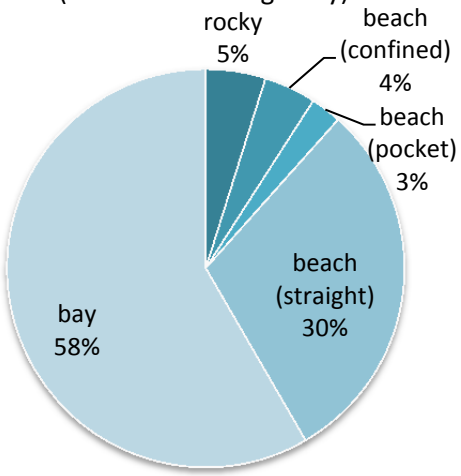
San Diego County

Coastal Zone

Outer Coast Shoreline

(includes San Diego Bay)



The San Diego County coastal zone, extending south from the Orange County line to the Mexican border, is rich in resources and geographic diversity. The county shoreline, including the shoreline of San Diego Bay and Mission Bay but excluding the lagoons, is approximately 177 miles long. The coastal zone area , approximately 87,888 acres (137 square miles), contains a wide variety of significant coastal resources including major state and local beaches, marine terraces, bluffs, coastal marshes, estuaries and lagoons, canyon-cut mesas, seaside beach communities, significant urban development, state university campus lands, cultural resources, recreational harbors, and the Port of San Diego. There are also major federal lands within the county, including Camp Pendleton Marine Corps Base, and numerous U.S. Navy facilities adjacent to San Diego Bay (North Island Naval Air Station, Naval Amphibious Base, Naval Station San Diego and Naval Submarine Base). The Tijuana River National Estuarine Research Reserve (NERR) sits along the US-Mexico border. The unincorporated coastal area of San Diego County contains no oceanfront lands, but the county's coastal zone includes the shoreline of 10 cities.

Coastal Zone Resources

Ports & Harbors: Oceanside, San Diego, San Diego Area
Publicly Owned/Accessible: 18,900 acres
Public Access Coastal Areas: 200 locations
Coastal Zone Wetlands: 7,600 acres

Ocean Economy

2013 County Ocean Sectors GDP	**$6.2 B**
2013 Major Ocean Economic Sectors	
Tourism and Recreation GDP	$4.0 B
Transportation GDP	$1.2 B
Ship and Boat Building GDP	$0.70 B

17%

of State Ocean Sector GDP

Source: National Ocean Economics Program, 2016

Accounting for 17% of the state's total ocean sector GDP, San Diego County has the second largest ocean economy in the state. Tourism and recreation are essential for the county's economic stability. Many of San Diego County's iconic beaches, natural resources, and recreational areas that drive its tourism and recreation economy are vulnerable to sea level rise. The Port of San Diego accounts for a major component of the transportation GDP in this county, and thus sea level rise impacts on port assets (in addition to tourism and recreation assets) could threaten the county's large ocean economy.

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Hazards and Vulnerability

According to the "Climate Change-Related Impacts in the San Diego Region by 2050" report, under moderate sea level rise (SLR) scenarios (12-18 inches) will lead to loss of public access, recreation, natural resources, and rocky beach habitat [1]. Intertidal reserves, such as Cabrillo National Monument and Scripps Coastal Reserve which are bordered by steep cliffs, will likely lose much of their intertidal habitats since there is no room to move inland [1]. The potential loss of habitat and species composition may also affect marine productivity and fisheries [1].

Bluff top development in Solana Beach

The City of Oceanside is currently experiencing hazardous shoreline conditions, which are expected to increase with rising sea levels [2]. The ocean regularly reaches revetments along some coastal residential areas. The Loma Alta Marsh and Buena Vista Lagoon may be impacted by sea level rise and have vulnerable recreational trail elements [2].

