuss and recommend that changes be made to those - Doug and Cea responded that yes, we are definitely looking for that information. Clif then asked about the future of the story map and where it will be housed. Sara responded that GFNMS will retain this information in a sediment-specific map, and an additional layer will likely be added onto the Resilient Lands and Waters Storymap in conjunction with NOAA Fisheries. Clif added that we can link directly to the Coastal Records photos - Clif can connect us with Alyssa Moore to get this figured out. The other regional sediment management plans have provided GIS data to the state that has been incorporated into their web mapper - this is the first project to develop its own mapping application to view the data and recommendations.

*Hattie Brown* asked how the work that Neil is doing will be incorporated into the storymap - Doug needs to see the data first, but his goal would be to include estimated sediment delivery for each watershed as it enters the ocean. We also plan to add the coastal erosion layer to the storymap. He added that this is a community plan - not just for the Sanctuary or the state - and that everyone should provide us feedback on how to improve the tool for widespread use by managers and planners.

### **Regulations and Governance**

Max shared that the Technical Advisory Committee convened once, at the end of June. The role of the TAC is to take the recommendations and ground truth them; look at the feasibility in terms of regulatory setting, consultations, and potential impacts to habitats or species. Members of federal, state, county, and

local agencies that have a role in sediment management measures are on the TAC. The process is iterative and we will circle back around.

The goal for the TAC's first meeting was to present the 8 strategy categories and assess the feasibility of each for each agency involved. He shared a handout sheet "Agencies involved in Reviewing and Approving Recommended Sediment Management Measures within the Marin-Sonoma Regional Sediment Management Plan Project Area". The handout is split by category (restoration, etc) and by agency (federal, state, local) and identifies constraints or challenges each agency has. A few notable outcomes:

- Restoration - broad support from all the agencies
- Every one of these measures will be complicated and technical.
- One goal of the TAC is to point out big picture red flags or issues. Example: Research and Education- if agencies have mandates under their statutes to have research and education programs, such as the sanctuary.
- Dredging - one of the hopes is that if dredging is a strategy, what are the major issues that may present themselves with dredging? Must coincide with agency policies and regulations. Highlight the constraints and challenges. By identifying these challenges, helps to make decisions to further refine recommendations, may be coordination between agencies, etc.

Comments/questions:

*Jack* asked about GFNMS sanctuary permits and if dredging for beach nourishment can be considered a restoration project? Max clarified that yes we could consider this as a permitted activity if it meets all criteria for permits.

*Abby* asked if the sediment plan for the Monterey area proposed regulatory changes to allow for beneficial reuse of sediment - Max responded that yes, MBNMS is currently looking at this (things move slowly) through their management plan review.

*Jeannine* added that it would be helpful to have some of the specific policies included (Max added that these technical details would be in the final plan).

Doug presented the full flowchart; the goal of the afternoon breakout groups is to run each strategy through the flowchart and 1) consider feasibility of strategy with existing regulations and policies - if feasible, identify implementation needs and if not, describe the barriers, and 2) determine if changes should be made to those existing regulations. Flowchart is a method of filtering recommendations into 3 categories: preferred, possible, and problematic.

### **Report-out and Group Discussion**

General (more regional) recommendations reported by breakout groups:

- Consider beneficial reuse of sediment trapped in culverts and drainages throughout the County - review permit that already exists to do this on county roads (permit #2-10-020, currently all sediment is going to an upland site) (Research strategy)
- Preserve/protect vegetated intertidal habitat created by railroad
- Sediment TMDLs need to be considered more in-depth
- A habitat goals project for Tomales Bay including sediment mgmt issues - within Tomales, we've lost a lot of subtidal habitat (SLR will help with that), but regionally we're losing intertidal marsh habitat so we need to create habitat goals
- An agency to step forward and characterize Stinson Beach - is it accreting? How fast? Beach profile needed. Need to describe and define the problem before developing solutions.
- Be mindful of beneficial uses of bodies of water (estuaries and rivers) and impact of using the

