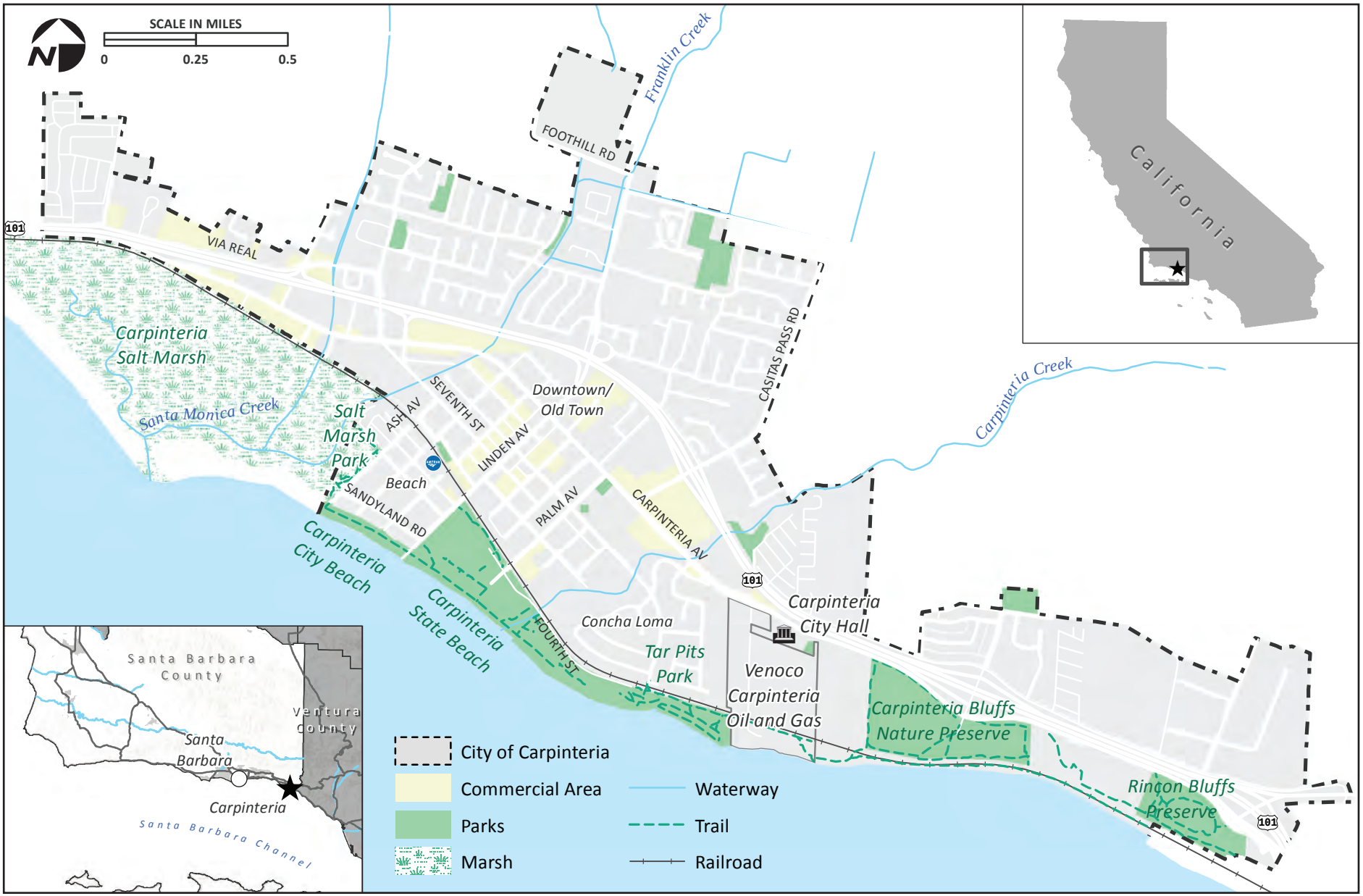
2. Background

2.1 Introduction

The California Coastal Act (1976) requires local governments in the state's Coastal Zone to create and implement Local Coastal Plans (LCPs). Each LCP consists of a Coastal Land Use Plan and an Implementation Plan. Using the California Coastal Act, the California Coastal Commission (CCC) and local governments manage coastal development, including addressing the challenges presented by coastal hazards like storms, flooding, and erosion. One of the CCC's goals is to coordinate with local governments, such as the City, to complete a comprehensive LCP update in a manner that addresses sea level rise and coastal hazards associated with large storm events and climate change.

