Advancing Science and Practice at the Seven Mile Island Innovation Laboratory

Lenore P. Tedesco, PhD
Executive Director, The Wetlands Institute
ltedesco@wetlandsinstitute.org

US Army Corps of Engineers® Philadelphia District

Dredge Research Collaborative

ERDC ENGINEER RESEARCH & DEVELOPMENT CENTER

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NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

- A Proving Ground Using Natural and Nature-Based Features to Provide Ecological Uplift and Enhanced Resilience for Ecosystems and Coastal Communities
- Test Bed to Advance and Improve Dredging Techniques and Marsh Restoration and Coastal Feature Creation Techniques in Coastal New Jersey
- Using an Adaptive Management and Systems Approach and Moving Forward From Pilots to Solutions
- Based on an International Concept Pioneered by the Dutch
- Back Bay Marsh Dominated System with Shallow Bays, Sounds and Tidal Inlets

SEVEN MILE ISLAND INNOVATION LABORATORY

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NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

NEW JERSEY DIVISION OF Fish and Wildlife

SEVEN MILE ISLAND INNOVATION LAB

- Encompassing 24 mi^2, and15,000 acres of Back Bay Tidal Marshes, Shallow Bays, and Inlets
- Bisected by the NJ Intracoastal Waterway
- Part of the Cape May Wetlands Wildlife Management Area
- Home of The Wetlands Institute

- Federal Beach Fill and Navigation Projects
- Confined Disposal Facility (CDF)
- Prior Placement Sites (PP)
- Elevated Nesting Habitat (ENH)
- Thin Layer Placement (TLP)
- Marsh Enhancement (ME)

SMIIL 2020/2021 Projects

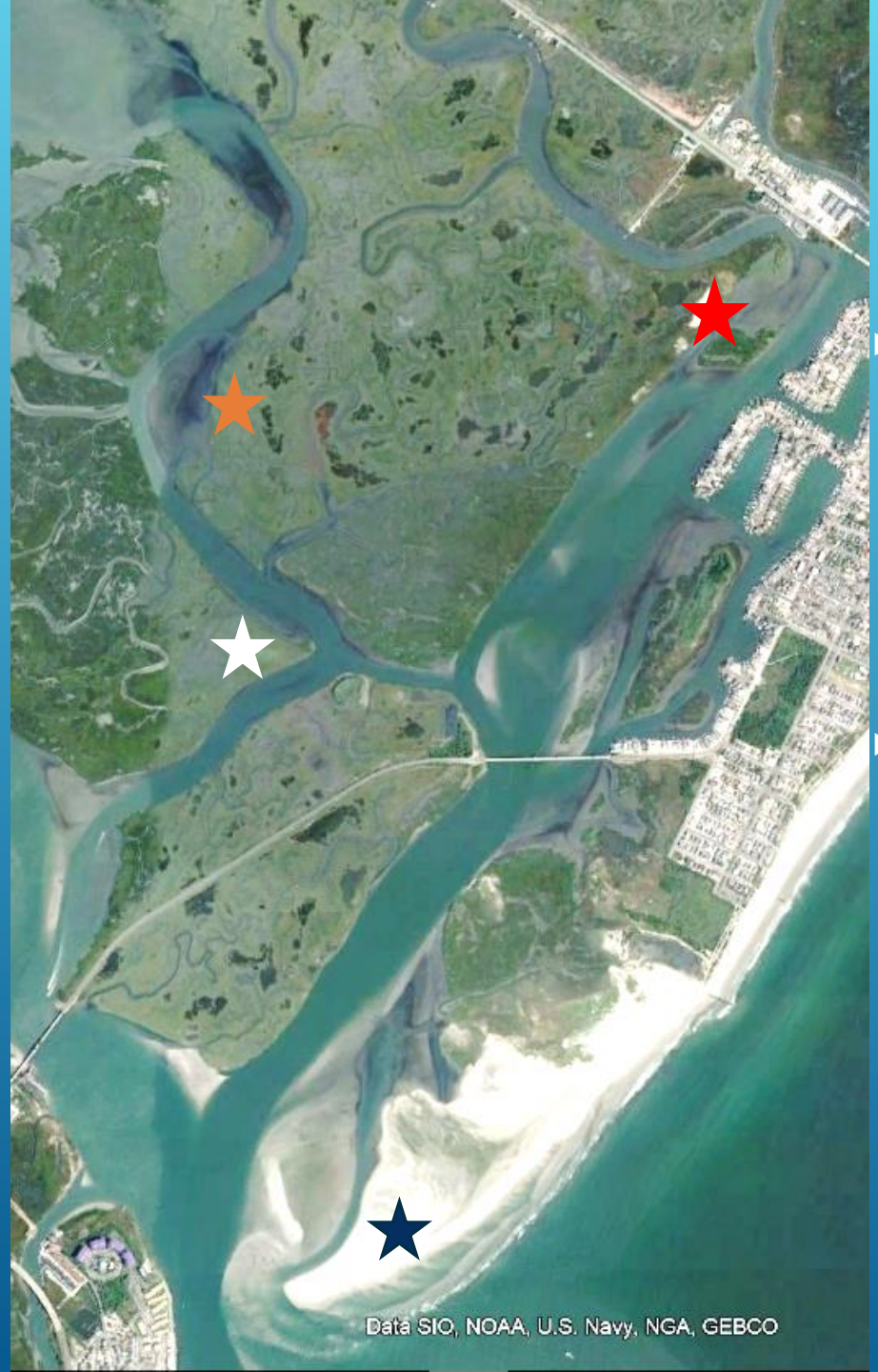
- Elevation Enhancement and Nesting Habitat
- Sandy Marsh Edge Protection
- Elevation Enhancement and Nesting Habitat
- Mud Berm Creation and Tidal Flat Enhancement

