# Executive Summary

## ES.1 Purpose

This study examines coastal hazard vulnerabilities with approximately 5 feet of sea level rise by 2100. However, sea level rise projections for 2100 range from a low of 2 to 10 feet, with recent science identifying this higher level as the worst-case scenario.

Sea level rise rates in Carpinteria will be dependent on three factors – warming of the ocean, ice melt, and vertical land motion. Local oceanic and atmospheric circulation patterns and groundwater extractions do not have a significant direct influence upon sea level rise rates in the City of Carpinteria (City). Existing coastal hazards from severe storms cause erosion and wave flooding. Routine tidal inundation already affects community resources; sea level rise could exacerbate already difficult and often competing management challenges. Many of the affected areas were once historic wetlands before the development of Carpinteria. As the habitats have been altered and land uses expanded into flat low-lying areas, infrastructure, roads, and neighborhoods have been built in these areas. These habitats, land uses, and built infrastructure will need to adapt to rising sea levels. The process of examining existing and future vulnerabilities is the first step for a community to take in understanding the extent of the potential challenges and to begin discussing and formulating effective adaptation strategies over time to maintain the quality of life in Carpinteria.

This **2019 Sea Level Rise Vulnerability Assessment and Adaptation Project (Report)** provides the City, public service providers, interested members of the public, and community organizations with a comprehensive, science-based assessment of the vulnerabilities of City resources, structures, and infrastructure, as well as the potential for future damages to the City associated with various coastal hazards, including sea level rise. This Report will be used by the City to inform community discussions on the impacts from existing and future coastal hazards, identify a full range of potential future adaptation strategies that can be employed to reduce the risk of future damages, and identify thresholds of impacts that can guide long-term land use and planning goals, policies, and programs, including capital improvements and implementation measures related to citywide physical development. This Report's identified vulnerabilities will support adaptation planning to inform the update of the City's Coastal Land Use Plan and General Plan and (CLUP/General Plan), which will ultimately lead to enhanced community resilience.

Funding for this Report has been provided by the Local Coastal Program Planning Grant received from the California Coastal Commission (CCC) and the California Department of

Transportation (Caltrans) Adaptation Planning Grant (FY 2017-2018). The Report is prepared for the City of Carpinteria Community Development Department, with assistance from Wood Environment & Infrastructure Solutions, Inc. and Revell Coastal consultants.

## ES.2 Report Overview

**Chapter 1, *Sector Profiles*,** summarizes the existing and future vulnerabilities of 11 key resource and infrastructure sectors to coastal hazards and sea level rise.

**Chapter 2, *Background***, describes the planning process that was conducted as part of the preparation of the Report. This Report follows the steps outlined in the *Sea-Level Rise Policy Guidance* (CCC 2015) and the *State of California Sea-Level Rise Guidance* (California Ocean Protection Council [OPC] 2018) guidance for preparing local communities for sea level rise and an uncertain future. An overview of the efforts of other local jurisdictions to address coastal hazards, climate change, and sea level rise is also included in this section.

**Chapter 3, *Existing Conditions & Physical Setting***, characterizes developed areas, natural resources, creeks, coastal and shoreline areas, and topography. Further details are provided in subsections that elaborate on the unique climate, geological, ecological, and coastal processes and hazards of the Carpinteria shoreline.

**Chapter 4, *Climate & Sea Level Rise Science*,** describes the current science on the topics of climate change and sea level rise. The scientific understanding of the natural climate cycles, human impacts, and feedback mechanisms within the earth systems continues to grow and evolve. A summary of the current state of the science in California is provided. In addition to the sea level rise projections used in the Report, a summary of the extreme worst-case scenario of up to 10 feet of sea level rise by 2100 (H++ scenario) is provided in Section 4.3 *Sea Level Rise*, of this Report. Table ES-1 shows the estimated elevations of sea level rise under the high emissions scenario and their associated probabilities by projected time in the future used in the Report. However, under the H++ worst-case scenario, the projected 5 feet of sea level rise could occur as early as 2070.

