7

Coastal Hazards

Managing development to respond to coastal hazards is a key objective of the California Coastal Act. Consistent with the Coastal Act, this chapter identifies the hazards listed below and provides policies that guide new development to reduce risks to life and property and to avoid substantial changes to natural land forms. This chapter addresses the following coastal hazards:

- Sea level rise hazard areas
- Flood hazard areas (other than sea level rise flood hazards), including dam inundation and tsunami run-up areas
- Geologic hazards, such as soil erosion, liquefaction, and seismic hazard areas
- Fire hazard areas

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7.1 Introduction

The primary Coastal Act policies related to coastal hazards include the following:

Section 30235, *Construction altering natural shoreline*
Revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline processes shall be permitted when required to serve coastal dependent uses or to protect existing structures or public beaches in danger from erosion, and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply. Existing marine structures causing water stagnation contributing to pollution problems and fishkills should be phased out or upgraded where feasible.

Section 30236, *Water supply and flood control*
Channelizations, dams, or other substantial alterations of rivers and streams shall incorporate the best mitigation measures feasible, and be limited to (l) necessary water supply projects, (2) flood control projects where no other method for protecting existing structures in the flood plain is feasible and where such protection is necessary for public safety or to protect existing development, or (3) developments where the primary function is the improvement of fish and wildlife habitat.

Section 30253, Minimization of adverse impacts
New development shall do all of the following:

(a) Minimize risks to life and property in areas of high geologic, flood, and fire hazard.

(b) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.

(c) Be consistent with requirements imposed by an air pollution control district or the State Air Resources Board as to each particular development.

(d) Minimize energy consumption and vehicle miles traveled.

(e) Where appropriate, protect special communities and neighborhoods that, because of their unique characteristics, are popular visitor destination points for recreational uses.

7.2 Sea Level Rise

California Coastal Commission Sea Level Rise Policy Guidance (November 7, 2018) states:

> *"Climate change is upon us, affecting almost every facet of California's natural and built environment. Increasing global temperatures are causing significant effects at global, regional, and local scales. In the past century, average global temperature has increased by about 0.8°C (1.4°F), and average global sea level has increased by 7 to 8 in (17 to 21 cm) (IPCC 2013). Sea level at the San Francisco tide gauge has risen 8 in (20 cm) over the past century, and recent reports developed by the California Ocean Protection Council (OPC) (in conjunction with the OPC Science Advisory Team) project that by the year 2100, sea levels may rise by approximately 2.4 to 6.9 feet, with the potential for rapid ice loss to result in an extreme scenario of 10.2 feet of sea level rise (Griggs et al., 2017; OPC 2018). While the California coast regularly experiences erosion, flooding, and significant storm events, sea level rise will exacerbate these natural forces, leading to significant social, environmental, and economic impacts. The third National Climate Assessment notes that there is strong evidence showing that the cost of doing nothing to prepare for the impacts of sea level rise exceeds the costs associated with adapting to them by about 4 to 10 times (Moser et al. 2014). Therefore, it is critically important that California plan and prepare for the impacts of sea level rise to ensure a resilient California coast for present and future generations."*

There is broad agreement in the scientific community that the earth is predicted to warm and that sea levels will rise because of the thermal expansion of water and increased contributions from melting glaciers.[1] Though there is consensus among the scientific community on these concepts, the timing and severity of sea level rise is relatively uncertain and is dependent on region-specific conditions. The uncertainty in the sea level rise projections is a result of future global emissions of carbon dioxide (a function of future social behavior) and the non-linear response of the ocean to warmer temperatures and contributions from land-based ice sources. Thus, planning for sea level rise must consider high and low estimates of sea level rise. Planning for a range of potential future conditions provides the City of Carlsbad with the tools to make current and future planning decisions that allow the city's resources to adapt to changing conditions.

The "City of Carlsbad Sea Level Rise Vulnerability Assessment," Appendix B of this Local Coastal Program, provides a Carlsbad-specific sea level rise analysis that evaluates the degree to which

[1] Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT) 2013; California Coastal Commission 2015

important community assets (e.g., beaches, public access ways, parcels, critical infrastructure, transportation) are vulnerable to the adverse effects of projected sea level rise. The assessment identifies the assets that are likely to be impacted in years 2050 and 2100, and the causes and components of each asset's vulnerability.

Best Available Science

The information below describes the science used to prepare the "City of Carlsbad Sea Level Rise Vulnerability Assessment," as well as science available as of 2017. The policies of this chapter require new development projects to be evaluated based on the best available sea level rise science and state guidance at the time of the proposal – the science referenced in this section may not be the best available science when future development is proposed. The "City of Carlsbad Sea Level Rise Vulnerability Assessment" is to be updated periodically to utilize the best available science and state guidance.

City of Carlsbad Vulnerability Assessment – CoSMoS 3.0 (2015)

For the "City of Carlsbad Sea Level Rise Vulnerability Assessment," the U.S. Geological Survey Coastal Storm Modeling System (CoSMoS) version 3.0 (released for use in November 2015) was used to identify areas and assets vulnerable to sea level rise. CoSMoS 3.0 makes detailed predictions of coastal flooding and erosion based on existing and future sea level scenarios in southern California.

For the year 2050, CoSMoS 3.0 utilized a sea level rise scenario of 1.6 feet; for the year 2100, a sea level rise scenario of 6.6 feet was utilized. These sea level rise scenarios (1.6 feet and 6.6 feet) roughly align with the National Research Council's 2012 sea level rise projections (2 feet in the year 2050 and 5.5 feet in the year 2100).

Rising Seas in California: An Updated Sea Level Rise Science (2017)

The CoSMoS 3.0 sea level rise projections are also within the range of sea level rise probability identified in the Ocean Protection Council's 2017 report titled "Rising Seas in California: An Update on Sea-Level Science." Table 7.1 shows the report's range of probable sea level rise projections, as well as a set of extreme sea level rise projections (no associated probability) that represent the highest sea level rise amount physically plausible according to the best available science at the time of the report. Table 7.1 also shows the report's recommendations regarding the applicability of the sea level rise projections.

Table 7-1, *Ocean Protection Council 2017 Sea Level Rise Projections and Recommended Applicability*		
Sea Level Rise Projection		**Recommended Applicability**
Low end of probability range	1.2 feet in 2050 3.6 feet in 2100	Inform development projects with high adaptive capacity and low consequences if impacted by sea level rise, such as trails.
High end of probability range	2.0 feet in 2050 7.1 feet in 2100	Inform development projects with low adaptive capacity and high consequences if impacted by sea level rise, including residential and commercial development.
Extreme projection	2.8 feet in 2050 10.2 feet in 2100	Inform development projects with low adaptive capacity and extremely high consequences if impacted by sea level rise, such as critical infrastructure.

Sea Level Rise Planning Horizons for Development

In areas subject to future sea level rise hazards, as identified by the "City of Carlsbad Sea Level Rise Vulnerability Assessment," an evaluation of future sea level rise impacts is required. The appropriate time horizon to use to evaluate the potential impacts of sea level rise on development depends on the anticipated duration/life of the development (i.e., the time when the development is expected to be removed, replaced, or redeveloped). For example, if a new structure has an anticipated duration of 75 years, then a sea level rise hazards analysis should evaluate the impacts to the site and development based on projected sea level rise over a minimum of 75 years. The duration of any development is generally defined by the following timeframes, unless a site- or project-specific analysis determines otherwise.[2]

Table 7-2, *Anticipated Duration of Development*	
Development Type	**Anticipated Duration**
Ancillary development or amenity structures (e.g., trails, bike racks, playgrounds, parking lots, shoreline restrooms)	5 years
Manufactured or mobile homes	30 years
Buildings (e.g., residential, commercial, office, industrial, etc.)	75 years
Critical infrastructure	100 years

Adapting to Sea Level Rise

Adaptation to sea level rise involves taking appropriate actions to prevent or minimize the adverse effects of sea level rise. This Local Coastal Program includes a range of policies that guide city decision making and actions to improve community resilience to the impacts of sea level rise.

Adaptation strategies generally fall into four main categories: do nothing, protect, accommodate, and retreat. These strategies are generally described in Table 7-3. When considering which strategy (or

[2] California Coastal Commission Draft Residential Adaptation Policy Guidance, Interpretive Guidelines for Addressing Sea Level Rise in Local Coastal Program, March 2018

combination of strategies) is most appropriate to address a particular hazard, it is important to consider the associated secondary and cumulative effects (e.g., loss of beach resulting from the use of seawalls) and trade-offs (i.e., who/what will benefit and who/what will be adversely impacted?). The "City of Carlsbad Sea Level Rise Vulnerability Assessment" provides more information about the general strategies and secondary impacts.

The policies of this chapter provide guidance to assist the city in adapting to the sea level rise hazards identified in the "City of Carlsbad Sea Level Rise Vulnerability Assessment."

Table 7-3, *General Sea Level Rise Adaptation Strategies*

General Adaptation Strategy	Description
Do Nothing	One option is to "do nothing" or follow a policy of "non-intervention." Doing nothing results in the need to react when sea level rise impacts occur. The reactive approach involves emergency response, attempts to maintain the status-quo, and respond to impacts caused by episodic storm events and other sea level rise impacts. This approach will likely fail to anticipate and prevent or mitigate long-term consequences of sea level rise and may result in significant financial costs, as well as adverse impacts to coastal resources, development, and the city's economy.
Protect	Protection strategies employ some sort of engineered structure or other measure to protect or floodproof development (or other coastal resources) in its current location without changes to the development or resources themselves. Protection strategies can be further divided into "hard" and "soft" defensive measures. Examples of a hard approach would be to construct a seawall or revetment, while a soft approach may be to nourish beaches with sand or build sand dunes. Although the California Coastal Act allows for potential protection strategies for existing development, it also directs that new development be sited and designed to avoid hazards and not require future protection that may alter a natural shoreline.
Accommodate	Accommodation strategies employ methods that modify existing or design new developments or infrastructure in a manner that decreases hazard risks and, therefore, increases the resiliency of the development/infrastructure to the impacts of sea level rise. These accommodation strategies include actions such as elevating structures, retrofitting or using materials to increase the strength of development/infrastructure such as: the ability to handle additional wave impacts; building structures that can easily be moved and relocated; using additional setback distances to account for acceleration of erosion; and clustering development in less vulnerable areas.
Retreat	Retreat strategies relocate or remove existing development out of hazard areas and limit the construction of new development in vulnerable areas.

Important Considerations about Sea Level Rise

Siting Development to Avoid Sea Level Rise Hazards

New development within sea level rise hazard areas is vulnerable to erosion and flood hazards and may result in impacts to coastal resources, such as loss of sandy beaches, impacts to bluff stability, and impacts to natural shoreline migration. The policies of this chapter require development to be located and designed to minimize risks from hazards, ensure structural stability, and ensure the protection of coastal resources, as required by the Coastal Act.

Shoreline Protective Devices (Armoring)

Coastal Act Section 30253 requires new development to minimize risks from hazards, to avoid creating or contributing significantly to erosion and geologic instability, and to not in any way require construction of armoring that substantially alters natural landforms along bluffs and cliffs. Other Coastal Act provisions also limit the circumstances in which shoreline armoring may be permitted. For example, Section 30251 requires that new development minimize the alteration of natural land forms and be visually compatible with the character of surrounding areas.

Coastal Act Section 30235 allows armoring that alters natural shoreline processes when it is needed to protect coastal dependent uses, existing structures, or public beaches in danger from erosion. However, shoreline armoring is only to be permitted if it is necessary (i.e., if the existing structure is in fact in danger) and if the proposed shoreline protection is the least environmentally damaging alternative to abate the danger. Also, when shoreline armoring is permitted, it must be designed to eliminate or mitigate adverse impacts on beach area and local shoreline sand supply (e.g., losing sand and beach area through the device's physical encroachment on a beach, fixing of the back beach, preventing new beach formation in areas where the bluff/shoreline would have otherwise naturally eroded, and losing sand-generating bluff/shoreline materials that would have entered the sand supply system absent the shoreline protective device).

