



Sea Level Rise Adaptation Strategy for San Diego Bay

Executive Summary

January 2012



Prepared by ICLEI-Local Governments for Sustainability for the project's Public Agency Steering Committee, with the support of The San Diego Foundation.

PROJECT PARTNERS



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The Coastal Training Program (CTP) is part of the National Oceanographic and Atmospheric Administration's (NOAA) National Estuarine Research Reserve System (NERRS) and provides training and technical assistance to individuals who are responsible for making decisions that affect coastal resources. At the Tijuana River NERR, CTP works to improve decision-making at local and regional levels by equipping coastal decision-makers with science-based information and tools they need to address coastal resource management issues in the San Diego and Baja California regions.

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Figure 4.5: Kristen Goodrich

Figure 4.6: San Diego Coastkeeper

Figure 4.7: Kristen Goodrich

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EXECUTIVE SUMMARY

The San Diego region is a center of economic activity, diversity, and culture in Southern California. The region has long been known for its remarkable landscape, biological diversity, economic prowess, and prestigious academic institutions, and many have acclaimed it as one of the nation's most livable communities. While the region's growth and status as an economic center is projected to continue for the foreseeable future, real threats to this status are posed by the impacts of climate change. Among these expected climate change impacts, perhaps none poses a greater risk than sea level rise. This century, elevation of average high tide could change by as much as 1.5 meters, or approximately five feet.

San Diego is a region defined by its relationship with the coast and heavily invested in its coastal communities. San Diego Bay, in particular, is a treasured asset, the anchor of the regions' tourism and military economies. With so much at stake, it is critical to begin considering policy responses long before the worst impacts associated with sea level rise are projected to occur, because developing and implementing solutions will require unprecedented collaboration with long lead-times, and because infrastructure is being built now that will be vulnerable to impacts in the future. To begin, a Public Agency Steering Committee comprised of staff from the five bayfront cities, the San Diego Unified Port District, and the San Diego County Regional Airport Authority came together to develop this *Sea Level Rise Adaptation Strategy for San Diego Bay* (Adaptation Strategy). The Adaptation Strategy consists of two primary components: a Vulnerability Assessment that evaluates how community assets could be impacted by sea level rise, and Recommendations for building the resilience of those community assets.

The Adaptation Strategy was prepared by ICLEI-Local Governments for Sustainability through a collaborative, regional stakeholder process that included most of the public agencies and private sector representatives with a major interest in the future of San Diego Bay. Over the course of multiple workshops, stakeholders and technical advisors developed common assumptions and consensus-based recommendations that should form the basis of the region's climate adaptation planning going forward. The Adaptation Strategy is a living document that can be implemented by local agencies and re-evaluated as new information becomes available in the coming years.



Sea Level Rise Scenarios and Impacts

Greenhouse gas emissions from human activities are trapping heat within the Earth's atmosphere, leading to a well-documented warming trend in average global temperatures. As the Earth warms, oceans undergo thermal expansion and sea levels rise; over the past century, sea level in San Diego has risen by just under one inch per decade on average. The scientific community expects the rate of sea level rise to increase as

higher concentrations of emissions lead to faster warming and the melting of glaciers into the ocean. Rising seas can lead to widespread flooding and erosion in low-lying areas, as well as impacts such as shifting habitats and rising water tables.

While these concepts are widely agreed upon, there remains significant uncertainty around the timing and severity of sea level rise, particularly in the latter half of the century. The State of California the use of projections of between 10 and 17 inches (26 to 43 cm) in 2050 and of 31 to 69 inches (78 to 176 cm) in 2100.¹ The Adaptation Strategy project utilized sea level rise assumptions on the upper end of this range to ensure a risk-averse approach to planning.

Vulnerability Assessment Findings

The Vulnerability Assessment evaluates where and when sea level rise impacts may occur, as well as the extent to which exposed community assets would be impaired by an impact and whether they may be able to cope or adapt on their own. The assessment was conducted through a combination of modeling, mapping, and intensive consultation with the project's Technical Advisory committee. Key findings of the Vulnerability Assessment include:



- In the next few decades, the greatest cause for concern will be an increase in the kind of flooding that the region already experiences due to waves, storm surge, El Nino events, and very high tides. When planning for this period, an emphasis should be placed on preparing for more common and more severe extreme events.
- Starting around mid-century, the Bay may become more vulnerable to regularly-occurring inundation of certain locations and assets, some of which are being planned and built today. As a result, this longer-term risk of inundation should be a consideration in today's decision-making.
- The most vulnerable sectors in the community include stormwater management, wastewater collection, shoreline parks and public access, transportation facilities, commercial buildings, and ecosystems.

¹ State of California, Sea Level Rise Task Force of the Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT), *Sea Level Rise Interim Guidance Document*. October 2010.

Primary Vulnerabilities by Sector

Ecosystems and Critical Species

- Bay ecosystems, which provide habitat for many endangered and threatened species, are extremely vulnerable to **inundation** that is expected to result in habitat shift. These shifts could cause the loss of irreplaceable habitats for critical species in many areas.
- Upland areas are vulnerable to **erosion**, and subtidal ecosystems are threatened by erosion of upland areas when it results in degraded water quality.

Contaminated Sites

- Hazardous waste sites are highly vulnerable to **flooding and inundation** as storage tanks in the area could be opened or moved, or motors and pumps could be impaired thus releasing contamination into flood waters or area soils.

