CONNECTICUT
Association of Flood Managers

Improving Community Resiliency through Salt Marsh Elevation Enhancement

Presented by

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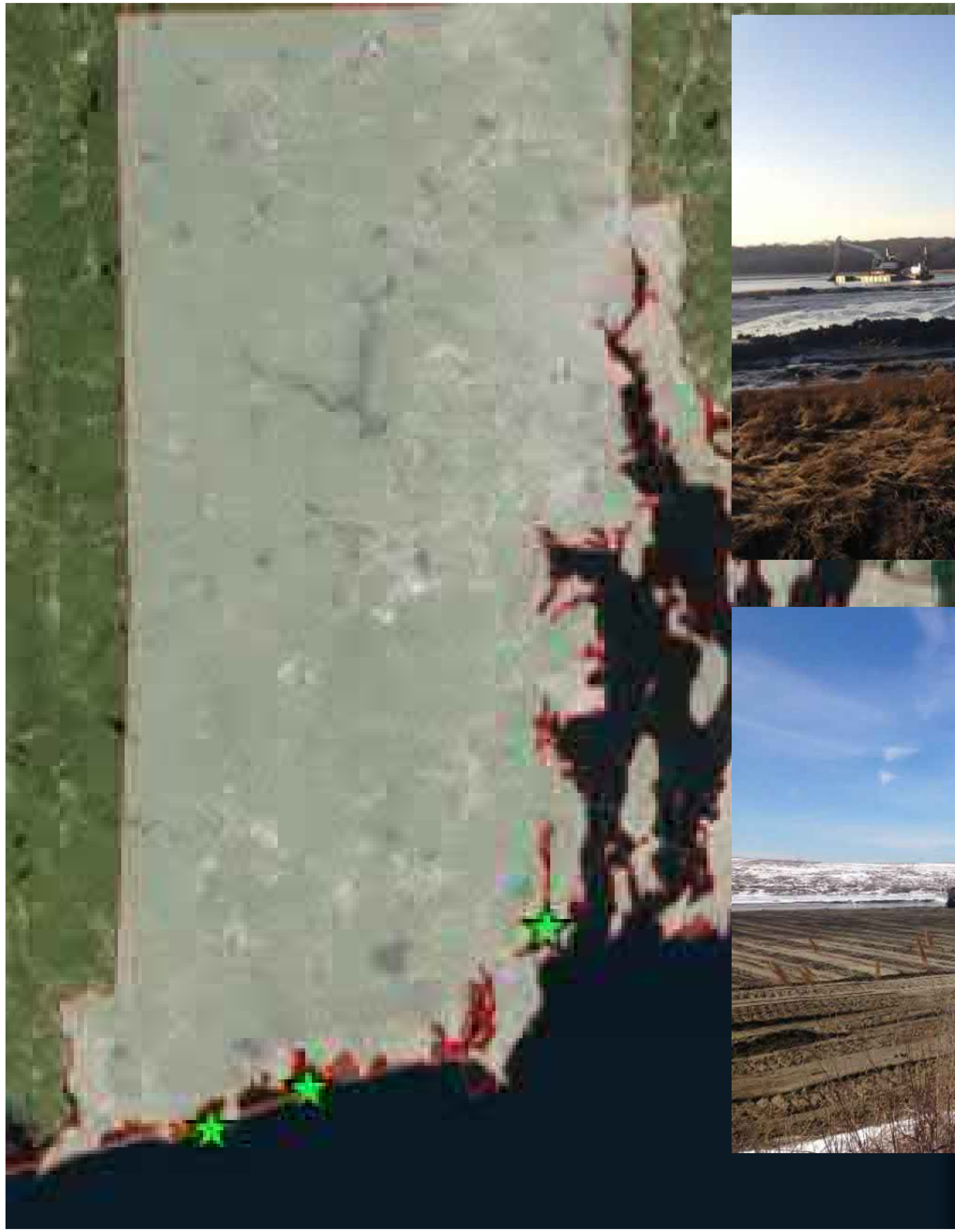
FUSS & O'NEILL

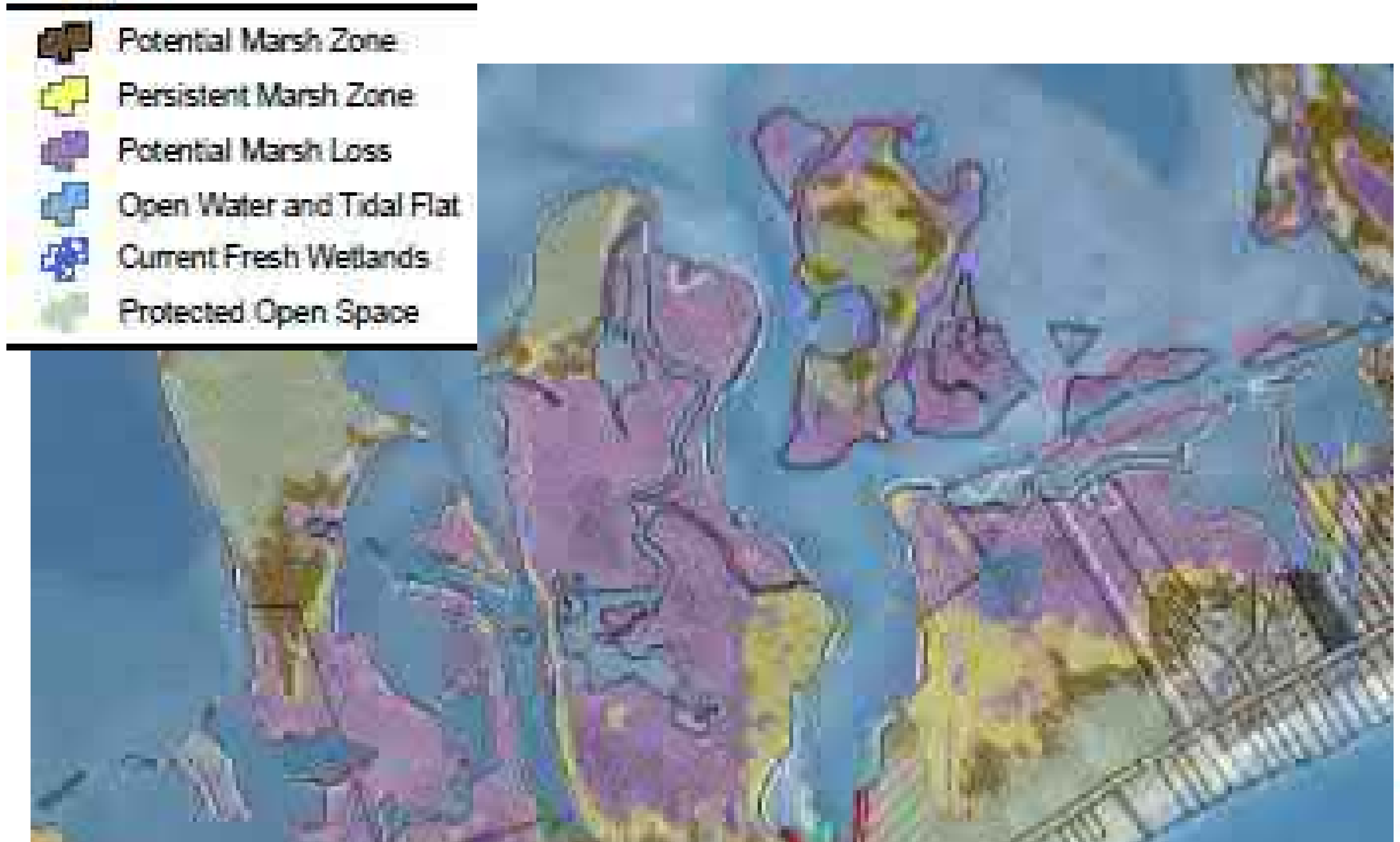
Presentation Overview

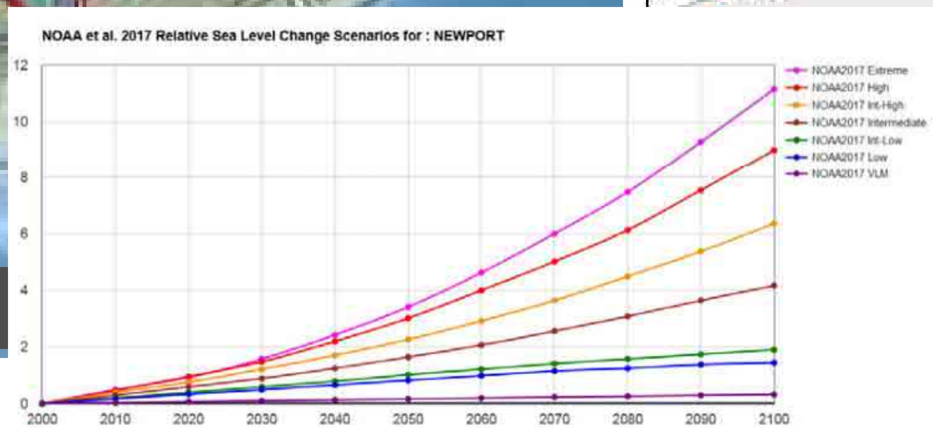
Statewide Strategies to Improve Salt Marsh Resiliency in RI

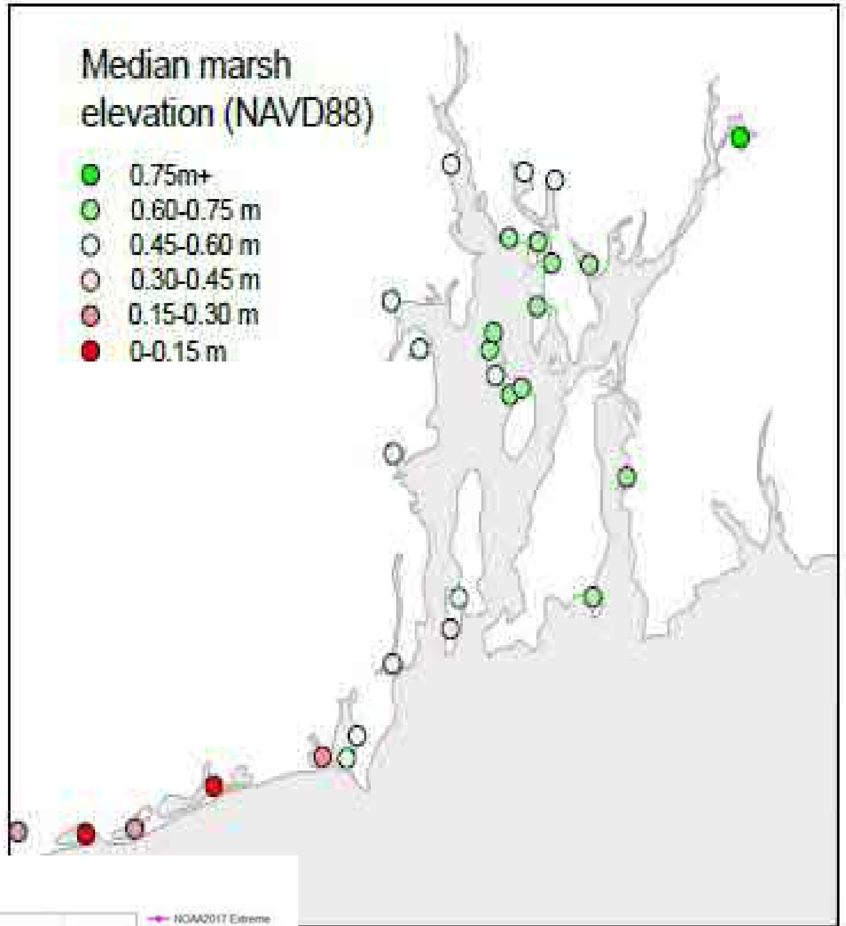
- Salt Marsh Elevation Enhancement Case Studies
  - 2016/17 - Ninigret Pond (Charlestown)
  - 2016/17 – Narrow River (Narragansett)
  - 2018/19 - Quonochontaug Pond (Charlestown/Westerly)