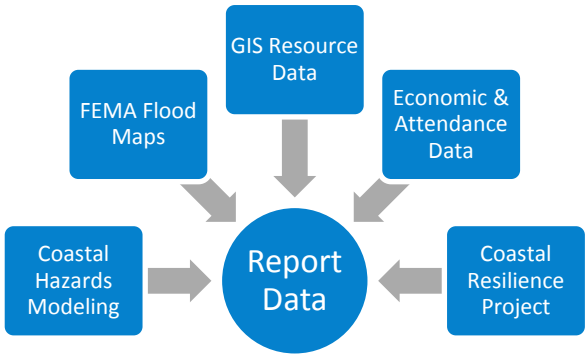
**Table ES-1. Sea Level Rise Projections Used in the Carpinteria Vulnerability Assessment, with Associated Probabilities of Occurring in the Projected Year**

| Projected Horizon Year / Time | Sea Level Rise (inches/feet) | Probability of Occurring in Projected Year[1] |
|---|---|---|
| 2030 | 10.2 in/~ 1 ft | <0.5% |
| 2060 | 27.2 in/~ 2 ft | ~2% |
| 2100 | 60.2 in/~5 ft | ~2% |

*Source: Revell Coastal and ESA 2016 and OPC 2018.*

*[1]The range of probabilities relate to scenarios in future greenhouse gas (GHG) emissions as well as sea level rise uncertainties largely associated with the rate of global ice sheet melt. The H++ scenario does not have a specific probability assigned and is presently considered the worst-case scenario.*

**Chapter 5, *Vulnerability Methodology*,** provides an overview of methodologies used in assessing existing and projected vulnerabilities from coastal hazards. The City Community Development Department and consultant team evaluated a range of available coastal hazard models and sea level rise projections, with input from the CLUP/General Plan Update Committee and public. Input was also considered for key decisions including resource and service sectors to be included in the vulnerability assessment, during a public meeting in July 2017 (Appendix A). Based on comparative analysis and needs of the City, the hazard model selected is the County of Santa Barbara Coastal Resilience Project (Coastal Resilience), funded by the California State Coastal Conservancy (SCC) and the County of Santa Barbara (County) (Revell Coastal and Environmental Science Associates [ESA] 2016). Coastal Resilience modeling results are also used by the neighboring jurisdictions of Santa Barbara and Ventura Counties, and the Cities of Oxnard and Goleta.




Vulnerable assets, facilities, and infrastructure are identified by using Geographic Information System (GIS) data to determine the change between the existing (baseline) and each future hazard and sea level rise scenario. The results identify the potential effects of coastal hazards under a variety of future scenarios. The model does not consider the influence of existing development and/or future adaptation decisions.

Fiscal Land Use Impacts were assessed by:

1. Escalate County Assessors database to Fair Market Value (2017 $)
2. Estimate losses due to sea level rise/storms/ coastal erosion (2017 $)
    - Erosion impacts based on percent land and structure damage
    - Coastal flooding impacts based on depth of flooding and replacement
    - Tidal inundation based on "property (land and structure) at risk"

Economic analysis was conducted using County assessor data for land uses to fair market value to evaluate impacts to property, for both land and structures at risk. This included an evaluation of multi-unit structures such as apartments and condominiums as well as single parcels with multiple structures on them for each hazard type and sea level rise scenario. Recreation and camping data obtained from the California Department of Parks and Recreation (State Parks) and other local sources were used to estimate revenues associated with recreation. Additionally, replacement costs for key infrastructure was estimated based on readily available cost estimates from similar studies and City documents.

**Chapter 6, *Sector Results***, provides an overview of potential risks to 11 resource sectors for three (3) sea level rise elevations (1 foot, 2 feet, and 5 feet of sea level rise) for the medium-high sea level rise scenario. Coastal hazards are presented and include the following:

- **Coastal Flooding:** Flooding caused by wave run-up and overtopping from a 1 percent annual chance storm.
- **Coastal Erosion:** Coastal erosion based on sea level rise and a 1 percent annual chance storm.
- **Tidal Inundation:** Tidal inundation based on a predicted monthly high tide.

For most of the resource sectors, the vulnerability assessment also includes an economic component to provide an initial estimate of fiscal impacts to the vulnerable resources. Further, information on potential vulnerabilities related to fluvial flooding and coastal confluence is included within Appendix C.

