

*New Jersey Department of Transportation
Office of Maritime Resources*

The Beneficial Use of Dredged Material as a Tool
for Saltmarsh Ecosystem Restoration in Coastal New Jersey:
Lessons Learned from Fortescue, NJ

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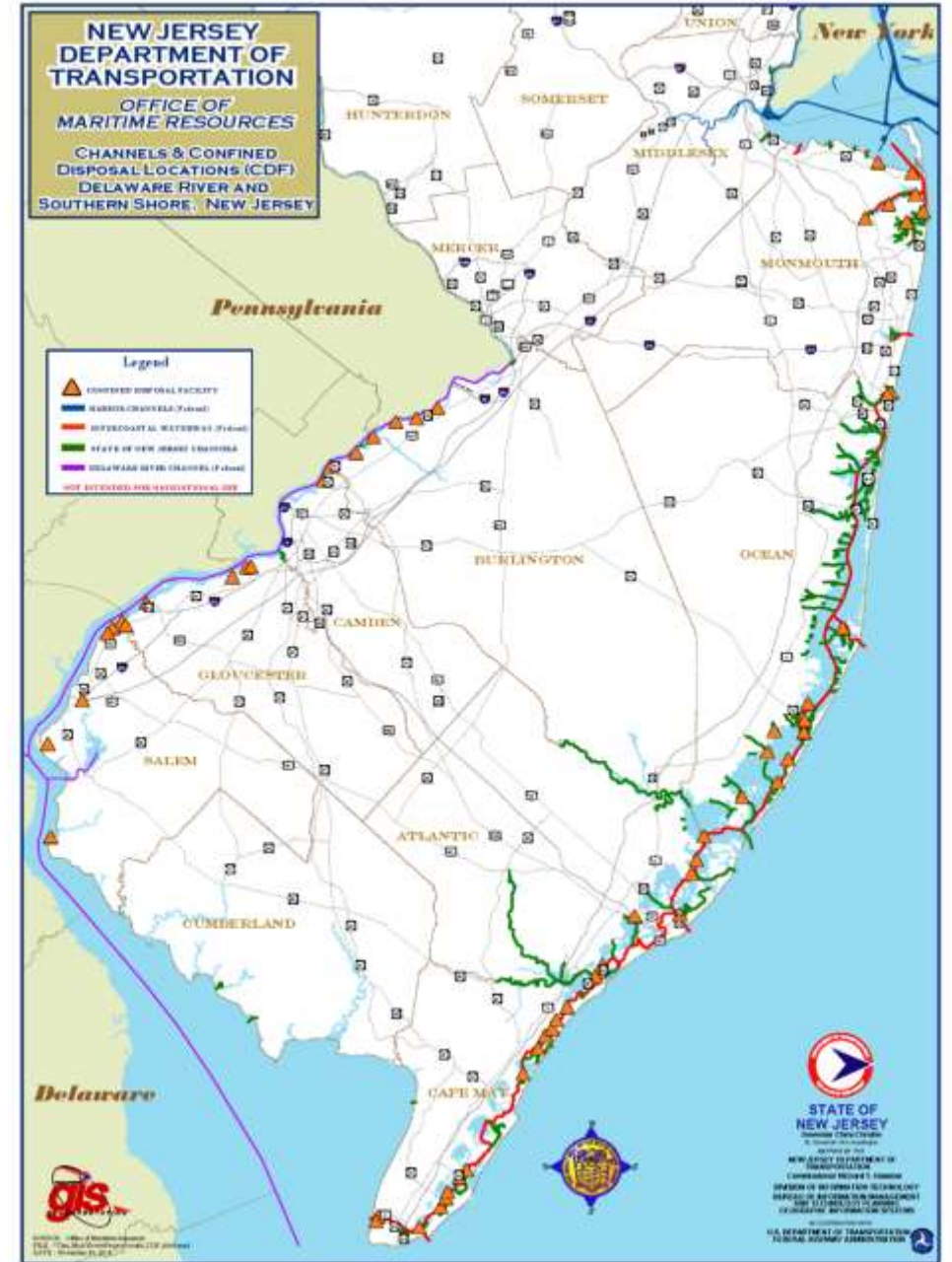
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WEDA –Eastern Chapter Meeting, October, 2019

New Jersey's Marine Transportation System

- Federal Channels in NY/NJ Harbor, Delaware River, and NJ Intracoastal Waterway; over 465 nm (860 km) of engineered waterways
- State Channel Network - 215 Marked and Identified Channels; over 200 nm (370 km) of engineered waterways
- Two International Ports (PONYNJ and South Jersey Port Corporation)
- Internationally recognized tourism destination
- World Class Fishery (most lucrative shellfishery in the U.S.)
- Worth over \$50 billion annually to the New Jersey economy



State Channel Dredging

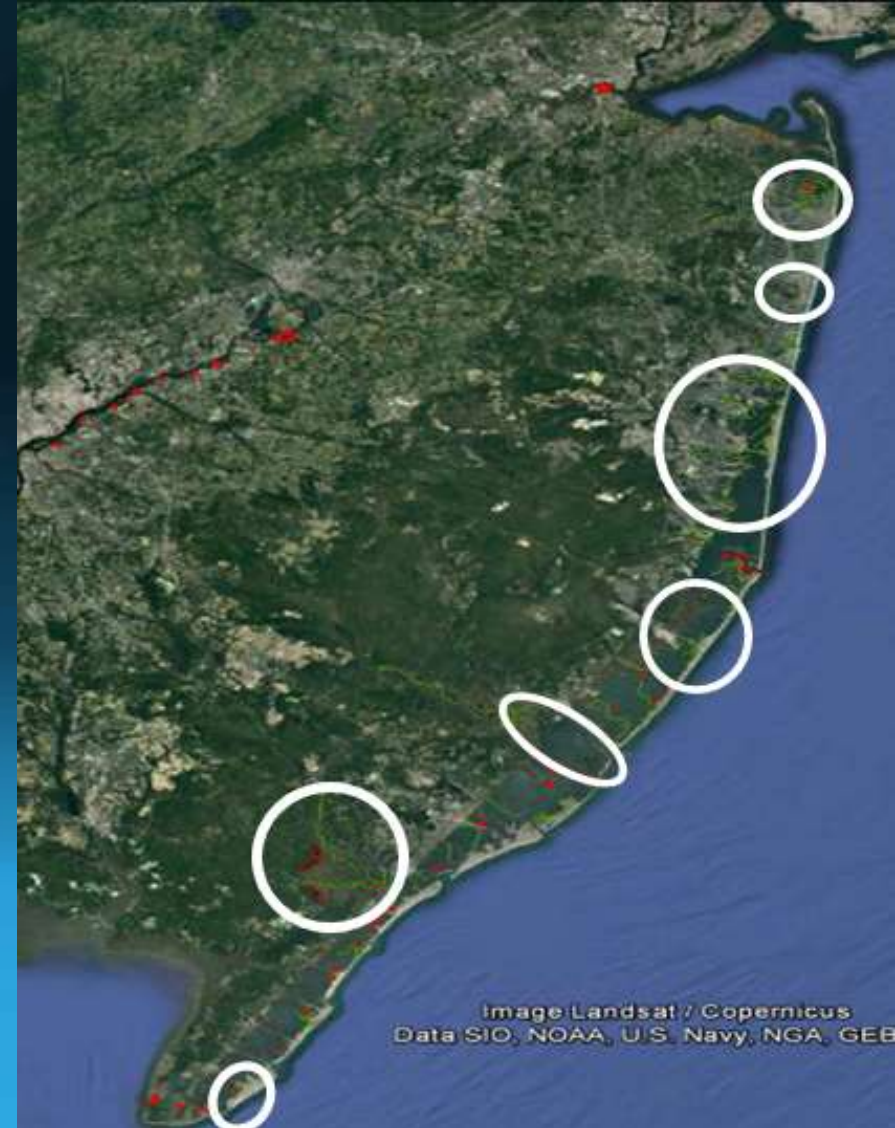


- 200 nm of State channels
- 100 nm of Federal Intracoastal Waterway
- 500,000 cy per year of material ranging from sand to silt
- Immediately following Superstorm Sandy we identified 3 million cubic yards of dredging need system wide
- Hydraulic cutterhead pipeline dredging to CDFs for silt or beachfill for sand