- sediment; limiting anthropogenic sources of sediment; protective of beneficial uses
- Coastal bluff erosion sites have similar geomorphic conditions and similar characteristics
- Cultural resources, public lands may be an additional filter to look at
- Looking at processes that lead to loss of public access
- Processes are playing out at different time scales
- For the Russian River, a process exists for the overall management at a higher level
- Work with permitting agencies on Gleason beach project to identify conditions and/funding opportunities to remove debris
- Geomorphology dictates a certain set of recommendations
- Implementation need: River mouth sites also have similar characteristics (development down low, managed by different agencies and different stakes; several classifications of sites) outcomes are similar; finding common ground and way to manage to restore/get to functional system
- Inter-agency collaboration; identifying agencies, creating communication structure for these agencies
- Streamlining permitting at all levels; creating memorandums of understanding, regional planning (example at Gleason Beach with CCC) there are examples of streamlining that have worked (SCWA); designating one agency if appropriate; programmatic approach; eliminating redundancies; bundling or batching permitting processes

Clif talked with a permitter at the Corps. Doran Beach did not have applicable permits. Dredging came up relatively quickly, they didn't have time to get permits in place. Their least cost alternative is going to a permitted facility. Recommendation would be to make sure that in the future Doran is permitted to receive sand/material. Also recommend to characterize potential receiving sites.

Cea had a question about if the county tried to identify storage areas for clean sediment. Mary Nichols said that around a wastewater treatment plan, was going to use spoils for the berm.

Abby Mohan added there was no storage or receiver sites so it was just dumped offshore.

Jack recommended that we should identify storage areas, and pre-qualify receiver sites. (*This would be a bigger question for the TAC – what info do they need about potential receiving sites; approvals*). We would also need an easy way to characterize the materials that are collected, and develop an efficient way of doing this for small amounts.

Clif mentioned the Sand Compatibility (SCOUP) report. What are the most likely source and receiver sites.

- General recommendation would be to put together a matrix similar to SCOUP with sand compatibility.
- Did that study look at hazardous materials? Indirectly it does, (green, yellow, red) source areas. Green is suitable, yellow deals with size, nearshore, but not on beach. Red is bad sediment and unsuitable.

The goal for this project is to produce something together but continues to have life going forward. The whole plan will be put together by February 2018, after we bring the recommendations to the SAC.

Meeting ended at 4:00pm

## **Working Group Meeting 4 Summary**

Monday October 2nd, 2017, 9:30am - 4:00pm

Marin County Health and Wellness Campus

### Welcome: Cea Higgins

Thank you to all working group members for being a part of this process to identify the priority areas for the region and to formulate recommendations for the areas. The key objective for the day is to finalize and approve all working group county and regional recommendations for Marin and Sonoma counties to be presented to the Sanctuary Advisory Council at the November 15th meeting.

### [Click for Slide Presentation](#)

### Review August 29th meeting minutes

Minutes approved

### Next steps for recommendations

Sara shared the project timeline moving forward. The next big milestone is for the recommendations to go through the Sanctuary Advisory Council, who will vote on which recommendations will be forwarded to the sanctuary. The recommendations need to be clear and directive. Sara and Cea will be leading the discussion at the SAC meeting. They will give a primer on each location and issues and concerns to provide context; Cea will present the recommendations for each county followed by a vote for those recommendations (one vote per county), and present the regional recommendations followed by a vote, for a total of three votes. Staff will review the working group process and timeline at the SAC meeting so they are aware of the broad participation across the region and to note that the recommendations were vetted by different stakeholder groups.

Jack Liebster asked about when the science will be integrated in the report. He asked if we want the SAC to vote on recommendations that reflect best available science.

Doug said we will provide more background information to the SAC to familiarize SAC with the sediment issues and problem areas identified.