**Chapter 7, *Adaptation Overview*,** provides an overview of the process to identify potential adaptation strategies, followed by a discussion of possible strategies that may address Carpinteria-specific hazards and vulnerable assets. Tradeoffs of different adaptation strategies are presented to provide further context in the decision-making process. The focus is on the areas of protection, accommodation, and managed retreat, consistent with CCC policy guidance.

**Chapter 8, *Adaptation and Resiliency Building Strategies,*** identifies focused regional coordination needs, policy enhancements and specific sea level rise adaptation strategies that warrant additional analysis for the Carpinteria region as well as within three distinct areas in the City.

- Area 1: Beach Neighborhood
- Area 2: Carpinteria Salt Marsh
- Area 3: Carpinteria Bluffs

The adaptation strategies included within this Chapter are based on modeling of coastal hazards using the Coastal Resilience model, technical analysis within Chapter 6, *Sector Results*, and are intended to address impacts to known vulnerabilities within the City. In accordance with *Update to the Sea-Level Rise Policy Guidance* (CCC 2018), the adaptation strategies are based on best available science, known adaptation practices implemented in other regions, input from stakeholders, special districts, the CLUP/General Plan Update Committee, and the public. The below adaptation strategies were developed specifically with the intent of minimizing damage to the known vulnerabilities within Carpinteria and prioritizing the protection of assets valued most by the community.

## ES.3 Key Findings of this Report

The future elevation and rates of sea level rise affect the extent of potential hazards and are projected estimates based on the best available science and modeling results. Rising sea levels alone are not anticipated to be the primary cause of vulnerabilities and potential damages to City resources and public infrastructure. Rather, impacts may be caused by existing severe storm coastal process-related hazards increasing in frequency and duration as a result of sea level rise. Initially, if sea level rise proceeds at the higher-level projections, episodic coastal erosion and coastal flooding impacts that already occur during large storm wave events could become more frequent as predictable high tides regularly inundate public beaches and City neighborhoods.

**Figure ES-1.** *Historic coastal erosion along Carpinteria City Beach, near Ash Avenue (Winter 1983).*

## Coastal Hazards Expansion

Coastal hazards and sea level rise escalate potential damages from coastal flooding exposure, coastal erosion, and tidal inundation. Storm waves associated with a 1 percent annual chance storm have historically caused coastal flooding and coastal erosion in the Beach Neighborhood, Carpinteria State Beach, and along the Carpinteria Bluffs. Coastal confluence flooding, (creek flooding exacerbated by sea level rise), are also a future risk, however additional study is needed on this topic. Further information on coastal confluence and fluvial hazards is provided within Appendix C.

With approximately **1 foot of sea level rise**, coastal beach and dune erosion could increase the landward extent of coastal flooding, which in turn could raise the vulnerabilities of oceanfront dwellings and increase the likelihood of infrastructure damages in the Beach Neighborhood and Carpinteria State Beach. Salt Marsh Park could also be affected during storm events. Cliff erosion along Carpinteria Bluffs may affect the Union Pacific Railroad (UPRR) and recreational trails.

> Vulnerable residential dwellings exposed to coastal wave flooding within Carpinteria could increase from 86 today, to 237 by 2030, and up to 1,090 by 2100.

With approximately **2 feet of sea level rise**, more extensive coastal flooding and coastal beach erosion during storms could affect structures, land uses, and infrastructure between Ash and Linden Avenues north of UPRR, as well as in the Carpinteria State Beach campgrounds. Coastal bluff erosion could continue to impact UPRR, recreational trails, and habitats along the Carpinteria Bluffs. Coastal flooding may also begin to encroach the Carpinteria Salt Marsh and into the Beach Neighborhood. Routine high tides would largely be confined to existing creek channels and the Carpinteria Salt Marsh, but during rain events, the increased tide elevations would likely back up stormwater drains and could cause extensive stormwater flooding in low-lying neighborhoods.

