Coastal Resilience Community of Practice Meeting

Tuesday, October 15, 2024 – 1:00 - 3:00pm

Purpose of the COP: Bring together diverse coastal stakeholders to focus on how ecosystem resilience can build local community resilience. We don't necessarily have to have a "thing" to work on but will take on projects as appropriate and mutually agreed on. Website: https://deq.nc.gov/coastal-resilience-cop

In Attendance:

- Abby Williams, NC Coastal Reserve & National Estuarine Research Reserve
- Alisa Davis, NC Wildlife Resources Commission
- Brian Byfield, NC Office of Recovery and Resilience
- Cat Bowler, Audubon NC
- Charles Grisafi, NOAA's Office for Coastal Management
- Charlie Deaton, NC Division of Marine Fisheries
- Claire Rapp, North Carolina Coastal Federation
- Dawn York, Moffatt & Nichol
- Eryn Futral, NC Emergency Management
- Forest Shepherd, NC Division of Water Resources
- Helene Wetherington, NC Office of Recovery and Resilience
- Jacob Boyd, North Carolina Coastal Federation
- Joe Heard, Town of Duck
- Kasen Wally, NC Division of Coastal Management
- Kiera O'Donnell, Duke University
- Lisa Rider, Coastal Carolina Riverwatch
- Lisa Williams, Mid East Commission
- Lora Eddy, The Nature Conservancy
- Mackenzie Todd, NC Division of Coastal Management
- Madison Teeter, Arcadis
- Marae West, Sandbar Oyster Company
- Margaret Boshek, Moffatt & Nichol
- Mariko Polk, NC Sea Grant
- Meg Perry, SWCA Environmental Consultants
- Michelle Lovejoy, Environmental Defense Fund
- Niels Lindquist, Sandbar Oyster Company
- Paula Gillikin, NC Coastal Reserve & National Estuarine Research Reserve
- Phillip Todd, Freese & Nichols
- Rachel Baker, Moffatt & Nichol
- Riley Lewis, Coastal Carolina Riverwatch
- Robin Hoffman, NC Division of Water Resources
- Sara Marschhauser, Audubon NC
- Stacey Feken, Albemarle Pamlico National Estuary Partnership
- Steve Bevington, NC Department of Natural and Cultural Resources, Land and Water Fund
- Tashya Allen, NOAA's Office for Coastal Management
- Whitney Jenkins, NC Coastal Reserve & National Estuarine Research Reserve

Notes:

Carrot Island Living Shoreline, on the Rachel Carson Reserve in Beaufort – Paula Gillikin, NC Coastal Reserve & Dawn York, Moffatt & Nichol – See Slides

Paula:

- Rachel Carson Reserve – approximately 2300 acres, designated in 1985, outdoor classroom and living laboratory
- Living shoreline on east end of Carrot Island – rapidly eroding. Wanted to reduce erosion through natural infrastructure. A dredge spoil cell from ACOE, turned into maritime forest, steep bluff there. Needed to protect houses behind it.
- Used loose oyster shells at first, completely unsuccessful.
- Then worked with UNC Institute of Marine Science create a sill out of 48,000 bushels of oyster shells. Again, unsuccessful, rolling over itself with high energy
- Dawn York and Carteret County approached to help stabilize the area. Reserve cares about habitat and novel techniques.
- Erosion of Shackleford Banks is contributing to changes at the Rachel Carson Reserve (RCR)

Dawn:

- Idea of project came from RCR resilience planning efforts. Because of Hurricane Florence, there was emergency coastal resilience funds available from National Fish and Wildlife Foundation, as Carteret County was an area of impact where congressional funds could be spent.
- Goals of the project include enhancing lost habitat, supporting oyster reef that had been lost, stabilizing the upland, minimizing wave impact, and using novel shoreline stabilization techniques.
- Basis of design – lengthy process based on local conditions. Only focusing here on waves – wave modeling completed. Boat wakes and storm events are primary causes of erosion.
- To determine the height of marsh sill needed to support vegetation, wave transmission study was conducted. Sill height of approximately 2 feet was selected
- To further protect the shoreline, second row of sill was installed, OysterCatcher material was used. Not just attenuating waves, but also enhancing lost oyster habitat. And we saw sand deposition just days after installation.
- Planted *Spartina alterniflora* and *Spartina patens*
- 10-foot gaps for critter movement. Worked with Natrix on wave attenuation devices, set on a bedding layer that is 6 feet wide. OysterCatcher materials are tables and pillows – roughly 2800 of those
- Many funders, see slide. Cost per linear foot = $1254
- Permitting – complicated but regulators were able to work with the project timeline.
- Navigation markers required

Paula

- Pre and post construction monitoring, for 3 years. Also measuring recreational use, quite a few kayakers around the site

Q&A with Paula & Dawn

Oysters settling? Yes, even though we install after the peak of oyster spawning. There is scour around Natrix material, but these spots may become good recreational fishing holes once the oysters settle.