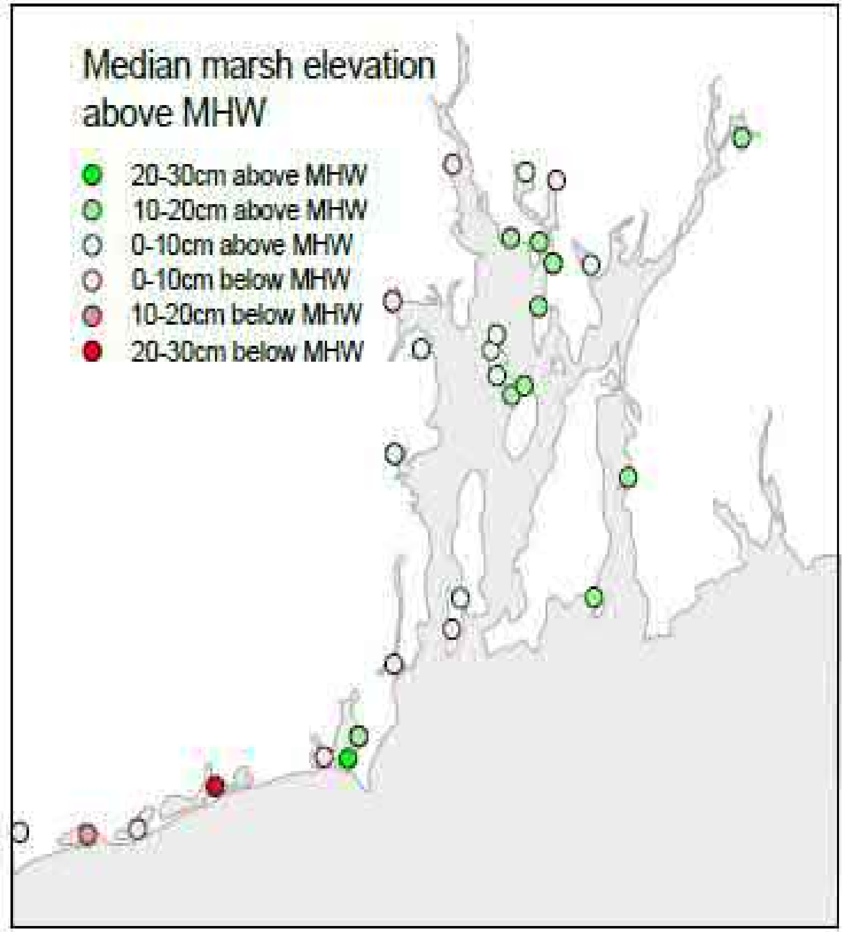


Sea Level Affecting Marshes Model Results and Intervention Options



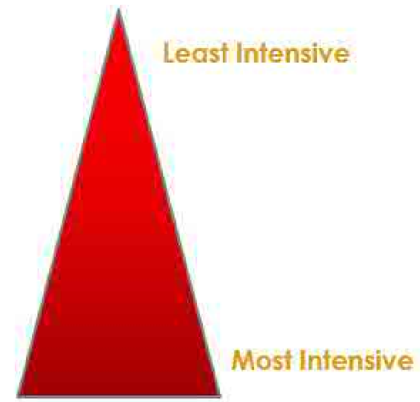






	2030	2050	2080	2100
NOAA 2017 projections based on "high curve"	1.67 feet (83% CI)	3.25 feet (83% CI)	6.69 feet (83% CI)	9.6 feet (83% CI)

- Land Conservation / Land Use Planning
- Removal of Barriers to Future Migration
- Hydrologic Modification
- Elevation Enhancement with Sediment



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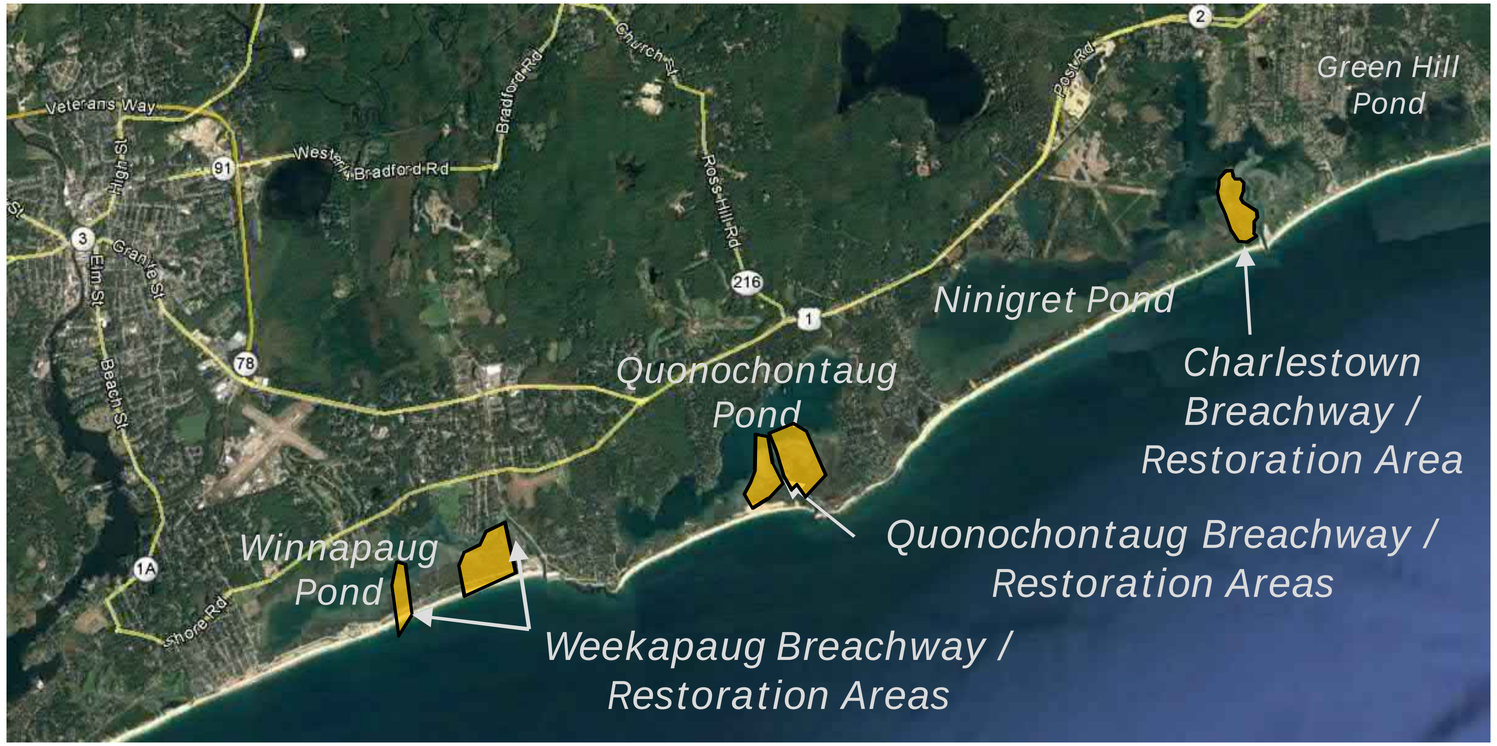
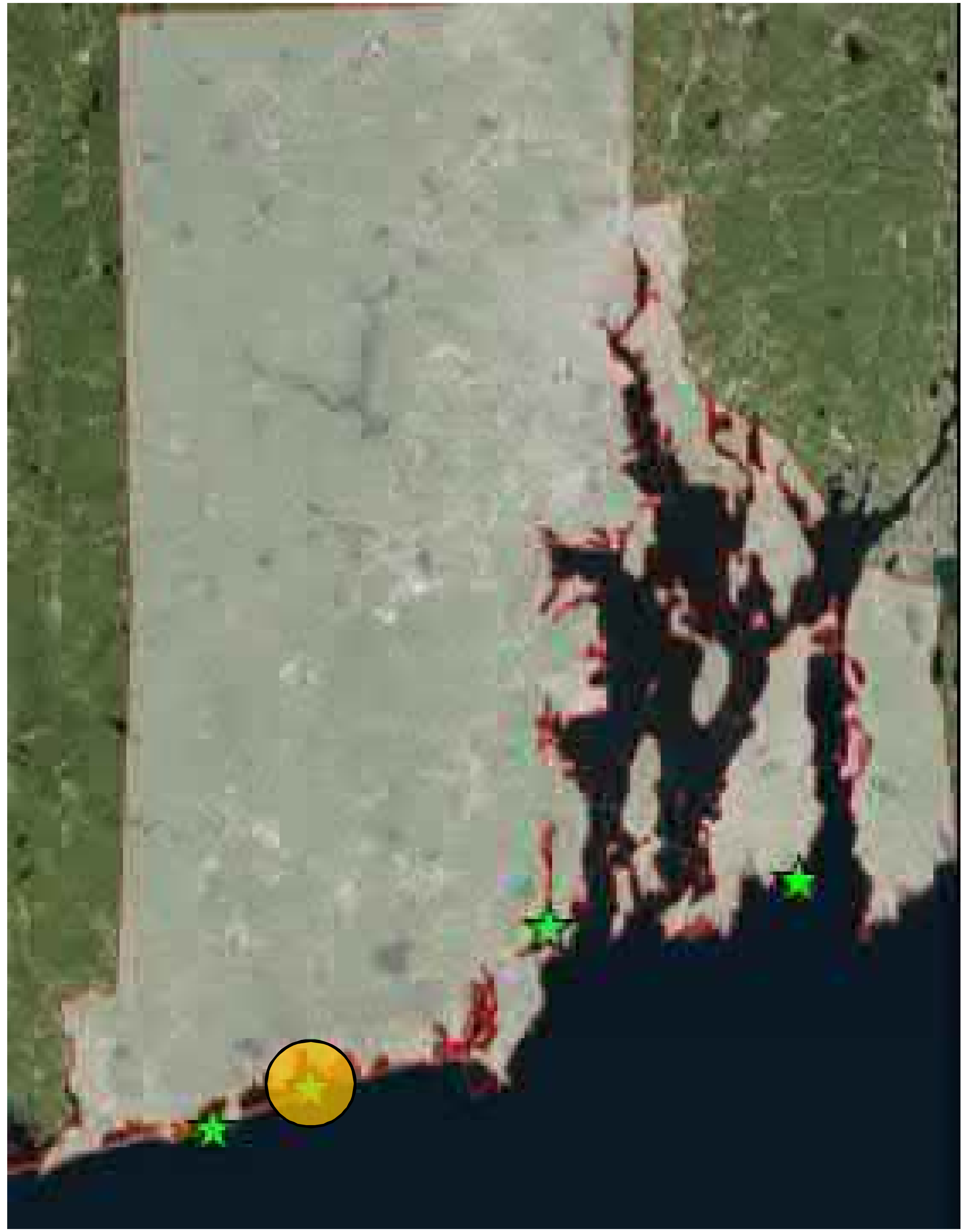
2013 South Shore Habitat and Community Resilience Project

- Focused on Rhode Island Southern Coastal Salt Ponds and Back-Barrier Marshes
- Planning, Design, and Implementation of Dredging and Salt Marsh Restoration at Ninigret Pond and Quonochontaug Pond
- Permitting and Design for Dredging and Restoration at Winnapaug Pond –
  - Eel Grass Restoration
  - Potential Future Salt Marsh Restoration



Partners:

Ninigret Pond Salt Marsh Restoration Charlestown, RI



Project Site - Ninigret Pond

- Back-Barrier Marsh Adjacent to Manmade Breachway, State-owned Public Access Point, Beach, and Campground
- Adjacent to National Wildlife Refuge
- Microtidal Salt Marsh Habitat Exhibiting Areas of <u>Prolonged Flooding</u>, <u>Vegetative Die-off</u>, <u>Subsidence,</u> and <u>Marsh Edge Erosion</u>