Gap Analysis

- Roughly 7 areas statewide without readily available management options
- Over 100 channels affected
- Non-traditional technology is very expensive and time consuming
- Permit requirements often limit practical solutions – more hard data on dredging and dmm impacts are needed
- Sustainable solutions require community input and support



Fortescue, Cumberland County, NJ

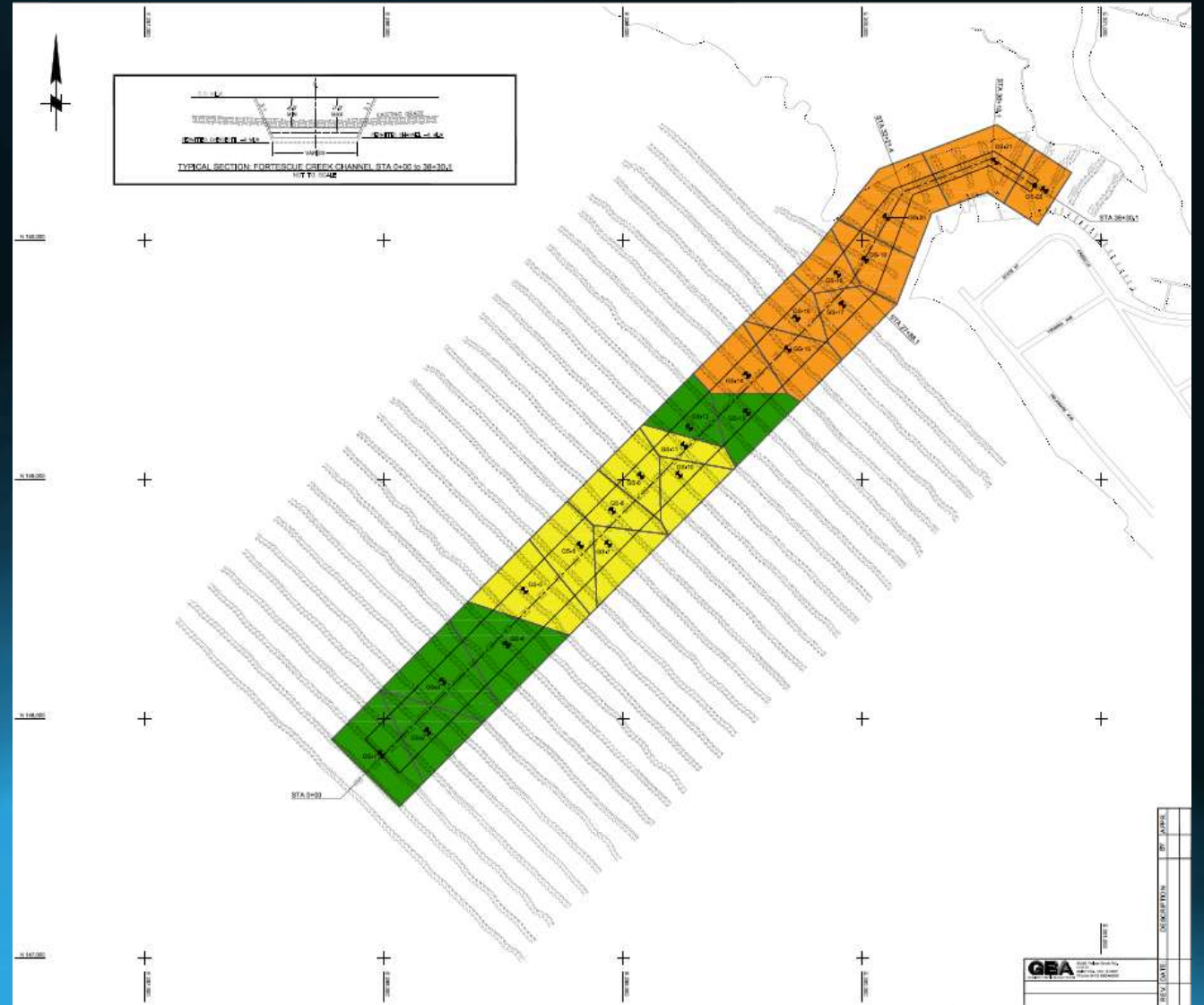
- 2 Large Marinas
- State boat ramp
- Charter boats
- Dock and Dine
- Search and Rescue



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Channel Characterization

- 7,800 cy of >90% sand
- 16,650 cy of fine sand and mixed sandy material (>75% sand)
- 11,350 cy of fine grained material