Jack wants the science to underlie the plan. The working group has had discussions but not about data; he would like a more rigorous scientific analysis included.

Suggested to be proposed as a regional recommendation. Some of the other plans have been prescriptive, but recommendations are regional dependent on how they are received (dependent on knowledge base and community). Our plan does not intend to be prescriptive, and the scale of this project is much bigger than others, so it is difficult to get into the details.

Doug talked with USGS and has access to wave data to add to the storymap to show spatial patterns of wave dynamics, mean conditions, etc.

Jack suggests that recommendations should be commensurate with the strength of the analyses.

John Largier noted that the SAC sees more of the working group process and the scientific and technical input is found in the report.

Optional Review Period for draft CRMSP: December 4 - 22

The last TAC meeting will be held on December 4th after the SAC has weighed in. The goal is for sanctuary staff to interact with agency leads with detail for every identified location and they will have the opportunity to share agency purview for those locations.

December is the review period; staff will be producing documents and drafting the plan. Working group members are invited to voluntarily participate in the draft plan review (optional). Sanctuary staff and CSMW staff will produce the final plan in January.

End of the Beginning

Steps are being taken to implement actual projects; funding is a large component.

Doug described the proposed California Esteros Climate Adaptation Research Program and potential funding sources.

Jack mentioned a Marin County-focused program through Coastal Conservancy on natural adaptation. They are going to expand to the outer coast and are looking into information needed to develop a natural adaptation approach in Stinson Beach, such as protecting lives and access. The money comes from Marin community foundations. An idea for this to inform implementation for this project.

Let staff know if you are familiar with any opportunities for funding moving forward.

Doug also mentioned the Bolinas graben study that is addressing sand resource availability through the USGS-BOEM. Their interest is stability for alternative energy platforms and they want to understand substrate before putting alternative energy sources out in ocean.

Overall, we are encouraging continuing partnerships and collaborations between agencies.

Abby Mohan asked if any of the plan outcome is going to be sediment regulations or restrictions. Are there any mechanisms that this final plan will help to restore natural processes? The plans have been used to varying degrees as a guide. Since the sanctuary is not on land, very little can be done.

Discussion on Regional Recommendations

It was clarified that the SAC vote on the recommendations would be whether or not to forward the recommendations to the sanctuary superintendent. Implementation of these recommendations and decisions on lead agencies would come at a later time. The SAC may be reviewing recommendations that cross boundaries, but are mainly concerned with how the recommendations impact the sanctuary.

It was suggested to have an overall statement at the beginning of the recommendations with an encompassing theme of agency collaboration and integration across recommendations.

FINAL REGIONAL RECOMMENDATIONS  
(WG wording in italics; WG discussion below)



1. *Receiver sites. The working group recommends the development of a list of potential “receiver” and storage sites to be pre-qualified for placement of excess sediment. Develop a matrix similar to the SCOUP (Sand Compatibility Opportunistic Use Program) report to characterize sediment compatibility across the region and develop a process to pre-qualify and permit both sediment storage and beneficial use locations.*
  - SCOUP is national level standard. Asking that the sanctuary moves that forward. Separate section for regional in the final plan. May just require coordination with agencies, which Marin county may want to pursue. There should be an effort for opportunistic beach nourishment program.
  - Receiver sites and storage sites are not necessarily the same. Want to look at what the sediment is within the prequalifying stage (SCOUP) part, protocols in report; passing through filters. 2 parts - first is prequalifying storage and second is prequalifying receiver
  - “The sanctuary should pre-permit the receiver and storage sites”
  - Consider both sediment storage and deposition
  - The sanctuaries should work in concert with agencies. Will go into local governance within the report; will refine the details within the TAC process. Will have to involve any potential agencies involved with permitting and review. Unsure about a master permitting process, but could suggest examples and models that would be good to include
  - County and city would have to identify land storage sites

