

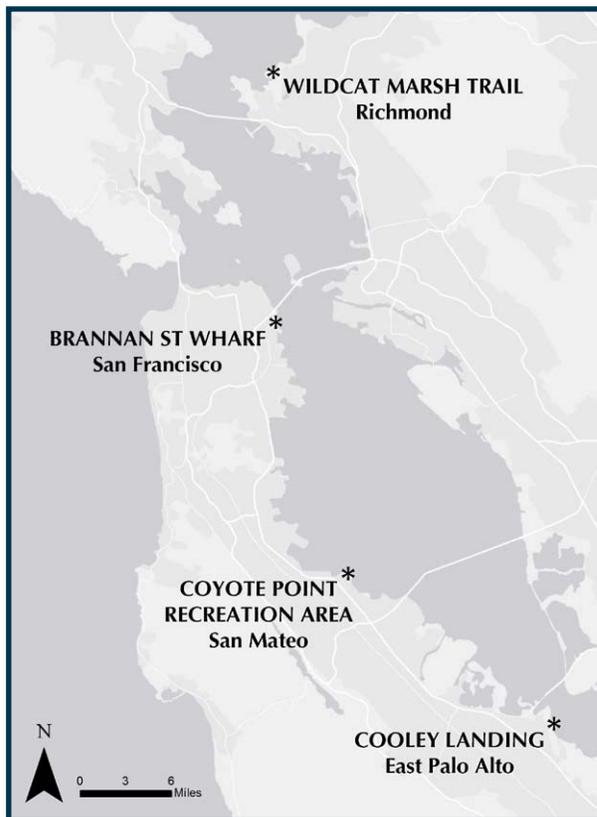
CLIMATE CHANGE ADAPTATION IN ACTION

Designing Public Shoreline Spaces for a Rising Bay

Synopsis

Shoreline trails, parks and other public access areas along the San Francisco Bay are important community assets that provide a range of recreational and enjoyment opportunities to the public. Agencies that manage these valuable areas are beginning to factor future sea level rise into project design, budgeting and management. The Port of San Francisco, San Mateo County Parks Department, East Bay Regional Park District and others recognize that shoreline public spaces will be increasingly threatened by flooding and erosion as the bay rises.

Public spaces designed for sea level rise: Examples from around San Francisco Bay.



Presented here are four examples of how agencies have considered sea level rise in planning new public access projects. They assessed how these public spaces may be affected by sea level rise impacts, and made design and management changes to minimize public safety risks and financial liabilities. For some managers the analysis of future flooding impacts was straightforward, but others had to consider changes in erosion rates and wave effects on large infrastructure in order to develop project designs that would be resilient to a rising Bay. In all cases, managers selected strategies that fit their existing project goals, plans and budget constraints. Future sea level rise contributed to the design of appealing shoreline spaces that the public will enjoy for many decades to come. By designing public spaces to fit current and future needs, these projects are leading the way towards a resilient and accessible Bay Area shoreline.

THE LAY OF THE LAND

As one of the largest estuaries in North America, the San Francisco Bay influences and enhances the natural, aesthetic, and economic quality of the entire nine-county Bay Area, much to the benefit of millions of residents and visitors. Access to the Bay provides for recreational activities, educational and interpretive opportunities and a means for alternative transportation. Diverse public access experiences are in great demand, both along urban waterfronts and natural shoreline areas, and the full potential for access to the 1,000-mile Bay shoreline has yet to be reached.

Brannan Street Wharf San Francisco



Source: Port of San Francisco

With the construction of the new Brannan Street Wharf, the Port of San Francisco will create a 1.3-acre public space on the San Francisco waterfront for enjoying dramatic views of the Bay Bridge and Central Bay, learning about the cultural and maritime history of the site, and accessing the Bay for boating. Less obvious, but equally important is the continued flood protection that the wharf will provide to the inland area. The project is located between Piers 30-32 and 38, and adjacent to the Embarcadero, a heavily-used four-lane boulevard including bicycle lanes, light rail in the median and a wide pedestrian promenade that is an iconic feature of the San Francisco waterfront.

The Port recognized sea level rise as an important issue early in planning the wharf, and considered two future sea level rise scenarios based on the San Francisco Bay Conservation and Development Commission's (BCDC's) *Living with a Rising Bay* report into their analysis of flood risks to the project: 16 inches at mid-century and 55 inches at end-of-century. Their analysis showed that flood events at mid-century could very easily overwhelm existing flood protection. By the end of the 75-year design life of the wharf, it could experience tidal flooding lasting one to two hours several times per year.

As Port planners and engineers reviewed design strategies for addressing sea level rise, they considered the dual role of the wharf as "safe and useful" public space and essential flood protection. They considered raising the wharf deck, but this proved unsuitable because the wharf public access must connect smoothly with the Embarcadero at its existing height, and preserve views of the Bay.