Although coastal armoring generally has significant adverse impacts on coastal resources, there are situations, as described in the policies of this chapter, where armoring may be allowed and may represent a reasonable short- to mid-term adaptation strategy. This may be especially true in urbanized areas where existing residential development and/or critical infrastructure exist, where development is already protected by armoring, where the impacts of armoring on natural shoreline processes will be minimal due to the geology of the area, and where the armoring is the least environmentally damaging alternative for adaptation. However, to the extent that this Local Coastal Program allows for shoreline armoring, new development must avoid impacts to public trust resources and mitigate for all impacts to coastal resources and public coastal access affected by armoring.

Emergency Coastal Development Permits

California Code of Regulations Section 13009 defines an emergency as "a sudden unexpected occurrence demanding immediate action to prevent or mitigate loss or damage to life, health, property, or essential public service." The Coastal Act provides for issuance of emergency coastal development permits to allow temporary development to occur in response to an emergency. Along the shoreline, emergency permit applications for shoreline protective devices are likely to increase as risks of storm damage are exacerbated by sea level rise. It is important to note that the emergency permit is only a

temporary authorization of development – the emergency permit provisions are not intended to allow for construction of permanent shoreline protection.

Migration of Public Trust Lands

The State of California acquired sovereign ownership of all tidelands and submerged lands and beds of navigable waterways upon its admission to the United States in 1850. The state holds and manages these lands for the benefit of all people of the state for statewide purposes consistent with the common law public trust doctrine (public trust). The public trust ensures that title to sovereign land is held by the state in trust for the people of the state.

In coastal areas, public trust lands include both tidelands and submerged lands, from the shore out three nautical miles into the Pacific Ocean. Tidelands lie between mean high tide and mean low tide.

As the sea level rises over time, the mean high tide line/public trust land moves inland. An important consideration when planning for sea level rise is recognizing that the public trust boundary will migrate inland in some locations as sea levels rise. As this occurs, shorefront development might come to be located on public trust property during its lifespan. Development that encroaches on public trust land may cause new coastal resource and public trust impacts. The policies of this chapter ensure that development does not interfere with the protection and use of public trust land as it migrates inland.

Moving Development Away from Hazards (Retreat)

As described above, Coastal Act policies require new development to minimize risks from hazards and ensure structural stability without the need for shoreline protection that alters natural landforms. Other Coastal Act policies require protection of sensitive habitat, public access, and other coastal resources. Thus, as sea levels rise and hazardous areas and public trust lands migrate inland, Coastal Act policies will require new development to be located further inland in situations where other adaptation measures are infeasible, essentially resulting in the retreat of development inland.

The policies of this chapter address the circumstances when development must be removed to avoid hazardous conditions and impacts to public trust lands and coastal resources. Also, the policies require the city to develop a sea level rise adaptation plan(s) to identify how development can adapt to the impacts of sea level rise, including the circumstances (triggers) that may require retreat.

7.3 Flood Hazards

The information about sea level rise hazards in Section 7.2 identifies hazards, including flood hazards, that are projected to occur in the years 2050 and 2100. Existing flood hazards are also described in this section.

Flood Prone Areas

Flood prone areas are lands susceptible to being inundated by water from any source (e.g., the ocean, lagoons, creeks, surface water runoff, etc.). Flooding occurs when normally dry lands are partially or completely inundated by water on a temporary basis. Flooding may occur when there is:

- Overflow of floodwaters;
- Unusual and rapid accumulation or runoff of surface waters from any source; and/or
- Collapse or subsidence of land along the shore of a body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level in a natural body of water, accompanied by a severe storm, or by an unanticipated force of nature, such as flash flood or an abnormal tidal surge, or by some similarly unusual and unforeseeable event.

Flood prone areas are identified in terms of the statistical annual chance of flood. The Federal Emergency Management Agency (FEMA) prepares Flood Insurance Rate Maps (FIRMs) that identify special flood hazard areas with a 1-percent-annual-chance flood (i.e., a flood event with a 1-percent chance of being equaled or exceeded in any given year). The 1-percent-annual-chance flood is also referred to as the base flood or 100-year flood. Areas outside the special flood hazard areas, with a moderate or minimal flood hazard, are also shown on the FIRMs; moderate flood hazard areas are between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood, and minimal flood hazard areas are at a higher elevation than the 0.2-percent-annual-chance flood. As shown in Figure 7-1, the potential special flood hazard areas identified on the FIRM maps in Carlsbad include the entire coastline and the following major drainage basins:

- Buena Vista Creek and Buena Vista Lagoon
- Agua Hedionda Creek, its northern tributary, and the Agua Hedionda Lagoon
- San Marcos Creek and its northern tributary
- Batiquitos Lagoon
- Encinitas Creek

Preserving or restoring natural floodplains helps with flood loss reduction benefits and improves water quality and habitat. Pursuant to this Local Coastal Program, development is restricted in a 1-percent-annual-chance flood area.

Dam Inundation

Dam inundation can be caused by the release of impounded water from structural failure or overtopping of a dam. The San Diego County Multi-Jurisdiction Hazard Mitigation (HAZMIT) Plan identifies dam failure risk levels based on dam inundation map data. Four dams and a reservoir are located within or adjacent to Carlsbad: the Calavera, Maerkle, San Marcos, and Bressi dams, and the Stanley A. Mahr reservoir, all of which are outside the Coastal Zone. However, failure or overtopping of the dams/reservoirs could result in inundation downstream within the Coastal Zone, as shown in Figure 7-2. All four dams and the reservoir have emergency action plans in place. These facilities are periodically inspected by the California Department of Water Resources, Division of Safety of Dams.

Tsunami Run-Up

Tsunamis are long wavelength ocean waves generated by sudden movements of the ocean bottom during events such as earthquakes, volcanic eruptions, or landslides. San Diego County maps zones of high risk for tsunami run-up. As shown in Figures 7-3A, 7-3B and 7-3C, Maximum Tsunami Run-Up, the areas identified in Carlsbad as at risk for tsunami run-up are in the immediate vicinity of the Pacific Ocean coastline and the Buena Vista, Agua Hedionda, and Batiquitos Lagoons.

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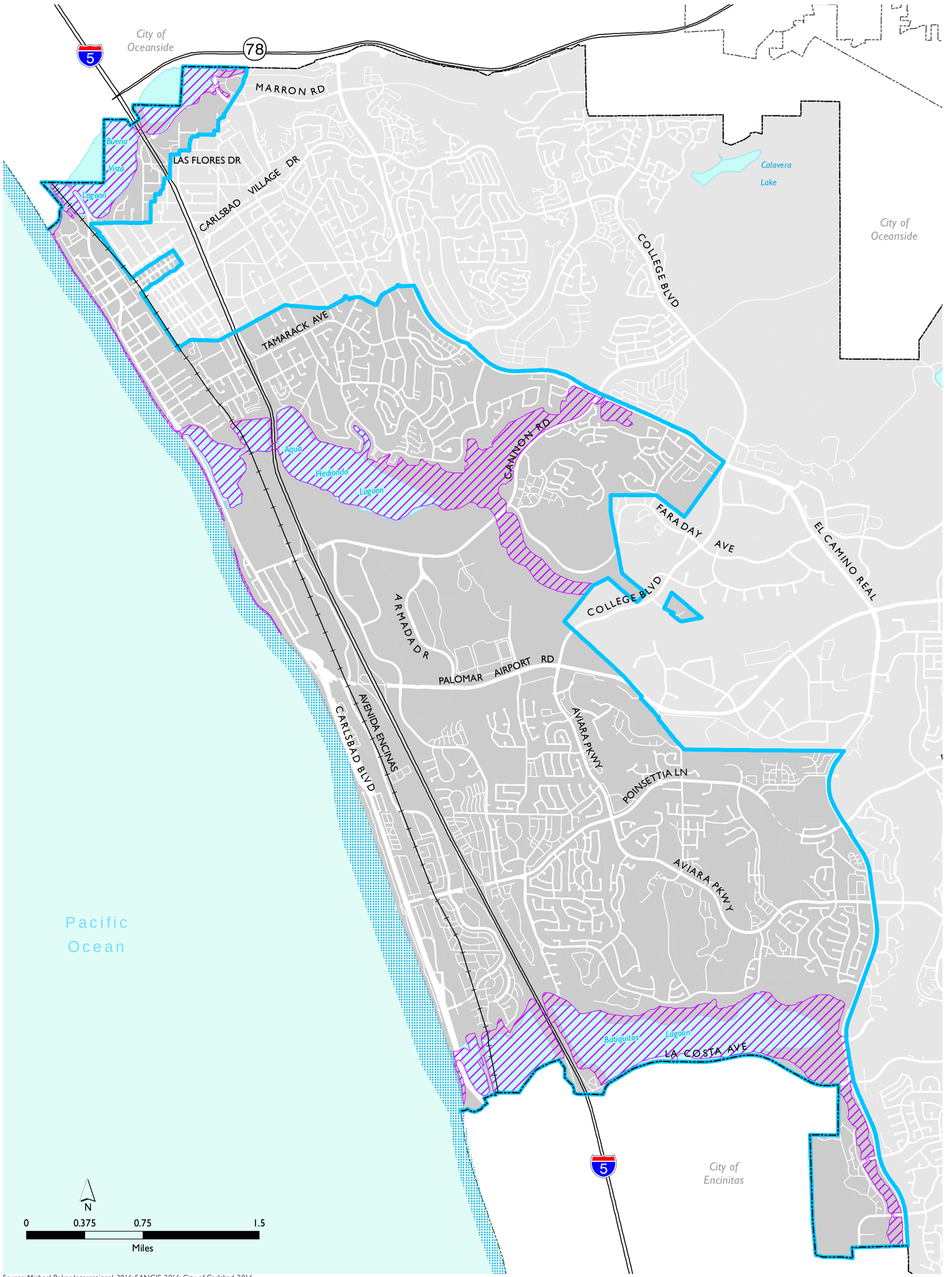
CITY OF CARLSBAD
LOCAL COASTAL PROGRAM



Source: Michael Baker International, 2016; SANGIS, 2016; City of Carlsbad, 2016

8/9/2019 JN M:\Mdata\149652\GIS\MXD\Carlsbad_MXD\LCP_2019\Chapter 7\Figure 7-1 Flood Hazard Zone_11x17.mxd

LEGEND

- Coastal Zone
- City Limit
- Railroad
- FEMA Special Flood Hazard Area (1-percent annual chance flood area - 100-year floodplain)
- FEMA VE Zone (1-percent annual chance flood area with wave action)