Sandbar Oyster Company – Marae West & Niels Lindquist – See Slides

- Shellfish are our construction partners, rough frame the reef and then the oysters nail it all together to create a reef.
- Design them so they are easy to ship, easy to put on small vessels and hand install
- Sink the legs into the sediment, rough legs that prevent them from coming out
- Started working at oyster leases in 2015, the reefs we created increased the elevation enough to grow *Spartina* marsh
- Worked with a sculpture from Florida State University, made pieces with OysterCatcher in the estuary
- Very high settlement rates of oysters on the material, growing off bottom also helps
- Interlocking table units help maintain shape
- Can work in high energy environments. Working with other materials, like Reefmaker, to attenuate wave energy. Can add *Spartina* in between the OysterCatcher material
- Shape is very adaptable
- Sugarloaf Island in Morehead City, reef building closer to the shoreline, seeing sediment accumulation
- Worked at the base of bulkhead, tables and pillows. There was a hurricane almost post construction, did not damage the material, and actually added sediment to the site
- Working with The Nature Conservancy in Virginia – works well in soft sediment
- Website: www.Sandbaroystercompany.com
- Contact: marae@sandbaroystercompany.com

Q&A with Marae & Niels

- At Carrot Island, there looked to be fallen trees and debris along the shoreline. What kind of maintenance do you have to do around the reef? Clear? We built the sill around the fallen trees, they were already there. There was some concern about the trees shifting and impacting reefs, but don't think that will happen.
- Permitting? Moffatt and Nichol led permitting for the Carrot Island projects. Larger projects are more difficult, have to go through the major permit process. Coastal Area Management Act (CAMA) and Army Corps of Engineer permitting took about 9 months. Had to do a Section 7 consultation with NOAA Fisheries to ensure construction was aligned with their concerns. Made sure permits were also in Reserve name to ensure they can modify if needed
- We have a new manufacturing facility in Leland – you're welcome to come by and check it out

Round robin – members share what they are working on related to resilience

- Lora, The Nature Conservancy Update: Completed building of 10 loose shell shoreline oyster reefs on the backside of Pea Island National Wildlife Refuge in Dare County. Project in partnership with USWFS & NCCF Oyster Shell Program. 8 reefs built by contractor and volunteers built 2 additional reefs. Preliminary site visits indicate oyster recruitment is occurring. In September our new hire Dr. Aaron Bunch started as our NC Coastal Applied Scientist.
- Dawn – You may be aware of the Town of Nags Head estuarine shoreline management plan. Three project from the plan have been funded. Two received Resilient Coastal Communities Program (RCCP) Phase 3 funding. Land and Water Fund funded the third project. Would love to work with NC Coastal Federation and The Nature Conservancy on their living shoreline projects, lessons learned, design adaptations, etc.
- Kasen – RCCP update – done with awarding Phase 3 & 4 (engineering, construction). Twenty grants, $6.21 million. The money is going towards living shoreline construction, ordinance updates, stormwater action plans, permeable pavers, bioswales by roadways, wetland restoration. Contracting process underway. Wrapping Phases 1 & 2. May have future funding for another round of Phases 3 & 4 and maybe Phases 1 & 2 around the new year.

- Steve - $15 million from General Assembly for flooding reduction – funded 17 projects, a couple were coastal. DEQ flooding resilience blueprint – additional funding for Aurora to address stormwater and river flooding
- Meg – RCCP successful project – Town of Hertford, Phase 3 funding, feasibility study to address drainage issues. Culvert replacement with Golden Leaf funding, exciting case of communities implementing projects beyond RCCP funding
- Alisa – Pender Co. landuse plan update, incorporating conservation and resilience into their planning. Brunswick County update looking at for climate resilience
- Joe – APA award tomorrow for Town of Duck shoreline/roadway restoration project
- Stacey – Virginia Crater Planning District Commission/Southern Rivers roundtable, reconvene former Albemarle Chowan Watershed roundtable Oct 19
- Helene: Holly will be presenting at the APA conference tomorrow afternoon. Be sure to stop by and support her Community Disaster Resilience Zone (CDRZ) presentation if you are in Greenville!
- Michelle: I'll be presenting with Cayla Cothron and Ben Hitchings on Thursday AM at conference in Greenville, come by and say hello!

Next meeting in January, next meeting topics

- Salt marsh impacts/migration, marsh migration corridor mapping
- SASMI – final conservation plan – Amanda (coordinator), connection to NC stakeholders (already heard about NC Salt Marsh Plan from Claire at NC Coastal Federation)
- Coastal Carolina Riverwatch: community organizing in North River – Riley Lewis, White Oak Waterkeeper with the Coastal Carolina Riverwatch
    - Study on public policy students, protecting wetlands in Carteret County with public policy changes – Riley
- UNC, ECU drone mapping of SAV. Susan Cohen/ UNC talk more about if interested – Robbie
    - Also, NERR drone mapping/monitoring of oyster reefs and salt marshes
- Don Hornstein – UNC CH – environmental topics
- Agricultural drainage – impacts, how do we manage, how they are governed, drainage districts. Driver in our coastal counties – tech experts at NC State, Soil & Water, SE drainage district – Michelle Lovejoy has contacts. WQ and water movt? Or Governance (Meg's interest)? (2 different talks) NC specific or broader?