No marsh elevation capital

Expanding dead areas

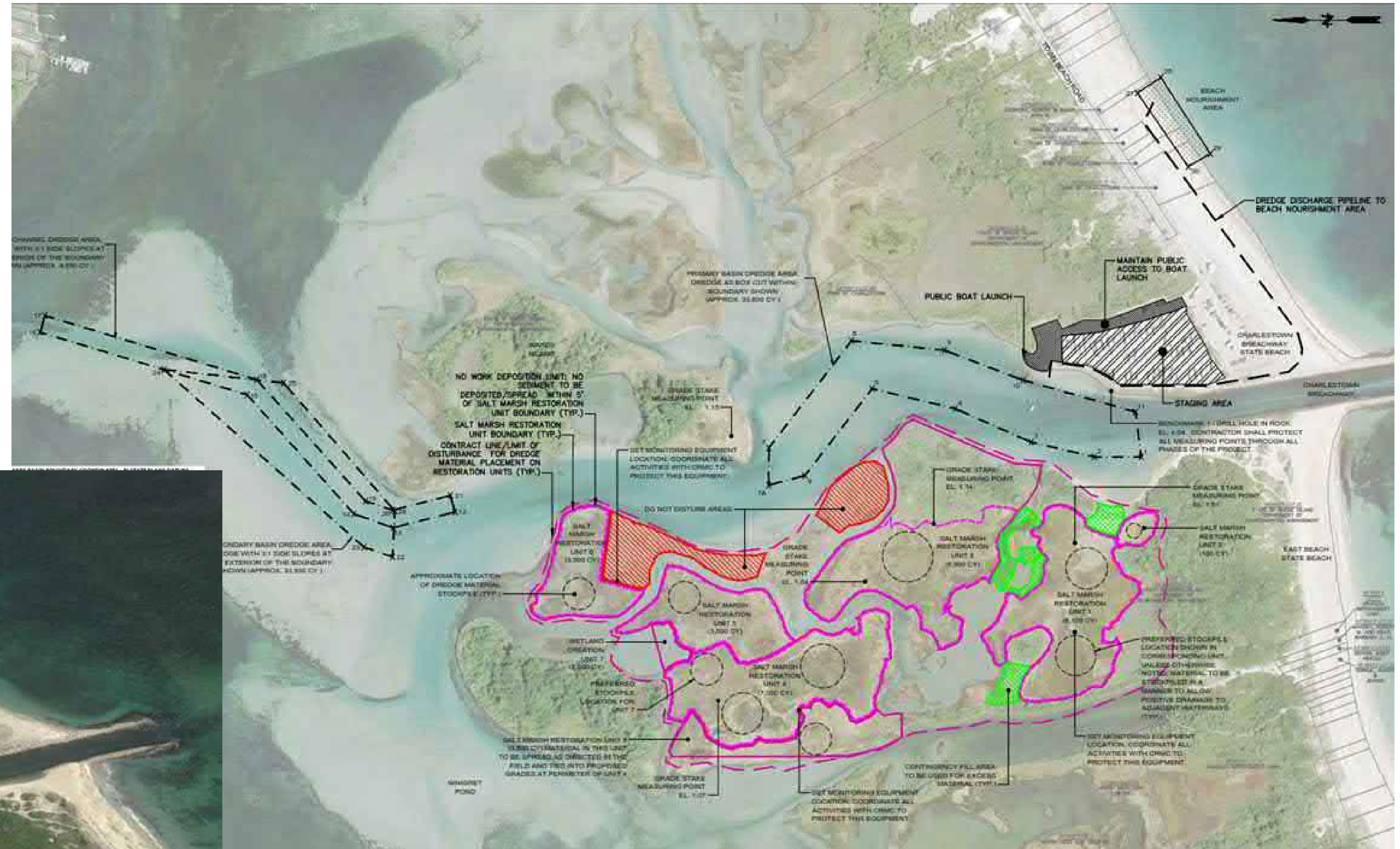
Shallow impounded water causing plant die off

Observed Impacts to Ninigret Salt Marsh

- Vegetation Die-off
- Shallow Ponded Areas with Algal mats
- Loss of High Marsh Species

Project Goals - Ninigret Salt Marsh

- Dredge Breachway Channel – Improve Tidal Flushing and Boat Safety
- Place Dredged Material to Increase Salt Marsh Surface Elevations to Improve Resilience to Sea Level Rise



- Increase High Marsh Dominance - Create Mosaic of Habitat Types
- Protect/Enhance Salt Marsh Habitat for Fish & Birds

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Challenges

- Uncharted Territory for New England Permit Team
- Addressing Needs and Expectations of Local Partners While Meeting Project Deliverables
- Time-of-Year Restrictions (for Dredging and Placement)
- Limited Local Pool of Expertise / Equipment
- Multiple Projects in Rhode Island Pipeline

Ninigret Salt Marsh Project Costs

Approx. 68,000 cy Dredged Material to Restore Approximately 20 Acres of Marsh

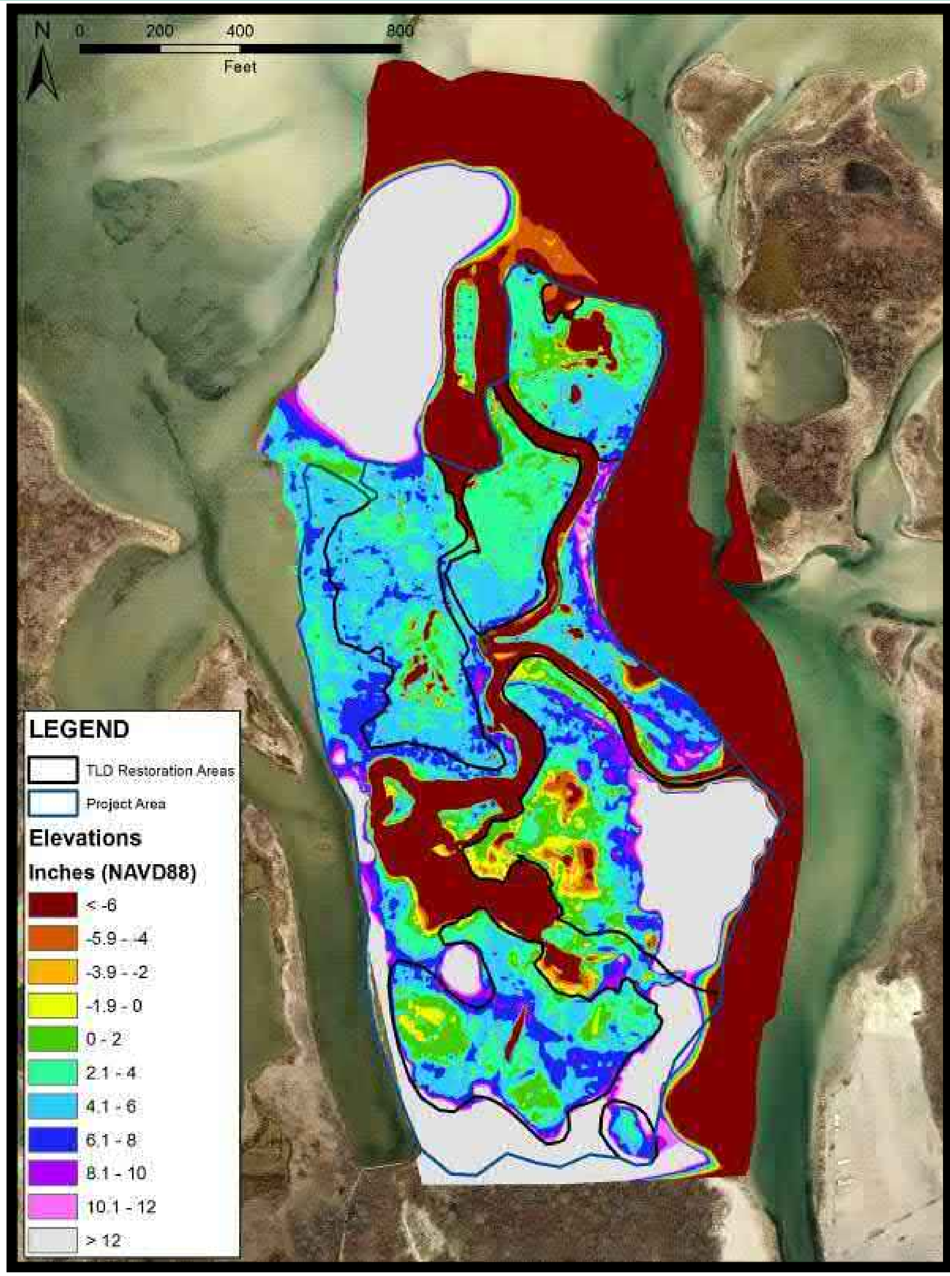
- Design, Engineering, and Permitting: <u>$110,453</u>
- Construction
  - Mobilization / Demobilization: <u>$334,400</u>
  - Dredging, Spreading, and Grading of Material: <u>$543,900</u>
  - Alternate Dredging: <u>$530,812</u>
- Planting: <u>$100,000</u>
- <u>TOTAL:</u> <u>$1,619,565</u>

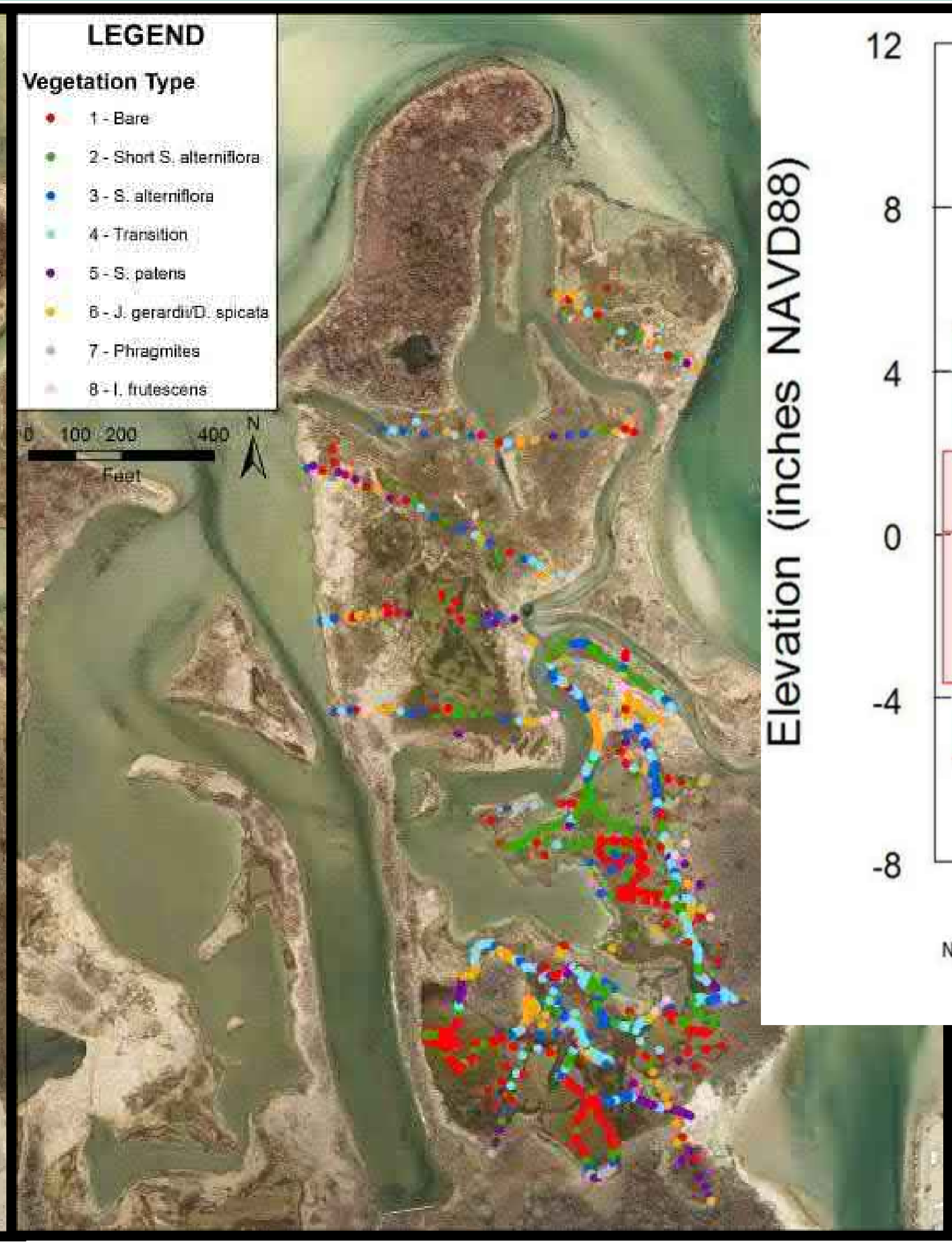
Data Collection Goals - Ninigret Salt Marsh