FIGURE 7-1

FLOOD HAZARD ZONE

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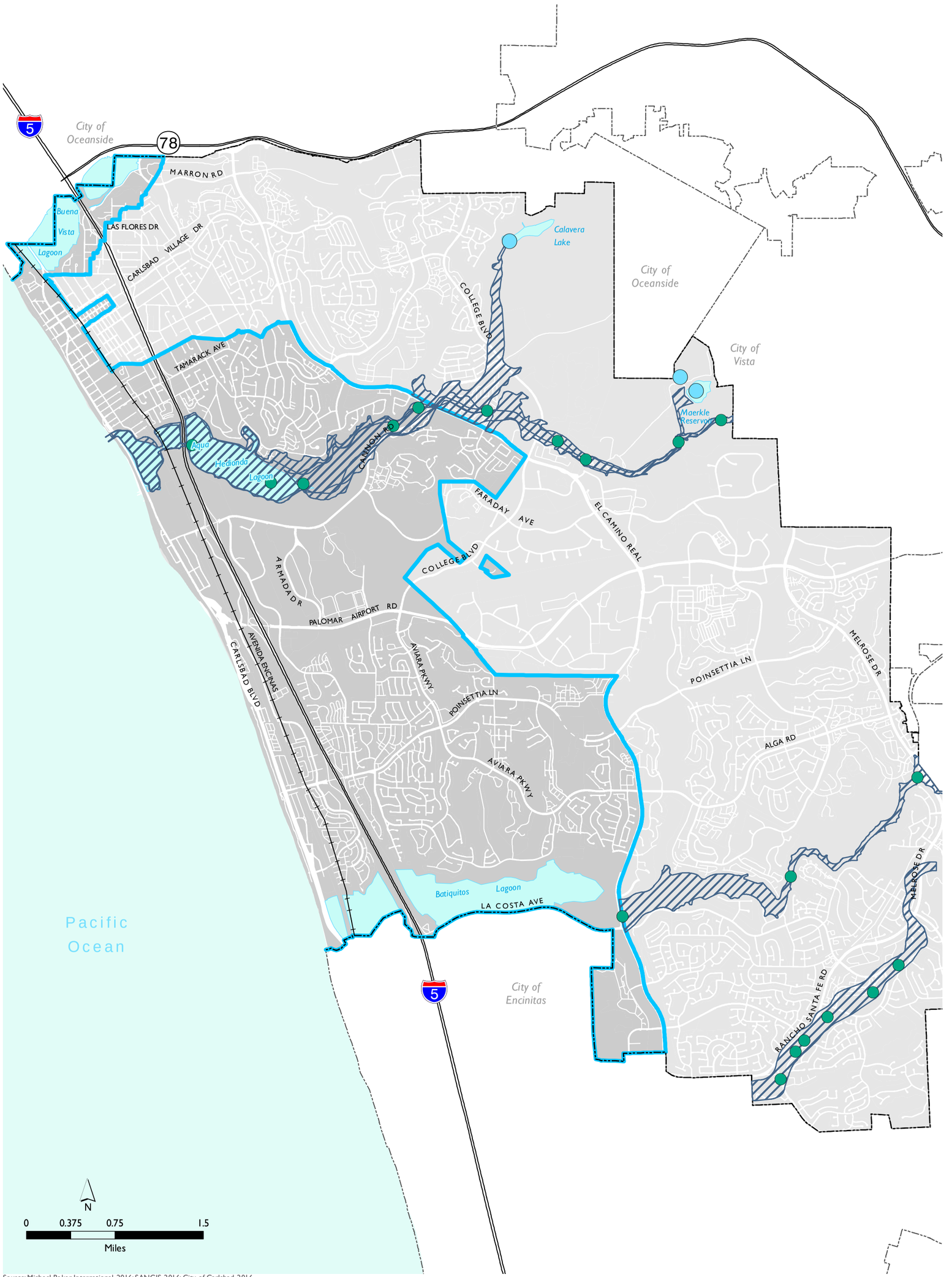
CITY OF CARLSBAD
LOCAL COASTAL PROGRAM



Source: Michael Baker International, 2016; SANGIS, 2016; City of Carlsbad, 2016

8/9/2019 JN M:\Misc\149632\GIS\MXD\Carlsbad_MXD\LCP_2019\Chapter 7\Figure 7-2 Dam Inundation Areas 11x17.mxd

LEGEND

- Coastal Zone
- City Limit
- Railroad
- Dam Inundation Areas
- Dams & Reservoirs
- Dam Inundation Points

FIGURE 7-2

DAM INUNDATION AREAS

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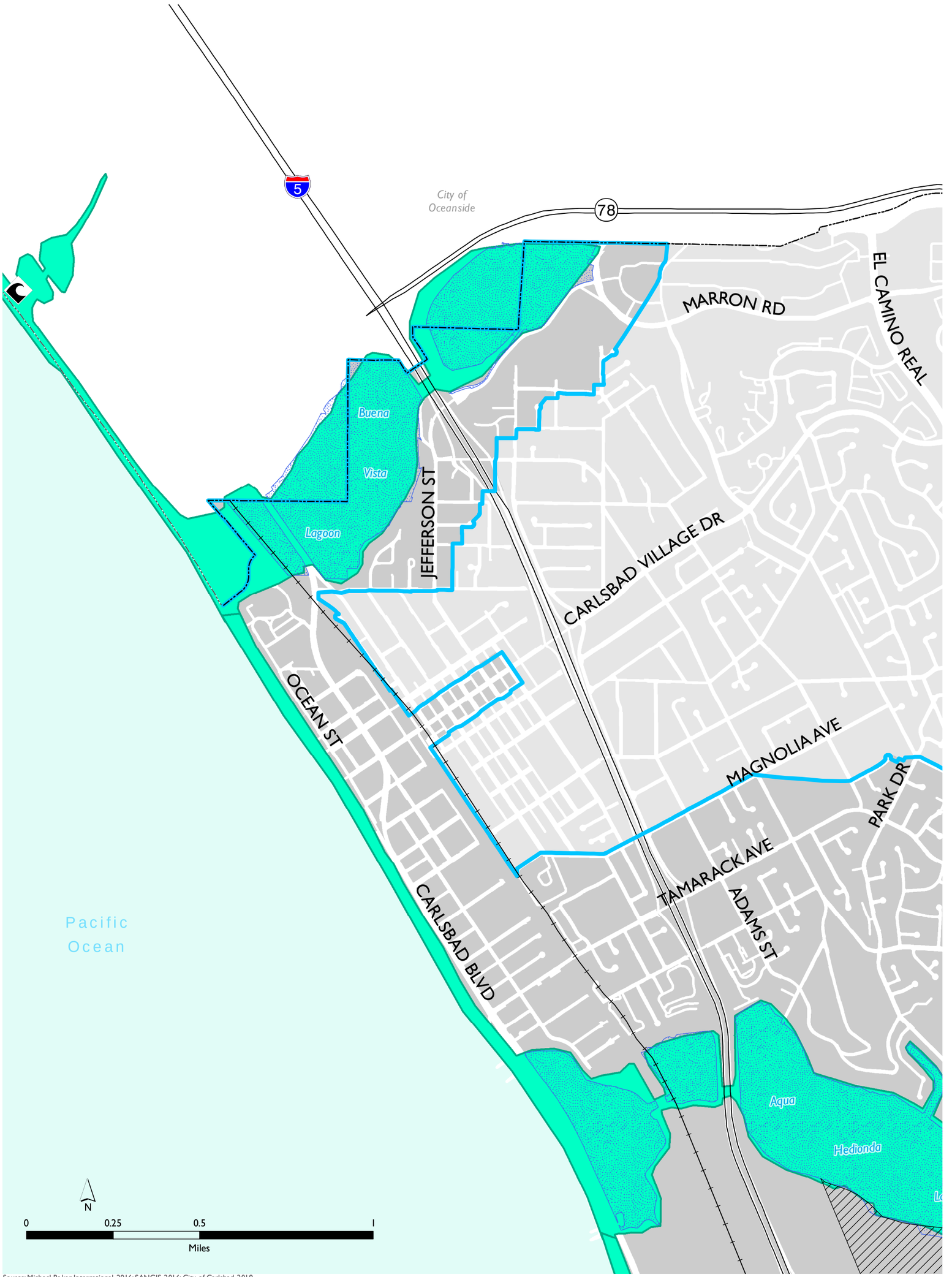
CITY OF CARLSBAD
LOCAL COASTAL PROGRAM



Source: Michael Baker International, 2016; SANGIS, 2016; City of Carlsbad, 2019

8/7/2019 JN M:\Mdata\149652\GIS\MXD\Carlsbad_MXD\LCP_2019\Chapter 7\Figure 7-3A Maximum Tsunami Run-Up 11x17.mxd

LEGEND

- Coastal Zone
- City Limit
- Lagoon
- Railroad
- Maximum Tsunami Projected Runup
- Historic Tsunami Effect Felt

FIGURE 7-3A

MAXIMUM TSUNAMI PROJECTED RUN-UP

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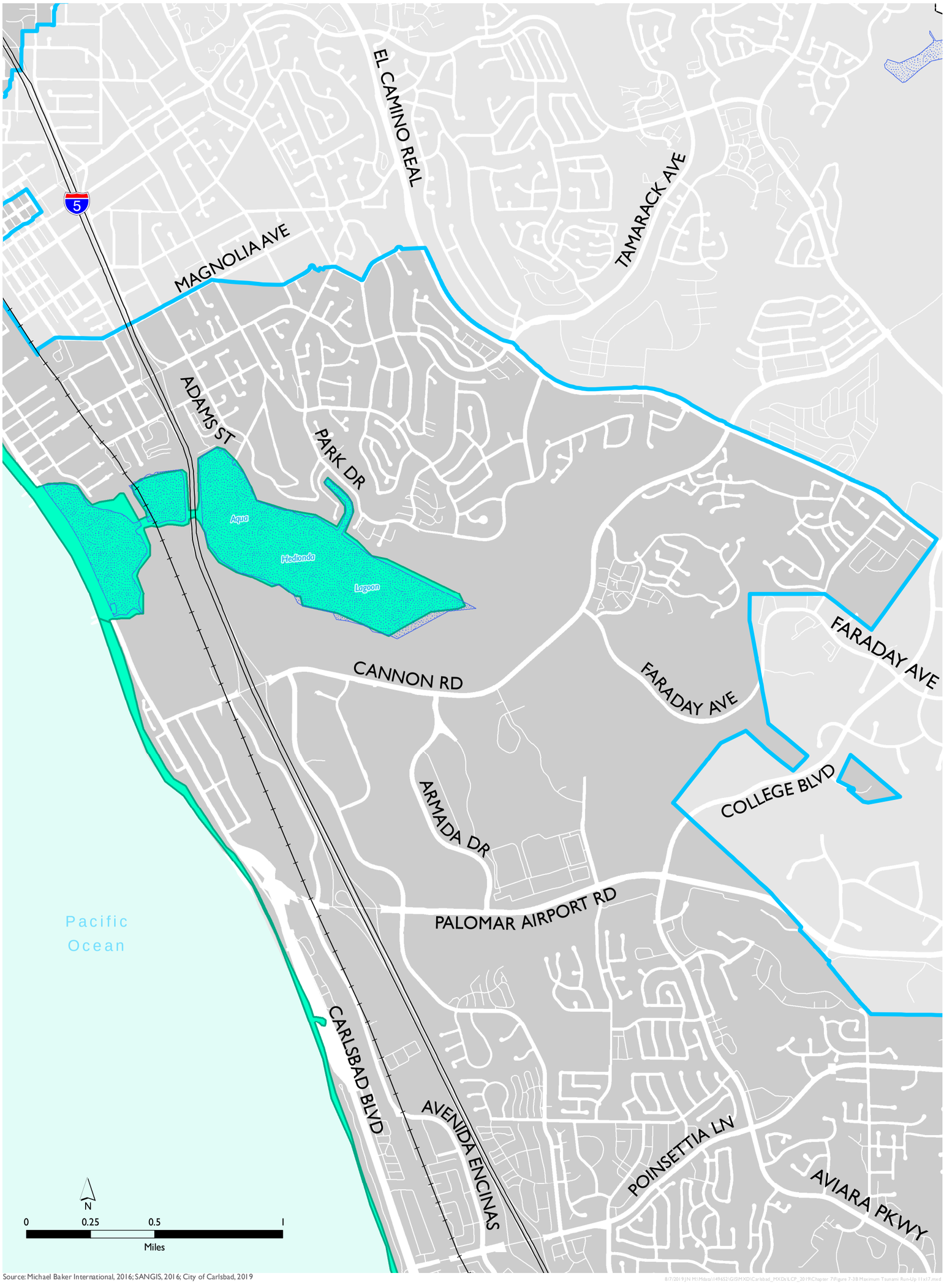

Source: Michael Baker International, 2016; SANGIS, 2016; City of Carlsbad, 2019

8/7/2019 J:\N M1\Misc\149652\GIS\MXD\Carlsbad_MXDs\LCP_2019\Chapter 7\Figure 7-3B Maximum Tsunami Run-Up 11x17.mxd

LEGEND

- Coastal Zone
- City Limit
- Lagoon
- Railroad
- Maximum Tsunami Projected Runup