2. *Managed retreat. Recognizing that this group and the Sanctuary do not have the authority to prescribe or recommend managed retreat at specific locations along the coast, the working group recommends that the following locations be explored for managed retreat options by the appropriate agency. [list locations and timeframe]*

*Possible rewrite:*

*The WG has identified coastal bluffs eroding due to wave impacts, causing infrastructure to fail. Long-term solutions would involve moving vulnerable infrastructure inland.*

- Locations in hazard zones and experience of WG members came up through the breakout groups. If it is listed as a regional recommendation it could be a larger recommendation for other agencies. Want to include but not as a prescriptive recommendation. Pull out term “managed retreat” and suggest “maybe should be explored” and list locations that were suggested in WG meetings
- Should dates and time frame be considered? Could be written as vague long term strategy
- May integrate with first recommendation; suggest to think about receiver sites and managed retreat together. “The WG encourage the sanctuary integrate/combine approaches”
- Jack noted that we have to look at options as they progress through time; using adaptive management process/planning process that takes into account physical conditions, environmental impacts, economic costs, politics
- “Managed retreat” to be pulled out separately because it is more of a climate adaptation strategy. Staff clarified that for the sanctuary to access some of the recommendations they must come forward to the SAC as a recommendation. Would need to list all the alternatives in the measure (augmenting beaches, limiting new development, etc)
- Considering erosion/bluffs are clearly eroding; phrase as vague: “moving infrastructure” without saying “managed retreat”... Uses science behind it to stay out of “planning” issue
- Managed retreat and armoring should be framed in the context of sediment management. Reframing them as sediment management alternatives. Gets out of politics and looking at how these strategies factor into the actions of sediment management
- Should rely on science and return of natural processes as first goals. Suggest to phrase “managed retreat”/ “armoring” as tools; could combine them? “This sediment plan needs to take into

account the means of dealing with sediment which might include beach nourishment, managed retreat, etc, the sediment effects of those alternatives needs to be addressed... for example..."

- Suggest to list pros and cons for managed retreat identified per site. Need a follow up process

3. *Armoring. The working group recognizes the negative impacts of coastal armoring (interrupts sediment dynamics) and recommends that throughout the region, armoring be considered a last resort option for coastal defense.*

- WG approved

4. *Referencing the SCOUP matrix (see recommendation #1), identify areas throughout the region where sediment delivery is interrupted by dams, culverts, etc. and consider beneficial reuse of the trapped sediment and options to prevent future impoundment of sediment; for example, review permits that already exist in the region.*

- Provide SCOUP report as context and background

5. *Consider reusing sediment from future landslides for beneficial reuse.*

- NEW: Added in Marin breakout group

6. *Take a holistic, watershed approach in understanding sediment dynamics and identifying areas of restoration to improve downstream water quality and encourage natural sediment transport.*

- Being mindful of impacts on bodies of water
- May belong with general overarching statements - "do no harm"
- Suggested requirement to consider natural processes/transport pathways
- Goal to have less harmful impacts from anthropogenic sources
- Restoration approach - How to heal the places where sediment dynamics are out of whack
- Taking a holistic, watershed approach in understanding sediment and identifying areas of restoration to improve downstream water quality and encourage natural sediment transport

7. *Increase permitting efficiency for sediment management activities (while preserving comprehensive environmental review) through means such as: creating memoranda of understanding, eliminating redundancies, consolidating permits, encouraging interagency collaboration, and taking a programmatic approach where feasible.*

- While preserving effective comprehensive review

8. *Promote interagency collaboration for sediment management by identifying relevant agencies and stakeholders, and creating a communication structure for these agencies.*

- Communication structure is a tangible thing
- Suggest to extend to sediment management planning and implementation

9. *Develop a regional monitoring program using best available science methods and citizen science including wave energy, water levels, shoreline change, bluff erosion, habitat evolution, water quality, sediment budget, and littoral transport. (MOVE TO #1)*