With approximately **5 feet of sea level rise**, coastal beach erosion could extend through the first row of parcels to inland of Sandyland Road, and begin to affect dwellings and infrastructure in the Concha Loma Neighborhood. Coastal flooding during a large storm wave event could expand in depths and extend inland into the Downtown core along Linden Avenue, affecting portions inland of UPRR, Carpinteria Salt Marsh and areas along Franklin Creek. Coastal bluff erosion could continue to impact UPRR, recreational trails, and habitats along the Carpinteria Bluffs and potentially impact one commercial structure. Routine monthly high tides could inundate much of the Beach Neighborhood and Carpinteria State Beach inland to the Tomol Interpretative Park, even in areas not directly connected to the ocean due to daylighting (surfacing) of groundwater due to tidal inundations. While this Report used sea level rise scenarios and modeling data for approximately 5 feet of sea level rise occurring in 2100, under the worst-case H++ scenario, this could occur as early as 2070.

## Key Vulnerabilities

The following is a summary of key community vulnerabilities, without adaptation in place. Please also refer to Chapter 1, *Sector Profiles,* and Chapter 6, *Sector Results*, for summaries of community resources and infrastructure vulnerabilities by time horizon, sea level rise elevation, and hazard type.

- **Residential Land Uses:** Residential dwellings are the most vulnerable land use exposed to coastal hazards and comprise over 90 percent of all parcels and structures at risk in the City today and in the future. Most of these impacts occur in the Beach Neighborhood. Multi-family units (apartments and condominiums) represent over 80 percent of these vulnerabilities, under both existing hazard conditions and in the future with increasing sea level rise. Many of these units are short-term (less than 30 days) rental properties; their loss may also impact transient occupancy tax (TOT) and sales tax revenues for the City.
- **Beaches and Dunes:** With approximately 5 feet of sea level rise by 2100, beaches and dunes would be severely eroded and frequently inundated. This would impact coastal recreation, Environmentally Sensitive Habitat Areas (ESHA), and expose landward development to coastal hazards and flooding. Transition of dry sandy beach and dunes over time to more frequently inundated intertidal or subtidal beach could impact City tax revenues and residents' quality of life if beaches narrow significantly or become largely intertidal/subtidal.
- **Coastal Access:** Today, during a 1 percent annual chance storm, all public coastal access points (vertical and lateral) are vulnerable to erosion and coastal flood hazards, especially when severe storms occur during high tides. Such a storm would affect beach visitation and recreational uses, and intertidal, dune, and reef habitats.
- **State Park Campground:** The Carpinteria State Beach and campground areas are vulnerable to coastal hazards with approximately 5 feet of sea level rise (2100). By 2100, 34 percent of the campground area may be damaged by coastal erosion; 31 percent may be vulnerable to tidal inundation; and 67 percent of the campground area may be flooded during large coastal storm events. Loss of the Carpinteria State Beach campground would result in the loss of low-cost overnight accommodations in the Coastal Zone, as well as a loss of open space and recreational opportunities.
- **State/City Beach Economic Revenues:** The total estimated spending for beach visitation is $48 million annually, generating $445,000 in sales taxes for the City, and just under $1.9 million in TOT for the City from overnight visitors who do not camp. Loss of the State and City Beaches could result in an economic impact associated with loss of beach visitation and associated spending. In addition to economic impacts, the State and City beaches are strongly associated with the community's identity and serve as important open space and recreation opportunities.