Existing SMIIL Projects

- Avalon Marsh Enhancement
- Ring Island Nesting Habitat (not shown)
- Great Flats Nesting Habitat (not shown)

- NWFW Hurricane Sandy Coastal Resilience Grant
- Early Pilot Testing Pool Filling and Thin Layer Placement
  - Winter 2014 6,000 cy; Winter 2015 49,000 cy
  - Average elevation change ranged between 0.9' – 1.2' but as much as 3' in some areas
  - On average, sites lost ½ elevation gain by 2017, 2 years post-placement
  - Overall are close to ecological target elevations

AVALON MARSH ENHANCEMENT PROJECT



NESTING HABITAT CLUSTERS: MIMICKING NATURE AND ACHIEVING A SYSTEM SOLUTION

- Ecologic Value
  - Creates Network of Nesting Sites at Different Stages of Succession
  - Separates Populations for Resiliency
  - Mimics Historic Distribution of Colonial Nesting Birds
- Dredging Value
  - Provides for Repetitive Placement
  - Creates More Volume Utilization
  - Allows for Staggered Placement

★ Ring Island A (2014; 2018; 2021)
★ Great Flats (2018)
★ Ring Island B (Future?)
★ Stone Harbor Point

RING ISLAND ELEVATED NESTING HABITAT REPETITIVE PLACEMENT

- Elevated Nesting Habitat Creation
  - Fall 2014 – 1 acre 6000 cy
- Sandy Thin Layer Placement
  - 2 sites – 0.9 acre 1000 cy

- Elevated Nesting Habitat Maintenance
  - March 2018 1,200 cy
  - 120' of Channel Cleared
  - Reestablish Berm Crest at 6'
  - Created Containment Berm with Onsite Sand

How did elevation affect nesting bird use of the site?