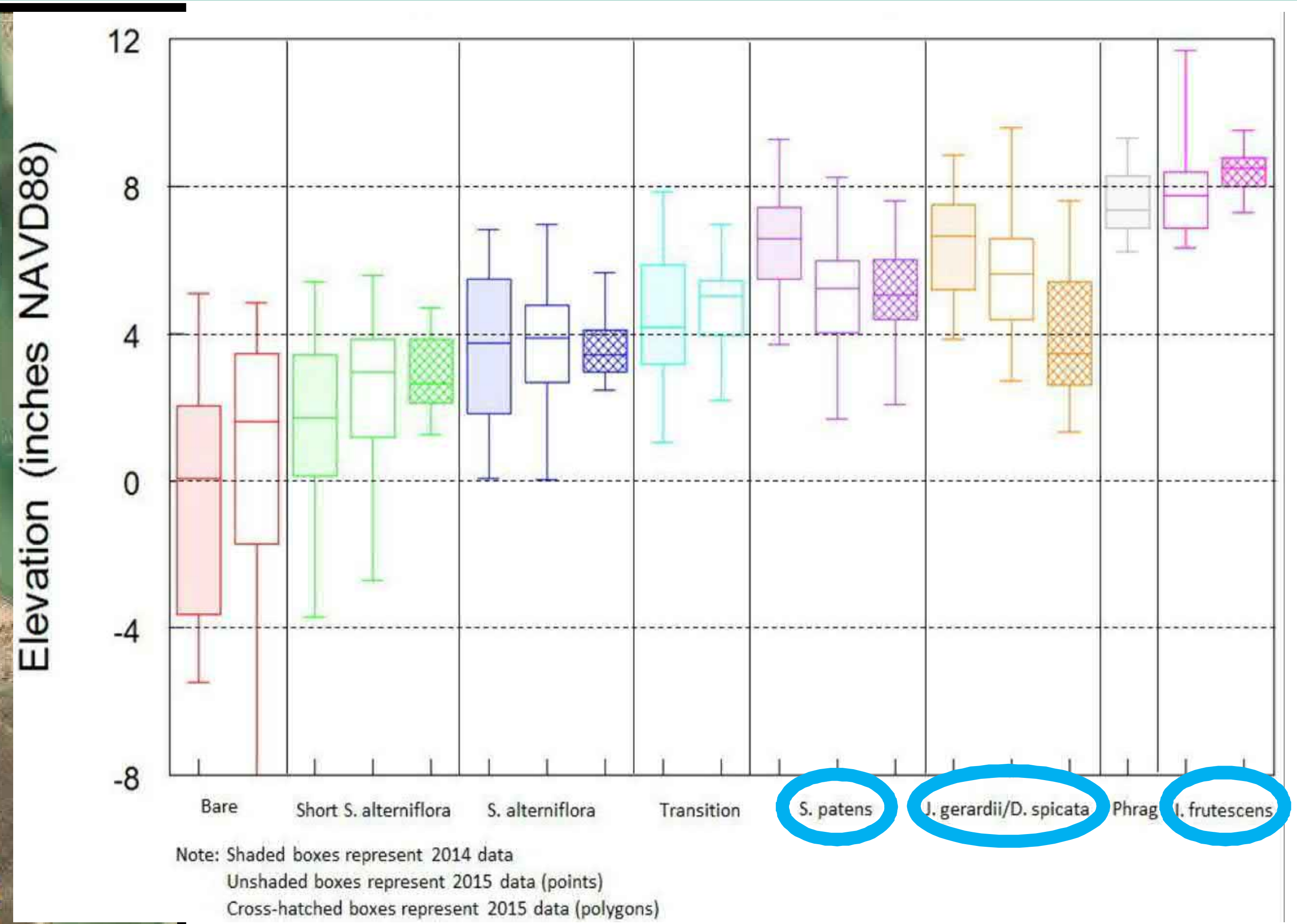
Data Collection Goals

- Create and Restore Marsh at Target Elevation for Key Vegetative Species *(saltmeadow cordgrass, blackgrass, seashore saltgrass, high-tide bush)*
  - Determine Target Elevation Based on Existing Vegetative Communities
  - Evaluate Existing Sediment Condition to Assess Potential for Settling from Added Weight of New Material

Vegetation Analysis - Ninigret Salt Marsh



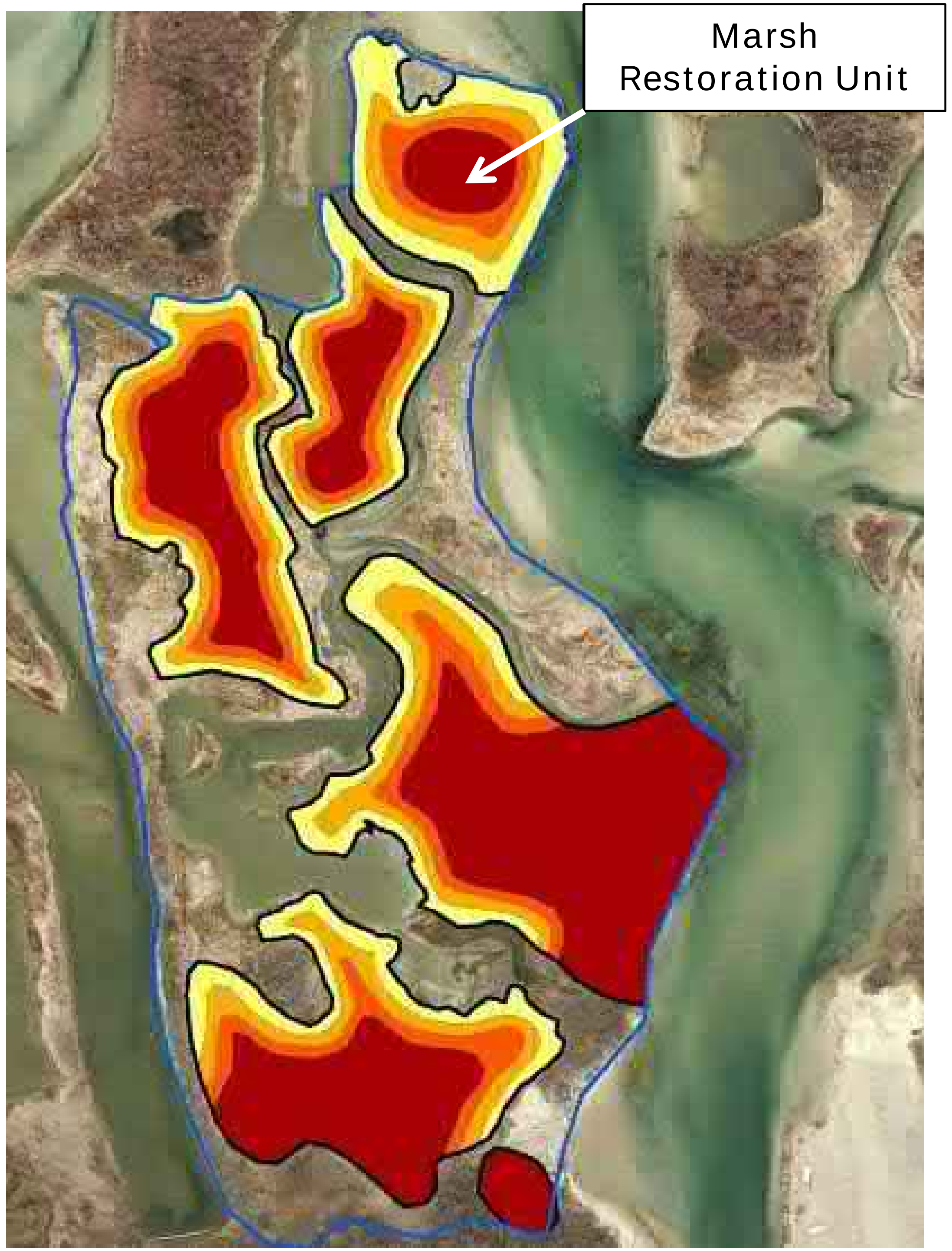




Vegetation Data Paired with RTK Elevation Data to Determine Target Elevations

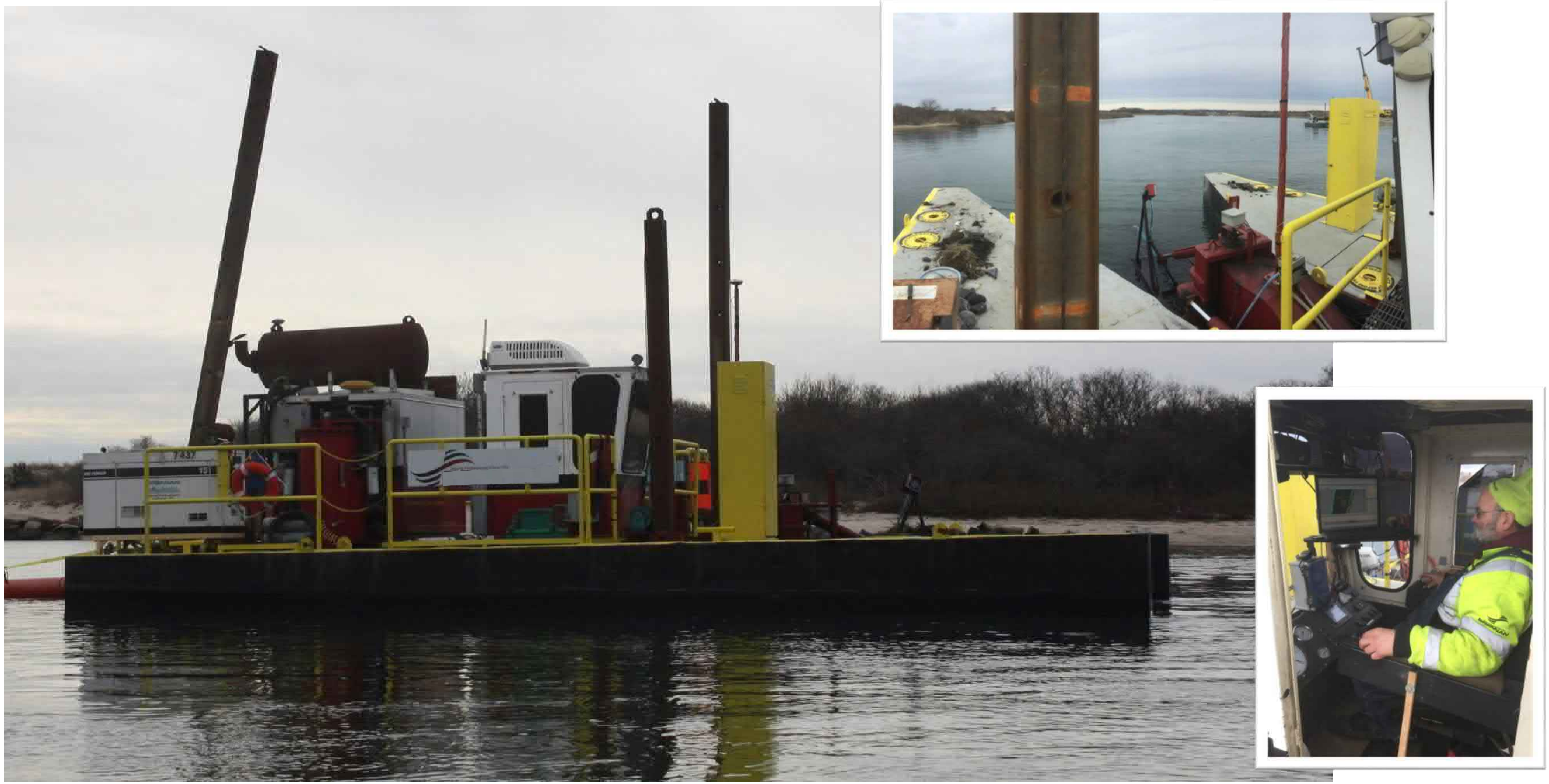
Fill Elevations and Grading - Ninigret Salt Marsh

- Set Maximum Target Elevation at Elevation 1.2 ft NAVD88
  - Compaction
  - Sea Level Rise
  - 20% Contingency Volume
- Grading / Runnels for Drainage
- Historic Creeks and Pools to Remain



Fusing Discharge Piping and Staging Equipment

Hydraulic Dredge Equipment



Hydraulic Placement of Dredged Sediment

Hydraulic Placement of Dredged Sediment

(Drone image, J.F. Brennan Marine Professionals)

Placing Excess Sediment as Beach Nourishment

Monitoring and Adaptive Management

- Pre- and Post-restoration Parameters
- Coordinated with Save The Bay, Saltmarsh Habitat and Avian Restoration Program, EPA Atlantic Ecology Division, and USFWS
- BACI (Before-After Control-Impact) Monitoring Plan Design
- Reference Site at Adjacent National Wildlife Refuge

Post Sediment Placement Planting

- Coordination with New England Wild Flower Society to Collect Native Seed
- Planting Design and Implementation by Save The Bay