- **Structural Damage and Property Loss:** Overall, a total of 914 parcels and 627 structures (including many that are multi-unit residential) overlying 223.6 acres may be exposed to the combined threats of erosion loss, inundation exposure or flood damages with approximately 5 feet of sea level rise. While most of these properties are exposed to tidal inundation or coastal flooding, this vulnerability represents an estimated $439.9 million in total land use property *lost* to coastal erosion, $219.1 million in total flood *damages* to property from a single severe wave storm, and $651.1 million in potential property *exposure* to routine monthly high tides.
- **Railroad:** The UPRR corridor alignment along the Carpinteria Bluffs is highly vulnerable to coastal erosion; with approximately 5 feet of sea level rise, up to 1.4 miles of railroad could be damaged. This vulnerability may lead to pressure to repair existing seawalls or armor a significant portion of the City's shoreline, which could further impact coastal access, beach habitats, and sand supply. Coastal flooding could also impact UPRR in other parts of the City north of Carpinteria Salt Marsh and in the Downtown core. Disruption of UPRR could have substantial economic impacts to the region.
- **U.S. Highway 101:** U.S. Highway 101 (U.S. 101) would not be affected by any coastal hazard until ~5 feet of sea level rise. With ~5 feet of sea level rise, a nearly 1,500-foot section north of the Carpinteria Salt Marsh could be flooded during a large coastal storm event. This model does not take into account creek runoff, and the combined extent of flooding from a 1 percent annual chance storm and impacts could be greater when combined with increased rainfall and creek runoff from Santa Monica, Franklin, and Carpinteria Creeks. As noted above, under the H++ scenario, damage could occur earlier than 2100 and may be more frequent and severe.
- **Environmentally Sensitive Habitat Areas:** Coastal hazards and sea level rise could result in erosion or inundation of beaches and dunes, transition of high marsh ESHA to mudflat or subtidal habitats, transition of riparian habitat along Carpinteria Creek to estuarine wetlands, and substantial erosion of coastal bluff scrub and other terrestrial ESHAs along the Carpinteria Bluffs. With approximately 5 feet of sea level rise, more than 340 acres of ESHA may be impacted by dune or bluff erosion, tidal inundation or coastal flooding, with some ESHAs dependent upon landward migration to remain viable.
- **Bluffs:** With approximately 5 feet of sea level rise by 2100, Tar Pits Park and Carpinteria Bluffs are projected to erode 360-460 feet landward, damaging parks and trails, ESHA, and exposing the Concha Loma Neighborhood, commercial industrial development, and UPRR to severe erosion hazards. Armoring the shoreline would limit erosion damage but may in turn cause inundation and loss of beaches and intertidal habitats in these areas.
- **Affordable Housing:** Currently, no affordable units nor mobile home units are vulnerable to modeled coastal hazards (coastal erosion, coastal flooding, or tidal inundation). However, up to 41 of affordable housing units would vulnerable to coastal flooding and regular monthly tidal inundation with 5 feet of sea level rise.

## Positive Findings

- No major emergency first response facilities (e.g., police, fire, or medical) would be exposed to coastal hazards with up to approximately 5 feet of sea level rise. However, three lifeguard towers are currently vulnerable to coastal flooding and coastal beach erosion on Carpinteria City Beach, and the Carpinteria State Beach Rangers Office/Visitors Center is vulnerable to coastal storm flooding with approximately 5 feet of sea level rise.
- No transit facilities (i.e., bus stops) would be subject to damage from erosion under any sea level rise scenario. Bus routes could be rerouted to avoid eroded or flooded roadways, though significant flooding associated with a coastal storm or tidal inundation combined with 5 feet of sea level rise could temporarily inhibit transit services.
- No hotels or motels would be vulnerable to coastal hazards with up to approximately 5 feet of sea level rise. However, many short-term rentals in the Beach Neighborhood could be exposed to the range of coastal hazards.
- Coastal erosion hazards associated with up to approximately 5 feet of sea level rise only affect three commercial parcels and one commercial structure within Carpinteria Bluffs.
- No municipal groundwater wells would be exposed to coastal hazards with up to approximately 5 feet of sea level rise.
- The City has minimal shoreline protection structures across its 2.5 miles of shoreline, largely as a result of its active seasonal winter storm berm program.[1] This creates an opportunity to plan for nature-based adaptation measures.
- Development within Bluff 0 would not be affected by coastal hazards with up to approximately 5 feet of sea level rise and represents an opportunity for future redevelopment when the site is remediated (refer to Figure 2-1).

## Recommended Future Studies

This Report provides a comprehensive and programmatic analysis of potential hazards to the City associated with sea level rise. However, limitations and data gaps to the analysis have been identified. The following issues warrant further investigation. Additional studies are described within Section 8.6, *Recommendations and Next Steps*.

- **Coastal Confluence and Fluvial Hazard Modeling:** This Report provides partial analysis of potential fluvial and coastal confluence hazards in Appendix C. However, at the time of this analysis modeling data was limited. Improved modeling of coastal confluences and analysis of updated Federal Emergency Management Agency (FEMA)

[1] The City's seasonal winter storm berm program is not incorporated under modeling projections of future coastal hazards.

flood maps is recommended for a more comprehensive understanding of the extent of impacts.

