Seal Beach NWR

Thin Layer Salt Marsh Sediment
Augmentation Project

Kirk Gilligan - Refuge Manager, Seal Beach NWR
Thin Layer Salt Marsh Sediment Augmentation
Beneficial Use of Dredge Material by Thin Layer Placement

• First Study – 1978 Georgia

• Many applications since - TX, LA, GA, NC, MD

• Often used where natural systems of sediment deposition have been altered

• 2015/2016 – Seal Beach NWR - First thin layer addition project on west coast of US?
Refuge Purpose

“Preserve and manage the habitat necessary for the perpetuation of two endangered species – the light-footed clapper rail and CA least tern.”

“Preserve habitat used migratory waterfowl, shorebirds, and other water birds.”
What’s missing?
But of course!
Light-footed Ridgway’s Rail

LFRR Platform maintenance:
Built and replaced approximate 20 LFRR platform covers & bases. Maintained all 90 nesting platforms. Fall count – 102

Captive-bred rail release – 2014
Seal Beach NWR had the lowest mean elevation and mean elevation relative to MHW out of 8 CA marshes studied by UCLA and USGS.

- We conducted surveys with a Leica Real Time Kinematic GPS (± 2 cm x, y, z, accuracy)
- Surveyed along transects every 12.5m; transects separated by 50 m
- 4757 elevation measurements; 266 hectares

<table>
<thead>
<tr>
<th>Site</th>
<th>Hectares</th>
<th>Elevation Measurements (n)</th>
<th>Mean Elevation</th>
<th>Maximum Elevation</th>
<th>Minimum Elevation</th>
<th>Elevation Range</th>
<th>Mean relative to MHW</th>
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<tbody>
<tr>
<td>Humboldt</td>
<td>169</td>
<td>3020</td>
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<td>2.82</td>
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<td>Bolinas</td>
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<td>San Pablo Bay</td>
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<td>-0.17</td>
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<td>Morro Bay</td>
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<td>Pt. Mugu</td>
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<td>Tijuana Slough</td>
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<td>0.99</td>
<td>4.33</td>
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Why elevation challenged?

1. Diversion of freshwater inputs
   - Change in salinity
   - Reduction or loss of sediment inputs
2. Land subsidence – subterranean fluid extraction and tectonic action

Evaluation of Subterranean Subsidence at Seal Beach National Wildlife Refuge (Takekawa et al, 2013)

- Subsidence occurring at NWSSB at a rate of -4.13 mm/yr (SE ± 1.21 mm/yr)

- SBNWR is experiencing a relative sea-level rise rate three times more (6.23 mm/yr) than that of similar southern California marshes not experiencing subsidence
3. Sea level rise – historic and future

Naval Weapons Station Seal Beach

Mid sea-level rise scenario (93 cm by 2110)
Subsidence = 4.13 mm/yr

Vegetation Classes
- Upland
- Transition
- High Marsh
- Mid Marsh
- Low Marsh
- Mudflat
- Subtidal

0 500 1,000 2,000

USGS
science for a changing world
Project Goals

1. **Sediment** - Within 2 years of sediment augmentation, achieve a minimum 3 inch increase in the marsh plain elevation over pre-project conditions. Note: A 10” sediment layer will be applied during the application process.

2. **Cordgrass** - Within 2 years of sediment augmentation, achieve cordgrass stem lengths equivalent to pre-project conditions and achieve terminal cordgrass elevations higher than pre-project conditions.

3. **Invertebrates** - Within 2 years of sediment augmentation, achieve a diversity and abundance of invertebrates within the project sediments that is similar to the selected reference site.

4. **Light-footed Ridgway’s rails & Mig. Birds** - Within 1 year of sediment augmentation, provide foraging opportunities for migratory birds, and within 2 years provide foraging and nesting opportunities for light-footed Ridgway’s rail.
Sediment Characterization
Sediment Characterization Results

• Results report published and presented to SC-DMMT on May 28, 2014

• Grain size distribution (silt/clay/sand content) of Main Channel West dredge material similar to Refuge samples

• Chemistry, bioassay, and bioaccumulation testing of MCW material indicates suitability for SBNWR (or open ocean/LA-2) placement.
Sediment Application Methods

Slurry delivered via floating or submerged pipeline directly from dredge or barge

Photo by USACE
Sediment Application Methods (cont.)

Placed on Refuge via Rainbow Spray or end-of-pipe Baffle Impingement

End up pipe pointed horizontal, up, or angled toward baffle
Monitoring Program

An essential component of this adaptation action is monitoring to evaluate both the ecological response to the action and the overall effectiveness of the action (specifically, have the project objectives been achieved).
Proposed Monitoring

- Sediment elevations; thickness, and compaction rate of applied sediment
- Sediment movement and turbidity in adjacent channels
- Tidal creek status/formation/reformation post sediment application
- Vegetation monitoring/Plant community assessment – to include % cover, biomass, cordgrass terminal elevation, cordgrass stem length, cordgrass stem density, physiological plant condition
- Abiotic parameter description
- Eelgrass monitoring
- Infaunal invertebrate community structure
- Epifaunal community diversity
- General avian surveys – abundance & diversity
- Light-footed Ridgway’s rail monitoring
Implementation Schedule

Pre-project monitoring – Underway

Application of 10” sediment layer – Oct - Jan 2015/2016

Post-application monitoring – Initiate immediately following placement of sediment
Project Partners

- U.S. Fish and Wildlife Service
- OC Parks
- California Coastal Conservancy
- Naval Weapons Station Seal Beach
- State Lands Commission
- Southwest Wetlands Interpretive Association
- USGS – Western Ecological Research Center
- UCLA – Richard Ambrose, Ph.D.
- CSU Long Beach – Christine Whitcraft, Ph.D.
- Moffatt & Nichol
Data Dissemination/Outreach of Project Results

Issue post-construction monitoring reports annually

Develop a webpage to provide quarterly updates

Conduct a workshop/webinar to present monitoring results

Prepare a final report with lessons learned and recommendations for future projects
Bigger picture: End goal is to implement and evaluate the success of thin layer placement as a regional sea level rise and climate change adaptation strategy that can be used at regular intervals to ensure the long term sustainability of Pacific coast marshes.