Example of NJ Coastal Marsh Loss



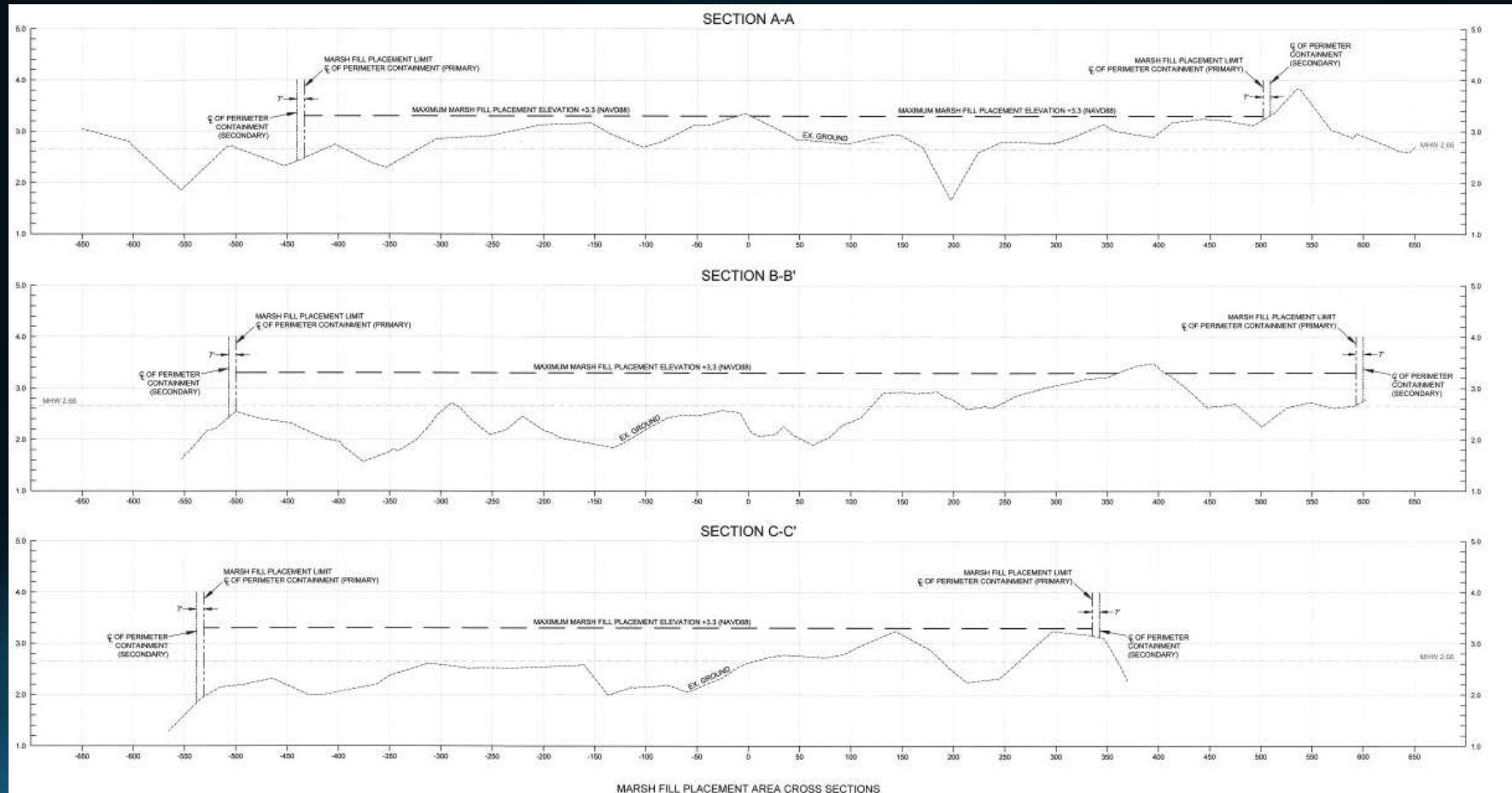
Overall Design Concept

- Achieve target grade of -6+1 MLW in channel by removing a total of 35,900 cy
- Place 11,400 cubic yards of fine grained material to marsh
- 7,700 cubic yards of coarse material to dune
- Remaining coarse material (16,800 cy) to beach

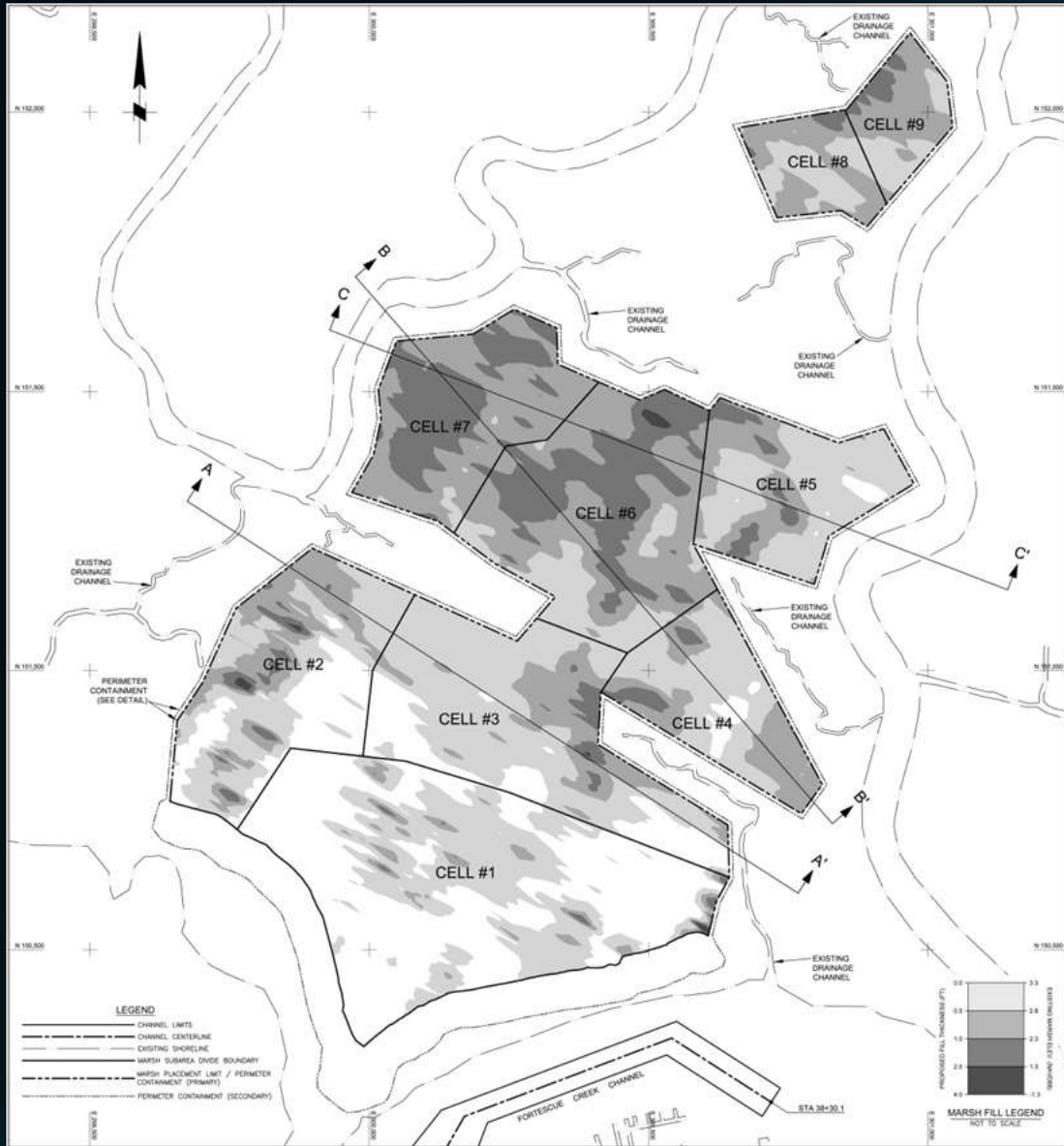


Marsh Enhancement

- Fill to elevation 3.3 ft NAVD88 (low marsh elevation)
- Original design called for 11,400 cyd over 22.4 acres



Fill Thickness



- Focus on biological endpoints of plant communities
- Final elevation drives plant communities
- Fill may be thin or thick depending on initial conditions and project goals
- Important to monitor consolidation and plant succession
- Material type matters for construction and for goals