FIGURE 7-3B

MAXIMUM TSUNAMI PROJECTED RUN-UP

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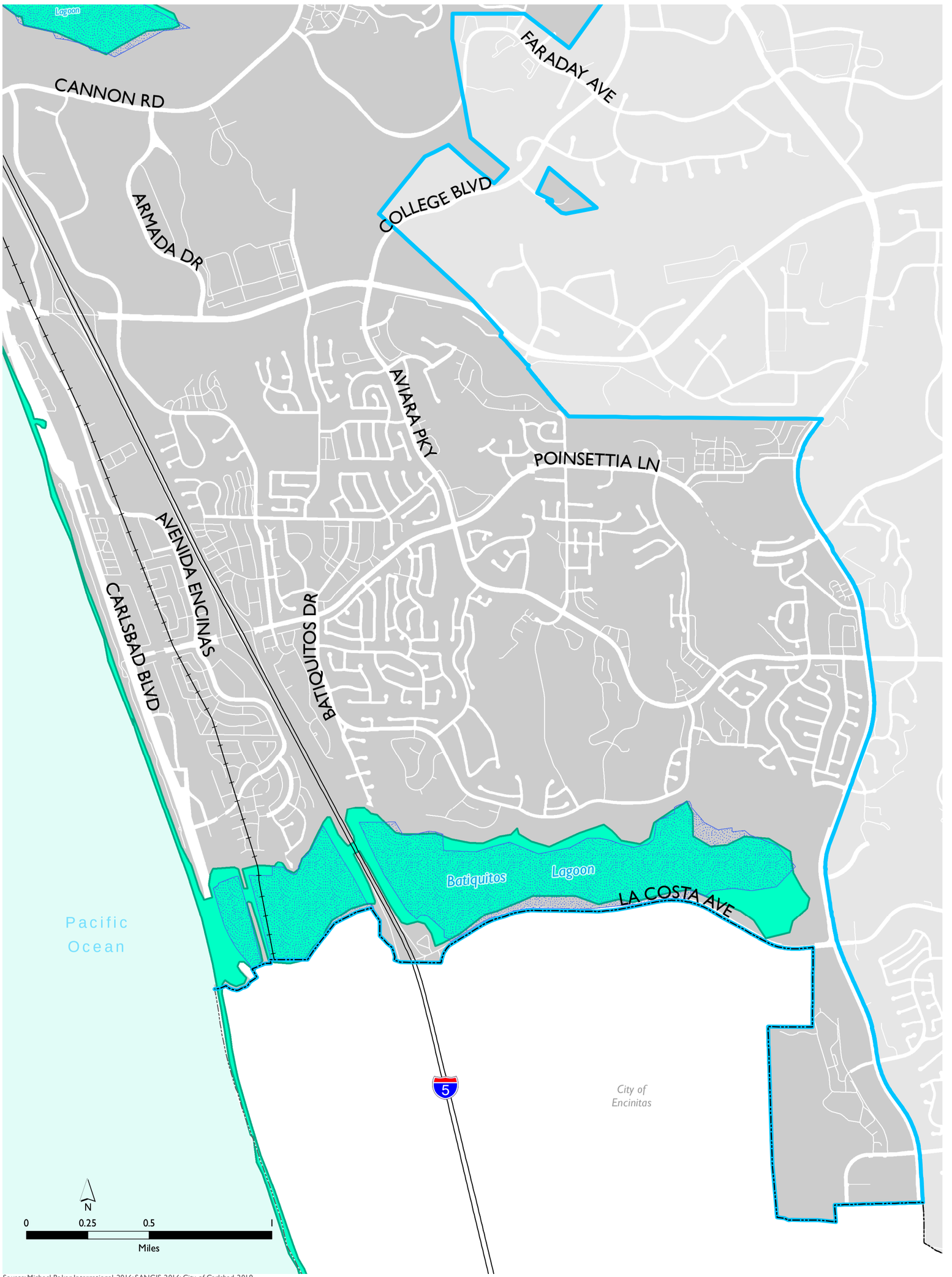
CITY OF CARLSBAD
LOCAL COASTAL PROGRAM



Source: Michael Baker International, 2016; SANGIS, 2016; City of Carlsbad, 2019

8/12/2019 JN M:\Mdata\149652\GIS\MXD\Carlsbad_MXD\LCP_2019\Chapter 7\Figure 7-3C Maximum Tsunami Run-Up 11x17.mxd

LEGEND

- Coastal Zone
- City Limit
- Lagoon
- Railroad
- Maximum Tsunami Projected Runup

FIGURE 7-3C

MAXIMUM TSUNAMI PROJECTED RUN-UP

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7.4 Geologic Hazards

Carlsbad's geologic formations and deposits are described in Chapter 5, Section 5.3 of this Local Coastal Program. The following information describes potential geologic hazards, including erosion and seismic hazards.

Soil Erosion

Erosion occurs when materials on the earth's surface are loosened, dissolved, or worn away and relocated by natural processes (e.g., rainfall, flowing water, wind, ice, temperature change, gravity, as well as coastal erosion from storms, wave attack, and rising sea levels in combination with those annual forces) or by human-driven activities (e.g., agriculture, construction). Section 7.2 provides more information about erosion impacts related to sea level rise.

Erosion can threaten the city's water quality, economic viability, and supply of natural resources, including beaches and coastal bluffs. Potential consequences include loss of topsoil, loss of agricultural productivity, sedimentation in lakes, rivers, and lagoons, pollution of soil and water by contaminants and nutrients, destruction of habitats, and damage to property and infrastructure.

Coastal Erosion

Carlsbad's beaches serve as a buffer between the action of ocean waves and coastal development. However, like many beaches along the California coast, Carlsbad's beaches are threatened by erosion and sediment loss.

Coastal sediment occurs, accumulates, and moves via natural processes (ocean currents, precipitation, landslides, stream flow, etc.) to replenish the shoreline, which is also naturally subject to erosion. However, urban development and marine structures such as piers and breakwaters can disrupt these processes and alter the quantity, quality, and location of coastal sediment deposition over time. Often, additional interventions, such as armoring, dredging, beach renourishment, and other methods are employed to stabilize the shoreline, but such interventions can have adverse impacts on shoreline erosion down shore and on coastal ecosystems and may accelerate sand loss.

North Carlsbad beaches, Agua Hedionda Lagoon, South Carlsbad beaches, and Batiquitos Lagoon beach have all been listed as "beach erosion areas of concern" by SANDAG's Coastal Regional Sediment Management Plan for the San Diego Region (2009). The regional sediment management plan is a step toward regional cooperation of shoreline management and identifies management strategies, potential sediment sources, and potential receiving sites. The city has also actively maintained its beaches through its own beach nourishment programs, sourcing sediments from the lagoons (which impound sediments once destined for the coast) and local construction projects. In 2012, North and South

Carlsbad beaches were replenished with 218,000 and 140,000 cubic yards of new sand, respectively, as part of SANDAG's Regional Beach Sand Project. Even with nourishment, the beaches are still affected by erosion damage from flooding and storm events, which will be exacerbated by sea level rise (see Section 7.2). Similarly, sea level rise will exacerbate erosion of coastal bluffs.

The policies of this Local Coastal Program, which address adaptation to sea level rise, are applicable to the coastal erosion areas identified in SANDAG's Coastal Regional Sediment Management Plan for the San Diego Region (2009), as well as all other coastal areas that become vulnerable to erosion and other hazards as the sea level rises (see Section 7.2 above for more information about sea level rise hazards).

Hillsides and Slopes

The policies of this Local Coastal Program require protection of hillsides and slopes against erosion hazards. Preserving hillside vegetation protects slope stability, nearby development, and the surrounding environment from damage related to erosion.

Landslides involve the downslope displacement and movement of material and can be triggered by either static (i.e., gravity) or dynamic (i.e., earthquake or rainfall) forces. The geology, structure, and amount of groundwater in the slope affect slope failure potential, as do external processes (i.e., climate, topography, slope geometry, and human activity). Slope failure is more likely to occur on steeper slopes, of 15 percent or greater, but may also occur on slopes of 15 percent or less. The probability is greater on steeper slopes that exhibit old landslide features such as scarps, slanted vegetation, and transverse ridges. Landslide-susceptible areas are characterized by steep slopes and downslope creep of surface materials and are more common in zones of active earthquake faulting (see below for more information about seismicity in Carlsbad). In general, south-facing slopes in Carlsbad have gentle grades and are not prone to landslides, while north-facing slopes are generally steeper and more susceptible to landslides.

The policies of this Local Coastal Program prohibit or limit development on hillsides and slopes and ensure that the effects of human-related or development-driven erosion are reduced or avoided. Examples of other slope protection/erosion prevention measures include the city's Habitat Management Plan, which protects slopes, such as banks, due to their proximity to riparian habitat or because they contain listed habitat types. Also, the city's hillside development regulations limit or prohibit development on steep slopes.

Seismicity

No active faults run directly through Carlsbad. Additionally, the California Geological Survey does not include Carlsbad on its list of cities affected by Alquist-Priolo Earthquake Fault Zones. The nearest fault to the city is the Newport-Inglewood-Rose Canyon Fault, which runs offshore of the western edge

of the city and is considered active. Other faults in the region include the Coronado Bank, La Nacion, Elsinore, Agua Caliente, and San Jacinto.

Fault activity has the potential to result in ground shaking, which can be of varying intensity depending on the intensity of earthquake activity, proximity to that activity, and local soils and geology conditions. Although there are no active faults in Carlsbad, the city is within a seismically active region, and earthquakes have the potential to cause ground shaking of significant magnitude. Figure 7-4 shows the location and extent of the profiled earthquake faults in San Diego County based on a U.S. Geological Survey earthquake model that shows probabilistic peak ground acceleration. Although located near fault lines, Carlsbad is in a medium-low probabilistic peak ground acceleration zone.

Historical documents record that an earthquake centered either on the Rose Canyon Fault or the Coronado Bank Fault struck San Diego on May 27, 1862, damaging buildings in Old Town and causing ground rupture near the mouth of the San Diego River. This earthquake is believed to have had a magnitude of about 6.0 based on descriptions of the damage it caused. The strongest recorded earthquake in the San Diego area was a magnitude of 5.3 that struck on July 13, 1986, on the Coronado Bank Fault, 25 miles offshore of Solana Beach. Several moderate earthquakes have also been recorded in the Rose Canyon Fault Zone. On June 17, 1985, three earthquakes hit San Diego measuring 3.9, 4.0, and 3.9, respectively; and on October 28, 1986, a stronger earthquake with a magnitude of 4.7 occurred.[3]

Seismic Risks

Earthquake damage to existing and new structures can be caused by ground rupture, liquefaction, ground shaking, and possibly inundation from tsunami (as discussed above). The level of damage at a location resulting from an earthquake will depend on the magnitude of the event, the epicenter distance, the response of geologic materials, and the design and construction quality of structures.

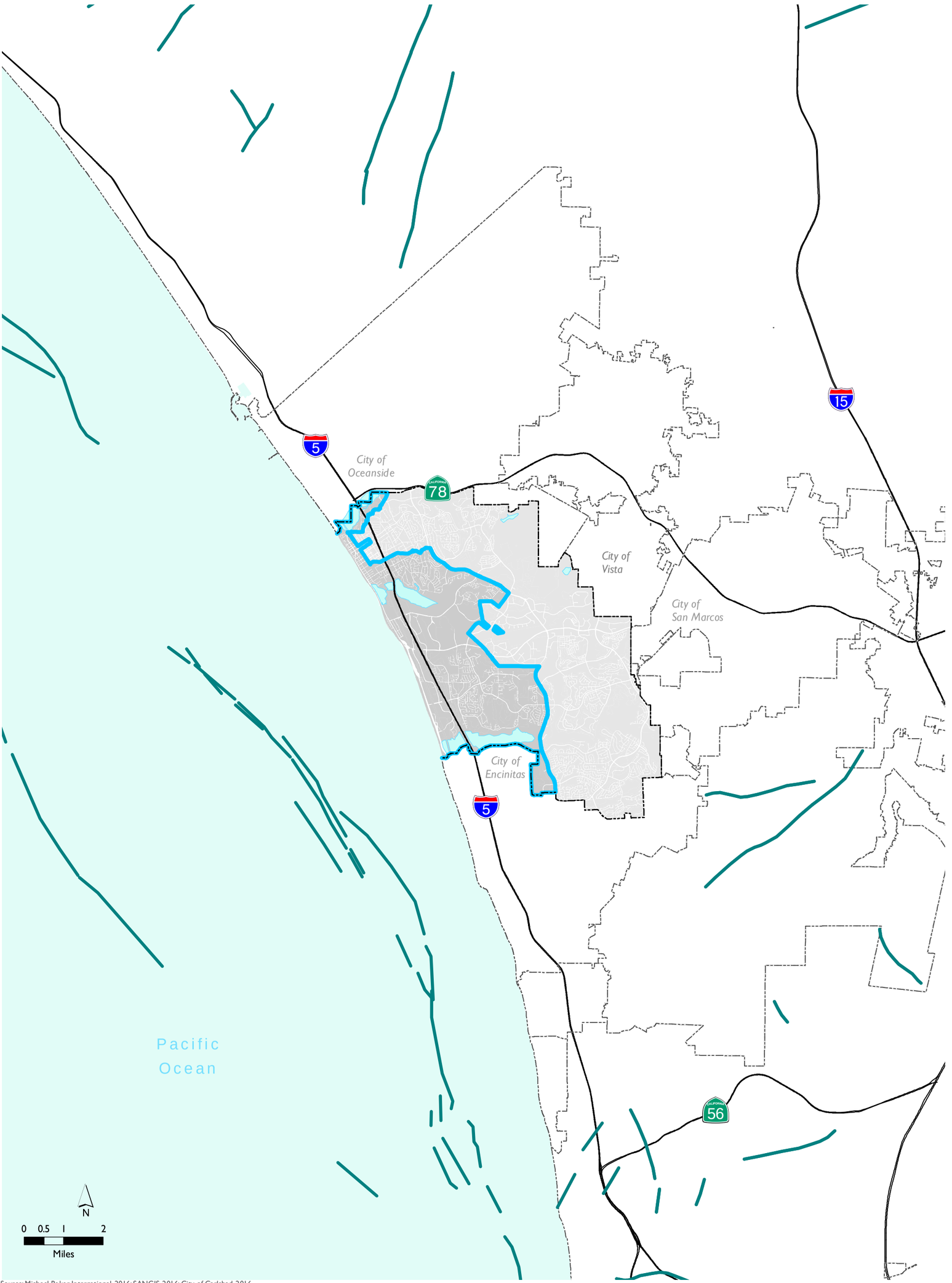
During an earthquake, shaking of granular loose soil saturated with water can lead to liquefaction, a condition in which sediments below the water table temporarily lose strength and behave as a viscous liquid rather than a solid. As a result, structures can lose foundation-bearing capacity. Historically, seismic shaking levels in the San Diego region, including Carlsbad, have not been sufficient to trigger liquefaction, and as such, the city generally has a low liquefaction risk. However, some areas of the city have a higher risk of liquefaction because of the presence of hydric soils or soils that are often saturated

