

**Memorandum – Coastal Engineering Review
GOGA Adaptive Management Plan (City and County of San Francisco)
TAR 10932**

19 October 2020

Review Request Summary:

GOGA

Coastal Engineering Review of Project Site Design

Introduction

This memorandum presents comments regarding the evaluation of the impacts on adjacent Fort Funston shoreline, including eroding bluffs and design elements of the southern terminus grading concept where it interfaces with Ft. Funston. All elevations are referenced to NAVD88 unless otherwise noted.

For this initial review, which we understand is time constrained, it should be first noted that the comments are based only from the perspective of overall design concepts for the Seawall Southern Terminus portion of the Ocean Beach Climate Change Adaptation Project. Further, this perspective is limited to the information as presented in the summary documents of the August 18 NPS meeting. As such EA was not tasked with nor did the team review calculations or other background design information in detail including but not limited to:

- Coastal engineering calculations
- Sediment transport calculations or modeling
- Geotechnical reports of the existing conditions
- Geotechnical design calculations for any options.

Based upon this limited information review, EA is providing initial observations for the Seawall Southern Terminus portion of the project in the Comments section below.

Issue review

At South Ocean Beach, shoreline erosion is threatening the most seaward component of the combined system; the Lake Merced Tunnel, a fourteen-foot diameter water pipe under the Great Highway. Other components are located just behind the tunnel. South Ocean Beach is subject to chronic coastal erosion, which becomes more acute during stormy El Nino winters, such as those of 1996-7, 2009-10, and 2015-16. Coastal Storms, compounded by the seasonally lower beach elevation, have undermined the bluffs and roadbed, resulting in exposed fill along the beach, and recession of the sandstone bluffs nearer to Fort Funston. In two locations, boulder revetments have been placed on the beach, limiting access and impeding coastal processes. The Ocean Beach Long-Term Improvements Project involves the implementation of coastal management strategies that include managed retreat (i.e., recontouring the bluffs and removing the Great Highway between Sloat Blvd. and Highway 35), removal of rubble and revetment rock from the beach and bluffs, continued beach nourishment, and installation of a low-profile sea wall to protect the Lake Merced Tunnel. This project will not only protect vital public wastewater infrastructure, but will also improve access, recreation, and habitat at South Ocean Beach. The Ocean Beach Long-Term Improvements Project, being implemented by the San Francisco Public Utilities Commission, is expected to begin construction in 2022.

As noted above, NPS has asked EA to provide input to the concept level designs for the Seawall Southern Terminus portion of the project only. There are three concepts for review are designated as follows: 1) Smooth Transition, 2) DSM Buttress, 3) Anchored Seawall.

Comments

General comments:

1. All 3 options appear to provide protection to the Lake Merced Tunnel (LMT) in the near term based upon distance from the treatment. It is understood overall resiliency of the LMT and the adjacent Southwest Ocean Outfall (SWOO) tunnel are a major focus of the project design. We would encourage that planning be continued to understand sea level rise impacts into the long-term future so that the design being considered presently will fit into the possible adaptive treatments over time for this area to meet the long term objectives for protection of this infrastructure along with other project objectives.
2. The design for stabilization should consider sea level rise projections for the duration of the design life of the seawall. It was not clear that this was taken into account within the concept sketches provided and meeting notes. Based upon these protections both wall design and the amount and number of sand replenishment operations over time could vary.
3. The treatment of the Seawall Southern Terminus area protection will likely hinge upon sand replenishment operations being conducted on a regular/recurring basis. Otherwise, based upon the water level elevation, the new low-profile seawall and alternative treatments at the Seawall Southern Terminus will be exposed to ongoing wave force which would limit their operational lifespan.
4. If the sand is removed by a storm and the low profile seawall/ alternative treatments are exposed to wave force there will likely be negative impacts (more wave energy) transferred to the adjacent unarmored shorelines along the Ft Funston beach and cliffs. This would have the effect of increasing erosion in this area of the shoreline.
5. Based upon the rate of erosion of the shoreline within the Seawall Southern Terminus area of up to 5 feet per year, a robust design will be needed to stabilize the area and to provide protection to the wastewater outfall and water tunnel.
6. The rock buttress seems to provide robust protection above the Southwest Ocean Outfall (SWOO) tunnel. However, was consideration provided for keeping the seawall intact above the SWOO as well as completion of the rock buttress to provide additional protection to the area over time?

Specific Option Comments:

Alternative 1: Smooth Transition. This design provides for cut-back and stabilization of the bluff which will interact with the adjacent landscape to provide a smooth tie in. This will establish a post construction condition where it is less likely that on-going erosion will readily out flank the Seawall Southern Terminus area over time. As noted above it will be important to maintain sand nourishment in front of this alternative as with all the alternatives presented. As indicated in the supplied information the design would likely not need adaptation through 2060.

Alternative 2: DSM Buttress. This approach utilizes the technology of Deep Soil Mixing (DSM) to provide a stabilized area of soil mixed with concrete/grout with the intent of providing greater resiliency to wave force over time compared with the existing substrate. DSM provides in-situ mixing of soil with cement to create a stabilized area. This technique in alternative 2 presented in the August 18 presentation stands to provide protection to the end of the Seawall Southern Terminus area. However, the higher density material of the completed DSM will likely lead to erosive forces from waves and wind flanking the DSM monolith over time and leaving possible

gaps to either side. This would possibly create increased erosion of surface material in these adjacent areas if the DSM structure is uncovered after storm events (once placed sand is removed by storm induced wave impact). This would leave a condition in which the DSM structure would need relatively more operations and maintenance efforts to maintain. This alternative would also more readily impact view-scape as well as stability of adjacent lands as compared with Alternative 1. The view-scape impact could be an issue, because if the placed sand is removed the generally more 'blocky' structure of the DSM will become visible. It is noted in the provided information that due to flanking of the structure, adaptative measures may be needed by 2060 as the adjacent bluff face erodes adjacent to the DSM structure.

Alternative 3: Anchored Seawall. The anchored seawall approach utilizes surface protection tied to the existing substrate through soil anchors. This deployment would have a similar disadvantage to Alternative 2 as it would be outflanked over time by erosive forces and could lead to greater erosion rates of the land immediately adjacent to the structure. This would then lead to a structure which is exposed over time and which visually appears as an outcrop compared to the adjacent land. Thus, although initially it may visually look similar to the existing coastline, over time it will differ significantly and would affect the view-scape. Treatment of adjacent areas to restrict erosion would likely be needed in a short time frame following construction. The protective nature of this treatment as with the others will hinge upon regular sand replenishment.