Material Distribution

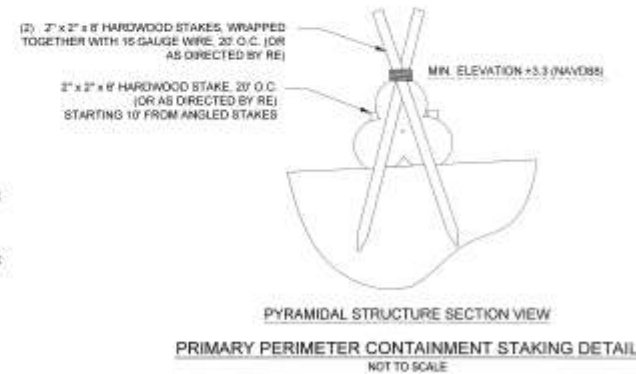
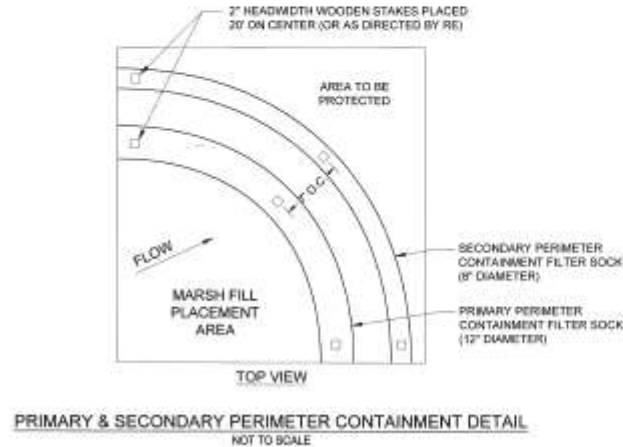
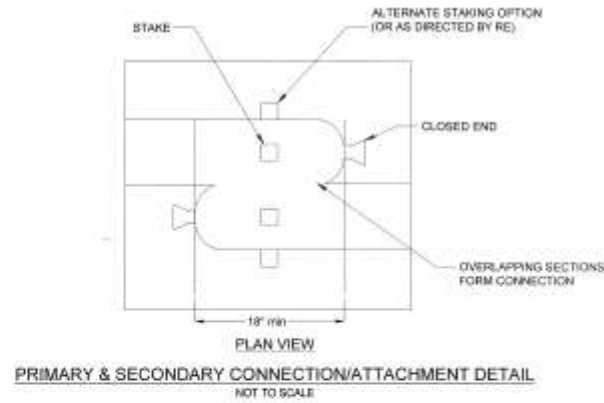
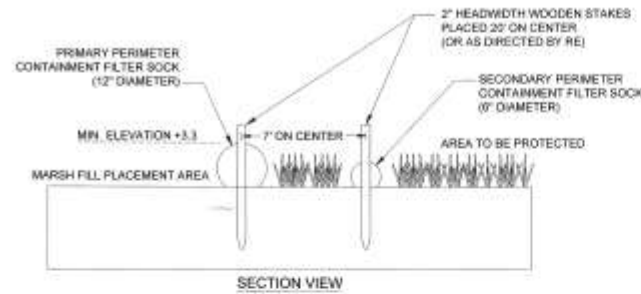


Fill Placement in Sequence:

- Install inflow piping for initial two sequences.
- Three inflow points available any dredging day.
- Three groupings of sequential fill. Change as directed by RE.
- Direct inflow point within each grouping with quick change valves.
- Each inflow point has both pipe spreader and nozzle discharge tools available.

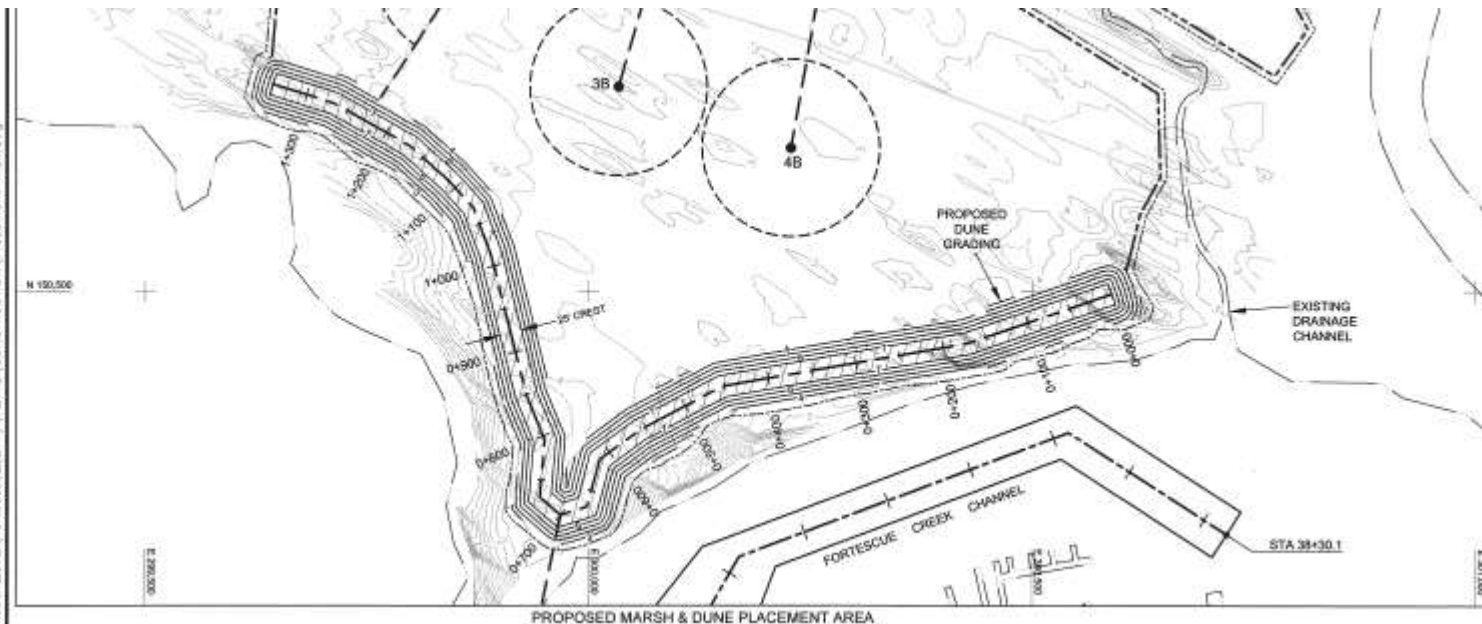
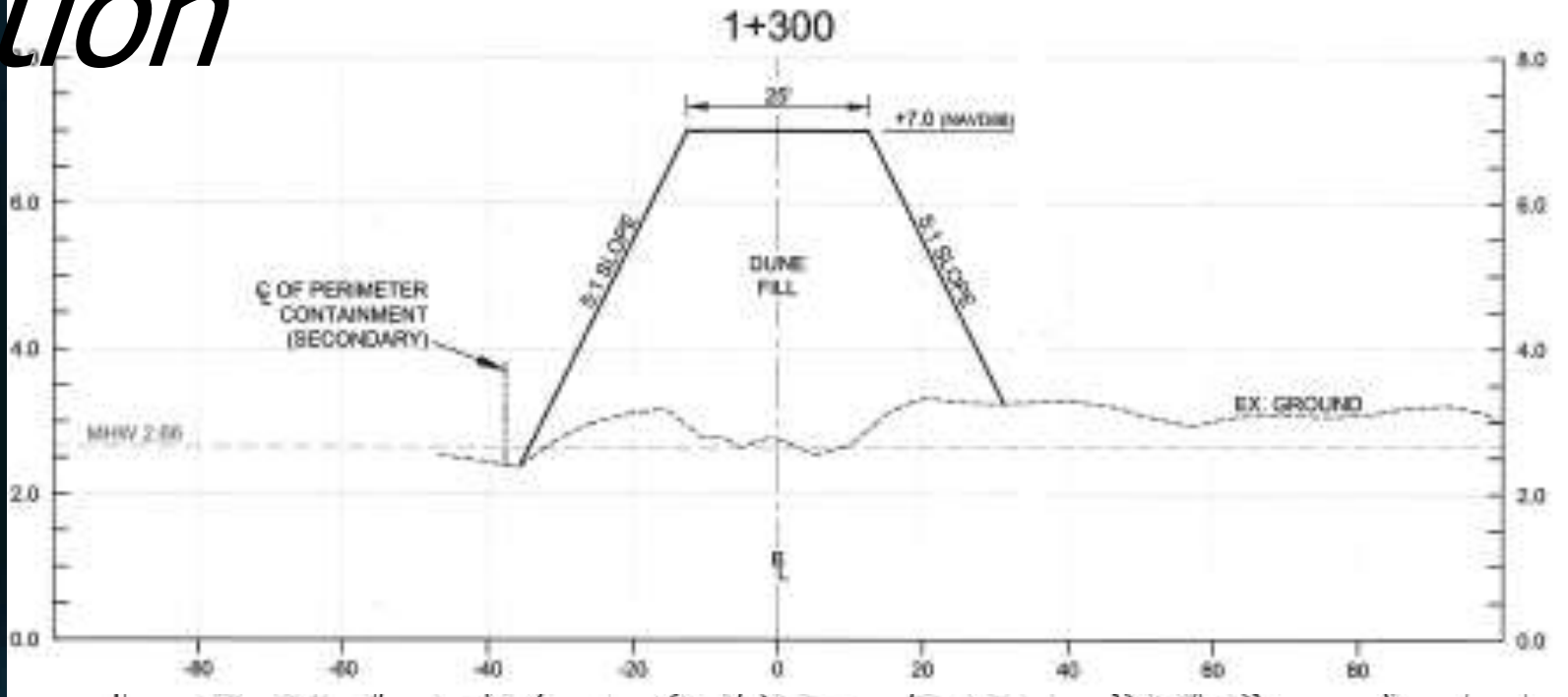
Material Containment