Recognizing that they would not be able to eliminate flooding on the wharf, Port staff identified design changes to reduce various impacts:

- Designing the deck structure to resist forces from wave action
- Using finishes that tolerate limited flooding
- Tilting the deck of the wharf up as it reaches out to the Bay
- Using a short, solid base on the perimeter railing to gain 12 inches of protection
- Raising a large lawn area by 18 inches to minimize salt water damage during storms

The Port estimated that this approach would make the wharf "safe and usable for 99% of design life days, and usable immediately after coastal flooding recedes." Occasional flooding of portions of the adjacent Embarcadero to the north, which is lower than existing flood protection, remains an issue – one that cannot be addressed through this development project. Crucially, the Port's strategy for addressing sea level rise at Brannan Street Wharf accommodates future changes to the Embarcadero, while maximizing near- and long-term benefits of this exciting new public space.

Coyote Point Park San Mateo County

Shoreline erosion, already a major management challenge for many jurisdictions, will increase with higher tides and changes in storm events. The San Mateo County Parks Department has long grappled with erosion of the beach and adjacent promenade at Coyote Point Recreation Area, a large, popular shoreline park that supports a variety of activities including swimming, windsurfing, boating, walking, biking and more. Waves, particularly during 2004-2005 storm events, have eroded the beach and undermined a portion of the promenade causing the asphalt pathway to fall away.

Erosion of the promenade at Coyote Point Park

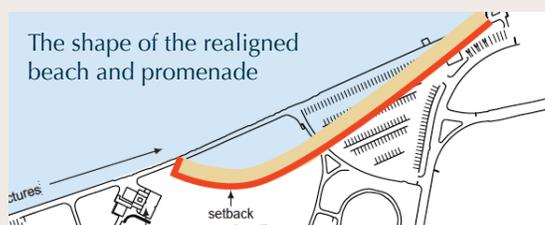


Source: Max Delaney, BCDC

In 2008 the Parks Department began exploring a sustainable solution to erosion of the shoreline and promenade that would provide good public access to the beach and water. After thoroughly assessing the site's history, hydrology and future exposure to sea level rise, the Department developed a plan to strengthen existing shoreline protection in some areas, and elsewhere maintain a natural shoreline that offers quality beach recreation. With 18 inches of sea level rise and a worst case scenario of erosion rates, the available beach above high tides should exceed 70 feet, a tremendous improvement to the current status of the Coyote Point beach.

FINDING THE RIGHT MIX

The San Mateo County Parks Department knew that a 'one-size-fits-all' design would not provide a sustainable solution for the Coyote Point Recreation Area beach and promenade. A mixture of approaches is needed. Along the park's eastern shoreline, where the goal is to restore the beach, the design calls for realigning the beach inland by 170 feet to create a shape that will help dissipate wave energy and reduce erosion rates. The new beach will be backed by a berm with vegetated dunes, and a new promenade with multiple access paths through the dunes to the beach.



Source: County of San Mateo

For the park's western shoreline, already hardened with riprap, the plan includes improvements to this shoreline protection to make the promenade and windsurfing access more resilient to sea level rise.

The design's success will depend on periodic nourishment of the beach, and site monitoring to identify when and how much nourishment is required. The Parks Department will look for opportunities to utilize this site as a local repository for beneficial reuse of sand from projects around the Bay.

Trade-offs were an important consideration for the Parks Department. The design requires shrinking a parking lot and removing a restroom. Parking spaces will be added elsewhere in the park and a new bathroom must be constructed. However, when the public access benefits and project costs were weighed against those of less sustainable designs, beach realignment emerged as the best alternative. Integrating sea level rise into the project planning enabled the Parks Department to identify a design with the best chance of performing well now and in the future.



Source: City of East Palo Alto

Cooley Landing, East Palo Alto

The City of East Palo Alto and the Midpeninsula Regional Open Space District have developed Cooley Landing, a nine-acre peninsula that juts out onto the Bay, into a new city park. The City's plan for the new park culminated years of engagement with and support from adjacent communities that envision low-intensity recreation, education, and conservation uses that preserve the natural and historic integrity of the site.

East Palo Alto has a critical lack of park space. For many years, residents of all ages have shared a common vision for Cooley Landing to be their first direct access to experience the natural wonders of San Francisco Bay.

The City committed to constructing the best park possible for the community, and this meant ensuring that the park would endure for the enjoyment of future generations.

Shannon Alford, City of East Palo Alto

The history of the peninsula played a central role in determining the ultimate park design. During the 1930s and 1940s Cooley Landing was a county dump for construction debris. Later, a private landowner imported additional construction debris and soils. These historic uses significantly raised the elevation of the site by as much as 13.5 feet relative to the surrounding tidal wetlands. Analysis of flood elevations with a 16-inch mid-century sea level rise suggests that few of the park features would be affected by flooding.