Sea level rise and the changing climate present new management challenges as well as opportunities to address long-term protection of coastal resources, including natural resources, public beach access, critical public infrastructure, and other development and structures.

The goal of the City for this project is to identify vulnerabilities in the City to inform planning for adaptation to future sea level rise conditions. The findings and recommendations of this Report will support policy development that ultimately leads to enhanced community resilience and certification of a LCP consistent with the California Coastal Act. A priority of the LCP is to conserve coastal-dependent uses into the future. Key jurisdictional boundaries and subareas in the City are shown in Figure 2-1.



Regional Overview of the City of Carpinteria

FIGURE 2-1

2.2 Carpinteria General Plan/ Local Coastal Plan History & Status

The City's General Plan/Local Coastal Plan (GP/LCP) is the primary long-term planning document for the City. The GP/LCP encompasses the City's vision for maintaining a high quality of life, preserving its small beach town character, and natural resource protection through the identification of opportunities and constraints, development of goals and objectives, and policy and regulatory implementation.

The GP was initially adopted in 1969 after the City's incorporation and comprehensive updates were completed in 1986 following implementation of California Coastal Act regulations. The Central Coast Regional Coastal Commission certified the City's LCP which included land use policies and regulations with suggested modifications on December 15, 1979. The State Commission found no substantial issue with the LCP as approved by the Regional Commission and certified the LCP with suggested modifications on January 22, 1980. In 2003, the City combined the GP and LCP into one consolidated document, which included significant amendments to land use policies that focused on the Carpinteria Bluffs, including the oil and gas processing facility at Bluff 0 and the remainder of the bluffs extending east along Carpinteria Avenue.

The GP/LCP contains seven elements, including the mandatory Land Use Element, Circulation Element, Open Space, Recreation, & Conservation Element, Safety Element, and Noise Element, as well as the optional Community Design Element and Public Facilities & Services Element. In addition, the City contains a standalone Housing Element adopted in 1995 and updated in 2011.

As required by state planning law (Government Code Section 65300.5) all City GP/LCP elements are designed to be integrated and internally consistent and are also consistent with the California Coastal Act. In 2017, the City began preparation of this current comprehensive update to the GP/LCP given receipt of an LCP planning grant received from the CCC.

2.3 The Planning Process

In August 2015, the CCC adopted the *Sea Level Rise Policy Guidance* to aid public agencies in preparing for sea level rise in LCPs and regional strategies, and to assist applicants preparing coastal development permit (CDP) applications. The 2015 CCC policy guidance document outlines specific issues that policymakers and developers may face as a result of sea level rise, such as extreme weather events, challenges to public access, increased vulnerabilities, and compliance/consistency with the California Coastal Act. The policy guidance document also lays out the recommended planning steps for public agencies to follow in their efforts to incorporate sea level rise into their planning strategies and regulatory context, and to

reduce vulnerabilities and inform sea level rise adaptation planning efforts (Figure 2-2). In April of 2018, as this Report was being completed, the California Ocean Protection Council (OPC) finalized an update to the guidance that follows the same methodology as this Report (OPC 2018).

The purpose of this vulnerability assessment is to complete Steps 1-3 shown below in Figure 2-2, and provide initial input on Step 4. The 2015 CCC policy guidance document places an emphasis on incorporating coastal hazards and sea level rise into LCP planning and using "soft" or "green" adaptation strategies, which mimic or enhance natural processes and defenses, rather than "gray" or "hard" engineering strategies, such as seawalls and riprap. The following are specific steps outlined in the 2015 CCC policy guidance document:

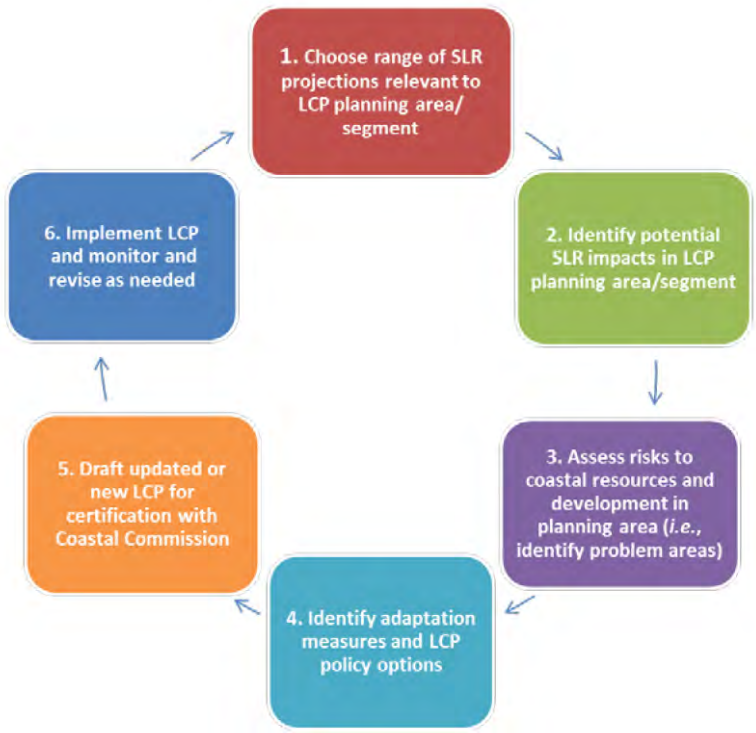


Figure 2-2. California Coastal Commission Policy Guidance for Incorporating Sea Level Rise into Local Coastal Programs

Step 1. Establish the Projected Sea Level Rise Ranges

Consistent with the CCC policy guidance, the City evaluated a range of scenarios, including a high sea level rise scenario with an estimated 60.2 inches by 2100 as based on available coastal hazard modeling which relied on the science from the National Research Council (NRC) *Report on Sea Level Rise* (NRC 2012). This sea level rise scenario is considered a high,

though not worst-case scenario[1] and was used in the regional *County of Santa Barbara Coastal Resilience Project* (Coastal Resilience model) to map projections of existing and future coastal hazards. The City selected 2030, 2060, and 2100 as the planning horizons for this Report because they align with the best available modeling completed in 2016, prior to the updated OPC 2018 projections, to support coastal management, planning, and LCP updates in the County of Santa Barbara (County). Probabilities shown in Table 2-1 provide the probability of sea level rise elevations being reached by 2030, 2060 and 2100, that were used in the model.

2010 represents the "existing conditions", or topographic baseline used for the modeling and mapping of future coastal hazards. The 2100 timeframe is the furthermost (or most distant) planning horizon since this is the last year that the coastal hazard models are available and is close to the approximately 75-year economic life of a typical structure. However, under the H++ worst-case scenario, approximately 5 feet of sea level rise could occur by 2070 and up to 9.8 feet by 2100.

Table 2-1. Sea Level Rise Scenarios

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

Source: Revell Coastal and ESA 2016, and OPC 2018

Step 2. Identify Potential Impacts from Sea Level Rise

The potential hazards for the City associated with sea level rise include beach and dune erosion, cliff erosion, coastal flooding from waves, coastal confluence flooding (river flooding altered by sea level rise), and tidal inundation. In addition, saltwater intrusion into the groundwater aquifers could also pose substantial risk to water supply and agriculture; although limited work has been done on this issue by the Carpinteria Valley Water District (CVWD), additional analysis is recommended.

[1] Worst-case scenario is the H++ scenario which projects 9.8 feet by 2100 and is discussed further in Section 4, *Climate and Sea Level Rise Science*.

[2] The range of probabilities relate to scenarios in future greenhouse gas emissions as well as sea level rise uncertainties largely associated with the rate of ice melt around the world.

Step 3. Assess the Risks and Vulnerabilities to Coastal Resources and Development

The following sectors were determined to experience existing and/or future vulnerabilities and risk due to sea level rise (e.g., erosion, flooding, and/or tidal inundation):

- Land Use Parcels and Structures
- Roads and Parking
- Public Transportation
- Camping and Visitor Accommodations
- Coastal Trails and Access
- Hazardous Materials Sites, and Oil and Gas Wells
- Stormwater Infrastructure
- Wastewater Infrastructure
- Water Supply Infrastructure
- Community Facilities and Critical Services
- Environmentally Sensitive Habitat Areas

Step 4. Identify Adaptation Measures

The City anticipates conducting additional work on adaptation strategy development during future public education, outreach, and decision-maker engagement efforts. The process will consider the full range of potential adaptation measures including, but not limited to, beach nourishment, shoreline protection including living shorelines/beach sand dune restoration, groins, managed relocation, and shoreline management. The process will identify triggers and evaluation criteria to determine the most appropriate approach, measure success of the various strategies, and evaluate whether the strategies could be considered long-term maladaptation. A thorough cost benefit analysis of the various adaptation strategies is also recommended as an important decision-making tool.