A Hybrid Living Shoreline Approach to Protect Carrot Island, a NC Estuarine Research Reserve

October 15, 2024

NC Coastal Resilience Community of Practice

Paula Gillikin, Central Sites Manager, Rachel Carson Reserve

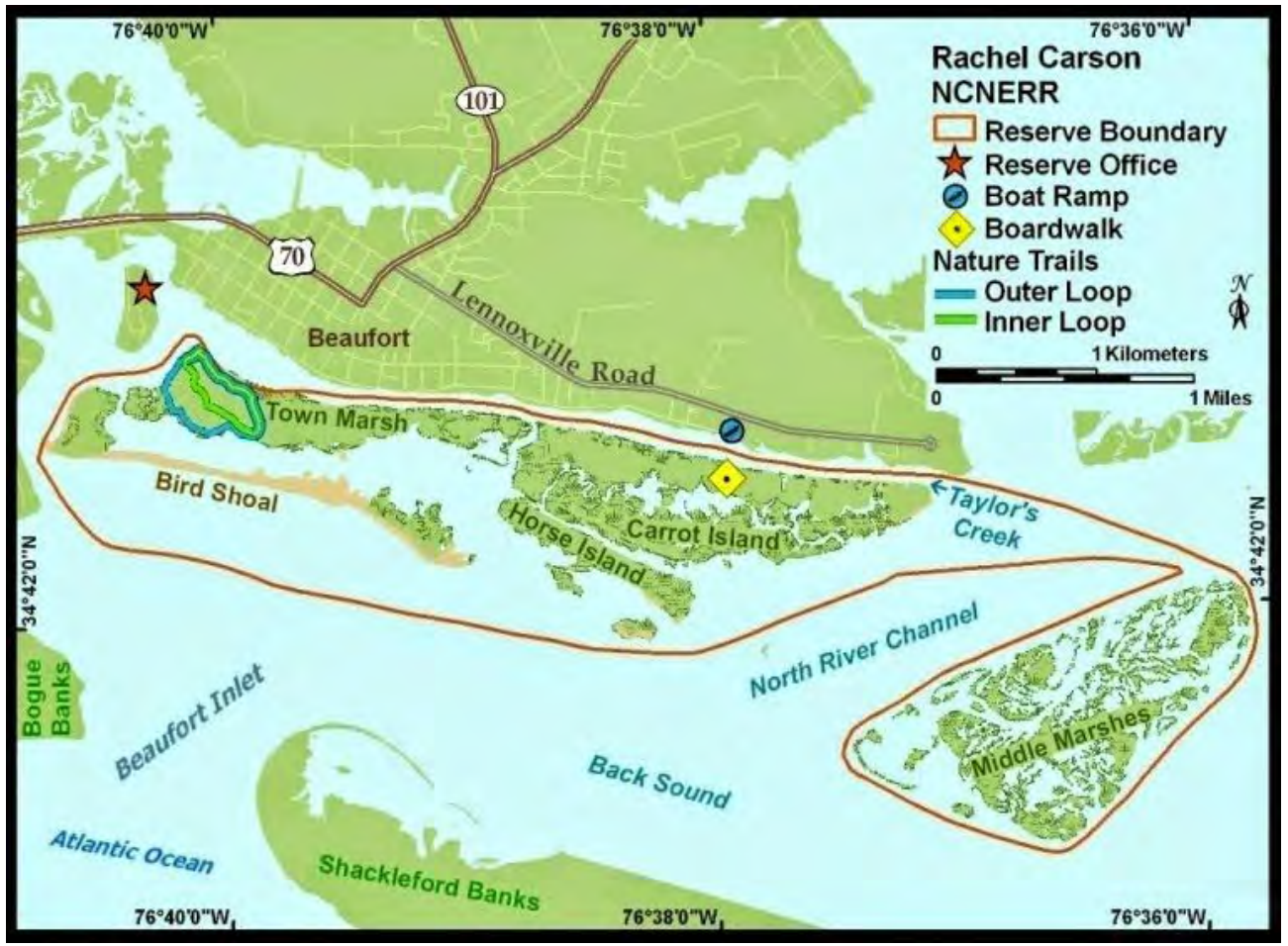
Dawn York & Margaret Boshek, Moffatt & Nichol