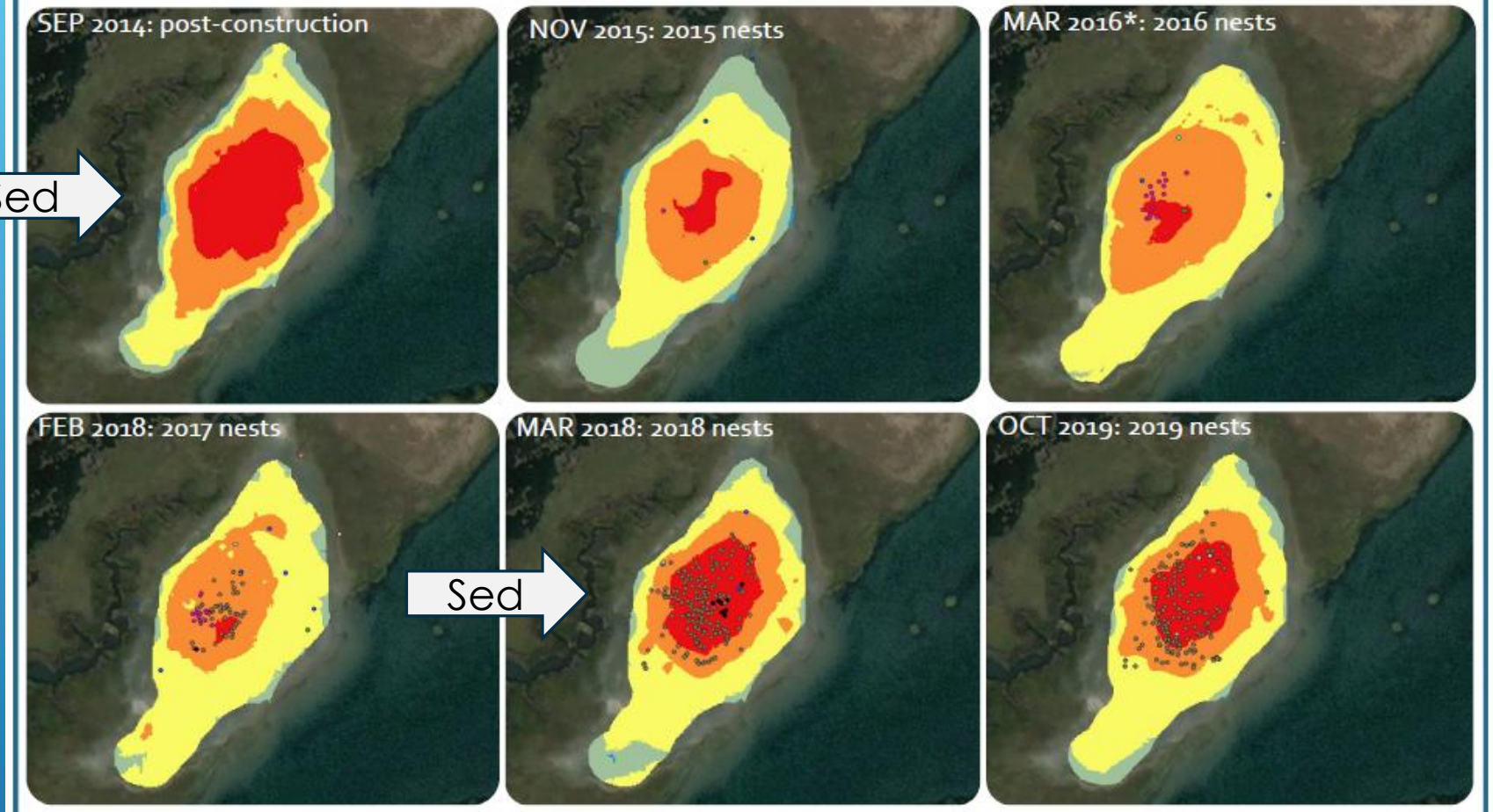