- **Sediment Management:** Sediment debris basins in the Carpinteria Valley have had the negative effect of starving Carpinteria beaches of coarse grained materials which provide storm buffering capabilities. Further examination of sediment fluxes and the range of conditions that contribute sediment to the coast is warranted.
- **Future Redevelopment of Bluffs 0:** Bluffs 0 is located in a highly desirable area on the coast which could potentially be redeveloped following remediation of soil and groundwater resources with land uses that are subject to coastal hazards in other areas of the City.
- **Environmentally Sensitive Habitat Area (ESHA):** Additional study could be conducted to evaluate the potential impacts of the full suite of climate change variables (e.g. temperature, precipitation, drought, sea level rise, etc.) to provide a better understanding of the potential future impacts to ESHA.

## ES.4 Adaptation Planning and Next Steps

A variety of cost and benefit tradeoffs between adaptation strategies exist and are essential to understand to help decision-makers determine the most effective policies and project-level adaptation strategies to implement. Adaptation planning is introduced in Chapter 7, *Adaptation Planning,* of this Report, with more specific adaptation strategies identified as a result of this analysis in Chapter 8, *Adaptation and Resiliency Building Strategies*. Adaptation planning requires considering each vulnerable sector and taking effective and timely actions to reduce the anticipated consequences.

Sea level rise adaptation generally falls into five main categories, consistent with CCC policy guidance:

- **Do nothing** or a policy of non-intervention is also considered an adaptation strategy, and often results in emergency response at the highest cost without consideration of the full range of tradeoffs and secondary impacts.
- **Protection strategies** employ engineered structures or other measures to protect existing development (or other resources) in its current location without changes to the development itself. Protection strategies can range from “grey” or “hard” engineered seawalls to “green” or “soft” natural dune defenses.
- **Accommodation strategies** employ methods that modify existing or design new developments or infrastructure to decrease hazard risks. On a community-scale, these strategies include changes in land use designations, zoning ordinances, or clustering development in less vulnerable areas. On an individual project scale, these accommodation strategies include actions such as elevating structures.

- **Managed retreat strategies** gradually realign infrastructure and development away from hazard areas and limit new construction in those same areas. These strategies can include a range of policies and programs that incentivize relocation such as repetitive loss programs, acquisition and buy-out programs, and transfer of development rights programs. The key to effectiveness is determining which, if any, of these policies fit the local community's goals and adaptation strategies, and then managing their implementation in a proactive, phased, and orderly manner to avoid expensive emergency responses.
- **Hybrid strategies** blend a variety of strategies to achieve different hazard reduction and resource protection goals across a range of time horizons. The effectiveness of different adaptation strategies varies across time and space. There is no single adaptation strategy that will effectively adapt to climate impacts; a hybrid approach that uses strategies from multiple categories will be necessary, and the suite of strategies will change over time.

## Recommended Adaptation Strategies

The City has identified a range of adaptation strategies with consideration to the community's values and priorities, including maintaining the City's small beach town character and high quality of life, protection of public access to the beach and coastal recreational opportunities, and protecting or adapting vulnerable neighborhoods within the City's fiscal capabilities. A list of key adaptation strategies is provided in Table ES-2.

**Table ES-2. Summary of Adaption Strategies for Carpinteria**

| Adaptation Strategy | Description & Approach |
|---|---|
| **Winter Storm Berm Program** | • Continue the existing winter storm beach berm program to protect the Beach Neighborhood from high energy wave events |
| **Army Corps of Engineers Storm Damage and Shoreline Protection Feasibility Study** | • USACE has an existing agreement with the City to conduct a coastal erosion feasibility study and fund a mitigation strategy as a result of construction of the Santa Barbara Harbor<br>• Opportunity to identify project to address the coastal erosion issues, such as nourishment, cobbles, sediment management pier, using USACE funding |
| **BEACON Projects** | • BEACON projects and programs represent a valuable opportunity for the City to begin early coordination and/or collaboration with BEACON to optimize protection of City resources from coastal hazards |