moffatt & nichol

Beaufort and the Town Marsh

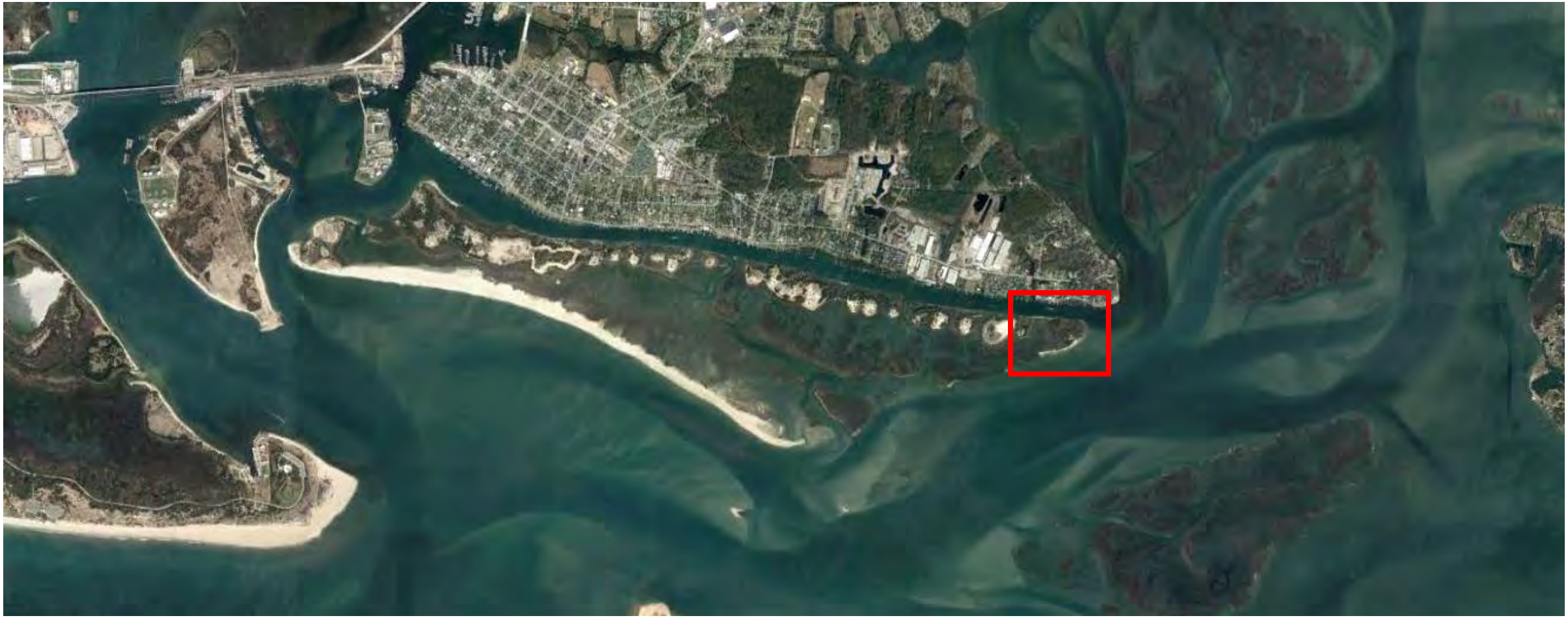
- Town of Beaufort
  - Est 1709 – 3rd oldest town in the state
  - Fishing Village and Port of Safety
- Town Marsh
  - Included on the National Register of Historic Places
  - “Needed to Protect the Waterfront and Harbor View of the Town”

Rachel Carson Reserve



Photos: Rachel Carson Reserve & William Martin

Carrot Island



Carrot Island

Carrot Island

Carrot Island – Changing Neighbors

Carrot Island – Pre-Project Condition

Goals of the Project

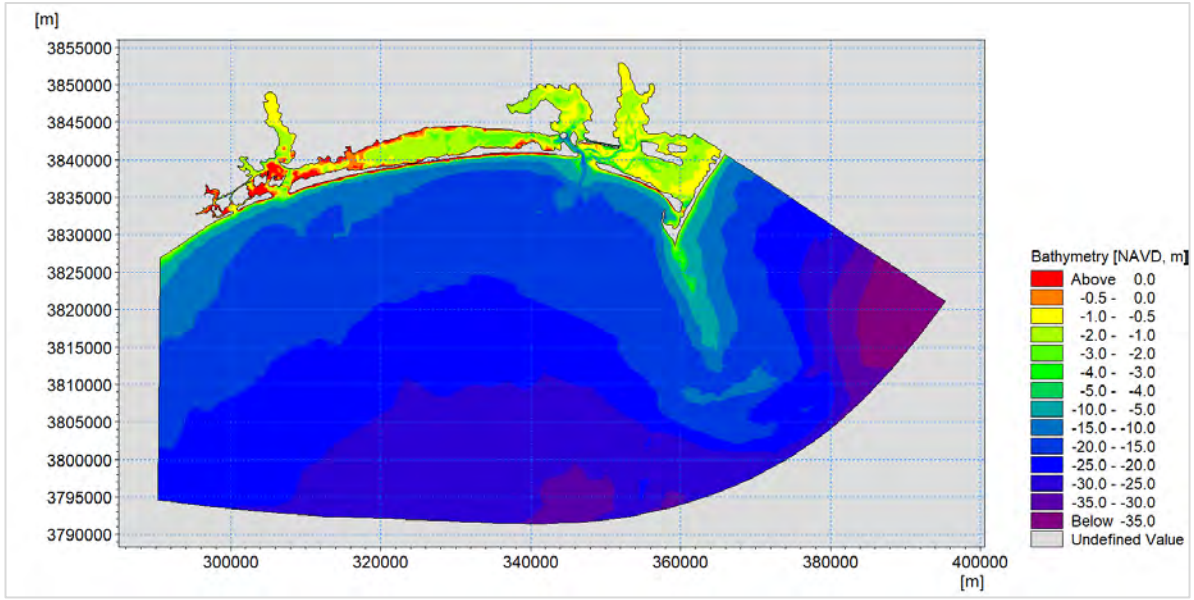
- **Construct living shoreline features to provide shoreline protection** from documented long-term erosion while also helping to restore upland habitat
- The shoreline structure will help **stabilize the upland and estuarine marsh habitat** by minimizing wave impacts, enhancing sedimentation, and buffering tidal velocities
- Construct a **resilient shoreline structure** capable of sustaining the flood and wave events
- The proposed project will include a **hybrid design** to incorporate both natural and structural elements