- 22,000 linear feet
- Keep as much material on the marsh as possible
- Ensure material does not end up in areas where not needed
- Protect tidal streams from sedimentation
- Use biodegradable materials or remove containment once material has consolidated



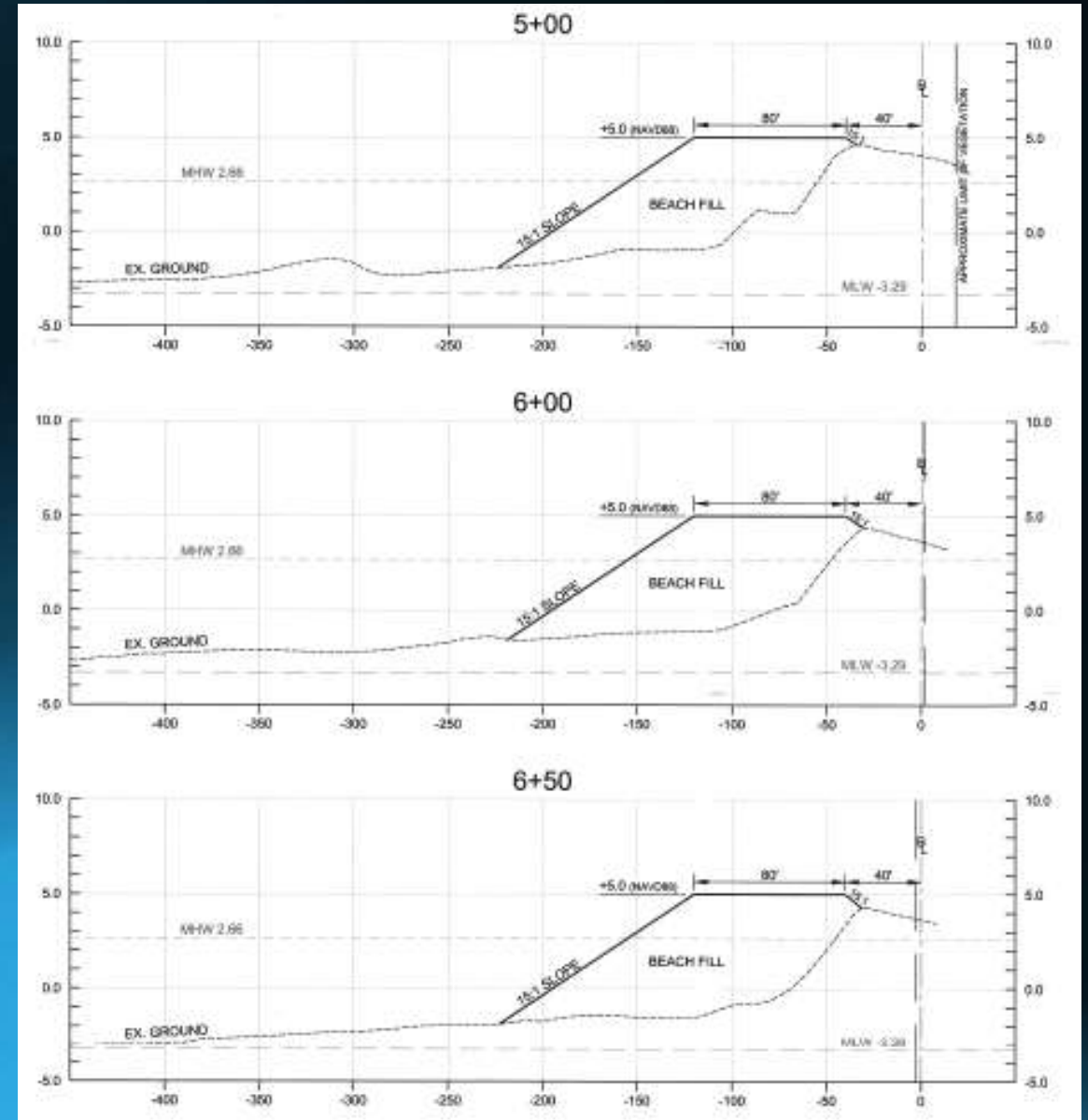
Dune Restoration

- Protect marsh from wave action and storm surge.
- Original design called for a dune approximately 3' high, 25' wide at the top and 1340 ft long comprised of 7,700 cyd of sand on 1.9 acres.
- Material to be pumped into a surge hole then excavated and placed in lifts to achieve design.