Managing Migration of Placed Sediment

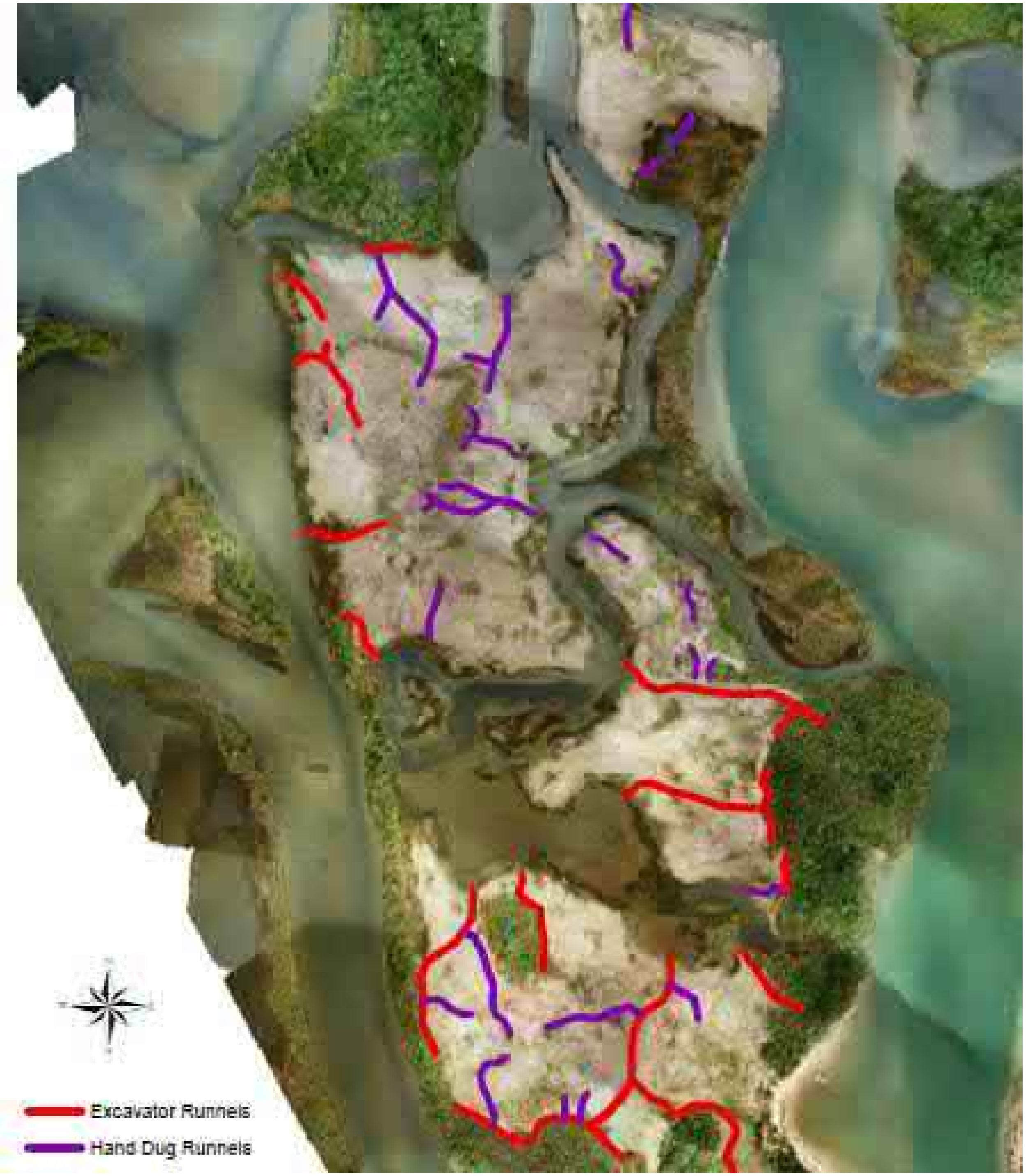
Vegetated buffers used for sediment control of sand; if finer sediment, increase the buffer size