Basis of Design

- Water Levels
- Winds
- Water Temperatures
- Currents
- *Waves*

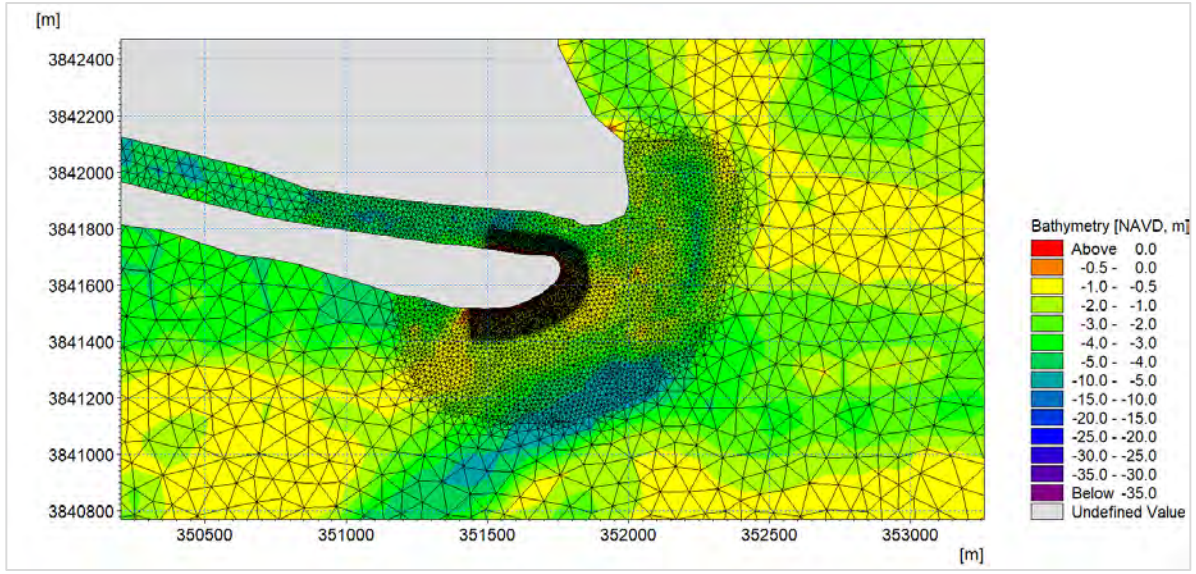
Wave Modeling

Regional Model



Type	Annual Probability of Exceedance [%]	Water Level [ft,NAVD88]	Significant Wave Height [ft]	Peak Wave Period [sec]
Normal	25%	1.2	0.3	1.7
Normal	10%	1.9	0.4	1.7
Normal	5%	2.2	0.5	1.8
Normal	1%	2.8	0.6	2.0

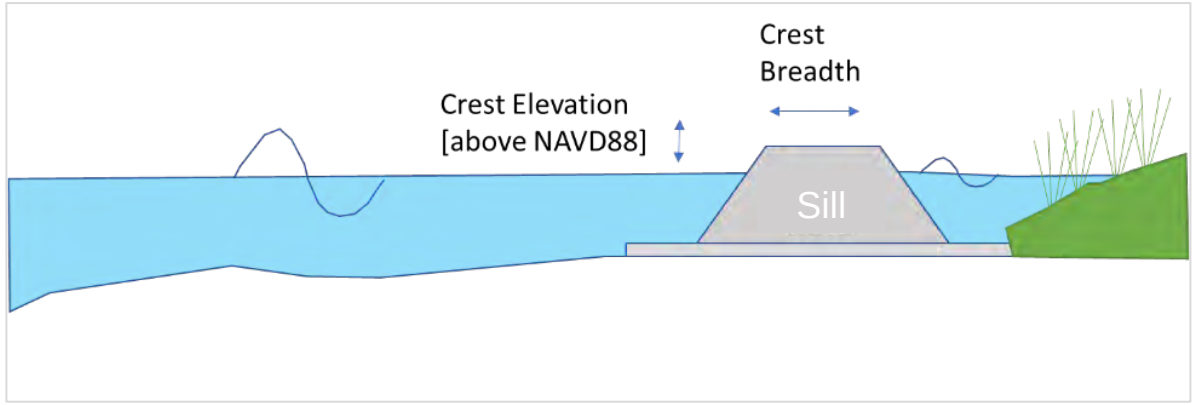
Project Site Model



Type	Return Period [yr]	Water Level [ft,NAVD88]	Significant Wave Height [ft]	Peak Wave Period [sec]
Extreme	1	2.8	2.0	2.9
Extreme	2	3.2	2.2	3.0
Extreme	5	3.7	2.5	3.1
Extreme	10	4.2	2.7	3.2
Extreme	25	4.7	3.0	3.4