[3] Deméré, Thomas A., PhD, San Diego Natural History Museum, "Faults and Earthquakes in San Diego County," accessed September 25, 2012, http://www.sdnhm.org/archive/research/paleontology/sdfaults.html.

or characteristic of wetlands. These areas are limited to the immediate vicinity of the Buena Vista, Agua Hedionda, and Batiquitos Lagoons, as shown in Figure 7-5.

Development in a liquefaction hazard zone requires adherence to the guidelines for evaluating and mitigating seismic hazards as required by California Public Resources Code Section 2695(a). Before a development permit can be granted for a site in a seismic hazard zone, a geotechnical investigation of the site must be conducted and appropriate mitigation measures incorporated into the project design. Mitigation of liquefaction hazards can include edge containment structures (e.g., berms, dikes, retaining walls), driving piles, removal or treatment of liquefiable soils, or modification of site geometry.

CITY OF CARLSBAD
LOCAL COASTAL PROGRAM



Source: Michael Baker International, 2016; SANGIS, 2016; City of Carlsbad, 2016

LEGEND

- Coastal Zone
- City Limit
- Earthquake Fault Lines

FIGURE 7-4
EARTHQUAKE FAULTS

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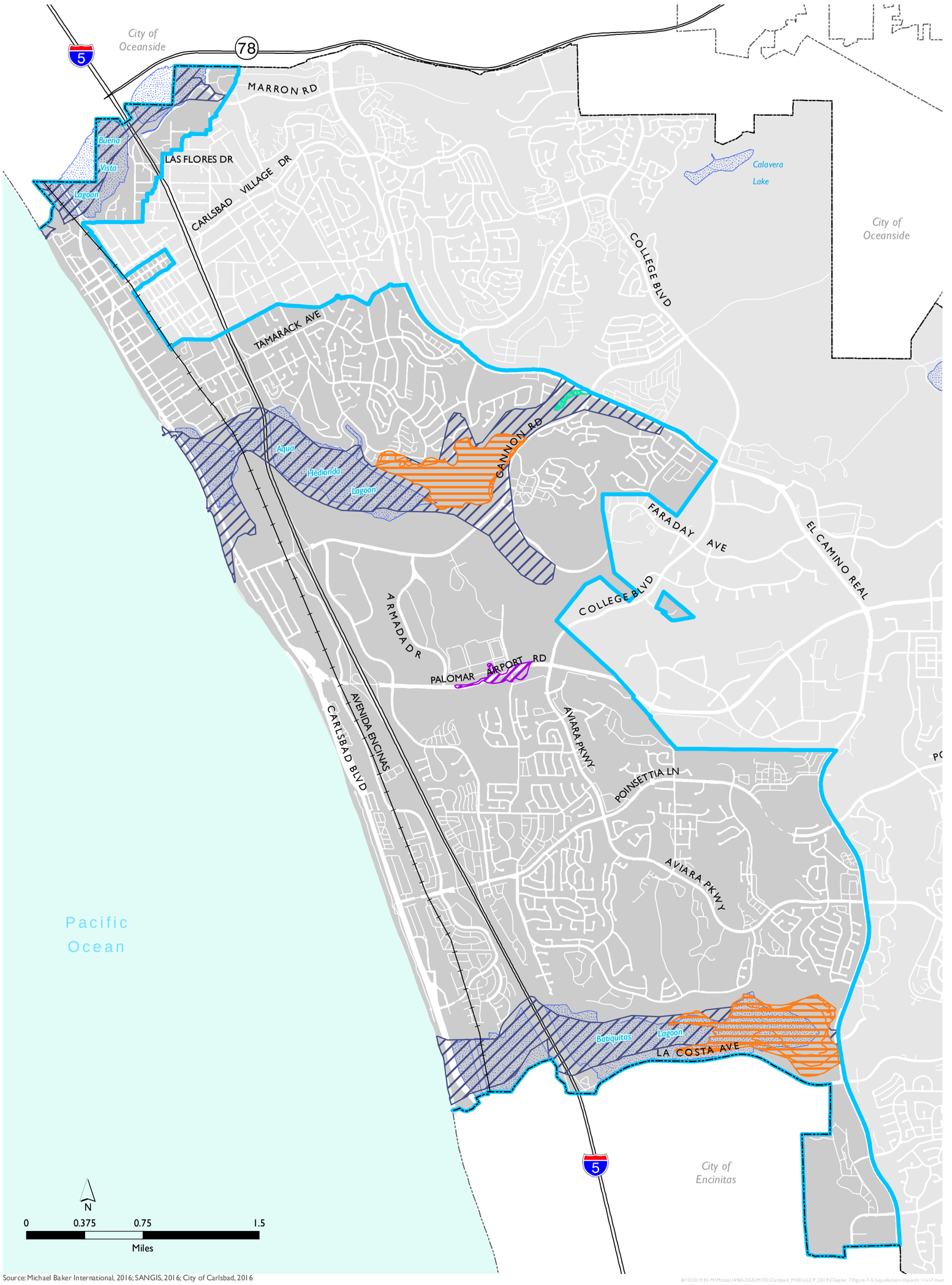
CITY OF CARLSBAD
LOCAL COASTAL PROGRAM



Source: Michael Baker International, 2016; SANGIS, 2016; City of Carlsbad, 2016

8/12/2019 JN M:\Mdata\149652\GIS\MXD\Carlsbad_MXD\LCP_2019\Chapter 7\Figure 7-5 Liquefaction Hazards 11x17.mxd

LEGEND

- Coastal Zone
- City Limit
- Lagoon
- Railroad

Potential Liquefaction

- Riverwash
- Tidal flats
- Tujunga sand, 0 to 5 percent slopes
- Other Hazard

FIGURE 7-5

LIQUEFACTION HAZARDS

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7.5 Fire Hazards

Wildland Fire Hazards

The California Department of Forestry and Fire Protection (Cal Fire) has mapped fire threat potential throughout California. Cal Fire ranks fire threat according to the availability of fuel and the likelihood of an area burning (based on topography, fire history, and climate).[4] The rankings include little or no fire threat and moderate, high, and very high fire threat. Large amounts of open space and wildland make Carlsbad susceptible to brush fires year-round. The proximity of native vegetation and the climate of the region contribute to a moderate-to-high threat of wildfires in the city, as illustrated in Figure 7-6. Most of the Coastal Zone has only moderate fire threat; however, there is high and very high fire threat in the central and eastern portions of the city.[5]

Urban Fire Hazards

Urban fire risk in Carlsbad is greatest in older structures and neighborhoods built before modern building codes for fire safety and building systems were in place. Other factors affecting urban fire risk and relative likelihood of loss of life or property include building age, height, and use; storage of flammable material; building construction materials; availability of sprinkler systems; and proximity to a fire station and hydrants.

Vegetation Management and Environmentally Sensitive Habitat Areas

Fire safety and prevention sometimes require managing vegetation to create defensible space around structures. But such vegetation management (sometimes referred to as fuel modification or brush management) if in or adjacent to significant environmentally sensitive habitat area (ESHA) can adversely impact and significantly degrade the quality of the sensitive habitat. Chapter 6 of this Local Coastal Program identifies the location of ESHA in the Coastal Zone. The Carlsbad Habitat Management Plan provides regulations that protect ESHA consistent with the Coastal Act. When evaluating fire prevention measures that involve vegetation management, any impacts to ESHA must comply with the requirements of the Carlsbad Habitat Management Plan.

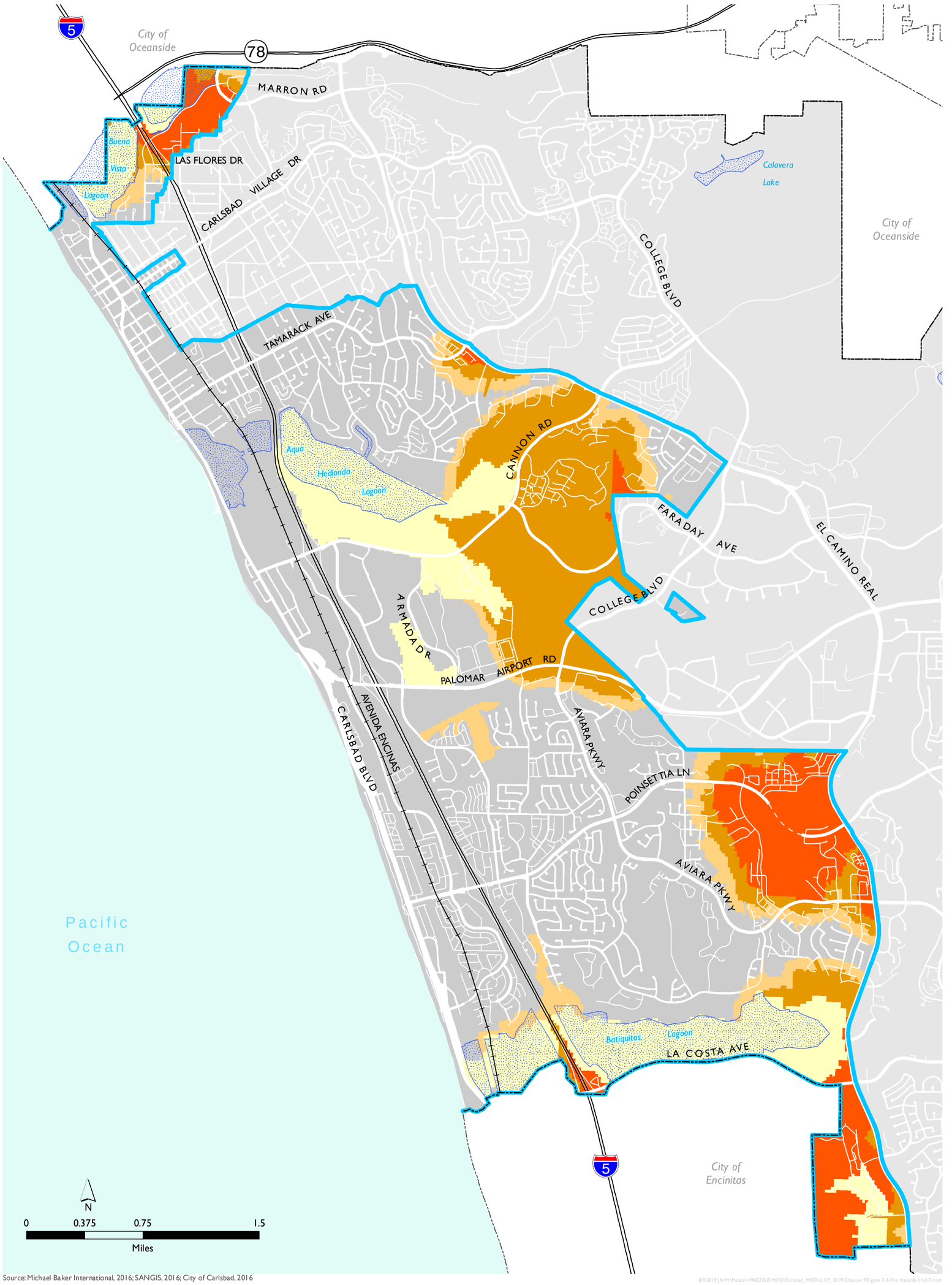
The policies of this chapter require a fire protection plan when a proposed project contains or is bounded by fire-hazardous native vegetation or when a proposed project is within an area bounded by a very high fire hazard severity zone. For properties with slopes that have or are adjacent to native

[4] County of San Diego, 2010, San Diego County Multi-Jurisdiction Hazard Mitigation Plan, page 4-89.