Step 5. Update the GP/LCP

The City has been taking substantive steps toward updating the GP/LCP which is being prepared concurrent with this Report. The City is currently developing a focused update of the GP/LCP that builds upon the City's success in maintaining its small beach town community character, with an emphasis on addressing sea level rise, incorporating a Healthy Communities Element, and focused amendments to key planning areas. The City intends to update their GP/LCP in a manner that defines the City's unique qualities and characteristics, reflects local preferences and objectives, and aligns with and implements the City's long-term vision and values through the planning horizon year of 2040.

Step 6. Implement and Monitor the GP/LCP

The City will implement and monitor the GP/LCP progress based on the final certified LCP.

2.4 Other Regional Sea Level Rise Planning Efforts

The City is one of multiple local jurisdictions addressing sea level rise. Currently, there are several regional planning and technical studies on the impacts of coastal hazards, climate change, and sea level rise. Many local jurisdictions are updating their LCPs with the intent of moving toward adaptation planning in the Santa Barbara and Ventura region. As part of the LCP update process, the City will integrate sea level rise hazards and adaptation planning into the update.

One unique component to the regional coastal governance along the South Central Coast region is the presence of a Joint Powers Authority (JPA) known as the Beach Erosion Authority for Clean Oceans and Nourishment (BEACON). BEACON is a California JPA established in 1986 to address coastal erosion, beach nourishment, and clean oceans within the South Central California Coast from Point Conception to Point Mugu. The member agencies of BEACON include the counties of Santa Barbara and Ventura as well as the coastal cities of Santa Barbara, Goleta, Carpinteria, Ventura, Oxnard, and Port Hueneme. The BEACON Board is made up of two Supervisors from each county and one Councilmember from each coastal city. The BEACON Board educates and provides important information to other elected officials, the public, and interested stakeholders, and provides a forum for the discussion of pressing coastal and beach issues.

Given the interconnectedness of regional sediment management in the Santa Barbara Sandshed (littoral cell and watershed), it is important to understand regional initiatives, as no single jurisdiction will be able to adapt their respective community in isolation. The regional studies discussed below provide a summary of current/ongoing initiatives that may support planning and adaptation efforts within the City. Relevant regional efforts and studies include:

- Carpinteria GP/LCP Update
- Carpinteria Hazard Mitigation Plan
- Carpinteria Recycled Water Facilities Plan
- Carpinteria Valley Water District Groundwater Initiatives
- County of Ventura Coastal Resiliency Vulnerability Assessment
- County of Santa Barbara Vulnerability Assessment and LCP Update
- City of Oxnard LCP Update
- City of Santa Barbara LCP Update
- City of Goleta Vulnerability Assessment and Fiscal Impact Report

Carpinteria GP/LCP Update - ongoing

The City is currently developing a focused update of the GP/LCP that builds upon the City's success in maintaining its small beach town character, with an emphasis on addressing sea level rise as part of the LCP update, consistent with California Coastal Act and CCC *Sea Level Rise Policy Guidance* document. The GP/LCP update will also include a new Healthy Community Element and focused amendments to key planning areas. The City intends to update their GP/LCP in a manner that defines the City's unique qualities and characteristics, reflects local preferences and objectives, and aligns with and implements the City's long-term vision and values through the planning horizon year of 2040.

2017 City of Carpinteria Local Hazard Mitigation Plan

Hazard mitigation is the effort to reduce loss of life and property by lessening the impact of disasters. It is most effective when implemented under a comprehensive, long-term mitigation plan. State, tribal, and local governments engage in hazard mitigation planning to identify risks and vulnerabilities associated with natural disasters and develop long-term strategies for protecting people and property from future hazard events. Mitigation plans are key to breaking the cycle of disaster damage, reconstruction, and repeated damage. The Federal Emergency Management Agency (FEMA) requires state, tribal, and local governments to develop and adopt hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance, including funding for mitigation projects. Jurisdictions must update their hazard mitigation plans and re-submit them for FEMA approval every five years to maintain eligibility.