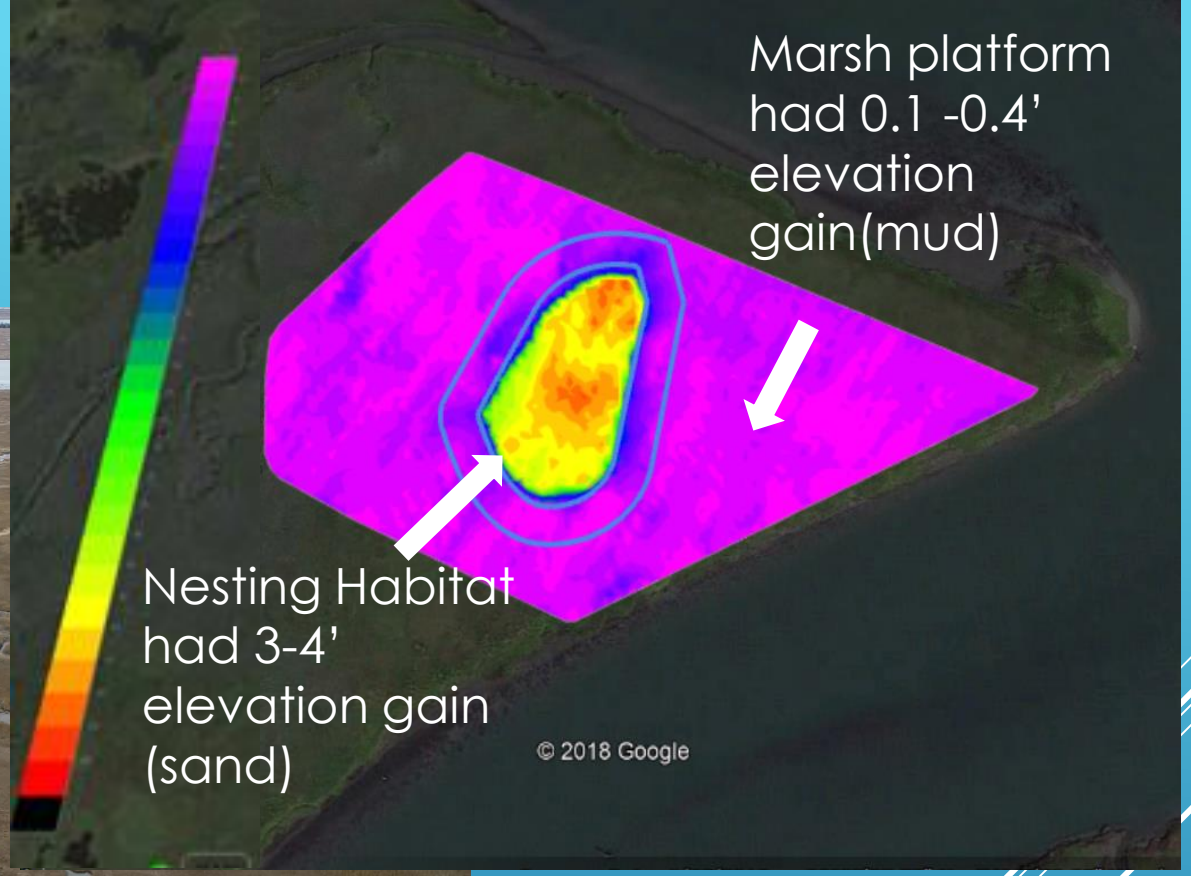