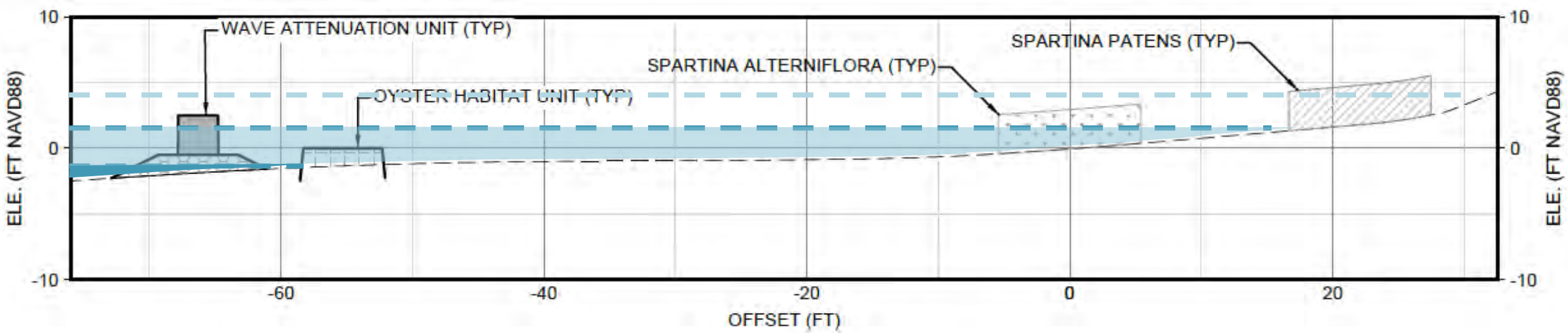
Modeled Wave Transmission Results

- Where transmitted wave heights are greater than 0.5 ft, it is expected that the protected marsh restoration feature could experience erosion