Stormwater Management

- In all scenarios, storm sewers are highly vulnerable to **flooding and inundation** in the Bay due to higher sea levels, a condition that would result in localized flooding in very low-lying inland areas.

Wastewater

- Sanitary sewers in low-lying locations will be vulnerable to **floodwater inflow** which could exceed their capacity, potentially resulting in discharge of wastewater to the Bay.
- The entire wastewater collection system in the planning area will be vulnerable to **inundation** impacts.

Potable Water

- Above-ground water distribution components such as valves, meters, and service points will be vulnerable to **flooding and inundation**.

Energy Facilities

- Above-ground electricity transmission and distribution in limited areas will be vulnerable to **erosion**, particularly after 2050 and during major storm events. Erosion could undermine infrastructure, causing outages or safety issues.
- Above-ground electricity transmission and distribution will be moderately vulnerable to **flooding and inundation**, particularly in the 2100 timeframe when more components are likely to be exposed to regularly-occurring flood events.

Local Transportation Facilities

- Access provided by local transportation facilities will be vulnerable to **flooding and inundation**, particularly in the 2100 timeframe when more components are likely to be exposed to regularly-occurring inundation.
- Roads and other facilities could also be vulnerable to **flooding and inundation** due to saturated soils and impacts on road substructure and pavement degradation.

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| <p>Building Stock</p> <ul style="list-style-type: none"> ➤ Residential buildings have a low vulnerability to flooding in the 2050 scenario due to limited exposure. They are highly-vulnerable to flooding and inundation in the 2100 scenarios as exposure expands to large portions of residential neighborhoods and major commercial facilities. |
| <p>Emergency Response Facilities</p> <ul style="list-style-type: none"> ➤ Fire stations in San Diego and Coronado are moderately vulnerable to flooding in the 2100 Extreme Event scenario. |
| <p>Parks, Recreation, and Public Access</p> <ul style="list-style-type: none"> ➤ Shoreline parks and recreational facilities are extremely vulnerable to regular inundation due to extensive exposure around the Bay and high sensitivity to inundation impacts. ➤ The system is highly vulnerable to flooding because of extensive exposure and high sensitivity, but adaptive capacity to cope with flooding is higher than for most other systems. |
| <p>Regional Airport Operations</p> <ul style="list-style-type: none"> ➤ Parts of the Airport site will be vulnerable to localized flooding from blocked storm outfalls in the Bay. ➤ In the 2100 scenarios, Airport operations will be extremely vulnerable to Bay flooding and inundation, particularly from impacts on access roads, future terminal areas, and portions of the runway/airfield. |
| <p>Vulnerable Populations</p> <ul style="list-style-type: none"> ➤ Many groups that are currently vulnerable – such as low-income residents, the homeless, elderly, and ethnic minorities – will face even greater threats from future flooding, particularly in the 2100 timeframe. ➤ Residents that work in sectors that could be adversely impacted by future flooding are also a key vulnerability for the region. |

Adaptation Strategies

As described above, the region faces a multitude of threats from a rising Bay. While it is critical that the region play its part in reducing the global greenhouse gas emissions that cause sea level rise, it must also be recognized that the seas are already rising and this trend is expected to intensify. Preparing for these changes through climate adaptation is necessary to fulfill the public obligation to protect public safety, health, and quality of life. Participants in this project identified the following ten “comprehensive strategies,” designed to address multiple impacts, sectors, assets, and timeframes. In addition to these comprehensive strategies, a set of “targeted strategies” were developed to address the specific vulnerabilities of each community sector; these targeted strategies are described in the main body of the Adaptation Strategy.

Comprehensive Strategies

1. Create a staff-level regional sea level rise (SLR) adaptation working group consisting of representatives from public agencies around San Diego Bay to implement the Adaptation Strategy.
2. Provide regular opportunities for stakeholder engagement around implementation of the Adaptation Strategy.
3. Create and enhance existing outreach, education, training, and peer exchange programs tailored to public agency staff, stakeholders, and the general public.
4. Establish and promote a regional research agenda to advance understanding of sea level rise impacts, vulnerabilities, and adaptation responses in the San Diego region.
5. Engage regulatory agencies to advocate for clear and consistent regulatory guidance on how to address sea level rise impacts in development permitting.
6. Engage the Federal Emergency Management Agency (FEMA) to encourage the incorporation of future risks from sea level rise into non-regulatory maps associated with upcoming Flood Insurance Studies (FIS).
7. Institutionalize or mainstream sea level rise adaptation by incorporating sea level rise and associated impacts into relevant local and regional plans and projects.
8. Consistently utilize guidance provided by the State of California Climate Action Team in developing sea level rise assumptions for planning purposes.
9. Perform more detailed vulnerability assessments at a site-specific level as significant plans or capital projects are undertaken.
10. Develop decision-making frameworks in each jurisdiction for selecting and implementing appropriate management practices in communities vulnerable to inundation or regular flooding, utilizing such frameworks as risk management and cost/benefit analysis.

Next Steps

Many of the recommendations in this Strategy are intended for consideration and implementation in each of the participating local jurisdictions in their own planning processes, such as Climate Mitigation and Adaptation Plans in the City of San Diego and Port of San Diego, and in bayfront planning in Chula Vista. A key next step will be to communicate these recommendations to local officials and stakeholders for adoption in local plans. Regional coordination in building resilience to sea level rise will continue to be critical, and the Public Agency Steering Committee will continue to meet to begin implementing the Adaptation Strategy, with support from ICLEI and The San Diego Foundation, in 2012.