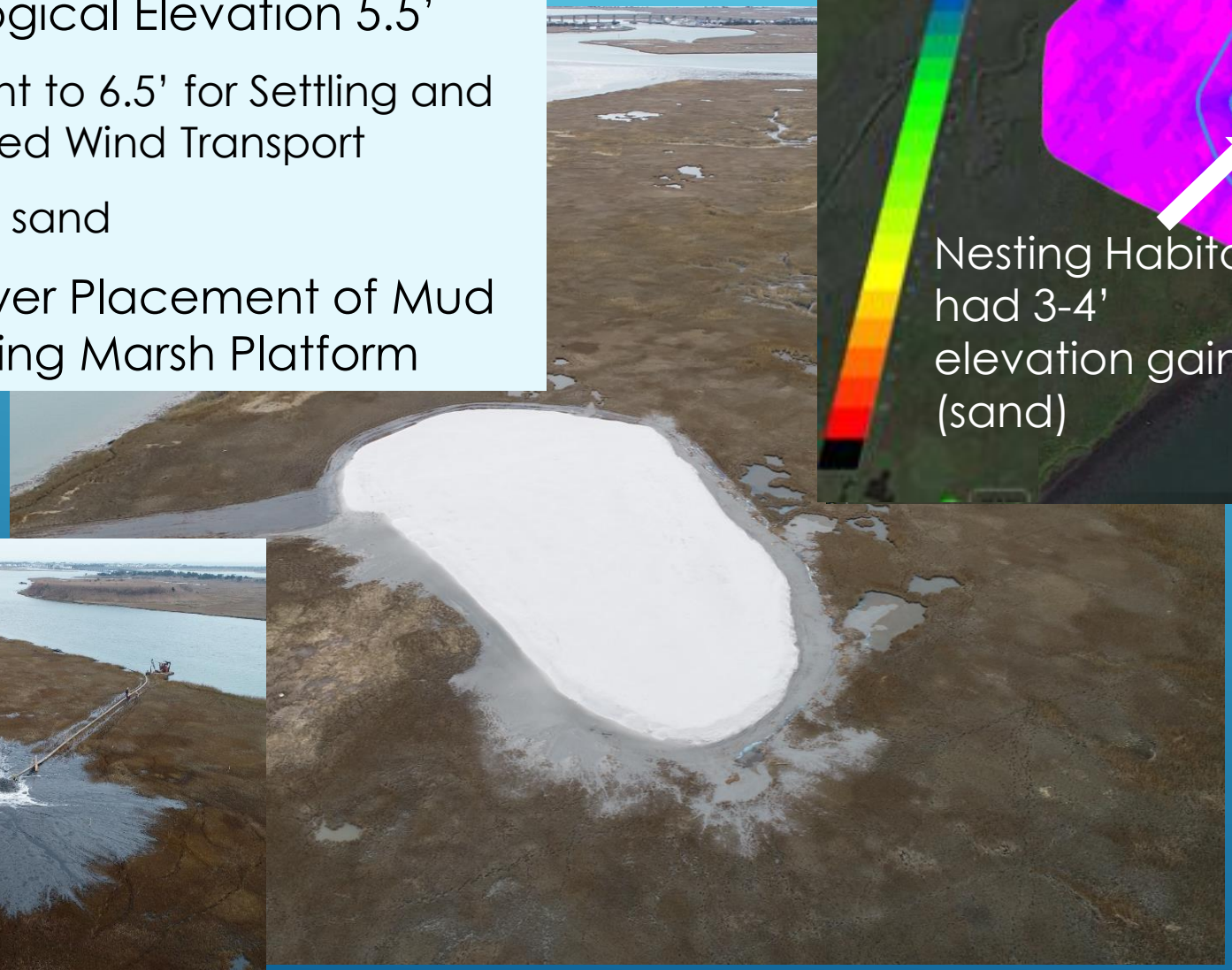