Population at risk to 100yr Flood
3,000 = current risk | 9,300 = future w/1.4m SLR
Source: Heberger et al.. 2009

Using high CoSMoS 3.0 sea level rise projections (55.2 inches of sea level rise by 2050 and 79.2 inches of sea level rise by 2100), the City of Carlsbad's draft sea level rise vulnerability assessment highlights key vulnerable assets subject to inundation, erosion, and flooding. These assets include beaches, environmentally sensitive lands, public access ways, transportation, and other critical infrastructure. While beach erosion impacts are not expected to be significant until after year 2050, many planning areas were found to lose 26 to 66 acres of shoreline by 2100 [3]. The assessment also found all of the beach access ways to be vulnerable to flooding and inundation by 2100, with approximately half of them vulnerable to flooding by 2050 [3]. Sewer pump stations and the commercial uses adjacent to Agua Hedionda Lagoon were also found to be vulnerable to rising sea levels. Transportation infrastructure, including major and private roads, was found to be vulnerable to flooding and bluff erosion by the year 2050[3]. Sensitive habitats such as wetlands, riparian areas, coastal prairies, woodlands and forests, and other natural resources in the coastal zone were found to be vulnerable to flooding; however, in some areas, there might be room for habitats to move in land with rising seas [3].

Potential Bluff Erosion Risk w/55in SLR
1,800 properties
Source: CoSMoS 3.0 (2016), County parcel data

In the City of Encinitas and City of Solana Beach, many assets such as bluff-top development, public access ways, parking lots, and beaches are vulnerable to erosion and the impacts associated with rising sea levels [2]. The Commission recently approved a 50-year Army Corps of Engineers beach replenishment project for Solana Beach and Encinitas to help maintain beaches in this area [2].

Hazards from rising sea levels will impact many coastal resources and assets in Del Mar including residential properties, roads and bridges, sewer infrastructure, emergency

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services, public access, and the San Dieguito River lagoon wetland habitats [2]. A City of Del Mar assessment found that beaches above high tide will be lost to erosion with 1-2 feet of sea level rise, at which point coastal storms will threaten sea wall integrity and the City's North Beach District [4]. Flooding of the San Dieguito River will inundate the City's North Beach District, the Valley District, and the Del Mar Fairgrounds more frequently and at greater depths [4]. The assessment also found that the wetlands in the San Dieguito Lagoon could be drowned out by sea level rise. Del Mar is conducting a follow-up study to identify the potential for wetland migration in this area [2].

For the City of San Diego, many beaches (such as Mission Beach, Ocean Beach, La Jolla Shores, and Blacks Beach) and homes are already experiencing flooding and erosion, and both are expected to increase with sea level rise [2]. Torrey Pines State Beach, a highly visited area, is currently experiencing flooding to its parking lot located at sea level. Access roads to Blacks Beach, a popular surf and beach recreational area, have collapsed and more impact associated with rising sea levels is expected to occur over time [2].

The vulnerability assessment for the San Diego Bay region used high sea level rise projections (17 inches of sea level rise by 2050 and 69 inches of sea level rise by 2100)to determine the most vulnerable sectors in the Bay region. These sectors include stormwater management, wastewater collection, shoreline parks and public access, transportation facilities, commercial buildings, and ecosystems, many of which will experience regular inundation in certain locations around the Bay in the longer term [4]. The Sea Level Rise Adaptation Strategy for San Diego Bay report also found that within the next few decades, the greatest concern will be an increase in frequency of flooding that the region already experiences due to waves, storm surge, El Nino events, and very high tides. In addition, the Port of San Diego, located within San Diego Bay, is developing a Climate Mitigation and Adaptation Plan (Climate Plan) to address both reductions in greenhouse gases and local vulnerabilities to climate change. Preliminary sea level rise mapping efforts reveal that much of the Port's infrastructure will be inundated by higher sea levels when combined with storm events at 2050 and 2100[4].

Imperial Beach faces unique challenges from sea level rise as it is surrounded on three sides by water and has a relatively high population of lower to moderate income demographics [2]. The city plans to complete an update to their shoreline protection inventory and do an economic analysis of vulnerabilities and adaptation options in early 2017.

Tijuana River NERR is currently in the process of assessing vulnerabilities in the reserve to inform development of adaptation strategies. Vulnerabilities in this region are largely related to riverine flooding [6]. This effort will also analyze the river-ocean connection, sediment dynamics, flooding and inundation, and surface and ground water salinity.