[5] County of San Diego, 2010, San Diego County Multi-Jurisdiction Hazard Mitigation Plan, pages 4-93 and 4-94.

vegetation, the fire protection plan must show that fuel modification areas are designed per the requirements shown in Figures 7-7A, 7-7B, and 7-7C.

CITY OF CARLSBAD
LOCAL COASTAL PLAN UPDATE



Source: Michael Baker International, 2016; SANGIS, 2016; City of Carlsbad, 2016

8/9/2019 JN M:\Mikai\149652GIS\MXD\Carlsbad_MXD\LCP_2019\Chapter 7\Figure 7-6 Fire Hazards 11x17.mxd

LEGEND

- Coastal Zone
- City Limit
- Lagoon
- Railroad

Fire Hazard Severity Zones

- Very High Threat
- High Threat
- Moderate Threat
- Little or No Threat
- Urban

FIGURE 7-6
FIRE HAZARDS

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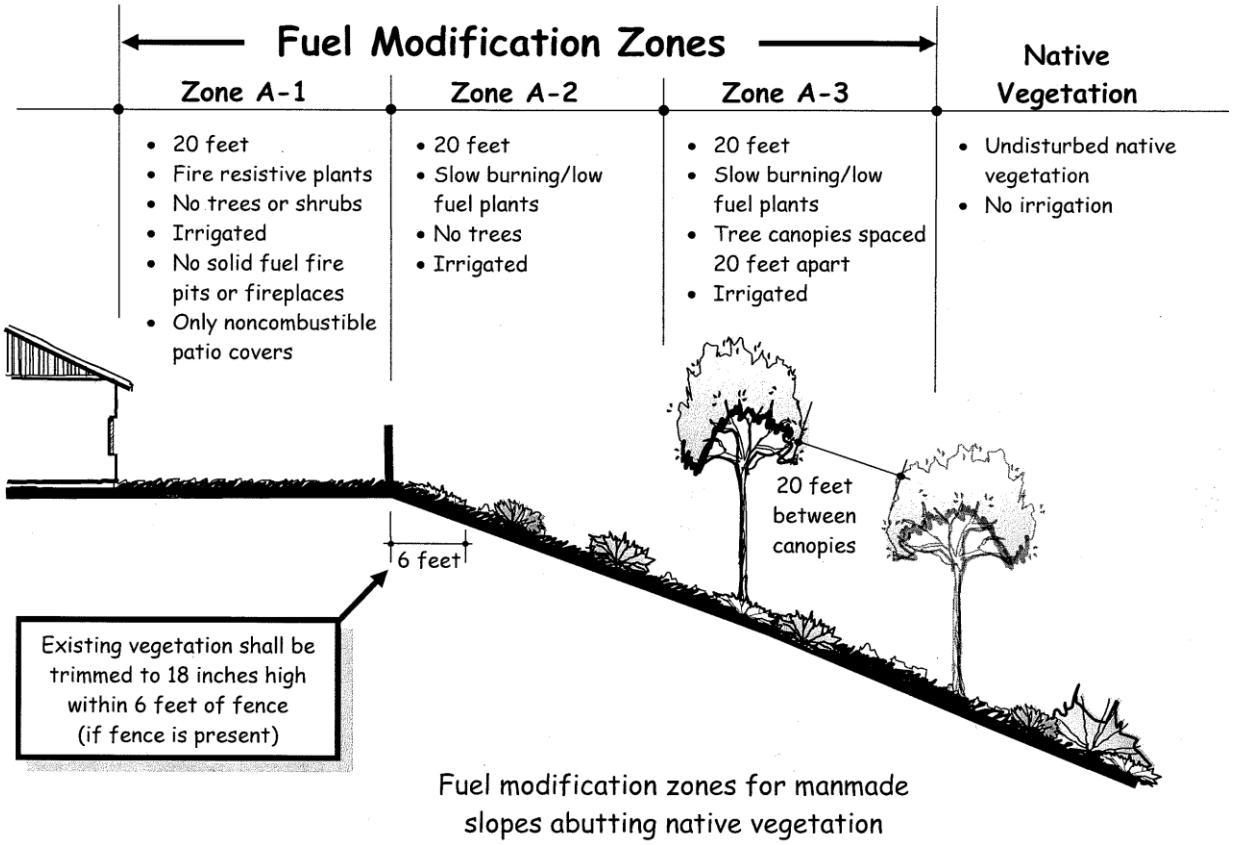
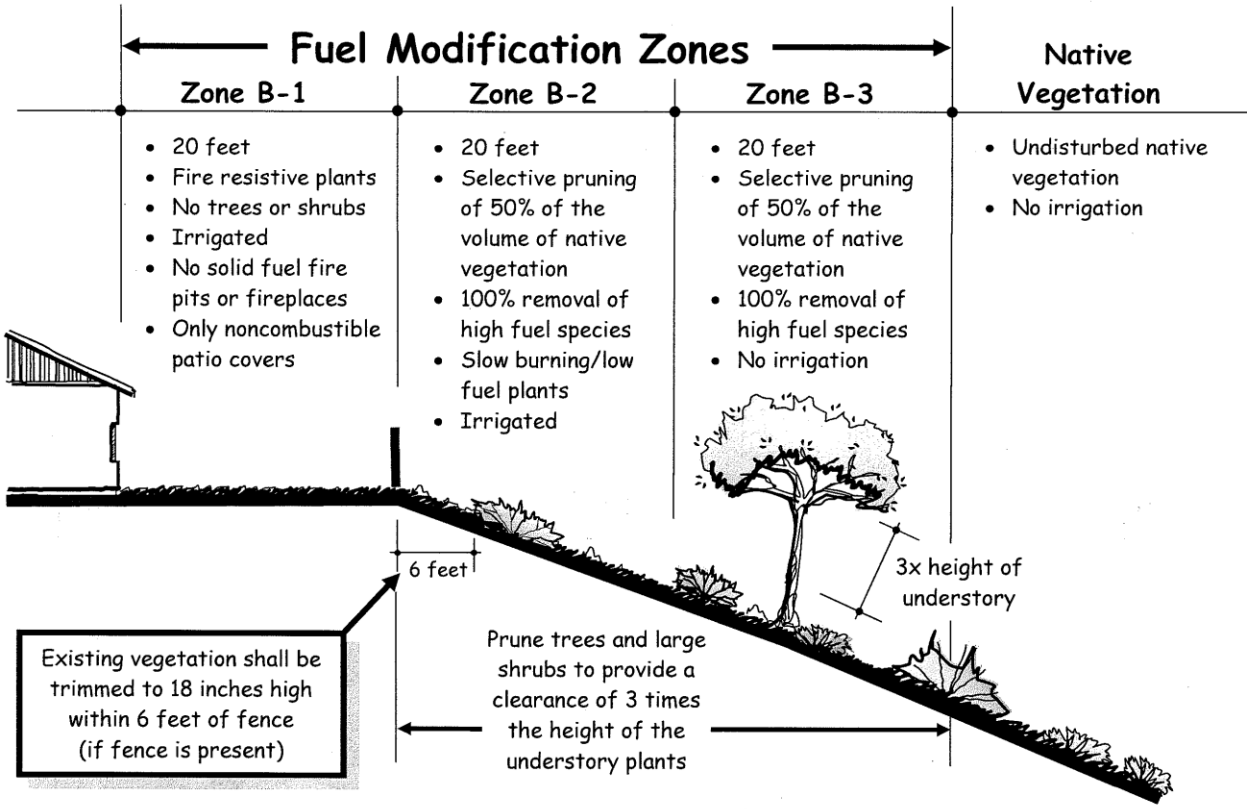
Figure 7-7A, ***Fuel Modification for Condition A – Manufactured Slopes***



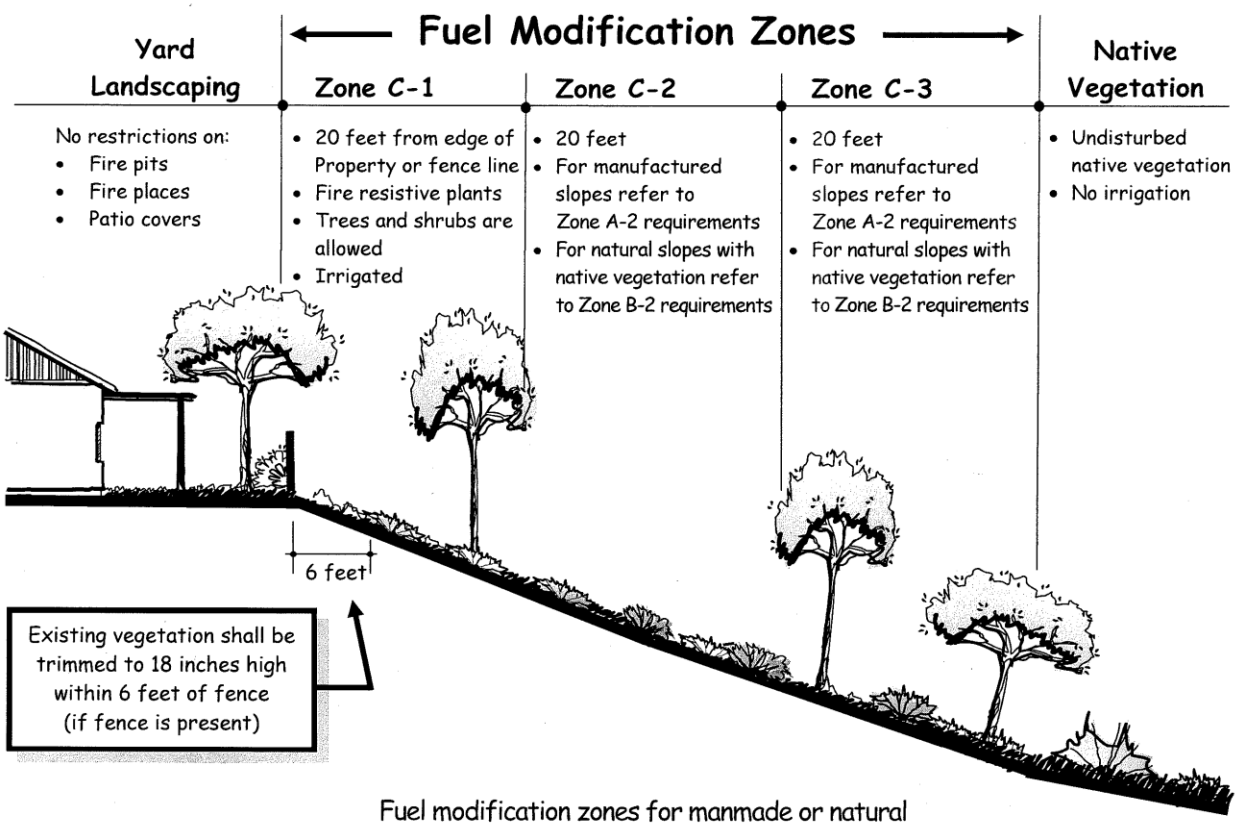
Fuel modification zones for manmade slopes abutting native vegetation

Figure 7-7B, ***Fuel Modification for Condition B – Native Vegetation on Natural Slopes***



For areas where removal of native vegetation is restricted within the fuel modification zones

Figure 7-7C, ***Fuel Modification for Condition C – Manufactured or Native Slopes Outside a Fence or Property Line***



Fuel modification zones for manmade or natural slopes which occur outside the fence line or property

7.6 Coastal Hazards Policies

The following policies provide direction to ensure that development in the Coastal Zone is consistent with Coastal Act requirements related to coastal hazards. Some of the following policies are directly related to the Coastal Act sections described in Section 7.1 of this chapter; reference to those Coastal Act sections is noted at the end of the applicable policies.

