Executive Summary

Sonoma Land Trust opened the 940-acre Sears Point Tidal Marsh Restoration site to the tides on October 25, 2015. Since that time, the site has seen tremendous evolution from its subsided diked agricultural bayland beginnings towards its future as a vegetated tidal marsh. The early years of restorations like this are always dynamic, reflecting rapid changes in physical conditions and associated ecological functions, and Sears Point is entirely in line with these expectations. This report provides a detailed analysis of the site's development between October 2015- October 2020, with limited topics extending through 2021.

Regulatory compliance overview

Project permits established a small suite of performance objectives and targets. The site has met 5-year objectives for establishing transition zone habitat in the northeastern "fishtail" basin, establishing effective and well used public access trails atop the levee, and establishing long-term integrity of the flood control levee. The site did not meet its tidal marsh vegetation target of 30 acres though it is progressing toward it. The site also did not meet its transition zone habitat targets along the main basin northern levee and the northern half of the western separator levee. The fall 2021 construction of a nature-based levee shoreline protection adaptive management project and its partial rebuilding of eroded habitat levee is anticipated to remedy this issue. It is too soon to assess the objective of developing 940 acres of tidal marsh over 30 years, though the site is progressing satisfactorily at this early stage especially following the fall 2021 adaptive management action.

Highlights of positive progress and ecological functions

Accretion

The site has accreted about 3 million cubic yards of sediment through natural deposition in the 4.75 years from breach to the most recent (June 2020) site-wide LiDAR topographic survey. These numbers reflect a cumulative deposition rate of about 0.6 ft/yr across these four years, with incremental rates varying from a high of 0.6 ft/yr in the first 1.75 years to 0.4 ft/yr from 2018 to 2020. Deposition thickness averages about 2.5 ft with a maximum thickness of more than 4 ft.

Avian use

The site has been utilized extensively by resident and migratory shorebirds and waterfowl. Species assemblages and uses have changed as site elevations rose. In the early days, the deeper water attracted more diving ducks and pelicans with shorebirds found less often and only around the intertidal margins. As elevations rose, the emerging mudflats presented vast habitat extents for shorebirds and more narrow use by deeper water birds as suitable water

depths had shorter durations. That being said, thousands of waterfowl have been observed each year during surveys, with Canvasbacks being the most abundant followed by Ruddy Duck, Greater Scaup, and Bufflehead. Dabbling ducks were present in lower numbers, led in abundance by Northern Pintail, American Wigeon, and Green-winged Teal. Least sandpiper, Dunlin, Willet, Western Sandpiper, American Avocet, Marbled Godwit, Black-bellied Plover, and Long-billed Dowitcher. were the most abundant shorebirds. Canada geese were observed nesting and raising broods in the early years but have not been observed more recently.

Fish use

One of the most striking (and expected) uses is by bat rays, evidenced by the thousands of foraging divets readily observable in air photos. Beyond that, fisherman are commonly observed on their boats in the site especially near the breaches, catching striped bass. Two sampling events were completed in May and October 2017, which yielded a total catch of 14,358 individual fish, with far higher fall abundance (12,766 fish) vs. spring (1,592 fish). Eighteen species total were collected along with three crustacean species. The fish community in spring was dominated by native Bay Goby, Starry Flounder, Topsmelt, and Pacific Staghorn Sculpin. Non-native gobies (Chameleon, Shimofuri, Shokihaze, and Yellowfin) and Striped Bass were also abundant. In fall, the native Topsmelt and Pacific Herring accounted for about 88 percent of the entire fish catch. Striped Bass was the most abundant non-native fish, followed by Chameleon and Yellowfin gobies. Two additional fish species, White Sturgeon (Green Sturgeon not likely) and Bat Ray, were visually observed by field crews but were never collected.

Large mammals

In the early years following the breach, river otters and seals were observed within the site, including a surfacing seal with a striped bass in its maw. Coyotes are frequently observed along the levees.

Establishing tidal marsh and ecotone vegetation

Tidally restored basins typically experience vegetation establishment early around the margins (levee slopes) where elevations are suitable. Sears Point is no exception. Where constructed slopes have remained stable, species including cordgrass, pickleweed, saltgrass, alkali heath, creeping wild rye and various other dicots have been establishing well, some through natural colonization and some through planting efforts. See below regarding areas of levee erosion. The Invasive Spartina Project (ISP) planted 57 of the interior marsh mounds and two of the sidecast ridges with native Pacific cordgrass, creating “nodes” of marsh spread within the site interior as elevations rise to suitable heights. As of June 2020, 19.7 acres of tidal marsh vegetation had established up to the high tide line, below the project goal of 30 acres. During the fall 2021 adaptive management project construction, and observations in early 2022 show active expansion of tidal marsh vegetation in many areas.