In July 2017, the City Local Planning Team (LPT) participated in updating its Local Hazard Mitigation Plan (LHMP) as an Annex to the Santa Barbara County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP). The City's updated LHMP was adopted by the City Council on September 11, 2017 and approved by FEMA on September 26, 2017. The City Council also resolved to incorporate the updated LHMP by reference into the next update of the Safety Element of the GP/LCP.

2016 Carpinteria Recycled Water Facilities Plan

The City, CVWD, and Carpinteria Sanitary District (CSD) with funding from the State Water Resources Control Board (SWRCB), collaborated to investigate the feasibility and costs associated with developing a recycled water facility at the Carpinteria Wastewater Treatment Plant (WWTP). The 2016 Carpinteria Recycled Water Facilities Plan looked at a variety of options and projected costs to upgrade the WWTP and provide a range of recycled water options to offset CVWD's water supply portfolio. The existing portfolio currently relies heavily on imported supplies from Lake Cachuma and State Water projects, which face greater uncertainties in the face of future climate-related changes to temperature,

precipitation, and snowpack. The Carpinteria Groundwater Basin presently supplies about one-fourth of the existing supply. The plan considered the use of recycled water for landscape irrigation, agricultural irrigation, and groundwater recharge. Groundwater recharge with full advanced water treatment was selected as the preferred use of recycled water. It is unclear what the next steps in the process may be, but the GP/LCP should develop policies to streamline such a project, which would benefit the City and its natural resources.

Carpinteria Valley Water District Groundwater – ongoing

CVWD has been evaluating the Carpinteria Groundwater Basin for decades as a critical water supply source. The Groundwater Basin Plan was initially adopted in 1999 and bi-annual monitoring has been ongoing. In 2007, with a substantial update in 2012, the CVWD funded a groundwater basin model to provide CVWD with an ongoing basin monitoring tool to evaluate the supply and to assess potential impacts to the basin from increases in groundwater pumping, extended drought, and to simulate alternative basin management strategies. Using available well data, the Report examined previous droughts and found that during the extended 6-year drought between 1987 and 1992, water levels in the basin were 40 feet below sea level, a condition conducive to salt water intrusion into the aquifer. Presently, while salt water intrusion has not been detected, the location of the fresh and saltwater interface is unknown. One key recommendation was to install a sentinel well near the coast to monitor for saltwater intrusion. Presently, CVWD has identified a location, but has not completed planning and permitting processes. Any update to the LCP should facilitate the installation of this monitoring well.

The Carpinteria Valley Groundwater Basin was designated from a low priority to a high priority basin as part of the California Department of Water Resources 2018 Re-Prioritization. Based on this designation, the basin is now subject to the Sustainable Groundwater Management Act requirements to develop a Groundwater Sustainability Plan. As this process unfolds, enhanced coordination between the City and CVWD that involves land use planning efforts shall be necessary to ensure future development activities are aligned with available water supplies.

2015 City of Goleta Vulnerability and Fiscal Impact Report

The City of Goleta, with funding from the CCC, completed a *Vulnerability Assessment and Fiscal Impact Report* to support development of new LCP policies and zoning regulations. The City of Goleta utilized the Coastal Resilience modeling to evaluate the potential impacts of coastal hazards on their community. Key impacts identified were related to potential oil and gas spills, wastewater infrastructure, and some low-lying residential properties. Draft LUP policies were submitted to the CCC and the City of Goleta and are on hold (as of 2018), extending LCP certification until their Zoning Ordinance is updated.

Ventura County Coastal Resiliency Adaptation Project - ongoing

Ventura County received funding from the CCC and is currently conducting a Coastal Resiliency Vulnerability Assessment of their coastal resources using the *County of Ventura Coastal Resilience Project* modeling. This effort supports the sea level rise update to the LCP. Ventura County is addressing 13 natural resource and infrastructure sectors in three (3) subareas. The North County Subarea is facing substantial vulnerabilities to transportation, recreation, oil and gas, and residential land uses. The Central County is expected to experience substantial impacts in the relatively near-term in the agriculture and residential sectors. The South County Subarea faces challenges to transportation, parks, and recreation. With a higher sea level, agriculture is also anticipated to be impacted. Ventura County will be starting public outreach in the spring of 2018 with completion of the Vulnerability and Adaptation Project planning reports by the end of 2018 and draft policies submitted to the CCC in summer 2019.