**Table ES-2. Summary of Adaption Strategies for Carpinteria (Continued)**

| Adaptation Strategy | Description & Approach |
|---|---|
| **Living Shoreline/ Dune Restoration** | • Create a cobble and vegetative dune system along the City beach that would serve as the first line of defense during a large storm event, protecting landward development within the Beach Neighborhood |
| **Sediment & Beach Nourishment** | • Work with BEACON to develop a program that augments existing sand supply along the beaches and bluffs to provide additional natural defenses against wave attack by dissipating wave energy and buffering the bluffs and backshore from erosion<br>• Opportunistic beach nourishment activities in coordination with Santa Barbara County Flood Control and BEACON |
| **Sand Retention Structures** | • Cross shore sand retention structures are designed to trap sand and are often used to widen beaches which provide more natural defenses to coastal wave hazards. Sand retention structures can take many forms, the most common is called a groin. Other examples include a recreational pier<br>• Offshore structures dissipate high energy waves and result in less erosion and flooding. These can be designed as a nature-based solution such as a multi-purpose reef, a natural rock outcrop feature |
| **Stormwater Infrastructure Improvements** | • Beach Neighborhood: Rainfall events and high tides can create areas of ponded flood waters within the Beach Neighborhood. Modifications such as channel improvements along Franklin Creek, pumps, an floodgates could reduce flooding<br>• Carpinteria Bluffs: Capital improvement to drainage outlets along the bluffs, which may accelerate the rate of bluff erosion |
| **Coastal Adaptation Overlay** | • Establish policy and program framework for adaptation such as a development standards for accommodation of sea level rise<br>• Place a special zone district over properties within defined coastal hazard areas with provision of additional adaptation options to avoid the need for developers to seek costly variances for projects that are designed to avoid or accommodate sea level rise hazards but may not be consistent with existing zoning |
| **Repetitive Loss Program** | • In the long-term, relocate development subject to repetitive damage and highly vulnerable utility infrastructure |
| **Union Pacific Railroad/LOSSAN Rail Corridor** | • Downtown: Elevate the railroad to serve as flood protection for the Downtown area north of the tracks<br>• Carpinteria Salt Marsh: Raise the railroad on a causeway to provide opening for tidal inundation to extend beyond the tracks and encourage wetland transgression<br>• Carpinteria Bluffs: Armoring to slow erosion of the bluffs |

## Next Steps

The next steps include developing the long-term vision for the coast of Carpinteria, discussing with the community and decision-makers the potential pros and cons of each adaptation strategy, and accepting a certain level of risk to guide the selection of future adaptation strategies. This work will be evolving and the City's adaptation strategy will be refined as the science continues to provide updated and more accurate data, continued dialog with the community, and coordination with local and state agencies. Additional analysis of the potential site-specific could better inform decision-making and adaptation planning.

- **Financing Strategy:** the City would identify, evaluate, and pursue all feasible potential sources of revenue for funding within Section 8.5, *Funding Mechanisms*. The costs of priority adaptation strategies would be allocated and shared in proportion to the benefits realized by the affected parties, including the public, the City, and the beachfront and bluff property owners, respectively.
- **Future Technical Study:** Given the significant vulnerabilities identified in this Report, the City may consider a more detailed analysis of certain hazards or site-specific study to inform implementation of an adaptation strategy. Therefore, this Report recommends additional study to support City adaptation planning efforts prior to implementation of any of adaptation measure.
- **Public Outreach:** The City will continue to solicit input, comments and feedback from the public, agencies, and interested parties on these proposed adaptation strategies. Successful implementation of any adaptation strategy requires communication of vulnerabilities, potential adaptation tradeoffs, costs, and alternatives.
- **Multi-Agency Coordination:** The City will need to address coastal hazards by establishing collaborative regional solutions and partnerships with adjacent and affected jurisdictions and entities.
- **Monitoring Sea Level Rise and Triggers:** The City will monitor sea level rise elevation data, storm frequency, and storm damages to determine when to implement adaptation measures, with sufficient time for coordination, planning, permitting, engineering, and financing.

This page intentionally left blank.