LCP and Sea Level Rise Planning

Local Coastal Programs (LCPs) are planning tools used by local governments to guide development in the coastal zone, in partnership with the Coastal Commission. LCPs specify the appropriate location, type, and scale of new or changed uses of land and water and include a land use plan and measures to implement the plan (such as zoning ordinances). The Coastal Commission has awarded three rounds of the Local Assistance Grant Program since January 2014 to support certification and updates of LCPs, with an emphasis on addressing the impacts of climate change. Within this county, San Diego County (Round 2) and the Cities of Oceanside (Round 3), Carlsbad (Round 2), Solana Beach (Round 1), Del Mar (Round 2 and 3), and Imperial Beach(Round 3) have all been awarded grants from the Coastal Commission to address the impacts of sea level rise within their LCP jurisdictions. Other state agencies

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such as the State Coastal Conservancy and Ocean Protection Council (OPC) have awarded grants to support addressing sea level rise in LCPs, including grants to conduct local vulnerability assessments. Table 1 below shows whether jurisdictions have LCPs that address sea level rise. "In part" means an LCP segment has some explicit policy language addressing sea level rise and "in progress" refers to jurisdictions with LCP grants for addressing sea level rise.

Table 1. LCP Planning in San Diego County (as of Dec. 2016)

Jurisdiction/Segment	Certified LCP?	State Grant?	Vulnerability Assessments	Updated for SLR?	Shoreline by Jurisdiction
San Diego County	No	CCC	Yes [1,5]	In Progress	None
City of Oceanside	1986	CCC	Yes [1]	In Progress	5%
City of Carlsbad	-	OPC,CCC	Yes [3]	In progress	9%
Agua Hedionda Segment	No	(See above)	(See above)	(See above)	
Mellos I Segment	1996				
Mello II Segment	1996				
West Batiquitos/Sammis Segment	1996				
East Batiquitos/ Hung Segment	1996				
Village Redevelopment Area Segment	1987				
City of Encinitas	1995	No	Yes [7]	No	8%
City of Solana Beach	No	CCC	No	In Progress	2%
City of Del Mar	2001	OPC, CCC	Yes [1,4,8]	In Progress	4%
City of San Diego	No	No	Yes [5]	No	23%
North City Segment	1988	No	No	No	
La Jolla Segment	1988	No	Yes [1]	No	
Pacific Beach Segment	1988	No	Yes [1]	No	
Mission Beach Segment	1988	No	Yes [1]	No	
Mission Bay Segment	No	No	Yes [9]	No	
Ocean Beach Segment	1988	No	No	Yes	
Peninsula Segment	1988	No	No	No	
Centre City Segment	1988	No	No	No	
Barrio Logan Segment	1988	No	No	No	
Otay Mesa/ Nestor Segment	1988	No	No	No	
Tijuana River Segment	1988	No	Yes [6]	No	
Border Highlands Segment	1988	No	No	No	
City of Coronado	1984	No	Yes [1,5]	No	5%
City of National City	1991	No	Yes [5]	No	None
City of Chula Vista	1985	No	Yes [5]	In Part	None
City of Imperial Beach	1984	SCC, CCC	Yes [1,5], In Progress [10]	In Progress	3%
Federal Lands, State lands, University lands, and Ports					41%

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Coastal Act Management Priorities

San Diego County faces significant sea level rise vulnerabilities in every sector. The county must address longer-term impacts to its extremely valuable beach and lagoon resources, as well as flooding, continued shoreline erosion and increased demand for shoreline protection in the urban areas. Some top priorities by Coastal Act themes are presented below.

Public Access and Recreation (Coastal Act Sections 30210, 30211, 30213, 30220, 30221)
One of the highest priorities in the Coastal Act is the mandate to protect and maximize public access to the coast. Sea level rise in San Diego County could lead to a loss of public access and recreational opportunities due to permanent inundation, episodic flooding or erosion of beaches, recreational areas, and trails. Coastal communities in San Diego County, through SANDAG, have already joined together on two regional beach sand replenishment projects. With planning, funding, and collaboration, local governments can expand this coordination into regional efforts to preserve beach areas and relocate public access ways that will be lost as sea level rises. Coordinated regional shoreline management planning with federal government, state agencies and local governments will help in this process. Adaptation planning should include analysis of the costs and benefits of sand replenishment as a long-term adaptation approach to help San Diego communities better understand the feasibility and consequences of implementing this strategy. This analysis should also account for the greenhouse gas contributions associated with beach replenishment projects.