2016 Coastal Resilience Santa Barbara County - ongoing

In addition to the Coastal Resilience modeling described in more detail in Section 4, *Climate and Sea Level Rise Science*, Santa Barbara County conducted a vulnerability assessment evaluating the projected changes in hazard extents to multiple resource and infrastructure sectors. Key findings highlighted potential impacts from oil and gas vulnerabilities, transportation disruptions, and residential property impacts. The County is continuing to evaluate updates to their LCP, including consideration of restricting development in high risk areas, conditioning development on improved coastal construction standards, adjusting erosion setback calculations, identifying areas appropriate for managed retreat as implemented through rolling easements, protection, restoration, and enhancement of coastal resources, and maintaining public access to beaches and the coastline, including coastal trails. The adaptation strategy work is ongoing, and the County identified the need to work with adjacent jurisdictions, including Carpinteria.

City of Oxnard LCP Update - ongoing

The City of Oxnard has been preparing a *Coastal Hazards Vulnerability Assessment and Fiscal Impact Report* to address sea level rise and associated hazards in the City of Oxnard's Coastal Zone, and to provide a fiscal impact analysis to inform the LCP update process and future adaptation planning and regulatory processes. Key vulnerabilities identified the power plants, residential neighborhood around Oxnard Shores, and the regional wastewater treatment plant as critical. As part of the adaptation planning process, some economic tradeoffs of various types of strategies were evaluated including shoreline protection (hard structures), beach nourishment, dune restoration, and managed retreat. The economic analysis showed the benefits of various strategies at different points in time. Results of their report may support adaptation planning in the Ventura County's Central Coast Subarea. In

addition, there have been several public and regional stakeholder engagement efforts to obtain technical feedback and educate the public and elected officials. Submittal of LCP language to the CCC is expected in spring of 2018.

City of Santa Barbara Vulnerability Assessment and LCP Update - ongoing

The City of Santa Barbara received funding from the CCC in 2013 to update its LCP. These updates were intended to incorporate sea level rise adaptation actions. However, as the City of Santa Barbara began work, they realized that to codify the last 25 years of parcel by parcel amendments it was going to require a complete rewrite of the LCP. With an additional grant from the CCC, the City of Santa Barbara embarked on a longer-term adaptation planning process and expanded vulnerability assessment work by several graduate student groups at the University of California, Santa Cruz and University of California, Santa Barbara (Bren 2009, Russell and Griggs 2012, and Bren 2015), as well as some of the Coastal Resilience modeling. In the interim, the County proposed policies to support maintenance of existing shoreline protective structures along the City of Santa Barbara waterfront and continuation of the Santa Barbara harbor dredging.

2009 BEACON Coastal Regional Sediment Management Plan

In 2009, BEACON completed an update of the Coastal Regional Sediment Management Plan (CRSMP), which identified what is known about sand supplied to the Santa Barbara Littoral Cell between Point Conception and Point Mugu, including new understanding of erosion hot spots and shoreline protection. This plan did not include much sea level rise analysis; however, recommendations from this plan include new ways to manage sediment in the region, including development of an opportunistic sand placement program, sand rights policies, and changes in regional governance structure, which would support better use of coastal sediments. BEACON should also be a key partner in the development of regional adaptation strategies and education of elected officials.

City of Carpinteria and U.S. Army Corps of Engineers Shoreline Feasibility Study - ongoing

The City and the U.S. Army Corps of Engineers (USACE) have been working on a study of Carpinteria City Beach between Ash Avenue and Linden Avenue. The study reach is about 0.24-mile of shoreline. The Carpinteria State Beach borders the southern limit of the reach and the Carpinteria Salt Marsh borders the northern limit. There are existing structures within the reach that are directly affected by shoreline erosion and wave attacks. The structures behind the fronting properties may be affected by coastal flooding during severe storms.

The project was authorized by Section 208 of the Flood Control Act (1965). Current funding will be used toward development of an array of alternatives leading to the selection of a proposed project to address shoreline erosion along the City beaches. A joint Environmental Impact Report (EIR) and Environmental Impact Statement (EIS) will be prepared to evaluate potential environmental effects associated with the proposed project and alternatives, and is pending.