# Case Study 22:
# Developing a Multiagency Vision for an Urban Coastline, *Golden Gate National Recreation Area, California*

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**Left:** The south end of Ocean Beach is eroding. Image credit: Steve Ortega, NPS. **Right:** Erosion below the Great Highway along Ocean Beach is believed to be exacerbated by development around San Francisco Bay. Image credit: NPS with photo from Google Earth 2013.

## Goals

Golden Gate National Recreation Area is collaborating with local, state, and federal agencies to develop a long-term management strategy for Ocean Beach, where bluff erosion threatens natural and recreational resources, wastewater infrastructure, and a roadway (the Great Highway). Sea level rise and increased storminess are expected to increase the frequency of erosional events.

## Challenges and Needs

Ocean Beach, located within the park, includes 5.6 km (3.5 mi) of beach that borders a significant portion of infrastructure along the western shoreline of San Francisco. Beach width varies, and the backbeach includes seawalls, constructed dunes, and parking areas. Ocean Beach is the park's most important resource for wintering and migrating shorebirds and supports two threatened bird species. It is also a popular destination for recreational activities including birdwatching, surfing, and dog-walking. The beach is located adjacent to a major tidal inlet and in the shadow of the ebb tidal delta at the mouth of San Francisco Bay.

Over the last century, a significant volume of sediment has been removed from San Francisco Bay through dredging and mining, which has reduced sand supply to the ebb-tidal delta and open coast beaches and has changed wave energy distribution along Ocean Beach. These factors have contributed to a persistent beach erosion hotspot along the southern reach of Ocean Beach that continues to threaten the Great Highway and city wastewater infrastructure that is located beneath the roadway. Episodic El Niño events over the last 20 years have caused significant bluff erosion, and various bluff protection efforts (i.e., rock revetment, sand bags, sand placement) have been emplaced in an attempt to protect city infrastructure. Extensive rock revetments placed in 1998 and 2010 have negatively impacted aesthetics, habitat value, and coastal processes. The National Park Service (NPS) and regulatory agencies urged the city to discontinue this practice and use "softer"

engineering techniques, as it did in 2012, when approximately 58,100 cubic m (76,000 cubic yd) of sand was backpassed from the north end of Ocean Beach to the erosion hotspot at the south end.

Multiple federal, state, and local agencies share jurisdiction of Ocean Beach, but, until recently, lacked a shared management strategy. Because of the complex jurisdictional management, landowners and stakeholders sought assistance from the San Francisco Planning and Urban Research (SPUR) nonprofit organization to facilitate a planning process to develop a comprehensive management plan.

### Responsive Actions

The resulting Ocean Beach Master Plan provides a management framework that incorporates recommendations for coastal adaptation including managed retreat, infrastructure relocation, beach nourishment, and dune restoration.

Although the Ocean Beach Master Plan is not a compliance document, the consensus-based plan will help to guide short- and long-term management actions (e.g., storm impact response) so that long-term feasibility and resource impacts are considered in a way that is compatible with the common vision developed for Ocean Beach. To be implemented, the proposals in the Ocean Beach Master Plan will be subject to environmental review including additional technical analysis, consideration of project alternatives, and public outreach. The timing of the plan's adaptive approach will be driven by how, and how quickly, erosion occurs.

Some of the recommendations in the Ocean Beach Master Plan are expected to be implemented in the near term whereas other actions may not be implemented for several decades. For example, a vulnerable section of the Great Highway will be narrowed and eventually closed over the next decade, with new coastal access parking and a trail to improve user access. The timing of beach nourishment alternatives described in the plan will vary depending on the scope and availability of funding. Although sand backpassing may continue to be implemented as a tested method with a clear compliance pathway, additional data are required to understand the feasibility of other beach nourishment alternatives described in the plan. Those alternatives will require a large volume of sand to develop dunes and a beach in areas that are currently subject to extreme erosion. The plan is based on the assumption that the US Army Corps of Engineers (USACE) will pump large volumes of sand onto the beach as a beneficial reuse of sediment dredged from the San Francisco Bay navigation channel. The expected persistence of material placed in this location is currently unknown; additional research, conceptual design, and regulatory compliance will be required to understand the feasibility and cost of implementing the plan. Project funding will likely require a phased approach, which has yet to be described.

Several data collection efforts will support development of the plan alternatives, and continued monitoring will be an important component of any alternative that is implemented through the plan. With funding from the NPS, San Francisco Public Utilities Commission, and California Coastal Conservancy, SPUR technical studies for design development are currently underway. The studies focus on understanding coastal dynamics as they relate to current and future protection of city utility infrastructure; transportation planning for rerouting the Great Highway to an inland location; and visitor amenities. The US Geological Survey (USGS) Coastal and Marine Geology Program monitors nearshore bathymetry and beach morphology, and has completed extensive bathymetric and sediment mapping offshore and inside San Francisco Bay. The USGS has also monitored dredge disposal sites to examine sediment transport patterns, and has developed numerical models to understand historic beach change and erosion mechanisms, and to predict future geomorphological changes. The USACE has funded significant portions of this research and also collects monitoring data related to dredging efforts. The park monitors two threatened bird species along Ocean Beach including the state-threatened bank swallow. The colony at Ocean Beach is one of only two known

coastal bank swallow colony sites in California. The park has requested that monitoring of bluff conditions and protection of bank swallow habitat be considered in permits issued for short-term stabilization projects.

Improvements over the next three years will include removal of asphalt from the parking lots and roadway near the eroding bluff edge and the narrowing of the Great Highway as an initial step toward its future closure. Measures which may be used in the short term to address storm impacts may include additional sand backpassing, sandbag placement, and consolidation of existing rubble on the beach to stabilize the toe of the bluffs. Most recently, in October 2014, the 2012 renourishment strategy was repeated; approximately 22,900 cubic m (30,000 cubic yd) of sediment was backpassed from the accreting north end of Ocean Beach to the erosion hotspot at the south end of Ocean Beach. As the longer-term strategy of managed retreat is implemented, the artificial rock, rubble, and sandbags will be removed, allowing for the enhancement of beach and dune habitat.

The project is ongoing. This case study is an example of the following adaptation strategies:

- Incorporating climate change into policies, plans, and regulations
- Reducing non-climate stressors (e.g., sediment management)
- Coordinating planning and management across institutional boundaries
- Conducting/gathering additional research, data, or products
- Conducting vulnerability assessments and studies
- Making infrastructure resistant or resilient to climate change
- Managed retreat of built infrastructure

### For more information:

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Barnard, P.L.; Hansen, J.E., and Erikson, L.H., 2012. Synthesis study of an erosion hot spot, Ocean Beach, California (USA). Journal of Coastal Research, 28(4), 903–922. West Palm Beach (Florida), ISSN 0749-0208. http://www.bioone.org/doi/pdf/10.2112/JCOASTRES-D-11-00212.1 (accessed 3 February 2014).

Barnard, P.L., Jaffe, B.E., and Schoellhamer, D.H., editors. 2013. A multi-discipline approach for understanding sediment transport and geomorphic evolution in an estuarine-coastal system: San Francisco Bay. Marine Geology 345: 1-326. http://www.sciencedirect.com/science/journal/00253227/345/supp/C (accessed 3 February 2014).