- NEW: Added by WG

10. *Implementation need: River mouth sites also have similar characteristics (development down low, managed by different agencies and different stakes; several classifications of sites) outcomes are similar;*

*finding common ground and way to manage to restore/get to functional system \*\*NEEDS  
CLARIFICATION → check with State Parks and RRK\*\**

*Replace #10 with → Build on the range of management approaches to find lessons learned to identify successful management approaches in area types that have similar characteristics.*

- Identifying effective management approaches that have worked; not losing work, applying going forward
- Recognizing differences between public access. Similar characteristics but may not be similar solutions
- Look at what has been successful at other sites and apply here; lessons learned
- Recognize that river mouths are different; acknowledge behavior of sediment in areas could be similar in some areas
- Recognize knowledge based and range of management approaches; goal to do a statewide approach
- Geographic features? Habitats? Keep it vague? Area types?

*11. Complete a sediment management plan for Mendocino County coastline.*

- WG approved

*12. Within 12 months of this plan, request Caltrans to convene a task force of planners, managers, and relevant transportation entities to consider infrastructure impacts from sediment management. Highway 1 is integral throughout the region; actions taken to address erosion, retreat, and SLR by Caltrans will impact sediment decisions by others.*

- WG developed, approved

*13. Cross-walk extensive ongoing work in the region with this SMP (e.g. Tomales, Russian River, Bolinas North-End Restoration Project).*

- WG developed, approved

*14. Develop and implement education and outreach programs to inform communities and relevant agencies (regional waterboards regarding TMDLs) throughout the region about the importance of sediments to coastal regions, providing platforms to convey results from and opportunities for sediment management efforts and monitoring; encourage citizen science opportunities.*

- WG developed, approved

## **LUNCH**

### Afternoon Breakout Groups 1:00-3:45

Marin (11)

Sonoma (13)

#### Sonoma Breakout Group

- Suggest to incorporate other NGOs - Trout unlimited, Nature conservancy, friends of the gualala river, as well as other agricultural input
- Suggest to add new site above Jenner: Driftwood beach. Proposed caltrans project would cut off access. If armoring goes in, guaranteed coastal access.

## Appendix C: Wave Data at Recommendation Sites

Modeled seasonal mean and extreme wave height (m), peak period (s), and orbital velocity (m/s) for CRSMR recommendation sites. Wave data extracted from Erikson et al., 2014 and depth estimated from Google Earth-California Seafloor Mapping Program layer.