Fig. 7. Elevation models (ft, NAVD88) and nest locations on Ring Island elevated nesting habitat over 5 years. Images labeled by 'Elevation data month year: nest data year'
Nest displayed by species, collected by Garmin GPS or Trimble GPS. Elevations modeled from RTK data using empirical kriging model in ArcGIS, all years except 2016. *2016 elevations modeled from LiDAR data, provided by USACE, modeled by Princeton Hydro.

Ferguson, et al, 2019

- Placed 6,000 yd^3 on 1 acre habitat
- Free Pump until Material to Create Containment
- Target Ecological Elevation 5.5'
  - Placement to 6.5' for Settling and Anticipated Wind Transport
  - 95%+ fine sand
- Had Thin Layer Placement of Mud on Surrounding Marsh Platform





NORTHERN SMIIL USACE PRIOR PLACEMENT AREAS

- Prior Placement Sites Created Important Wading Bird Habitat
  - Nesting Areas Account for Nesting for Nearly 1/3 of Wading Birds in State of NJ
- Habitat Degrading with Elevation Loss

ISLAND ELEVATION ENHANCEMENT AND SANDY MARSH EDGE PROTECTION

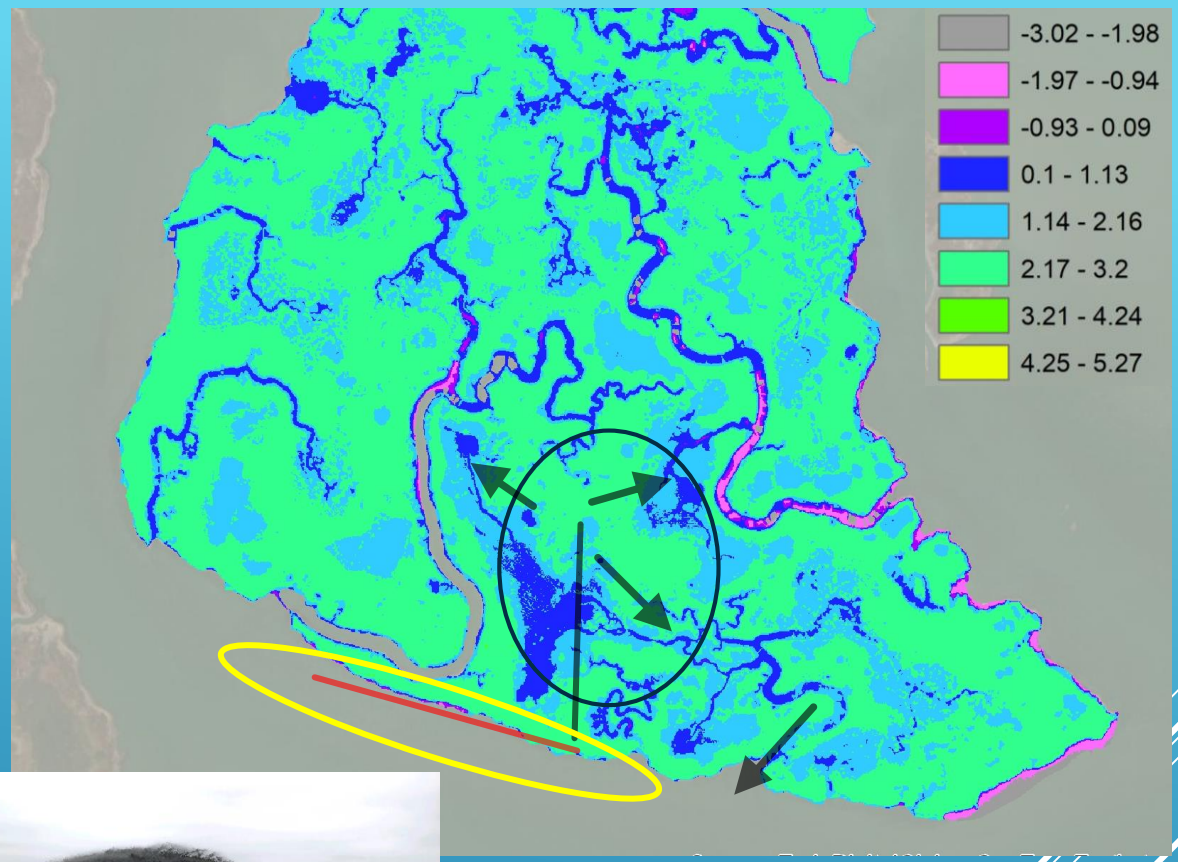
Ecological Goals

- Unconfined on Marsh Sediment Placement to Create Elevated Nesting Habitat for Wading Birds
- Tidal Creek Outflow to Expand Intertidal Flats
- In Water Placement to Create Sandy Marsh Edge Protection Feature and Diamondback Terrapin /Horseshoe Crab Nesting Areas

- Dredge Methods
  - Direct placement to build marsh elevation
  - Distribution Pipe to Separate Sand and Mud
  - Marsh Edge Placement of Sandy and In water Placement of Mud

ISLAND ELEVATION ENHANCEMENT & MUD BERM EMPLACEMENT

- Ecological Goals
  - Increase Elevation to High Marsh (> 3.5' NAVD88)
    - Target Seaside Sparrow and Wading Bird Nesting Elevation
    - Replace Lost High Marsh Habitat
    - Increase Marsh Platform Elevation to *Spartina* Benchmark Elevations
  - Build Subtidal Up to Intertidal Mud Berm
    - Shallow Subtidal Area to above MLLW to Enhance Benthic Macroalgae
- Dredge Methods
  - Direct placement to build marsh elevation
  - Y-valve to direct sand vs mud
  - In water placement of mud



ADVANCING SCIENCE AND PRACTICE AT THE SEVEN MILE ISLAND INNOVATION LABORATORY

- For more information:
- Lenore Tedesco – ltedesco@wetlandsinstitute.org
- Monica Chasten - Monica.A.Chasten@usace.army.mil
- Wetlandsinstitute.org/SMIIL
- ewn.el.erdc.dren.mil/

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Pursuit of Engineering With Nature® Strategies in the New Jersey Back Bays

Lenore P. Tedesco, PhD

Executive Director, The Wetlands Institute

ltedesco@wetlandsinstitute.org

Monica Chasten

Project Manager, USACE

Monica.A.Chasten@usace.arm.mil