General

LCP-7-P.1 Regulate development, including remodeling or structural rehabilitation, to minimize safety hazards on sites having a history or a newly identified threat of flooding, erosion, subsidence, or seismic dangers.

LCP-7-P.2 Require all new development and redevelopment be sited and designed to avoid hazardous areas and minimize risks to life and property from coastal and other hazards.

LCP-7-P.3 Enforce the California Subdivision Map Act by denying subdivision maps if a project site is not physically suitable for either the type or density of a proposed development because of geologic, seismic, or other hazards.

LCP-7-P.4 Issue emergency coastal development permits in the event of an emergency (i.e., a sudden unexpected occurrence demanding immediate action to prevent or mitigate loss or damage to life, health, property or essential services). Emergency coastal development permits shall only be issued if:

A. An emergency exists that requires action more quickly than permitted by the procedures for a regular coastal development permit;

B. The work can and will be completed within 30 days unless otherwise specified by the emergency permit;

C. The work is consistent with applicable Local Coastal Program policies;

D. The nature of the work is temporary and fully removable with minimal impact to the affected area;

E. The work is the minimum amount of temporary development necessary to abate the emergency in the least environmentally damaging short- and long-term manner;

Requests for emergency coastal development permits for any work to be conducted within the Coastal Commission's permit jurisdiction (tidelands, submerged lands, and public trust lands) shall be referred to the Coastal Commission.

LCP-7-P.5 Require that all emergency coastal development permits expire six months after the permit becomes effective, unless extended for good cause by the city, and if such extension is limited as much as possible in duration. Within 30 days of issuance of an emergency coastal development permit, the applicant shall apply for a regular coastal development permit. All emergency development is considered temporary and must be removed and the affected area restored within six months after the emergency permit becomes effective, unless the city authorizes an extension of time for good cause or the development is permitted by a regular coastal development permit.

LCP-7-P.6 Coordinate with San Diego County and other appropriate agencies to ensure future updates to the Multi-jurisdictional Hazard Mitigation Plan align with the city's Local Coastal Program.

Sea Level Rise Hazards

Note: As used in the following sea level rise hazard policies, the term "sea level rise hazard zone" refers to the sea level rise hazard zones identified in the "City of Carlsbad Sea Level Rise Vulnerability Assessment."

Sea Level Rise Hazards Analysis

LCP-7-P.7 Incorporate the "City of Carlsbad Sea Level Rise Vulnerability Assessment" as Appendix B of this Local Coastal Program Land Use Plan. The assessment, including sea level rise hazard maps, shall be updated approximately every 10 years; the update shall utilize the best available science and state guidance applicable at the time of the update.

LCP-7-P.8 Require a site-specific sea level rise hazard report(s) for all development that requires a coastal development permit and is proposed on property that is 1) wholly or partially in a sea level rise hazard zone (as shown on the sea level rise hazard maps for year 2100 – see Appendix B), or 2) an oceanfront parcel outside the boundary of a sea level rise hazard zone. The report shall be prepared pursuant to the requirements specified in the zoning ordinance and shall:

A. Be based on the best available sea level rise science and state guidance applicable at the time of the report.

B. Demonstrate that the development will avoid or minimize impacts from sea level rise hazards (inundation, bluff erosion, flood) for the anticipated duration of the development per Policy LCP-7-P.9.

C. For sites with existing shoreline protective devices, the analysis shall assume that the protective device does not exist, such that the site would erode in a manner similar to unarmored sites in the same vicinity with similar geologic attributes.

D. Demonstrate that the development will not encroach on public trust lands or a wetland boundary or required buffer during the anticipated duration of the development per Policy LCP-7-P.9.

Siting New Development and Redevelopment

LCP-7-P.9 Interpret the anticipated duration of development in the coastal zone, as shown in Table 7-1 of this chapter, as a guideline for sea level rise planning purposes, not as an entitlement to maintain development in hazardous areas. The duration of any development shall be limited by site conditions, which may result in a shorter duration of development than shown in Table 7-1.

LCP-7-P.10 Site all new development and redevelopment that requires a coastal development permit to avoid sea level rise hazards, including groundwater changes and shoreline migration, during the anticipated duration of the proposed development.

LCP-7-P.11 Ensure that all new development and redevelopment that requires a coastal development permit and is located in a sea level rise hazard zone is consistent with the following:

A. Locate and design development to ensure stability and structural integrity for the anticipated duration of the development, without creating or contributing significantly to erosion, geologic instability, or destruction of the site or surrounding area, or require construction of shoreline protective devices that, in combination with sea level rise hazards, will substantially alter natural landforms.

B. Provide adequate drainage and erosion control facilities that are consistent with the water quality protection policies of Chapter 6 and convey site drainage in a non-erosive manner to minimize hazards resulting from increased runoff and erosion. Blufftop runoff shall not be channelized or directed to the beach or the ocean.

C. Development shall not encroach on a wetland boundary or required a buffer and will remain on private land during the anticipated duration of the development.

The location of new development (during its anticipated duration) shall remain consistent with all Local Coastal Program policies and the Coastal Act, as the mean high tide line/public trust boundary migrates inland.

LCP-7-P.12 Permit development and redevelopment that cannot be located and designed to avoid impacts from sea level rise hazards, only if the development meets all the following criteria:

A. The proposed development is the least environmentally damaging feasible alternative and is sited and designed to protect coastal resources and minimize hazards to the extent feasible.

B. Approval of the development includes a condition that requires removal or other adaptation measures when specific triggers are met, including, but not limited to, those described in Policy LCP-7-P.27, to ensure that the development does not: 1) impact coastal resources, 2) substantially impair public trust resources, 3) become structurally unstable, or 4) pose unacceptable risks to life or property. The condition shall be recorded as part of a notice of restriction per Policy LCP-7-P.17.

C. The proposed development is consistent with the public access and recreation policies of the Coastal Act and this Local Costal Program.

LCP-7-P.13 Allow a minimum economic use and/or development of a property where full adherence with all Local Coastal Program policies, including sea level rise policies and other hazard avoidance measures, would preclude a reasonable economic use of the property. Continued use of an existing structure, including with any permissible repair and maintenance (which may be exempt from permitting requirements), may provide a reasonable economic use. If development is allowed pursuant to this policy, it must be consistent with all Local Coastal Program policies to the maximum extent feasible.

LCP-7-P.14 Ensure that new development and redevelopment on blufftop lots along the ocean and lagoon shorelines is set back from the blufftop edge. The setback line shall be the greater of the following distances:

A. The "string-line" distance, which is a line measured between structures on adjacent blufftop lots; the adjacent structures to measure from shall be the enclosed portion of the structure on the adjacent site that is: a) nearest to the ocean or lagoon, and b) nearest to the project site. No decks or other accessory structures shall be permitted closer to the ocean or lagoon than those on adjacent blufftop properties.

B. The geologic setback is the location on the blufftop inland of which stability can be reasonably assured for the anticipated duration of the development without need for shoreline protective devices. The geologic setback line shall account for the erosion, including erosion due to sea level rise, anticipated during the duration of the development.

LCP-7-P.15 Prohibit structures, grading, and other landform alteration on bluff faces except for the following: restoration of natural resources, public access structures where no feasible alternative means of public access exists, and shoreline protective devices, if allowed by this Local Coastal Program and the Coastal Act. Such structures shall be designed and constructed to be visually compatible with the surrounding area to the maximum extent feasible and to minimize erosion of the bluff face.

LCP-7-P.16 Prohibit improvements (including those that do not meet the threshold of redevelopment) to an existing structure which is legally non-conforming due to a sea level rise hazard policy or standard when the improvements increase the degree of non-conformity by increasing the hazardous condition, such as by developing seaward or in a location that conflicts with the policies of this chapter, or by extending the duration that the non-conforming structure will remain non-conforming.

LCP-7-P.17 Require recordation of a notice of restriction on property as a condition of approval of a coastal development permit for new development and redevelopment in a sea level rise hazard zone. As specified in the zoning ordinance, the notice of restriction shall identify existing and potential future sea level rise hazards and the associated limitations on land use and property rights.

Shoreline Protective Devices (Armoring)

LCP-7-P.18 Encourage the use of soft or natural shoreline protection methods, such as beach/sand nourishment, dune restoration, living shorelines, horizontal levees, and other soft or natural alternatives to hard shoreline protective devices. Prior to approval of a soft shoreline protection method, the city shall consider how the soft shoreline protection method may need to change over time as sea levels rise, and the impacts the shoreline protection may have on coastal resources.

LCP-7-P.19 Identify and give priority to non-structural shoreline protection options, prior to permitting shoreline protective devices pursuant to Policy LCP-7-P.20. Non-structural shoreline protection options may include, but are not limited to, relocation of the threatened development, beach nourishment, non-structural drainage and native

landscape improvements, sand bags, or other similar non-structural options that can address an erosion hazard and/or minimize risk of flooding and provide structural stability. Such non-structural options shall be used wherever feasible to protect coastal resources.

LCP-7-P.20 Permit shoreline protective devices, pursuant to Coastal Act Section 30235, including revetments, breakwaters, groins, seawalls, bluff retaining walls, and other such construction that alters natural shoreline processes, only when all the following criteria are met:

A. The protective device is required to serve coastal-dependent uses or protect public beaches in danger from erosion or protect existing principal structures. "Existing" in the context of this policy refers to structures that existed prior to Coastal Commission certification of this policy ([insert date after certification]).

B. The protective device is designed to eliminate or mitigate adverse impacts on local shoreline sand supply.

C. There is no less environmentally damaging alternative.

D. No waiver of rights to shoreline protective devices applies to the property.

E. The shoreline protective device is required, as a condition of approval, to be removed when the coastal-dependent use or structure, which the device is intended to protect, is no longer present or no longer requires armoring.

LCP-7-P.21 Prohibit the use of shoreline protective devices to protect new development, including redevelopment. If new development, including redevelopment, is protected by an existing legally authorized shoreline protective device, the new development/redevelopment shall be sited and designed in a manner that does not require or rely on the use of a shoreline protective device to ensure geologic stability. Require, as a condition of approval of a coastal development permit, that new development, including redevelopment, record a notice of restriction waiving the right, per Coastal Act Section 30235, to construct shoreline protective devices in the future. The condition shall be recorded as part of a notice of restriction per Policy LCP-7-P.17.

LCP-7-P.22 Require, when permitting new development or redevelopment, removal of existing shoreline protective devices that are under the control of the property owner, only if:

A. It is feasible to remove the device and restore affected areas; and

B. The device is causing adverse impacts to coastal or public trust resources, or will cause impacts over the anticipated duration of the development/redevelopment due to sea level rise during that time; and

C. The device is no longer necessary to protect the remaining existing principal structure on the property or adjacent properties that are entitled to retain shoreline armoring.

LCP-7-P.23 Require that new shoreline protective devices, when permitted pursuant to Policy LCP-7-P.20, are sited and designed to eliminate or mitigate adverse impacts on local shoreline sand supply, and to avoid impacts to other coastal resources and public access to the maximum extent feasible. If such impacts cannot be avoided, they shall be mitigated through options such as providing equivalent new public access or recreational facilities or undertaking restoration of nearby beach habitat. Mitigation of impacts to coastal resources and public coastal access shall ensure equitable public access to and benefits from coastal resources.

