# ALBANY BEACH SHORELINE STABILIZATION AND BEACH/DUNE NOURISHMENT

Scott Fenical, Mott MacDonald, LLC, scott.fenical@mottmac.com
Chris Barton, East Bay Regional Park District, cbarton@ebparks.org
Jeff Peters, Questa Engineering, Inc, scott.fenical@mottmac.com
Frank Salcedo, Mott MacDonald, LLC, frank.salcedo@mottmac.com
Keith Merkel, Merkel & Associates, Inc, kmerkel@merkelinc.com

## PROJECT DESCRIPTION

The Albany Beach Restoration Project was initiated with the goal of stopping landfill erosion into San Francisco Bay, while creating aquatic habitat, and nourishing a pocket beach at McLaughlin Eastshore State Park, Albany, California. The site contains an existing sandy pocket beach which is unique to San Francisco Bay, and was formed by construction of the Albany Neck and Bulb, which was created as a landfill. Coastal engineering analysis, numerical modeling of coastal processes, and pocket beach morphology modeling were performed to evaluate and protect against erosion on the Albany Neck and prevent contaminant entry to the Bay, evaluate potential enhancement alternatives for the sandy pocket beach, and develop design criteria for living shorelines structures/habitat elements. In addition, analysis was performed to evaluate the stability of living shoreline structures, including a crescent reef with oyster shell nourishment, a pebble beach and groin system, avian roosting islands/breakwater elements, and tidepools.

## COASTAL ENGINEERING ANALYSIS

Existing site morphology was analyzed using historical LiDAR data, new multibeam survey data and new topographic survey data. The site was also characterized in a detailed habitat mapping program to focus the restoration design. A total of 22 sand samples were taken from the existing beach and dunes, on which sieve analysis was performed to characterize the existing site and assist in sand compatibility analysis for potential nourishment sources. Coastal engineering analysis and numerical modeling were performed to develop detailed site conditions data, including development of storm wave conditions on a Bay-wide scale with stationary phase-averaged modeling tools, as well as nearshore phase-resolving modeling tools. Bay-wide hydrodynamic modeling of tidal currents was performed to evaluate the influence of tidal currents at the site, and local currents generated by storm waves. Nearshore CFD modeling was also performed to evaluate transformation of waves through avian roosting island breakwaters, and to evaluate runup on the revetment and public access trail. Wave runup analysis was performed using combined wave and design water level data to evaluate levels of flooding on the proposed trail improvement area, as well as backshore (dune/behind dune) areas.

Analysis also included modeling of beach morphology with XBEACH (Roelvink et al. 2010). The XBEACH system was used in a fully 2D application that surrounded the entire pocket beach. The model was used to evaluate nearshore water levels, waves, wave-generated currents, and erosion/accretion patterns and beach profile adjustments. The model was used to reproduce observed beach profile adjustments (upper beach erosion) in the period 2012-2016. Analysis indicated that the period 2012-2016 included elevated Mean Sea Levels as measured in San Francisco, and typical wind energy. Once the existing profile adjustment was reproduced, XBEACH was also used to estimate potential future adjustments under similar conditions as well as conditions under sea level rise in the future, and the performance of different imported beach sand alternatives. All three sources were determined to be reasonably compatible, with the coarsest imported sand alternative being recommended in order to maximize re-nourishment intervals. Aeolian transport was also evaluated to determine the relative mobility of imported sand materials in order to minimize nuisance transport onto the public access trail immediately upland of the enhanced beach and dunes.

Results of the modeling and analysis were used to prescribe appropriate types, locations/elevations, and volumes of imported sand nourishment material to maximize the beach longevity and minimize re-nourishment requirements.

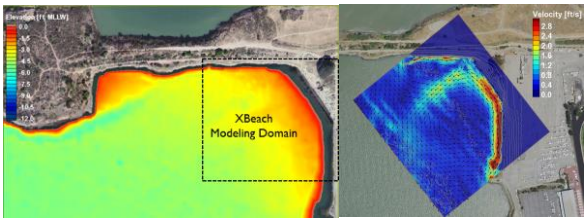


Figure 1 – Project site bathymetry and features, and XBEACH modeling domain (left), and nearshore wave-generated currents from XBEACH (right).

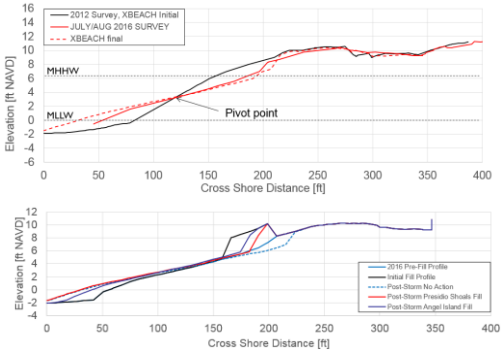


Figure 2 – Measured and reproduced beach profile changes at center of pocket beach (top), and beach profile adjustments through estimated four (4) years of storm activity for three beach nourishment material alternatives (bottom).


Figure 3 – Constructed pebble pocket beach, groin and roosting island breakwaters.