Taking advantage of and adding to the existing elevation of Cooley Landing was an important consideration in planning its transformation into a new park that will serve users for generations to come. For example, managers evaluated excavation and off-site disposal of all contaminated soil and waste materials. These costly efforts would have lowered the elevation of the peninsula thereby increasing the park's susceptibility to sea level rise. Instead, a less-costly two-foot cap was added to the site to contain contaminants in place, providing a win-win situation for reducing environmental and sea level rise risks to the future park. Further, a key piece of planned park infrastructure, a restored boat house that will become a nature education center, will be redeveloped with a first floor elevation more than four feet above the projected mid-century flood elevations.

Wildcat Marsh Trail, Richmond

The San Francisco Bay Trail is a recreational and transportation corridor that, when completed, will encircle San Francisco and San Pablo Bays with a continuous 500-mile network of bicycling and hiking trails. Three hundred and thirty miles of the Bay Trail are already in place, and where new segments of the trail are constructed, shoreline managers are factoring sea level rise into their trail designs.

In 2011 East Bay Regional Park District and West County Wastewater District completed the Wildcat Marsh Trail, a 0.8-mile segment of the Bay Trail along the western perimeter of the wastewater facility between San Pablo and Wildcat Creeks in the City of Richmond. In addition to hiking and biking, the trail offers scenic views across San Pablo Bay and opportunities to see wildlife and marsh habitats.

The project managers addressed sea level rise in development of the trail design in accordance with climate change policies of the project funder, the California Coastal Conservancy. Using a sea level rise estimate of 16 inches at mid-century, they developed a trail alignment that, at its lowest elevation, would still be well above future flood levels for the project design life of 20 years.



Source: Jeff Rasmussen

Recognizing that flooding may still affect this trail segment, the project managers chose surfacing and bridge construction materials to minimize damages and closures. Furthermore, the design allows for the trail to be readily elevated if necessary.

A key consideration in planning for the Wildcat Marsh Trail was the wastewater treatment facility. Portions of the trail sit atop the levee that currently protects the facility from flooding, but making major changes to the levee is well beyond the scope of the trail development. Future efforts to address sea level rise for the wastewater treatment facility will provide opportunities to plan for long-term preservation of this segment of the Bay Trail.

City of Richmond Mayor Gayle McLaughlin speaking at the Wildcat Marsh Trail dedication ceremony on September 8, 2012.



Source: Bruce Bayaert

NEXT STEPS*Brannan Street Wharf*

In March of 2012 demolition of Pier 36 and the Bulkhead Wharf between Piers 30-32 and 38 began in preparation for construction of the new wharf park, which is expected to be completed in June 2013.

Coyote Point Park

Improvements to the western side of the promenade are to be made in the summer of 2013. County staff is working to secure \$2,300,000 for construction of the eastern portion of the project, which includes the crenulate sandy beach.

Cooley Landing

The City of East Palo Alto finished the first phase of site renovation, and hosted a dedication ceremony for Cooley Landing in July 2012. With a \$5,000,000 grant from CA Department of Parks and Recreation, the City will complete future phases including the nature education center.

Wildcat Marsh Trail

The opening of the trail was celebrated in April 2011. The East Bay Regional Park District is working actively with the City of Richmond to close the remaining gaps in the Bay Trail along the Richmond shoreline.

For More Information

Brannan Street Wharf:

<http://www.sfport.com/index.aspx?page=262>

Coyote Point Park

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Cooley Landing

<http://www.cooleylanding.org/>

Wilcat Marsh Trail

www.ebparks.org

General information on climate change adaptation planning and educational can be found at:

http://www.bcdc.ca.gov/planning/climate_change/LocalGov.shtml

<http://collaborate.csc.noaa.gov/climateadaptation/>

<http://www.sfbaynerr.org/ctp/>

Who We Are

This case study was developed through a state-federal partnership of the San Francisco Bay Conservation and Development Commission (BCDC), the San Francisco Bay National Estuarine Research Reserve and the National Oceanic and Atmospheric Administration Coastal Services Center. The author of the case study is Sara Polgar, BCDC.

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PWA, Ltd. (March 2009). Coyote Point Recreation Area Phase 2 - Preliminary Design Report. Available at <http://www.co.sanmateo.ca.us/portal/site/parks/>

Callander Associates. (April 28, 2011). Memo: Sea Level Rise Analysis, Cooley Landing, East Palo Alto. BCDC Permit No. M2011.002.01

California Coastal Conservancy. (December 3, 2009). Staff Recommendation. San Francisco Bay Trail: West County Wastewater District Segment Construction. Conservancy File No. 07-063-10.