Red Light / Green Light: A Decade after the Start of Restoration, How is the South Bay Salt Pond Restoration Project Performing?

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The South Bay Salt Pond Restoration Project is the largest tidal wetland restoration project on the West Coast of the United States. As planned, the project will restore 15,100 acres of former industrial salt ponds to a mosaic of wetlands habitats for the benefit of native wildlife, public access, and flood risk reduction. As we finish up our first decade on the Project and ramp up design and planning for the next phase, we created a score card to gauge progress of our adaptive management program and investigations of key uncertainties. In collaboration with our project management and local science team, we derived a "traffic light" system for rating. Most topics were favorably in the green, including snowy plovers, sediment dynamics and mercury contamination; while water quality and island design for nesting birds clearly need more attention. This check-in comes at a time when funding uncertainties and impending sea level rise are key issues for us moving forward. However, we wish to acknowledge the progress that has been made in just 10 years: 3000 acres restored to the tides, 700 acres of ponds enhanced and reconfigured, and sightings of endangered species in new marsh habitat. The traffic light system can help guide the use of limited science and monitoring funds as we move forward with the next phase of restoration.

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Session Title: South Bay Salt Pond Restoration: Adaptive Management Success Story
Session Time: Wednesday 3:35 PM – 5:15 PM, Room 311-313

Sediment Supply for Restoring and Sustaining South San Francisco Bay Tidal Marsh

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The South Bay Salt Pond Restoration Project requires sediment deposition to succeed. Sediment is needed in restored subsided ponds to obtain elevations high enough for plant colonization and, along with organic accretion, to help sustain marshes as sea level rises. The primary source of sediment to the Project area is net southerly transport in South San Francisco Bay driven by tides, wind-generated currents, and wind-wave resuspension, particularly during dry periods.

Previous studies have shown that when freshwater enters Central San Francisco Bay from the Delta, Central Bay becomes fresher than South Bay, and the resulting density difference flushes South Bay and exports sediment out of South Bay. A tidal Froude number determines when tidally-driven or density-driven flows dominate and it accurately hindcasts a density-driven flushing event observed in 2011. Lack of density driven flushing during the recent drought likely increased sediment supply and deposition in the Project area as indicated by increasing suspended-sediment concentrations at Dumbarton Bridge. Flooding in local South Bay tributaries that results in large sediment delivery to the Project area has not occurred during the period of record of sediment flux measurements at the Dumbarton Bridge, so the threshold at which local tributaries begin to dominate sediment supply is unknown.

Given the importance of sediment to the ultimate success of the restoration, project managers are eager to understand the baywide trends and linkages. Additional work at the scale of the individual pond/marsh has indicated high accretion rates with little to no measureable erosion of the surrounding mudflats. To sustain these marshes in the context of sea level rise, managers are looking to reconnect marshes to natural sediment pathways and are participating in regional conversations about sediment management practices in the Bay.

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South Bay Salt Ponds Restoration: Managing for Mercury Contamination

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The South Bay Salt Pond Restoration Project has grappled with legacy mercury contamination from historic mercury mining operations, especially in the Alviso Complex in far South Bay, a known hot spot for mercury contamination within the San Francisco Estuary. This contamination gave restoration project managers pause in moving forward with a full tidal breach of the Pond A5/A7/A8 complex (Pond A8), as previous studies indicated that Pond A8 had some of the highest mercury levels detected in San Francisco Bay estuarine surface water, sediment, bird eggs, fish and other organisms. The concerns with opening up Pond A8 to tidal flows were twofold: 1) Opening Pond A8 would increase the sediment erosion in Alviso Slough, which would likely release additional mercury that had long been buried in the slough sediment, and 2) Opening Pond A8 might increase the mercury methylation and result in increased uptake of methylmercury in birds, fish, and other aquatic life. Methylmercury is the more toxic form of the compound and of most concern. In response, managers installed eight 5-foot gates on a levee between the pond and Alviso Slough. Starting in 2010, prior to the opening of gates in 2011, the effect of incrementally opening the gates over time was studied with respect to mercury speciation, concentration, mobilization and bioaccumulation within the pond itself, as well as in the adjacent slough. This presentation will describe the study results and the cooperation between scientists and managers to adaptively manage this pond complex.

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Measuring Waterbird Response to Salinity, Depth and Foraging Area Manipulation: An Experiment to Inform Adaptive Management

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The goal of the South Bay Salt Pond Restoration Project (Project) is to restore 50-90% of former salt ponds to tidal marsh and reverse historic wetland losses in the San Francisco Bay estuary. However, the Project is faced with the key challenge of balancing the needs of tidal marsh obligate species with those of waterbirds that depend on mud flats and managed former salt ponds. Project managers are currently exploring techniques to enhance managed ponds such that waterbird populations that can be sustained in fewer areas of open water. Towards this goal, the Department of Fish and Wildlife together with Ducks Unlimited reconfigured two former salt ponds (E12 and E13) in the Eden Landing Ecological Reserve with cells comprised of three different salinities and foraging berms designed to maximize prey resources for waterbirds. The U.S. Geological Survey is currently assessing the response of waterbirds and their invertebrate prey to experimental manipulation of salinity and depth within these experimental ponds, with the primary objective of determining optimal conditions for waterbirds during the key periods of wintering and spring migration. Waterbird density, foraging rates, habitat selection, invertebrate prey density and biomass, and water quality are measured at several spatial and temporal scales from September through May. Preliminary results suggest that invertebrate density is highest in low salinity cells, but diversity is greatest in medium and high salinity cells. Small shorebird are the most abundant waterbird guild using the ponds. Their use of different salinities varied across the winter, but their densities were highest in high salinity cells during most winter months. On-going analyses will define which pond and foraging berm characteristics are associated with highest densities of waterbird and invertebrates. Lessons learned from this experimental approach will help managers optimize pond characteristics to meet Project goals of maintaining pre-restoration waterbird populations.

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