LCP-7-P.24 Permit repair and maintenance of existing, legally permitted shoreline protective devices only if the activities do not result in an enlargement or extension of armoring. Repair and maintenance activities shall not result in a seaward encroachment of the shoreline protective device or substantially impair public trust resources. Repair and maintenance projects shall include measures to address and mitigate all coastal resource impacts that the repair and maintenance activities may cause. Replacement of 50 percent or more of a shoreline protective device shall not be considered repair and maintenance, but instead constitutes a replacement structure subject to provisions applicable to new shoreline protective devices.

LCP-7-P.25 Ensure that the emergency coastal development permit provisions (policies LCP-7-P.4 and LCP-7-P.5) do not allow for construction of permanent shoreline protective devices, such as seawalls, that are not temporary in nature and the removal of which would likely cause adverse impacts to the affected area.

LCP-7-P.26 Coordinate with the California Coastal Commission to prepare and maintain a coastal armoring database that identifies the location and condition of all existing shoreline armoring, as well as the permit status of all existing armoring in the city.

Moving Development Away from Hazards

LCP-7-P.27 Require removal or relocation of structures or portions of structures and restoration of the impacted property in the following circumstances (note: new and/or augmented

shoreline protective devices shall not be permitted to protect the structure(s) unless otherwise permitted by this Local Coastal Program):

A. Any government agency with relevant authority and jurisdiction has ordered that the structures are not to be occupied or are to be removed due to hazards that negatively affect public health and safety.

B. Essential services to the site can no longer feasibly be maintained (e.g., utilities, roads).

C. The structures are no longer located on private property due to the migration of the public trust boundary, and the development significantly impairs public trust resources.

D. The development requires new and/or augmented shoreline protective devices that conflict with the sea level rise policies in this chapter.

E. Removal is required pursuant to other sea level rise policies in this chapter.

It is the landowner's responsibility to remove the structure(s) and restore the site at the owner's expense in a way that best protects the public trust and coastal resources. In the event portions of the development fall to the bluffs, beach, or ocean before they are removed/relocated, the landowner will remove all recoverable debris associated with the development and lawfully dispose of the material in an approved disposal site. Removal and restoration activities requires a coastal development permit or an emergency coastal development permit, if warranted.

Sea Level Rise Development Standards and Adaptation Plans

LCP-7-P.28 Develop and implement a sea level rise hazard – shoreline development standards, as part of the Zoning Ordinance, for areas that are vulnerable to sea level rise hazards. The development standards shall minimize risks to life and property associated with sea level rise and ensure protection of the migrating shoreline.

LCP-7-P.29 Seek funding opportunities to develop a sea level rise adaptation plan(s) that identifies how development, resources, and other vulnerable assets can adapt to the impacts of sea level rise, including, but not limited to, the following:

A. Examination of priorities for adaptation, timelines, options, specific projects to be implemented, phasing, and action triggers.

B. Identification of methods and standards to address repetitive property damage.

C. Identification of methods and standards to maintain public lateral beach access.

D. Assessment of seasonal and long-term shoreline changes and the potential for flooding or damage from erosion, sea level rise, waves, storm surge, or seiches.

E. Evaluation of the feasibility of hazard avoidance, retreat, restoration of the sand supply, and beach nourishment in appropriate areas.

F. Consideration of the associated secondary impacts (e.g., loss of beach resulting from the use of seawalls) and trade-offs (i.e., who/what will benefit and who/what will be adversely impacted?) of adaptation strategies.

G. Recommendations for adapting existing development, public improvements, coastal access, recreational areas, and other coastal resources.

H. Evaluation of the feasibility of a program related to transfer of development rights

I. Evaluation of the feasibility to form a geologic hazard abatement district to help fund sea level rise adaptation

LCP-7-P.30 Prioritize the development and implementation of adaptation plans for critical infrastructure, such as Carlsbad Boulevard, public trails, parks, beach access, parking, utilities, and other important public improvements and resources that are vulnerable to sea level rise hazards. The adaptation plan should consider landward relocation of critical infrastructure where feasible.

LCP-7-P.31 Support and coordinate with the California Department of Parks and Recreation in sea level rise adaptation planning for the state campground in Carlsbad.

Other Sea Level Rise Adaptation Efforts

LCP-7-P.32 Continue to build community awareness about sea level rise hazards and future vulnerabilities.

LCP-7-P.33 Continue to participate in collaborative sea level rise adaptation efforts with other local, regional, state, and federal entities to promote restoration or enhancement of natural ecosystems such as coastal wetlands, lagoons, and sandy beaches. Support regional and local efforts to mitigate the impacts of sea level rise, such as implementation of beach nourishment projects and other adaptation methods.

LCP-7-P.34 Support efforts to monitor sea level rise impacts to beaches, bluffs, natural resources, and shoreline and public trust migration. Collaborate with other local, regional, state,

and federal entities to establish monitoring methods and track the effects of sea level rise.

LCP-7-P.35 Encourage development projects that create dredge spoils to deposit such spoils on the beach if the material is suitable for sand replenishment, and the deposit of spoils is consistent with the other policies of the Local Coastal Program, including habitat protection policies.

LCP-7-P.36 Prohibit the creation of new lots (including adjusted lots) in sea level rise hazard zones, unless it is demonstrated either that:

A. The new lot(s) will be permanently protected for open space, public access, or other similar purposes consistent with the city's Local Coastal Program and Coastal Act, or

B. Resultant parcels contain a buildable area in which development would remain located on private property despite the migration of the public trust boundary, not require the future construction or augmentation of a shoreline protective device, be adequately served by public services (e.g., water, sewer, and safe, legal, all-weather access as applicable), and otherwise be consistent with all Local Coastal Program policies and standards.

Lot line adjustments that do not meet the criteria above may be permitted if the adjustment will not exacerbate or create a current or future sea level rise hazardous condition and will not expose additional development to a sea level rise hazard.

Flood Hazards (not addressed above)

LCP-7-P.37 Channelization, dams, or other substantial alterations of streams shall incorporate the best mitigation measures feasible and be limited to: a) necessary water supply improvements; b) flood control measures where no other method for protecting existing structures in a floodplain is feasible, and where such protection is necessary for public safety or to protect existing development; or c) measures designed with the primary purpose to improve fish and wildlife habitat [related to Coastal Act Section 30236].

LCP-7-P.38 Implement flood control programs that reduce flood hazards, such as the city's Grading Ordinance, Drainage Master Plan, and the Floodplain Management Regulations.

LCP-7-P.39 Comply with the Federal Emergency Management Agency (FEMA) requirements to identify and regulate flood hazard areas. Cooperate with FEMA on shoreline flooding hazards and other mapping efforts.

LCP-7-P.40 Prohibit development within a floodway, unless certification by a registered professional engineer demonstrates that encroachments will not result in any increase in flood levels during the occurrence of the base flood discharge. Uses permitted in a floodway shall be limited to agricultural, recreational, and other such low-intensity uses provided that no use shall be permitted that will create significant adverse impacts on environmental resources, and development complies with all applicable provisions of the Local Coastal Program.

LCP-7-P.41 Prohibit the development of permanent structures in the 1-percent-annual-chance flood area unless no alternative development area exists on the development site and proper mitigation measures are implemented to minimize or eliminate risks to life and property from the flood hazard. Permitted development in the 1-percent-annual-chance flood area shall be subject to the following:

A. Development shall be limited to structures capable of withstanding periodic flooding without requiring substantial alteration of streams (on- or off-site), including channelization and dams.

B. Development shall not result in an obstruction to flood control and shall not adversely impact environmental resources.

C. Development complies with all applicable provisions of the Local Coastal Program.

LCP-7-P.42 Ensure that all floodways are designated as open space on the land use and zoning maps. One-percent-annual-chance flood areas shall be designated open space as part of the approval of a development project.

LCP-7-P.43 Require that all proposed drainage facilities are properly sized to handle 1-percent-annual-chance flood conditions.

LCP-7-P.44 Cooperate and coordinate with federal, state, and local jurisdictions and with other agencies that are involved in the mitigation of flood hazards from dam inundation, tsunamis, sea level rise, and major flood events.

Geologic Hazards

LCP-7-P.45 Ensure that all development occurs in accordance with the water quality protection policies in Chapter 6 of this Local Coastal Program, which addresses erosion control and water runoff flow (i.e., volume, flow rate, timing, and duration).

LCP-7-P.46 Require a site-specific geotechnical analysis and report of all sites proposed for development in areas where geologic conditions or soil types are susceptible to geologic hazards, such as coastal bluffs, steep slopes (25-percent inclination or greater), landslides, and liquefaction. Also require demonstration that the project site is suitable for the proposed development, the development will be safe from geologic hazards for the anticipated duration of the development (per Table 7.2), and the project conforms to all mitigation measures recommended in the geotechnical report prior to city approval of the proposed development.

LCP-7-P.47 Require the following when development is permitted on property with a bluff that faces an ocean or lagoon shoreline:

A. Where feasible, sub-drainage systems to remove groundwater from the bluff

B. Drought-resistant vegetation in landscaping

C. A waiver of public liability for hazards related to bluff stability

LCP-7-P.48 Avoid impacts to natural steep slopes, significant natural landforms, and environmentally sensitive resources by clustering development away from those features.

LCP-7-P.49 Limit development on natural steep slopes as follows:

A. Slopes with a 25-percent or greater gradient that contain environmentally sensitive habitat shall be preserved in their natural state to reduce erosion and protect sensitive habitat, except as follows and subject to the habitat protection policies of Chapter 6 of this Local Coastal Program:

   i. If the application of this policy would preclude reasonable use of the property, in which case an encroachment not to exceed 10 percent of the 25 percent or greater slope area may be permitted.

   ii. On lots with all or nearly all of the lot area in a 25-percent or greater gradient, encroachment may be permitted; however, no more than 20 percent of the entire parcel shall be disturbed from its natural state.

iii. No further subdivisions of land shall occur on lots with all of the lot area in a 25-percent or greater gradient, unless grading and development is limited to not more than 10 percent of the total site area.

iv. Use of slopes with a 25-percent or greater gradient is permitted to provide access to flatter areas if there is no less environmentally damaging alternative available.

B. Prohibit grading and development on natural slopes of greater than a 40 percent gradient, with or without sensitive habitat, if the slope area has all the following characteristics:

i. Elevation differential of greater than 15 feet.

ii. Minimum area of 10,000 square feet.

iii. The slope is a prominent land form feature.

C. Slopes required to be preserved in their natural state per subsection A or that are determined to be undevelopable per subsection B of this policy shall be protected with an open space easement.

LCP-7-P.50 Ensure development on natural steep slopes, when permitted, is designed to minimize grading and preserves the integrity of natural hillsides.

LCP-7-P.51 Require qualified geotechnical engineering professionals to review grading plans and inspect areas of excavation during and after grading to evaluate slope stability and other geotechnical conditions that may affect site development and public safety. In areas of known or suspected landslides and/or adverse geologic conditions, the following determinations should be made: extent of landslide, depth-to-slide plane, soil types and strengths, presence of clay seams, and groundwater conditions.

LCP-7-P.52 Prohibit the construction of buildings used for human occupancy on the surface trace of active faults.

LCP-7-P.53 Require applicants to conduct detailed geologic and seismic investigations at sites where the construction of critical structures (high-occupancy structures and those that must remain in operation during emergencies) and structures over four stories are under consideration.

LCP-7-P.54 Implement the California Building Standards Code to ensure structures are constructed to seismic safety standards.

Fire Hazards

LCP-7-P.55 Require that new development be sited to avoid very high fire hazards as well as to avoid the need to extend fuel modification zones into environmentally sensitive habitat area (ESHA).

LCP-7-P.56 Prohibit new subdivisions of land that would create a lot on which a subsequent development would result in fuel modification encroachment on adjacent ESHA.

LCP-7-P.57 Require that fuel modification be designed and maintained consistent with the city's Habitat Management Plan, as well as Figures 7-7A, 7-7B, and 7-7C of this chapter.

LCP-7-P.58 Require a fire suppression plan for all development adjacent to protected native vegetation or a very high fire hazard severity zone. The plan shall be subject to approval by the city's Fire Department and shall incorporate a combination of fire suppression measures, including building materials, sufficient structural setbacks from native vegetation, and selective thinning designed to ensure safety from fire hazard and protection of native habitat.

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