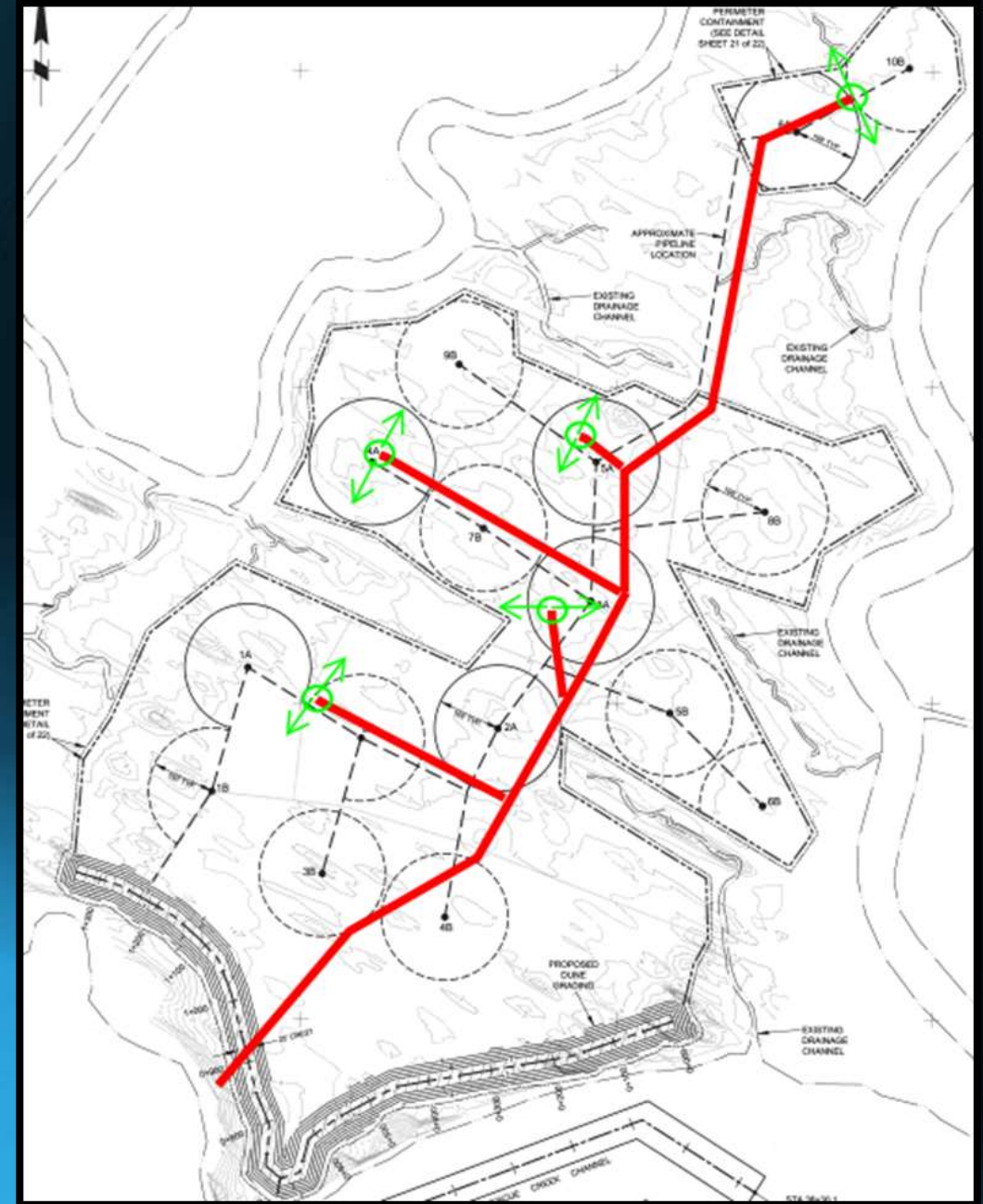
Horseshoe Crab Beach Enhancement

- Restore habitat for horseshoe crabs to breed and lay eggs
- Original design called for 16,800 cyd over 2.8 acres

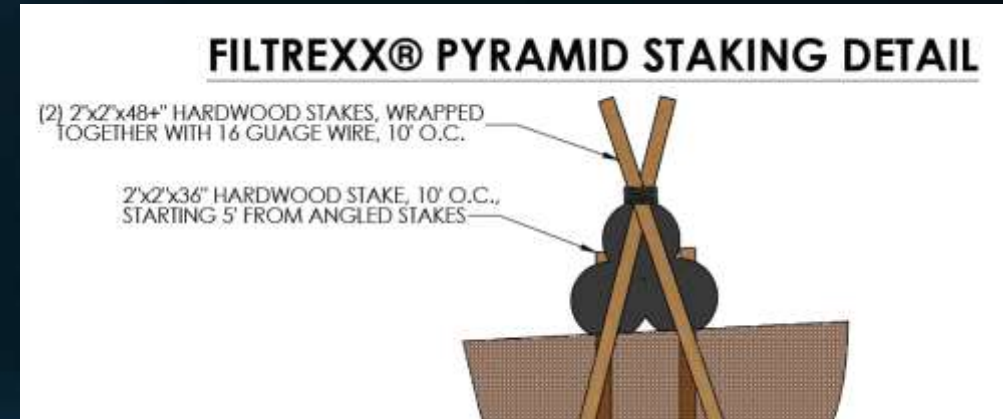
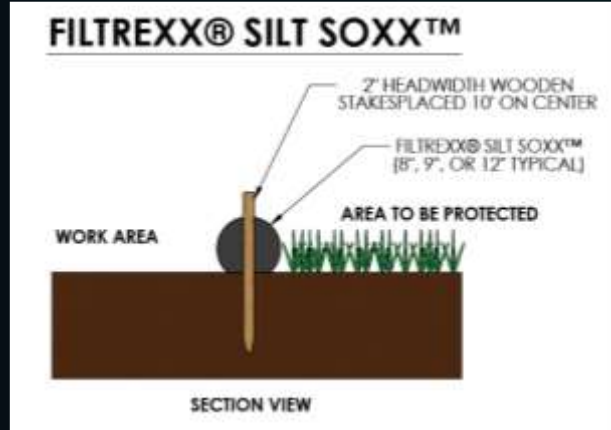


Fill Thickness





Material Containment



Marsh Enhancement

- 6.61 acres, 6,500 cyd over 16 days





1

2

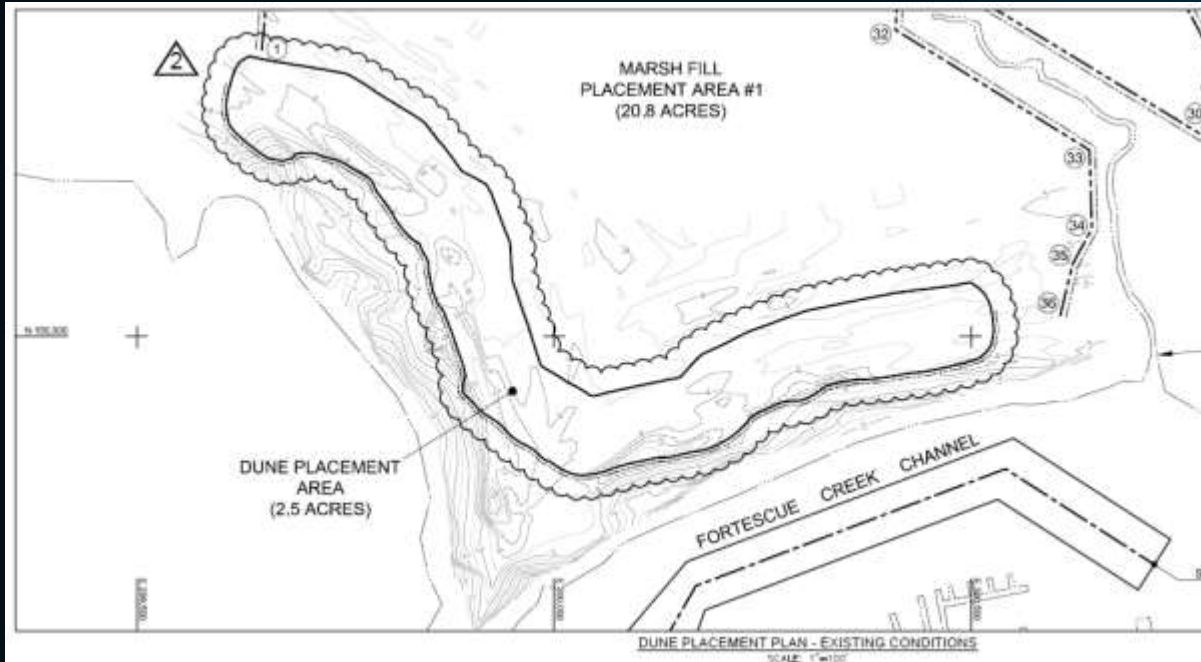
Horseshoe Crab Beach Enhancement

- 1.6 acres (two sites), 7,300 cyd over 8 days



Dune Restoration

- Increased volume to 18,500 cyd
- Increased footprint to 2.5 acres
- Increased top of berm width to 40'
- Decreased length to 1100'