						Wave Height								Peak Period								Orbital Velocity							
						Winter		Spring		Summer		Fall		Winter		Spring		Summer		Fall		Winter		Spring		Summer		Fall	
Site ID	Site Name	Latitude	Longitude	Depth (ft)	Depth (m)	M*	E*	M*	E*	M*	E*	M*	E*	M*	E*	M*	E*	M*	E*	M*	E*	M*	E*	M*	E*	M*	E*		
1	Gualala River	38.7646	-123.5382	46	14	2.51	5.42	1.81	3.8	1.11	1.69	1.55	3.61	14.2	15.6	11.7	14.2	9.7	9.7	11.7	14.2	0.945	2.1	0.649	1.44	0.351	0.549	0.555	1.37
2a	Sea Ranch N	38.7429	-123.5166	13	4	2.26	3.22	1.75	2.8	1.08	1.52	1.55	2.75	8.94	9.82	7.42	8.94	6.12	6.36	7.39	8.94	2.07	2.88	1.62	2.51	1.03	1.4	1.45	2.48
2b	Sea Ranch S	38.6971	-123.4445	24	7	2.34	4.9	1.69	3.52	1.02	1.5	1.44	3.33	12.3	13.5	10.2	12.3	8.41	8.41	10.2	12.3	1.09	2.32	0.757	1.64	0.412	0.621	0.64	1.56
3	Salt Point State Park	38.5650	-123.3304	15	5	1.94	2.56	1.6	2.25	0.997	1.37	1.44	2.23	9.89	10.9	8.18	9.92	6.77	7	8.18	9.89	2.07	2.59	1.74	2.33	1.09	1.47	1.57	2.31
4	Fort Ross Historic Park	38.5116	-123.2456	24	7	1.26	1.64	0.979	1.48	0.701	0.861	0.91	1.46	8.59	9.44	7.23	8.6	5.88	6.28	7.11	8.59	1.75	2.17	1.37	2.02	0.999	1.21	1.29	2.01
5A	Russian River - Driftwood Beach	38.4500	-123.1329	29	9	2.37	4.16	1.63	3.44	0.874	1.31	1.39	3.33	12.6	13.9	10.5	12.6	8.65	9.51	10.5	12.6	1.25	2.23	0.843	1.83	0.424	0.646	0.716	1.77
5B	Russian River - Jenner to Estuary	38.4500	-123.1329	29	9	2.37	4.16	1.63	3.44	0.874	1.31	1.39	3.33	12.6	13.9	10.5	12.6	8.65	9.51	10.5	12.6	1.25	2.23	0.843	1.83	0.424	0.646	0.716	1.77
5C	Russian River - Goat Rock	38.4399	-123.1288	19	6	2.84	4.4	2.17	3.8	1.27	1.97	1.9	3.74	10.9	11.9	8.99	10.9	7.44	8.07	8.99	10.9	1.68	2.62	1.27	2.25	0.702	1.11	1.11	2.22
6	Wrights Beach	38.4029	-123.1016	15	5	2.85	5.28	2.1	4.1	1.28	1.93	1.81	3.96	13.6	14.9	11.2	13.6	9.29	9.29	11.2	13.6	1.6	2.97	1.15	2.29	0.661	1.01	0.994	2.22
7	Gleason Beach	38.3839	-123.0884	15	5	2.66	4.91	1.99	3.79	1.25	1.92	1.72	3.67	14.2	15.6	11.7	14.2	9.7	9.7	11.7	14.2	1.49	2.78	1.08	2.12	0.64	0.999	0.936	2.06
8A	Salmon Creek Beach	38.3415	-123.0745	29	9	2.76	5.4	2.05	4.14	1.34	2.08	1.78	3.96	14.2	15.6	11.7	14.2	9.7	9.7	11.7	14.2	1.24	2.5	0.891	1.87	0.536	0.847	0.77	1.8
8B	Bodega Head	n/a	n/a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8C	Bodega Harbor	n/a	n/a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8D	Doran Park	38.3099	-123.0426	24	7	1.5	2.43	0.965	1.96	0.413	0.626	0.809	1.9	14.1	15.5	12.8	14.1	9.63	10.6	11.6	14.1	0.756	1.24	0.479	0.991	0.196	0.3	0.401	0.966
9A	Estero Americano	38.2932	-123.0045	11	3	1.15	2.45	1.15	2.45	0.595	0.862	0.967	2.32	14.2	15.6	11.8	14.2	9.7	10.6	11.7	14.2	0.606	1.35	0.394	0.885	0.179	0.27	0.331	0.845
9B	Estero de San Antonio	38.2669	-122.9861	35	11	2.12	4.45	1.59	3.2	0.995	1.5	1.37	3.05	14.2	15.6	11.7	14.2	9.7	9.7	11.7	14.2	0.86	1.85	0.616	1.3	0.349	0.541	0.53	1.25
10A	Dillon Beach (N)	38.2479	-122.9781	9	3	2.14	4.06	1.61	3.22	1.03	1.55	1.4	3.09	14.2	15.6	11.7	14.2	9.7	9.7	11.7	14.2	0.978	1.9	0.709	1.48	0.411	0.636	0.613	1.42
10B	Dillon Beach (S)	38.2479	-122.9781	9	3	2.14	4.06	1.61	3.22	1.03	1.55	1.4	3.09	14.2	15.6	11.7	14.2	9.7	9.7	11.7	14.2	0.978	1.9	0.709	1.48	0.411	0.636	0.613	1.42
11A	Marshall	n/a	n/a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11B	Chicken Ranch Beach	n/a	n/a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11C	Inverness	n/a	n/a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11D	Pt Reyes Station - Bivalve	n/a	n/a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12A	PRNS - Drakes Beach	38.0232	-122.9589	27	8	1.25	2.9	0.77	1.83	0.286	0.469	0.651	1.77	14.2	15.6	12.9	14.2	9.7	10.7	12.8	14.2	0.661	1.55	0.402	0.971	0.144	0.239	0.339	0.942
12B	PRNS - Schooner Bay	n/a	n/a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13A	Duxbury Reef and Off-shore Area	37.8378	-122.6203	67	20	2.26	4.81	1.61	3.42	0.943	1.35	1.37	3.26	14.2	15.6	11.7	14.2	9.7	9.7	11.7	14.2	0.61	1.35	0.401	0.933	0.19	0.285	0.339	0.9
13B	Bolinas Cliffs	37.8904	-122.7036	10	3	2.03	2.28	1.77	2.19	1.14	1.56	1.65	2.19	14	15.4	11.6	14	9.59	9.98	11.6	14	1.74	1.96	1.51	1.88	0.95	1.3	1.4	1.88
13C	Bolinas Lagoon	n/a	n/a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13D	Stinson Beach	37.9014	-122.6574	10	3	1.73	2.97	1.22	2.36	0.623	0.926	1.04	2.31	12.9	14.2	10.7	12.9	8.85	9.55	10.7	12.9	1.3	2.18	0.919	1.75	0.458	0.686	0.786	1.71
14	Muir Beach	37.8550	-122.5785	16	5	0.95	2.36	1.14	2.49	0.62	0.847	0.954	2.36	14.2	15.6	12	14.2	9.7	9.95	11.7	14.2	0.343	0.907	0.413	0.953	0.194	0.275	0.343	0.907