Narrow buffers were covered by sand movement post sediment placement

Planted beach grass as temporary sand stabilization for higher elevation areas

Used brush and dune fencing for sand stabilization

Re-Establish Hydrology



Plant Recolonization

Spring 2017 Juncus growing through 4” of sand

Spring 2017 *Spartina alterniflora* growing through 6” of sand

Salt Marsh Plantings 2017-18

- Salt marsh planting: 2017-2018
- 186 volunteers: 750 hours
- 46,850 plants

Post-restoration Planting


Spartina alterniflora August 2017


Distichlis August 2017


Distichlis August 2018

Plant Recolonization


Photo Station 1: Pre: Fall 2015


Post Placement May 2017


1st Growing Season September 2017


2nd Growing Season September 2018

Plant Recolonization – August 2018



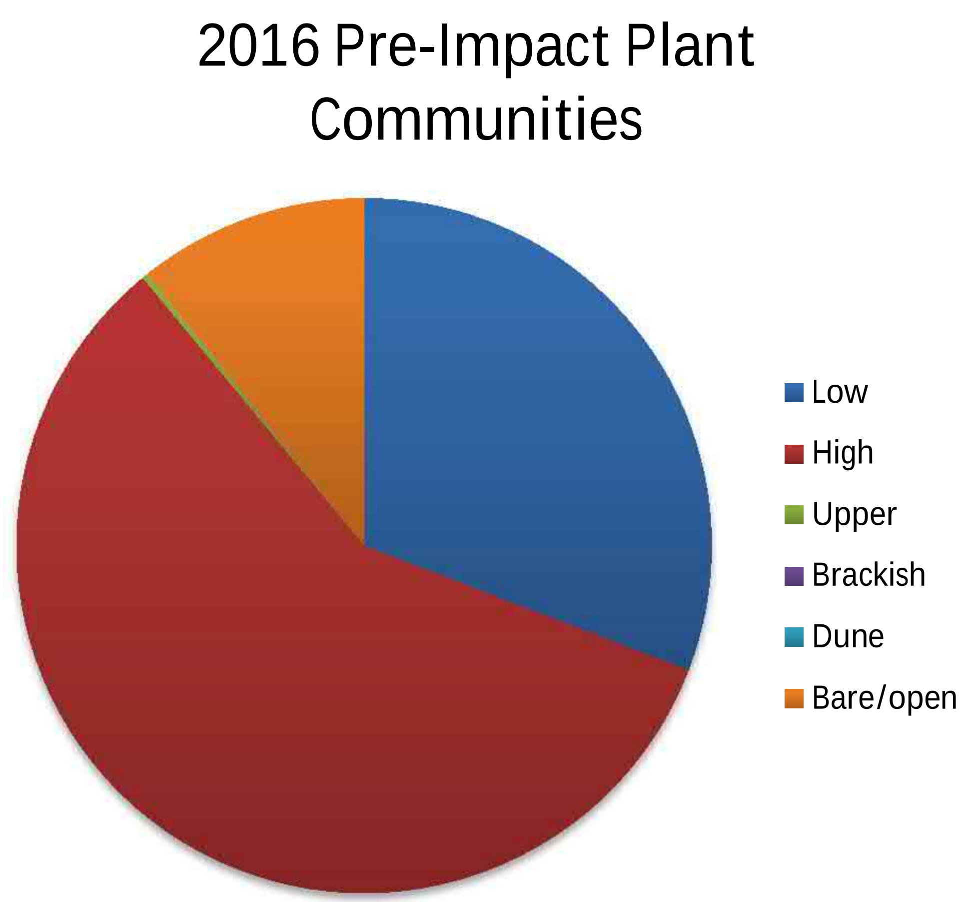


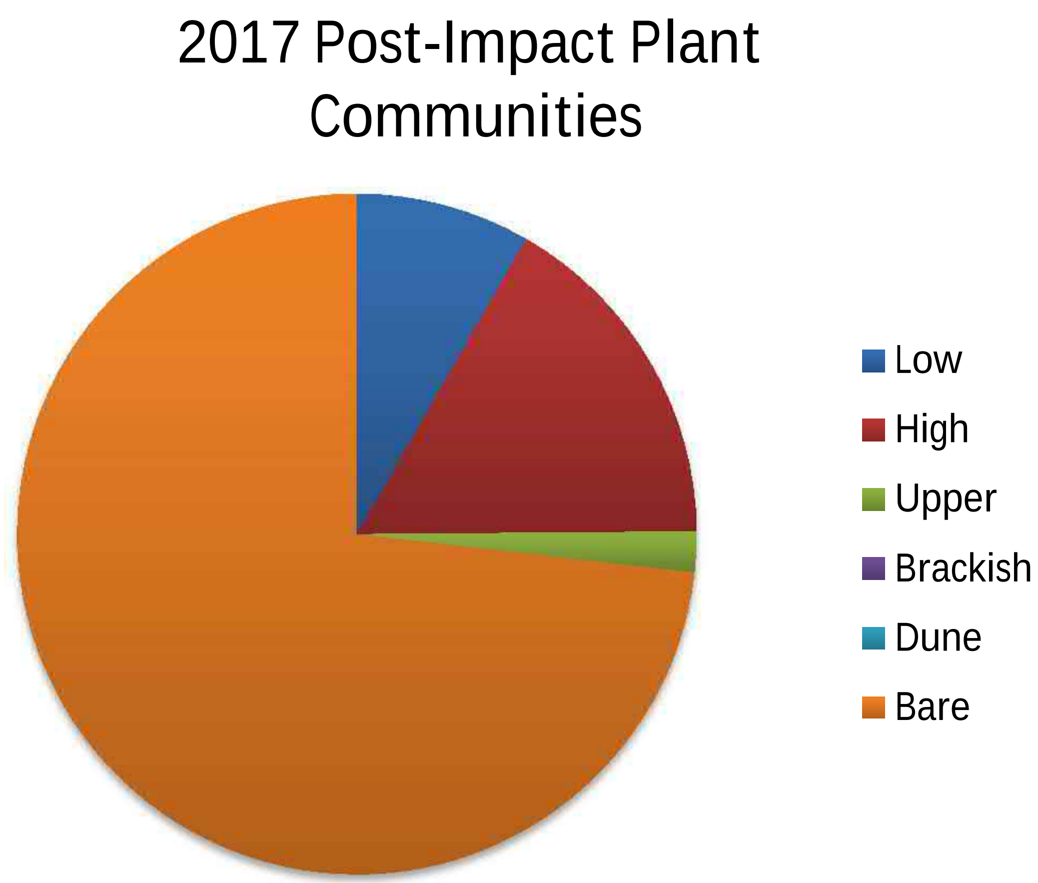

Plant Recolonization – December 2020

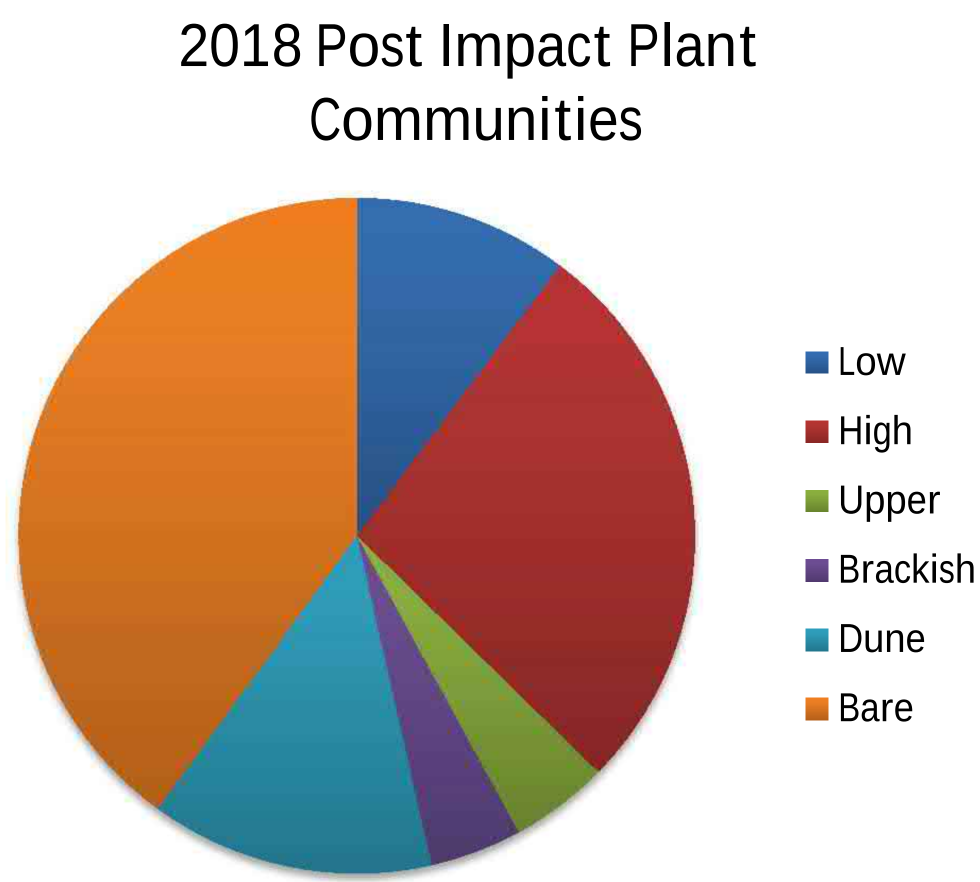
Plant Recolonization – December 2020

Plant Recolonization – December 2020

Post-Restoration Revegetation







Lessons Learned

Impounded water along edge of sediment placement

Regrading sediment to tie into existing elevations

Tie Into Existing Elevations

Lessons Learned

Depression holding freshwater after rain event

Hand dug runnel spring 2018

Depression Spring 2018

Hand dug runnels to drain depressions

Fall 2018

Provide drainage for precipitation in higher elevation areas

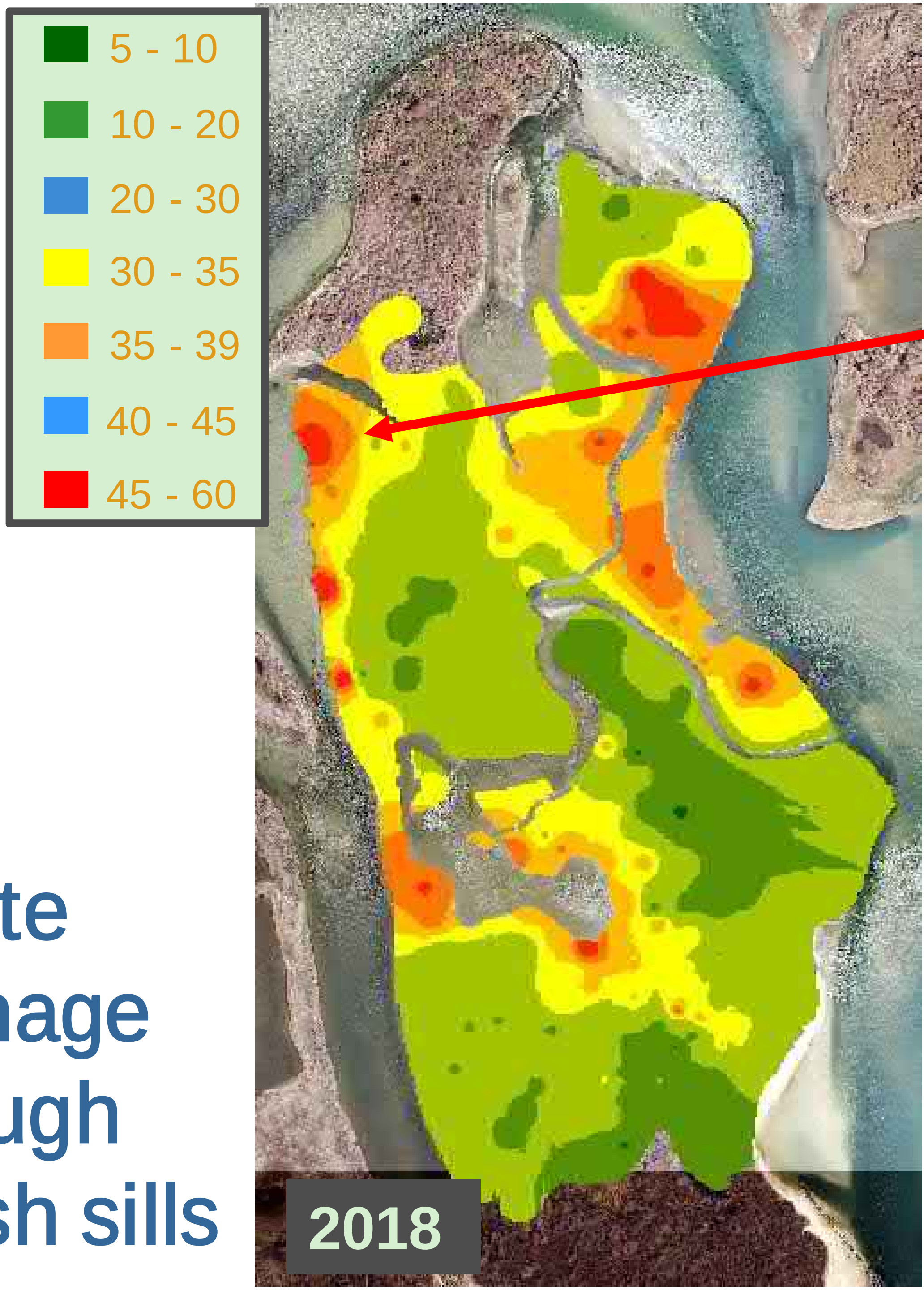
Lessons Learned

Quicksand conditions at edge of marsh sill

Marsh sills impound surface and groundwater

Groundwater draining once creek cut through marsh sill

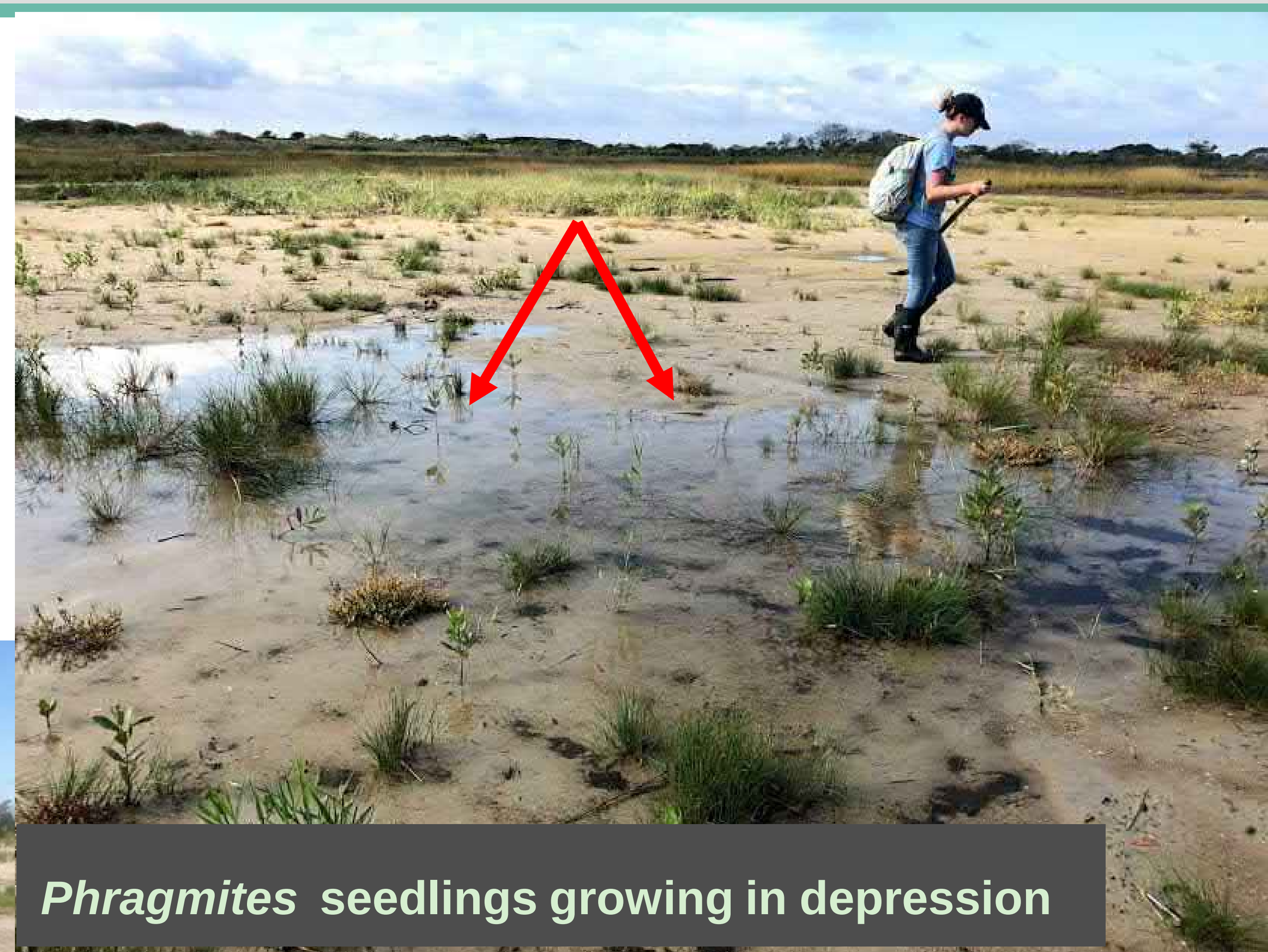
Lessons Learned



Create drainage through marsh sills

Lessons Learned

Phragmites growing in higher elevation areas with perched water table



Phragmites seedlings growing in depression

Actively weed invasives during the first 3 growing seasons if feasible

Manage invasives at higher elevation areas

Lessons Learned

Maintain creeks and runnels until site revegetates

Lessons Learned

May 2017

Plant creek edges to stabilize banks

August 2017

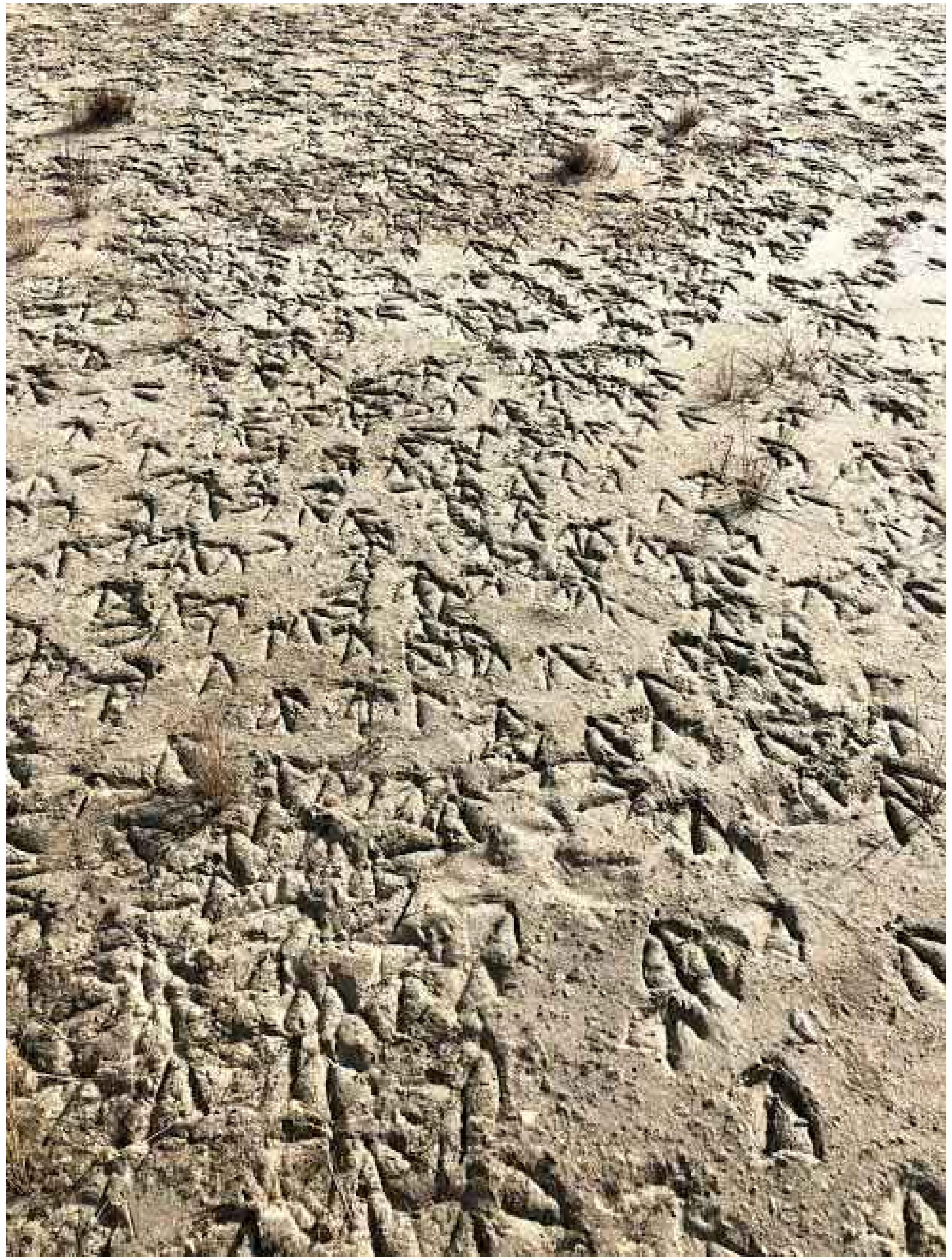
Exposed peat layer revegetates and stabilizes banks