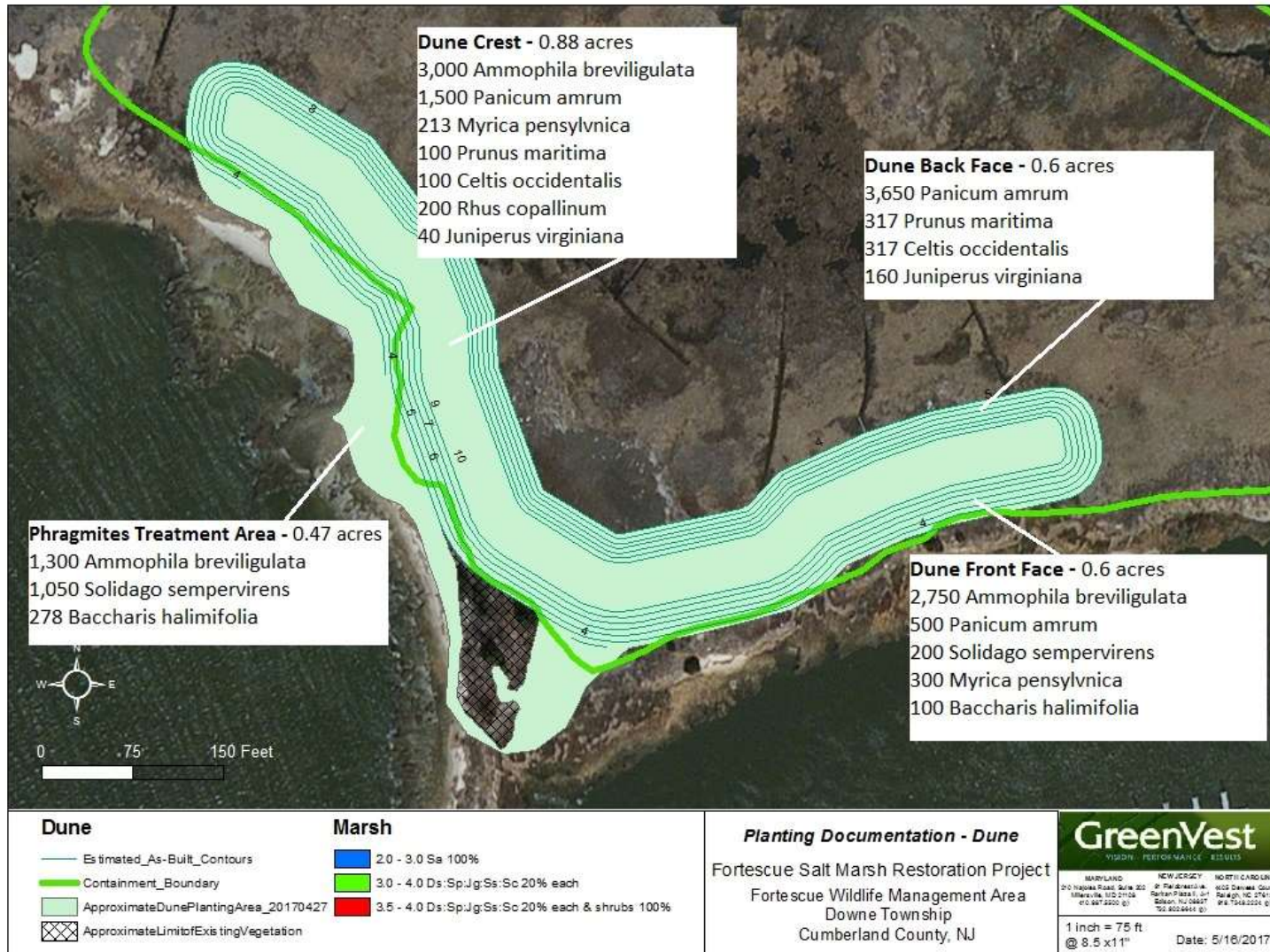


Dune Restoration

- 1100 ft, 18,350 cyd over 21 days



Dune Planting



- Phrag. control
- 16,000 plants
- 9 species



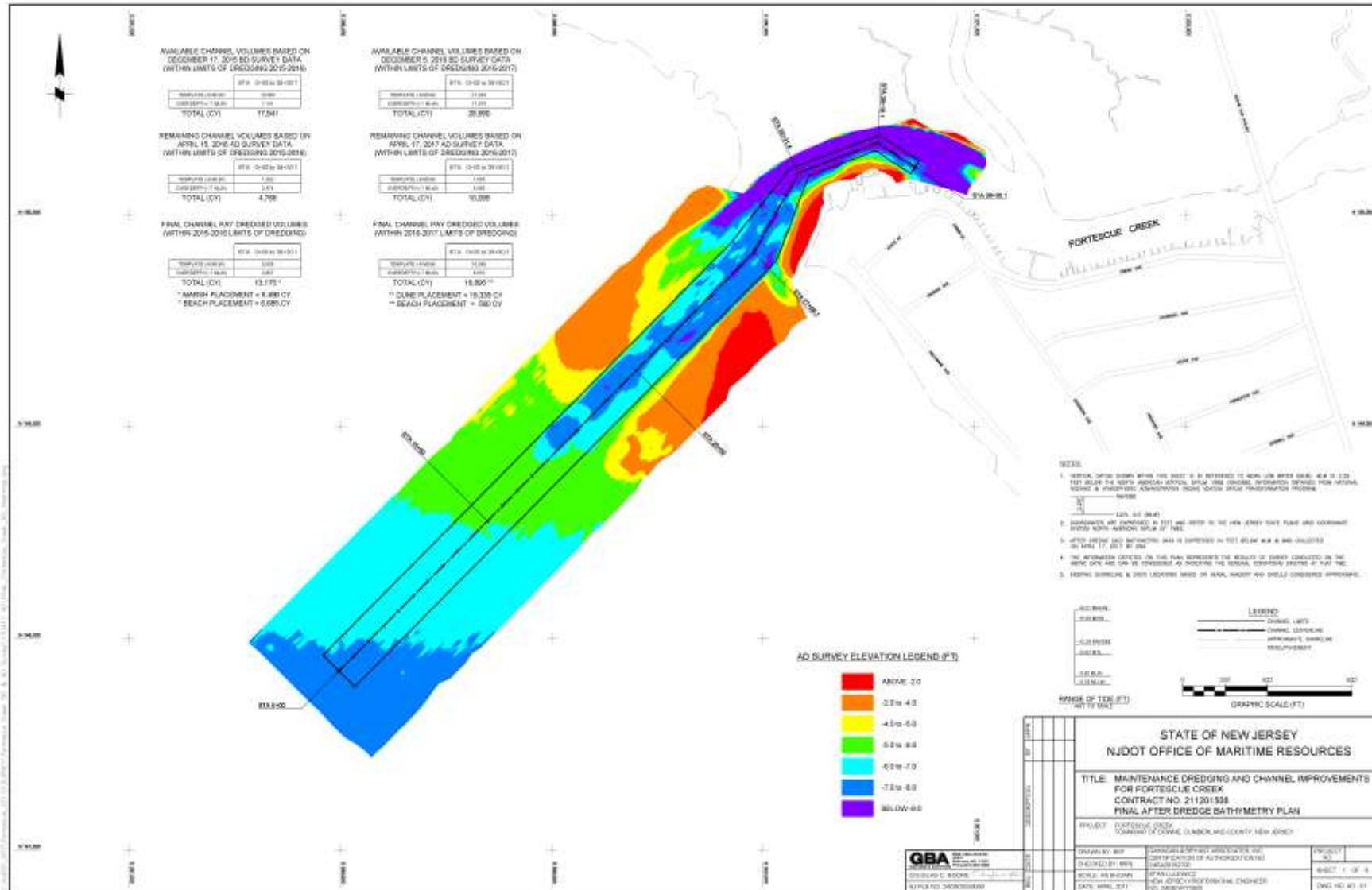
Logistics



Logistics

- Work window limited to October 1 to April 15
- No night operations due to safety concerns
- Year 1 NTP issued Dec 22, 2015
 - Year one 18 dredging days (Mar 6 to April 15)
 - Year two 23 dredging days (Feb 15 to April 12)
- Mob and containment took 77 days
- Unfavorable site conditions
- Weather delays (28 days)
- Waves, high tides and storm surge
- Equipment issues/contractor experience

Final Condition Survey



Post-Construction Monitoring Program

Formal Monitoring

- Vegetation
- Elevation & Topography
- Surface Water Levels
- Wildlife communities
 - Fish
 - Birds
 - Macroinvertebrates
 - Benthic infauna
- Sediment Testing
- Wave Energy & Flood Modeling

Monthly Site Inspections

- Started in April 2016
- Real-time observations to identify significant issues and guide adaptive management
- Observations of:
 - Vegetation recovery/die-off
 - Containment
 - Dredged material
 - Planted material
 - Wildlife
- Fixed photo points



Marsh Damage

2016



2017



2018



2019



Site Recovery



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Fortescue 20191010