Coastal Habitats, ESHA, and Wetlands (Coastal Act Sections 30230, 30231, 30233, 30240)
San Diego County contains more lagoons and wetland habitats than any other coastal county. Sea level rise threatens sandy beach, intertidal, wetland and lagoon habitats because of saltwater intrusion, drowning of marsh habitat, and vegetation conversion. There is a need for additional study on how managing water flows with tide gates can affect shoreline habitats and their ability to migrate with sea level rise because understanding this relationship will be critical to informing options to preserve or restore coastal wetlands. With sea level rise, it is possible that habitat mitigation and restoration projects (e.g., efforts in San Dieguito Lagoon restoration for Southern California Edison) will fail to meet restoration benchmarks in the long term. Where environmentally sensitive lands are outside the jurisdiction of local government (e.g., military land, ports), Coastal Commission review of federal activities will continue to be very important.

Coastal Development and Hazards (Coastal Act Sections 30235, 30236, 30250, 30253)
There is a need throughout San Diego County for shoreline management planning in LCPs to address residential development vulnerable to sea level rise. A common, challenging development pattern in most coastal communities is the proximity of residential development directly adjacent to sandy beaches or the edge of coastal blufftops. These communities are often protected by a patchwork of private seawalls and revetments which will eventually cause the beach area (which hosts habitat and recreational amenities) to be lost as sea levels rise. To address this challenge, local governments should consider a comprehensive set of rules for redevelopment and reevaluation of existing seawalls, as well as strong policies and direction for assuring that private shoreline structure development on public lands fully mitigates the impacts to public access and recreation, and other coastal shoreline resources. Other important developed assets that need long-term sea level rise planning in the county are energy plants, wastewater facilities, railroads, and roads. Adaptation planning for these assets will require multi-agency coordination and collaboration to develop feasible and cost-effective solutions that are consistent with the Coastal Act.

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Coastal-dependent Development/Ports (Coastal Act Sections 30703 – 30708)

Sea level rise could cause a variety of impacts to ports, including flooding and inundation of port infrastructure and damage to piers and marina facilities from wave action and higher water levels. There is a need for additional study to better understand vulnerability for the varied coastal dependent resources located in the Port of San Diego, Mission Bay, Agua Hedionda Lagoon and Oceanside Harbor (shipyards, industrial, commercial, public lands, military), as well as vulnerability of habitats, and public access and recreation in these areas.

Additional Considerations

- With planning, funding, and collaboration, local governments could create shoreline management plans for phasing adaptation actions that are a combination of protection, accommodation, and retreat strategies.
- For communities with significant residential development along the shoreline, establishing zoning overlays with design standards for new development or modification of existing buildings in vulnerable areas could be an effective way to ensure that structures can withstand flooding.
- For many San Diego County coastal-dependent uses, adaptation options to address sea level rise may be more limited (i.e. elevation approaches for ports, piers, breakwaters, etc.).
- Local governments in San Diego County should also capitalize on the results of NOAA's Regional Coastal Resilience Grant award to the San Diego Regional Climate Collaborative for regional coordination on sea level rise adaptation planning.

References

[1] Messner S, K Green, C Phillps, J Dudley, D Cayan, E Young. 2009. "Climate Change Related Impacts in the San Diego Region by 2050."

[2] California Coastal Commission South Coast District Staff Interview. July 22, 2016.

[3] City of Carlsbad. 2016. "Draft City of Carlsbad Sea Level Vulnerability Assessment."

[4] ESA. 2016. "Administrative Draft: City of Del Mar Sea-Level Rise Adaptation Plan."

[5] ICLEI-Local Governments for Sustainability. 2012. "Sea Level Rise Adaptation Strategy for San Diego Bay."

[6] Tijuana River National Estuarine Research Reserve. 2014. Climate Understanding & Resilience in the River Valley (CURRV) Project Workshop on Scenario Planning

[7] City of Encinitas. 2010. "City of Encinitas General Plan Update. Current Conditions Report. Chapter 16: Coastal Conditions."

[8] ESA. 2016. "Final Draft. Coastal Hazards, Vulnerability, and Risk Assessment Del Mar, CA."

[9] Gersberg R. "Mission Bay 2.0 M Sea Level Rise." Maps produced for San Diego Coastkeepers

[10] Revell Coastal, LLC. 2016. "City of Imperial Beach Sea Level Rise Study." Coastal Conservancy Climate Ready Grant deliverable