Lessons Learned

Include higher elevation areas to act as marsh migration corridors

Marsh migration areas flooding during a 6' tide equal to 2' SLR

Lessons Learned



Plan for predation

Winter goose damage

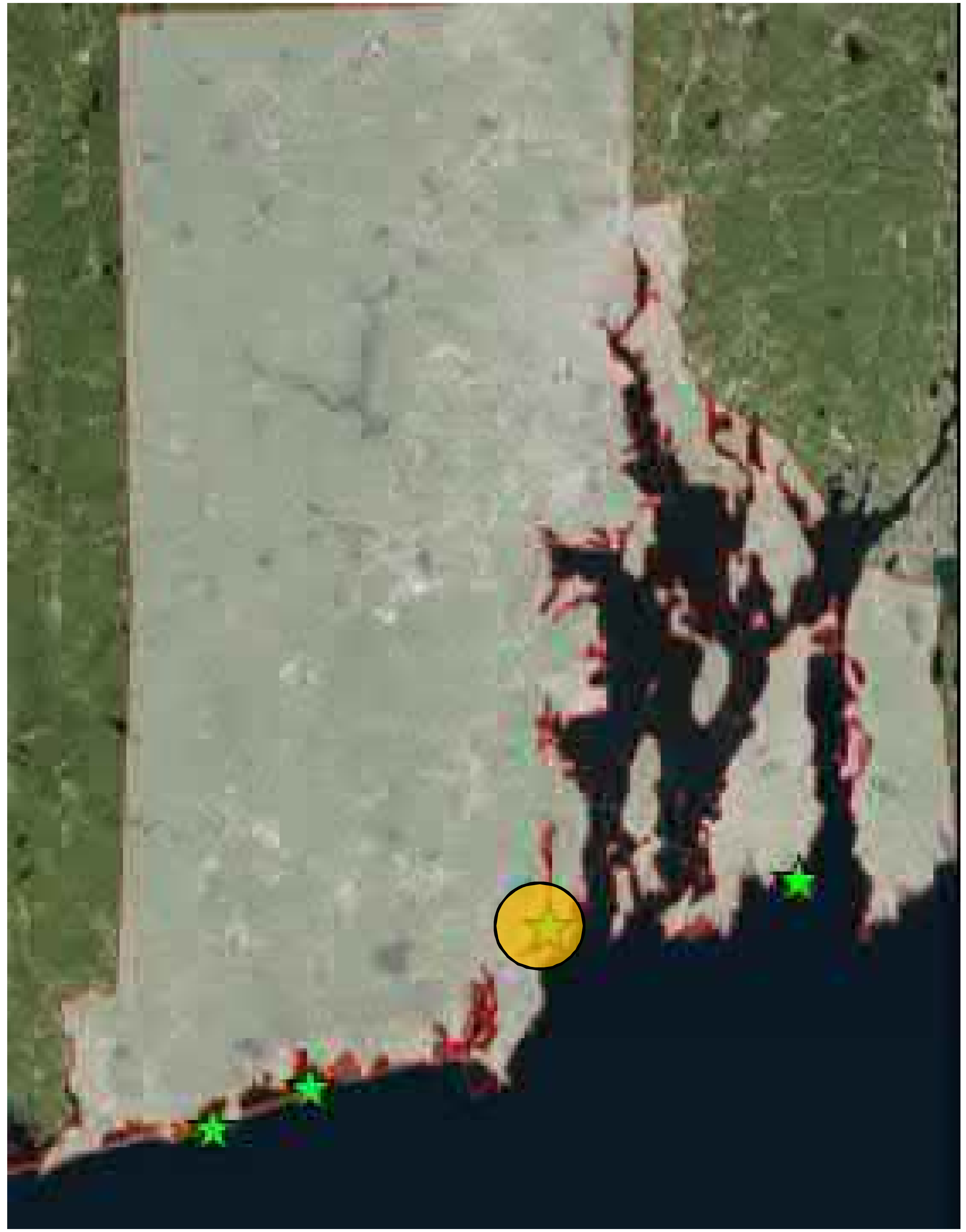
Lessons Learned

- Sediment and marsh type should dictate approach
- Begin permitting conversations early and often
- Low ground pressure equipment a must
- Grade to drain
- Sand moves!
- Incorporate drainage in design phase for tidal exchange and surface and ground flow
- Provide for immediate and long-term adaptive management to hydrology, management of invasive species)
- Manage partner expectations for design and outcomes

Monitoring

- Coordination with CRMC, Save The Bay, SHARP program, NBNERR, RINHS, EPA AED and USFWS
- BACI design, reference site at adjacent National Wildlife Refuge
- Time frame at least 5 years
- Parameters:
  - Elevation
  - Vegetation (above and belowground biomass)
  - Water levels
  - Salinity
  - Accretion rates
  - Nekton
  - Avian surveys
  - Photo stations

Narrow River Salt Marsh Restoration Narragansett, RI



Narrow River Sediment Placement

Sediment Geochemistry and Gradation Issues

Narrow River Sediment Placement

- Limited Intervention
- Limited Revegetation
- Predation

Narrow River Sediment Placement

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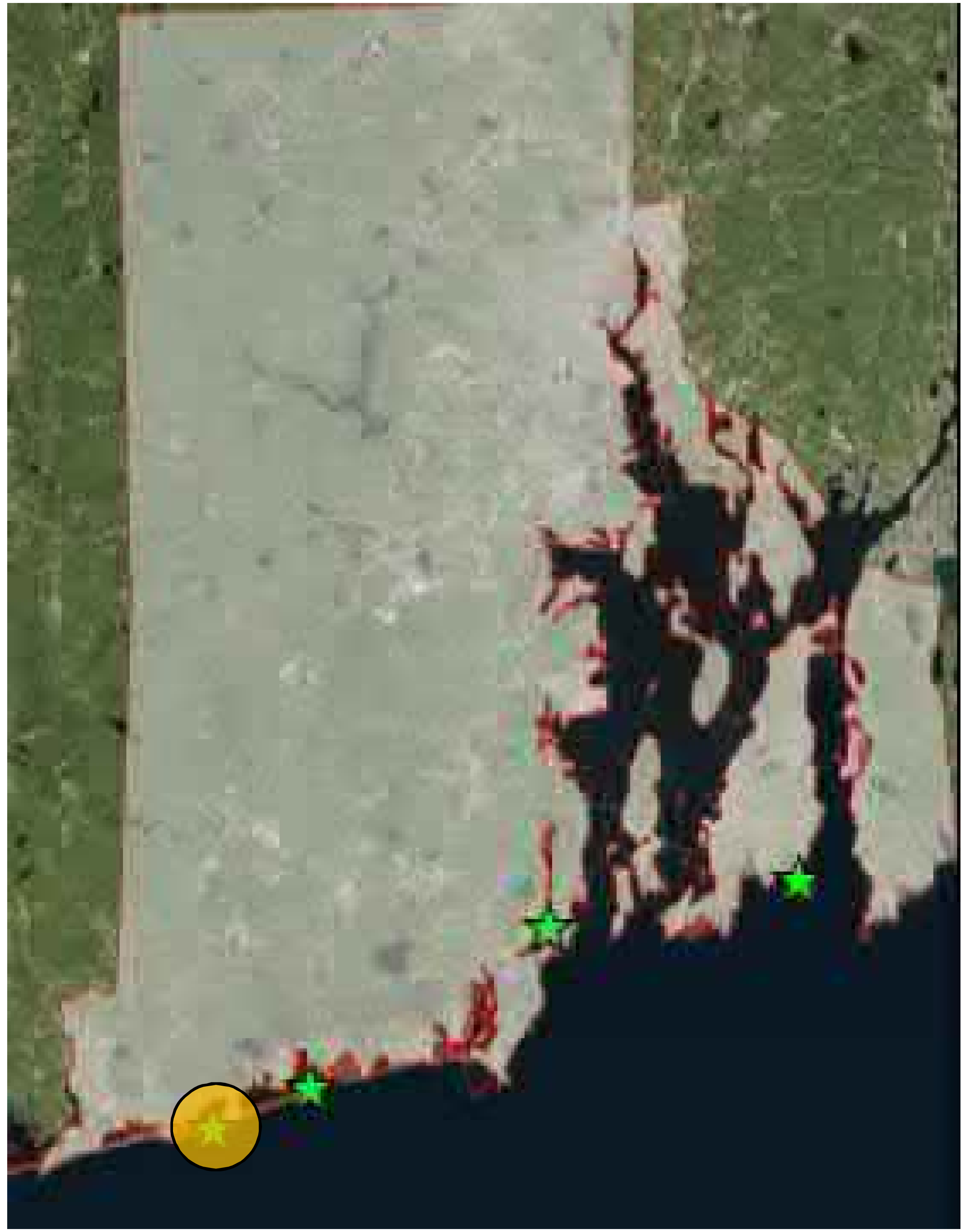
Narrow River Revegetation