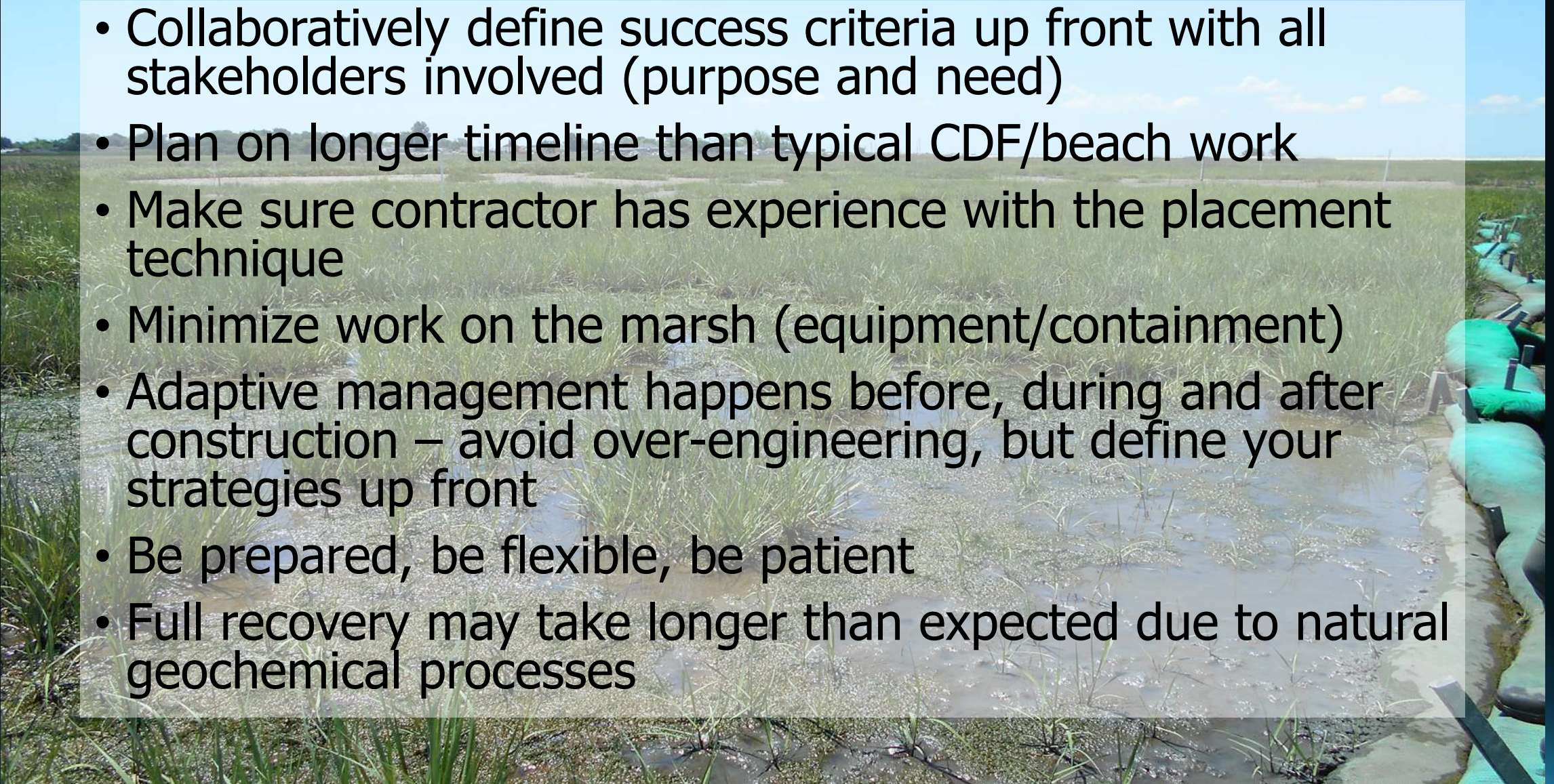
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The Bottom Line

- Overall Contract Cost
 - NJDOT (Construction) \$3,430,128
 - NJDOT Engineering and Oversight \$1,152,224
 - NJDEP (Permitting, Monitoring for 5 years) \$600,000
- Cost per cubic yard for Marsh Enhancement – **\$241.2** (plus E/O)
- Cost per cubic yard for Dune Restoration - **\$81.9** (plus E/O)
- Cost per cubic yard for Beach Replenishment - **\$59.9** (plus E/O)
- Cost per acre of marsh restored – **\$236,850** (plus E/O/Monitoring)
- Cost per linear foot of dune restored – **\$1,363** (plus E/O/Monitoring)
- Cost per acre of beach enhanced – **\$278,189** (plus E/O/Monitoring)

Lessons Learned

- Collaboratively define success criteria up front with all stakeholders involved (purpose and need)
- Plan on longer timeline than typical CDF/beach work
- Make sure contractor has experience with the placement technique
- Minimize work on the marsh (equipment/containment)
- Adaptive management happens before, during and after construction – avoid over-engineering, but define your strategies up front
- Be prepared, be flexible, be patient
- Full recovery may take longer than expected due to natural geochemical processes







Thank You!