Nascent tidal channel development

Though still too early in the site evolution process to assess more than qualitatively, development of a tidal channel network has progressed positively. The constructed large subtidal channel has filled in considerably as expected – as the site accretes and tidal prism shrinks, these channels can be smaller to carry tidal flows effectively. Within the footprint of this channel, smaller channels remain. Numerous very small channels are forming off this main channel and connecting to the many moats around the marsh mounds, some may persist others may not. A few slightly larger channels are forming around the site, some associated with old farm ditches, some from scour into the farm field near the breaches, and some running alongside the levees. Channel development will be easier and more meaningful to assess in later years as the restored basin begins to have extensive vegetation establishment.

Highlights of challenges

Erosion of constructed "marsh mounds"

The most demonstrable early challenge was rapid erosion of the 490 constructed marsh mounds that were largely unvegetated substrate at time of breach. A graduate student at San Francisco State University's Estuary and Ocean Science Center, Margot Buchbinder, conducted her Masters research on these mounds. She documented their erosion, installed a variety of experimental treatments to test stabilization, and worked with the Invasive Spartina Project to plant a total of 49 mounds with native cordgrass between 2018 to 2021, with a portion of the total planted annually. The mounds lost 1.5 to 2 ft of elevation rapidly, within the first 1-2 years after tidal restoration. LiDAR data and field measurements show that the mounds planted earlier (in 2018) had a demonstrable positive effect on retaining and rebuilding mound elevations, suggesting the value of establishing marsh mound vegetation early. The lesson from this challenge is that vegetative stabilization before breach, as incorporated into the original restoration design, would likely be an effective erosion control measure. Vegetative stabilization would require 2 or more years of brackish water management within the site, controlled by pumps, tide gates or other methods.

Erosion of north and west habitat levees

The most significant challenge the project faced was extensive and ongoing erosion of the north and west habitat levees that faced the deeper parts of the restored basin. Constructed with 10:1 to 20:1 slopes, planted, and intended to provide ecotone habitats between tidal marsh and uplands, instead about two miles of levee suffered erosion, eating away at up to about 50 feet horizontal of the levee. The erosion events repeatedly impacted vegetation colonization – tidal marsh and low ecotone plants would colonize, begin to establish, then be eroded away. These problems led to construction of a large adaptive management project in fall 2021 that partially rebuilt the lower slopes of the habitat levee and installed nature-based features intended to

provide shoreline erosion protection. The efficacy of these actions will be assessed in the coming years. Levee erosion did not occur in two notable locations – adjacent to the dredge spoil ponds in the southwest corner of the site as these bermed and higher initial elevations functioned as an effective wave break, and the northeastern "fishtail basin" that was sheltered from strong wind-wave action. The lesson from this challenge is that vegetative stabilization of the shoreline, marsh mounds, and the "floor" of the basin – the original design intention for shoreline erosion protection – should be implemented in advance of opening the site to the tides. A recent example where pre-breach vegetation community establishment took place is the Dutch Slough Restoration Project in eastern Contra Costa County. At Dutch Slough, 25,000 tule plugs and 50,000 shrubs and trees were planted. Sites like Sears Point would likely rely on passive colonization by water borne seeds.

Invasive and overly dominant native plant species interference with establishing diverse ecotone vegetation

Though SLT and others put in considerable effort to pursue "competitive exclusion" approaches to promote establishment of target diverse native plant communities along the habitat levees, persistent drought and atypical timing of rain events slowed and limited establishment. Oddly, the most successful establishment of a highly desirable plant species for its soil stabilization and ecological functions – creeping wildrye (*Leymus triticoides*) – occurred on the inland side of the north levee where inadvertent dispersal following construction thrived. One challenging native plant – coyote brush (*Baccharis pilularis*) – has proven to be too successful. Though it provides roosting and nesting habitat for passerine birds, it has spread so effectively (through plantings and natural colonization) that it occupies extensive coverage and excludes other desirable ecotone native vegetation. Extensive stands were thinned as part of the fall 2021 adaptive management project, with the harvested plants used beneficially as brush fencing.