\*-M: mean, E: extreme, top 5%



## Appendix D: Critical Habitat Locations

### Pinniped haul-out sites in the AOI:

Sea Lion Cove
Havens Neck
Del Mar Landing, The Sea Ranch
Walk-On-Beach, The Sea Ranch
Fisk Mill Cove
Otonoe Beach
Clam Beach, Fort Ross
North Jenner Beach
Goat Rock Beach
Russian River Spit
Miwok Beach
South Salmon Creek Beach
Bodega Head
Doran Beach
Pinnacle Gulch
Dillon Beach
Tomales Bay
Tomales Point
Point Reyes Headlands
Drakes and Limantour Esteros
Double Point
Duxbury Reef
Bolinas Lagoon
Point Bonita

### Seabird nesting sites in the AOI:

Gualala Point Island
Delmar Point
Sea Ranch
Black Point to Stewart's Point
Stewart's Point to Rocky Point
Horseshoe Cove
Cannon Gulch to Stump Beach
Gerstle Cove to Stillwater Cove
Bench Mark 125 to Timber Cove
Northwest Cape Rocks
Windermere Point to Jewell Gulch
Russian Gulch
Russian River Rocks
Goat Rock to Peaked Hill
Arched Rock
Peaked Hill
Gull Rock
Shell-Wright Beach Rocks
Duncan Point to Arched Rock
Bodega Head
Bodega Rock
Bodega Harbor
Pinnacle Rock
Sonoma-Marin County Line
Dillon Beach Rocks
Bird Rock
Tomales Point
Hog Island
Elephant Rock Complex
Point Reyes
Coast Campground South
Point Resistance
Millers Point Rocks
Double Point Rocks
Stinson Beach to Rocky Point
Gull Rock Area
Muir Beach Headlands to Tennessee Cove
Bird Island
Point Bonita
Bonita Cove
Point Diablo Bluffs and Needles