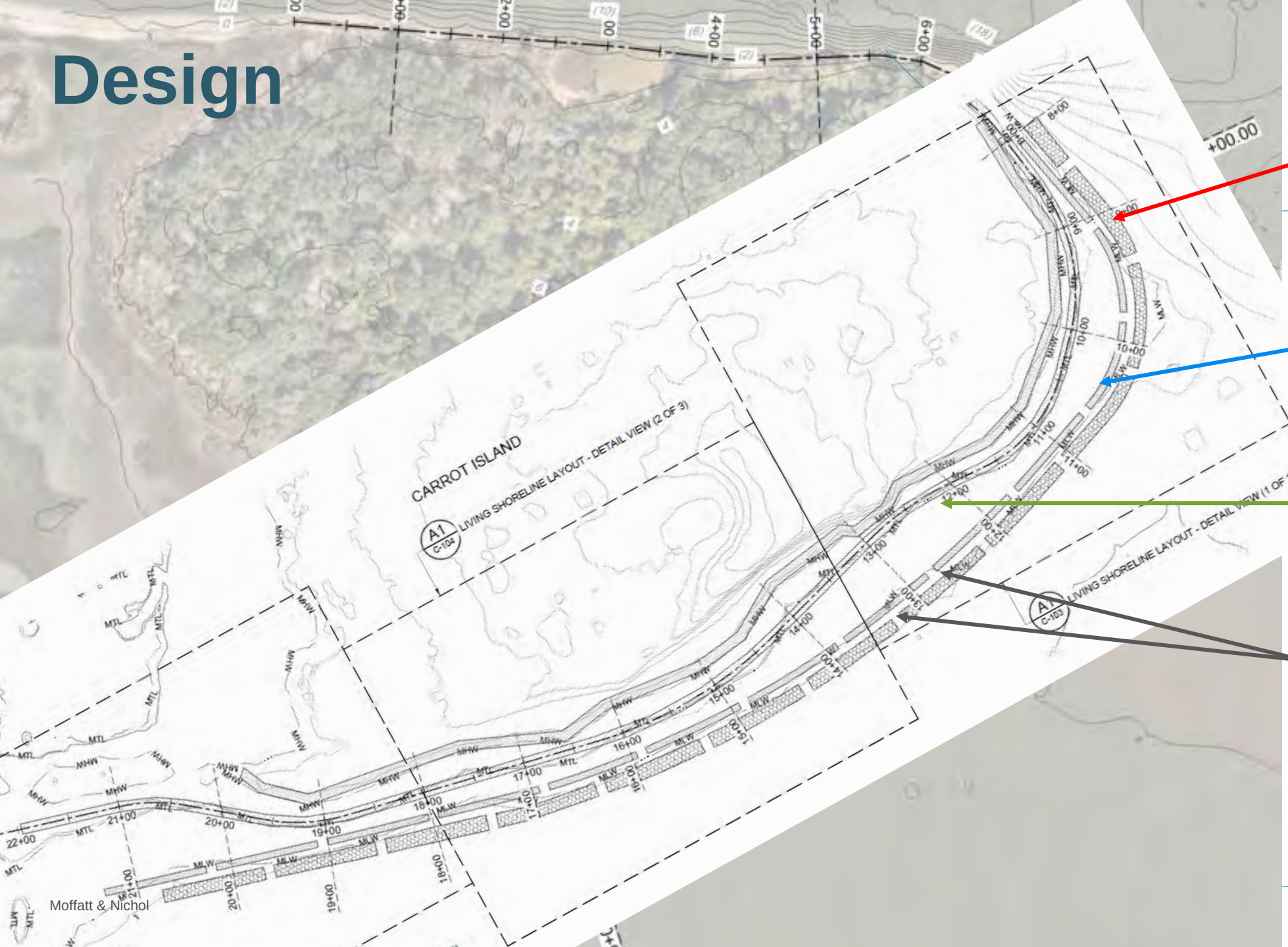


Type	Annual Prob. of Exceedance [%]	Return Period [yr]	Water Level [ft, NAVD88]	Significant Wave Height [ft, NAVD88]	Peak Wave Period [sec]	Design Crest Elevation [ft,NAVD88]			
						1.0	2.0	3.0	4.0
						Transmitted Wave Height [ft]			
Normal	25%		1.2	0.3	1.7	0.2	0.0	0.0	0.0
Normal	10%		1.9	0.4	1.7	0.5	0.1	0.0	0.0
Normal	5%		2.2	0.5	1.8	0.6	0.2	0.0	0.0
Normal	1%		2.8	0.6	2.0	0.9	0.5	0.1	0.0
Extreme		1	2.8	2.0	2.9	1.2	0.8	0.4	0.0
Extreme		2	3.2	2.2	3.0	1.5	1.1	0.7	0.2
Extreme		5	3.7	2.5	3.1	1.7	1.3	0.9	0.5
Extreme		10	4.2	2.7	3.2	1.9	1.5	1.1	0.7
Extreme		25	4.7	3.0	3.4	2.2	1.8	1.4	1.0

Design


WAVE ATTENUATION UNIT (TYP)
OYSTER HABITAT UNIT (TYP)
SPARTINA ALTERNIFLORA (TYP)
SPARTINA PATENS (TYP)
ELE. (FT NAVD88)
OFFSET (FT)
10
0
-10
-60
-40
-20
0
20

Design



Wave Attenuation (1,383 lf)

Oyster Habitat Units (1,367 lf)

Plantings (2,215 lf)

12 x 100 ft segments with 10 ft gaps

Funding + Partners

- National Fish and Wildlife Foundation
  - Emergency Coastal Resilience Funds
    - Congressionally authorized due to impacts from Hurricane Florence
    - Funds to be spent by November 2024
    - Total award = $1,513,500
- NC Land and Water Fund
  - Restoration implementation (construction)
  - Funds to be spent by June 30, 2024
  - Total award = $375,000

  Department of Environmental Quality
  - Construction Delta Costs
  - Total award = $180,740

  Cost per linear foot = $1,254.84

Construction

- Permits issued March 4, 2024 (CAMA Major) and May 10, 2024 (GP 291)
- Construction – April 8 – June 27, 2024
  - Moratorium Relief Request through June 28
  - Pre-final Inspection June 14, 2024
  - Final Inspection July 2, 2024

Construction

Construction

Construction

Construction

Monitoring

- Pre-construction and for 3 years
- Drone surveys
  - Elevation, substrate persistence, shoreline position
- Biotic
  - Oysters, vegetation
- Water Quality
- Wildlife utilization

Lessons Learned

- Maintain communication with funding agencies
- Project schedule should account for in-water construction moratoria
- Land ownership could trigger additional approvals and authorizations
- Innovative materials may require longer production time
- Retain contingency funds for construction
- Success criteria for the project may need to be adapted based on unique settings
- Work together as a team – everyone plays a role

Thank you

Paula Gillikin
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Dawn York
Moffatt & Nichol
dyork@moffattnichol.com

Niels Lindquist and Marae West

NC Coastal Resilience Community of Practice

October 15th, 2024

Photo credit: Moffatt & Nichol

Oyster Catcher™ ⟹ cement-infused cloth hardscapes

- structural versatility
- catalyze development of foundation species communities

shellfish and plants = *our construction partners*

- resilient structures in high energy environment – use the force to your benefit