Narrow River Revegetation

Narrow River Revegetation

Quonochontaug Pond Salt Marsh Restoration Charlestown, RI



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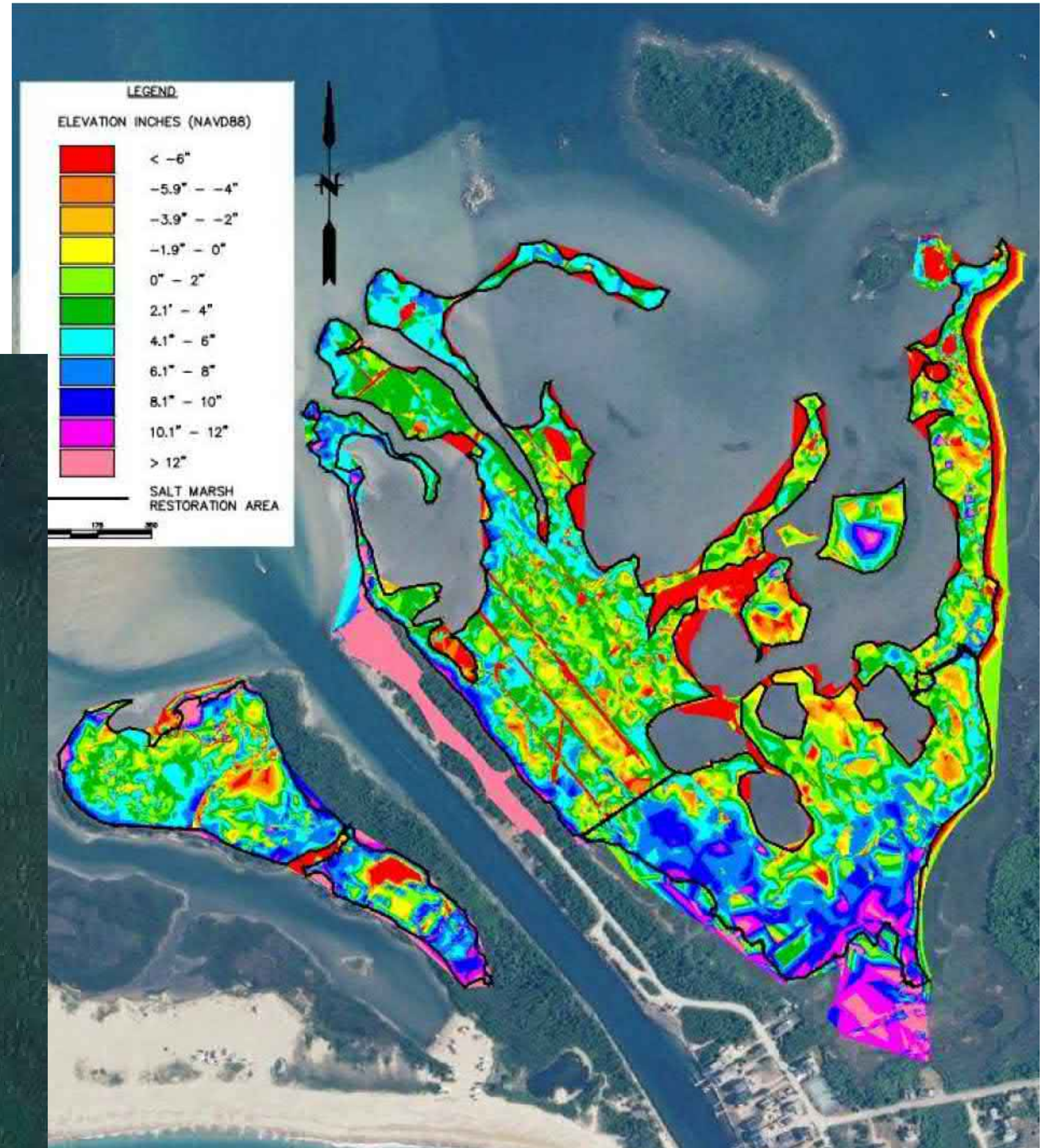
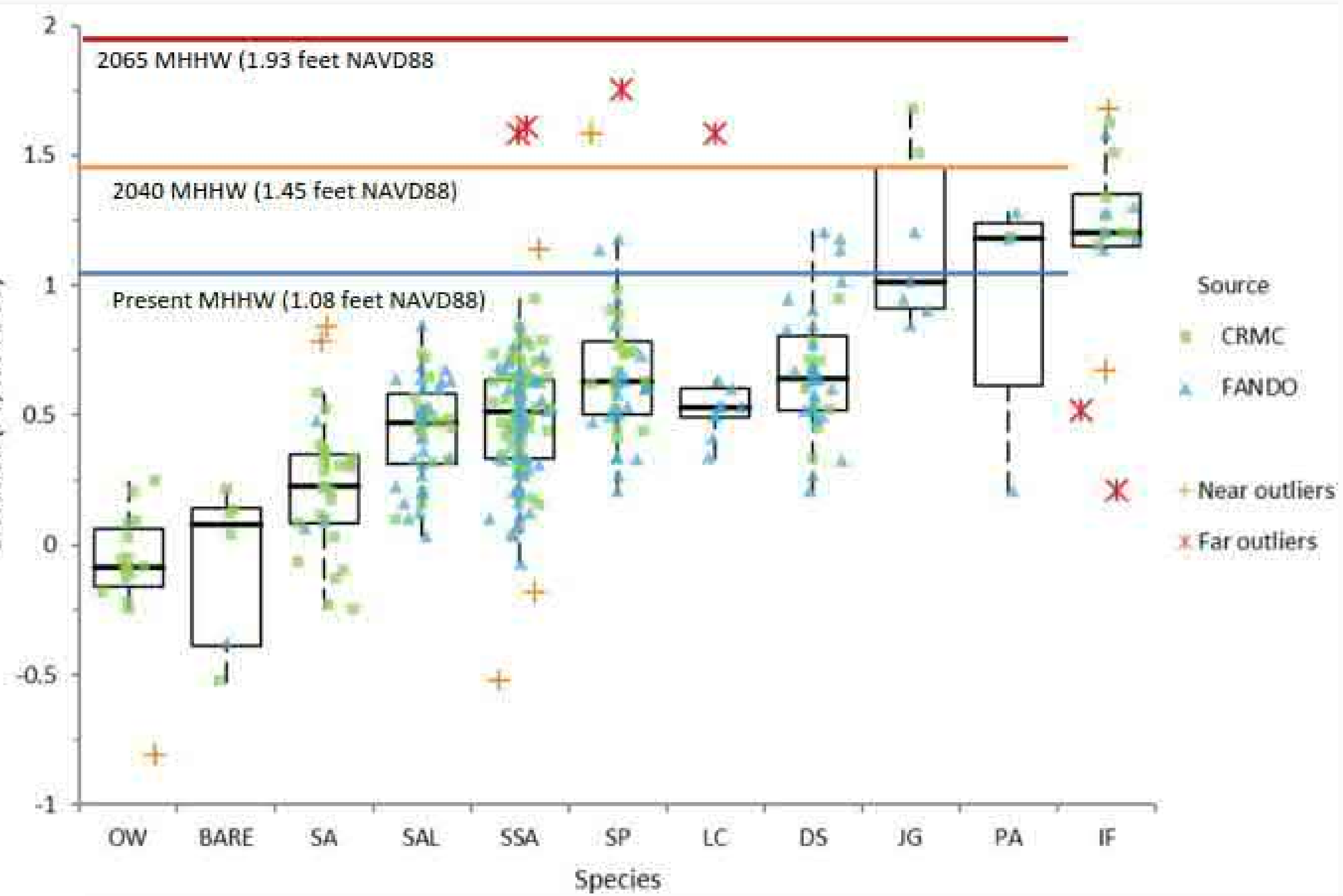
Quonochontaug Pond Project Goals and Approach

Similar Project Goals and Technical Approach as Ninigret

- Revised per Lessons Learned
- Eelgrass Restoration Areas

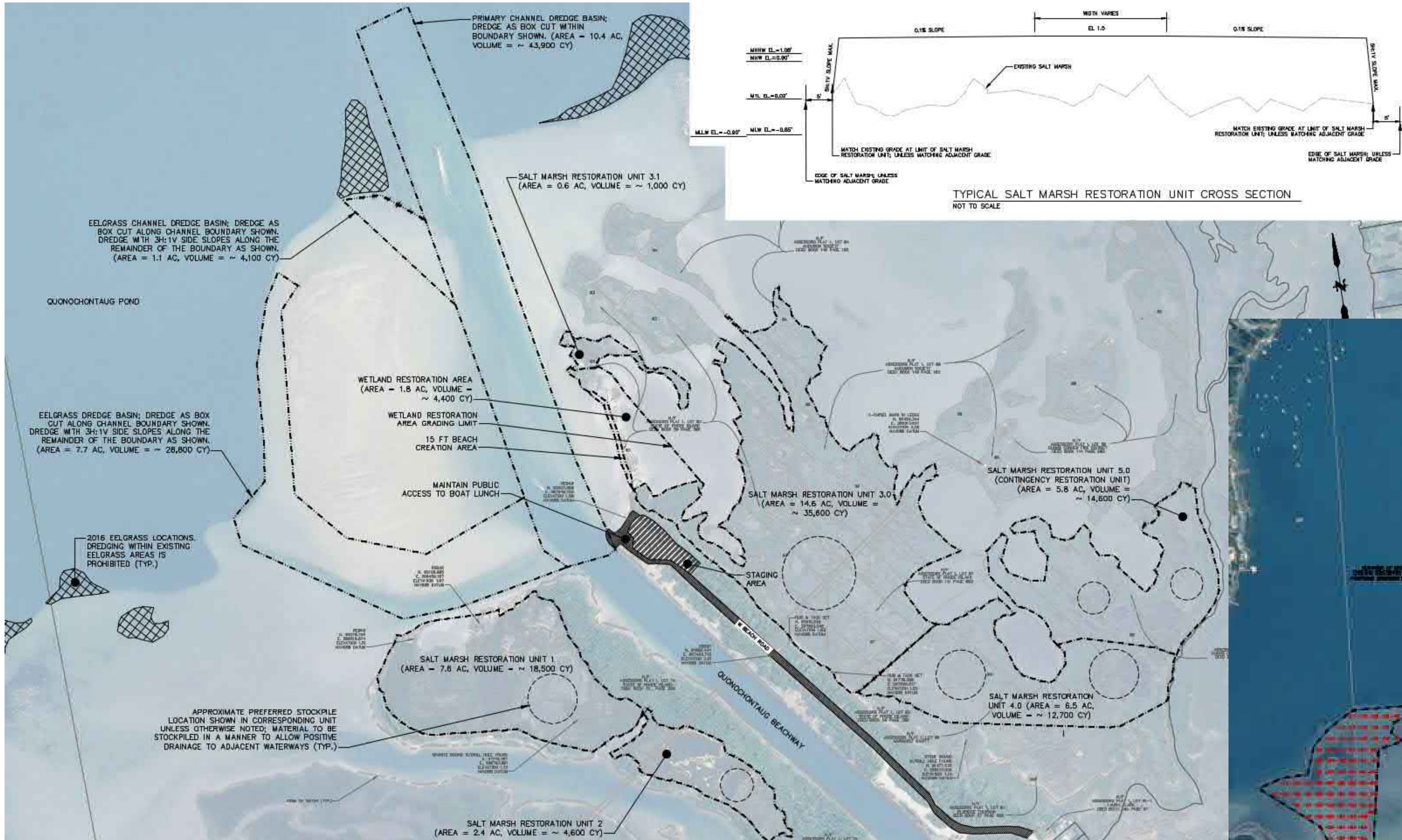


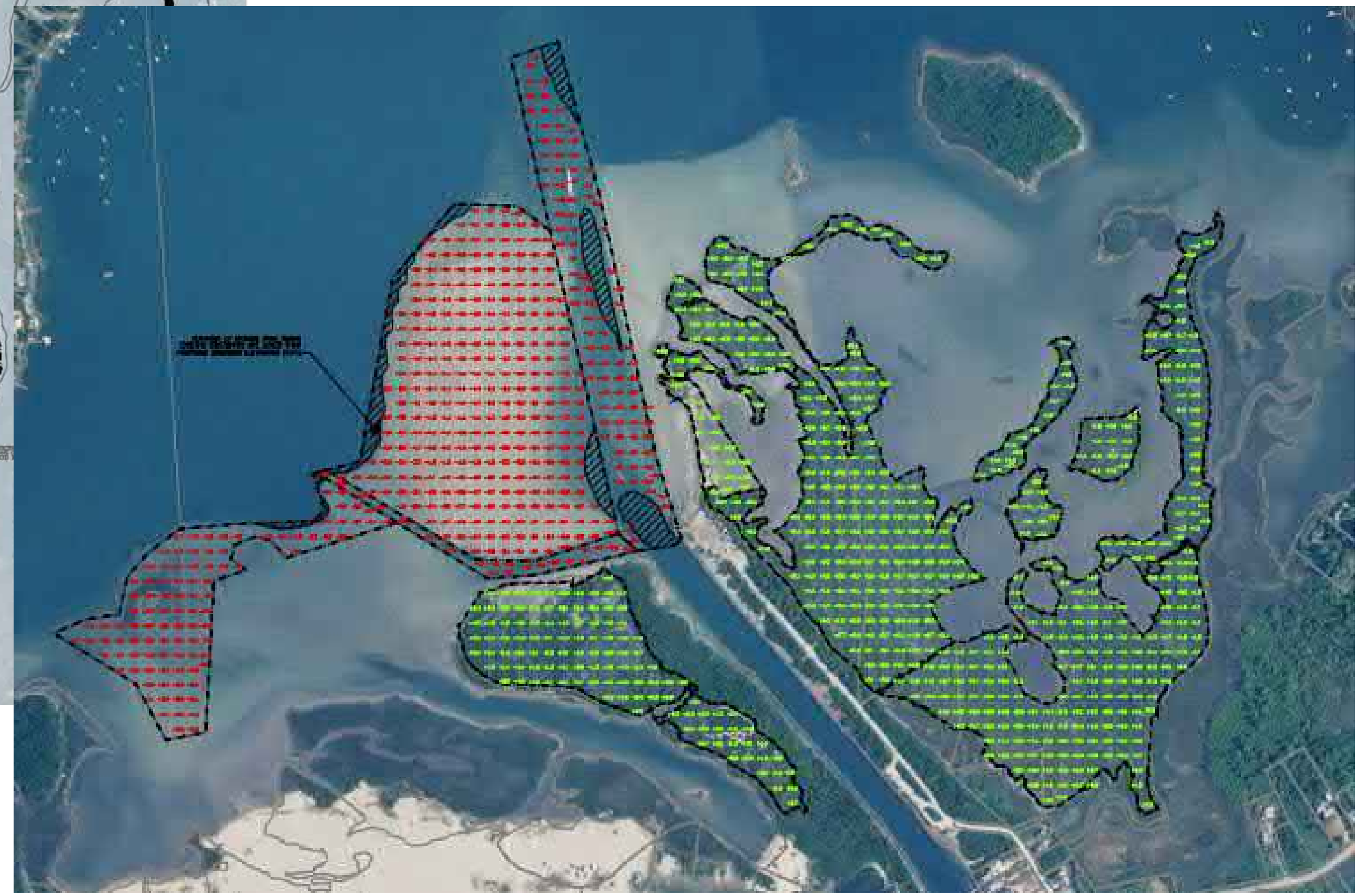
Quonochontaug Pond – Vegetative Assessment



Mean High High Water Elevations (current, 2040 and 2065) under Intermediate-Low Projected SLR Relative to Current Elevation Ranges of Vegetative Species within Restoration Project Area

Quonochontaug Pond Restoration Design





Quonochontaug Pond Implementation

Quonochontaug Pond Sediment Placement (2019)

Plant Recolonization – December 2020

Plant Recolonization – December 2020

Lessons Learned Recap

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- Begin permitting conversations early and often
- Low ground pressure equipment a must
- Grade to drain
- Sand moves!
- Incorporate drainage in design phase for tidal exchange and surface and ground flow
- Provide for immediate and long-term adaptive management to hydrology, management of invasive species)
- Manage partner expectations for design and outcomes

Questions?

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