Photo: Alexandr Ivaschenko / Adobe Stock


UNICARRIERS
78833PT
FREIGHTLINER
GENERAL RENTAL
UNICARRIERS
30

Newport River, Beaufort, NC; SANDBAR shellfish lease 2015


SANDBAR
OYSTER CO
BL1800853
WCI800861

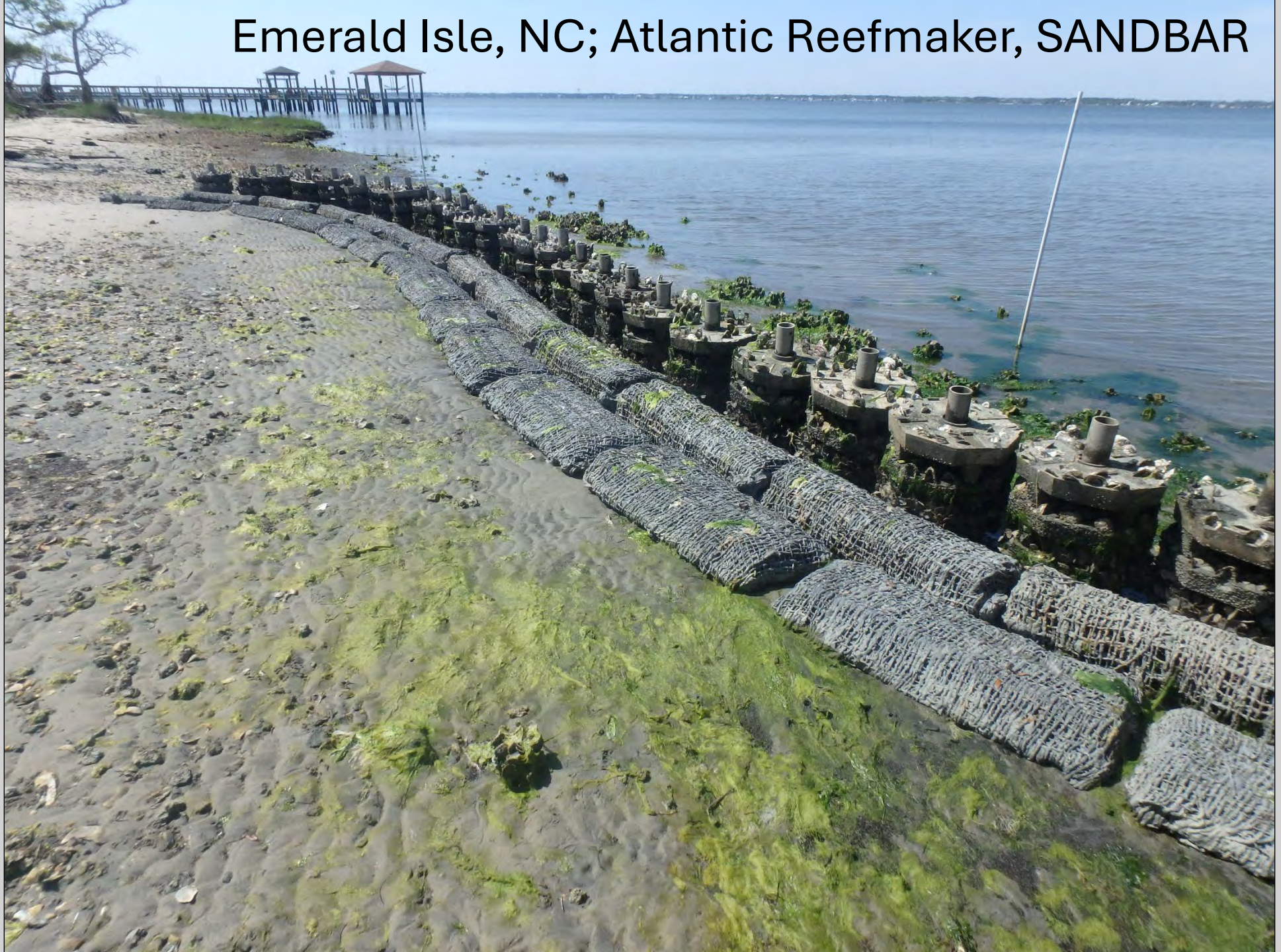

2024
SANDBAR
OYSTER CO

NC Aquarium, Pine Knoll Shores NC; SANDBAR, NCCF cost share

Morehead City, NC; SANDBAR, NCCF cost share


Saint James Plantation, NC
SANDBAR test reef

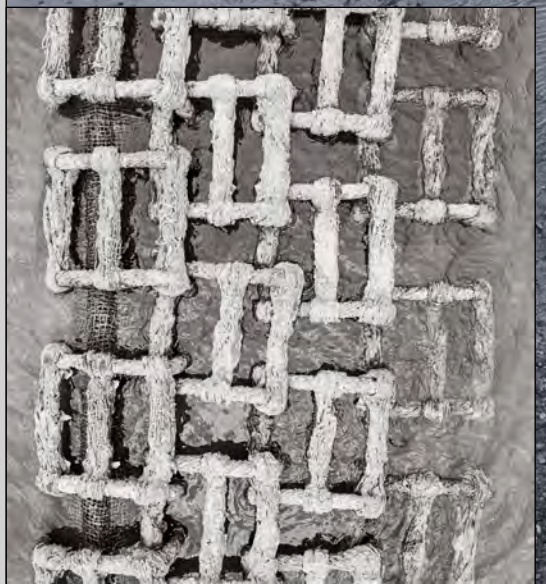

Morehead City, NC; SANDBAR,
NCCF cost-share


Emerald Isle, NC; Atlantic Reefmaker, SANDBAR


Swansboro, NC; NC DOT, NCCF, SWCA, TA Loving, Native Shorelines, SANDBAR

Beaufort, NC; Rachel Carson NERR, Moffat & Nichol, NC DEQ, Carteret County, NATRX, Carteret Marine Services, Native Shoreline, SANDBAR

picture credit – Moffat & Nichol



picture credit – Moffat & Nichol

Morehead City, NC; Sea & Shoreline, State of NC, NCCF project


Savannah, Georgia; Savannah State University project
2021


2021


2022
picture credit – SSU & Ga DNR


2023

Wachapreague, Virginia; TNC – Virginia Coast Reserve, SANDBAR

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