

Keep it in the System (KITS): A decision tool for managers considering beneficial use of dredged sediment to increase resilience of coastal marshes and built infrastructure

NOAA Effects of Sea Level Rise Program

Susan Cohen, UNC Chapel Hill, Institute for the Environment

Kathryn Cerny-Chipman, EA Engineering, Science, and Technology, Inc., PBC

Carolyn Currin, NOAA, National Ocean Service, National Centers for Coastal Ocean Science

Jenny Davis, NOAA, National Ocean Service, National Centers for Coastal Ocean Science

Brian Harris, USACE Research and Development Center, Coastal and Hydraulics Laboratory

Brian McFall, USACE Research and Development Center, Coastal and Hydraulics Laboratory

Peggy Mullin, UNC Chapel Hill, Institute for the Environment

Sam Whitin, EA Engineering, Science, and Technology, Inc., PBC



KITS Project Objectives

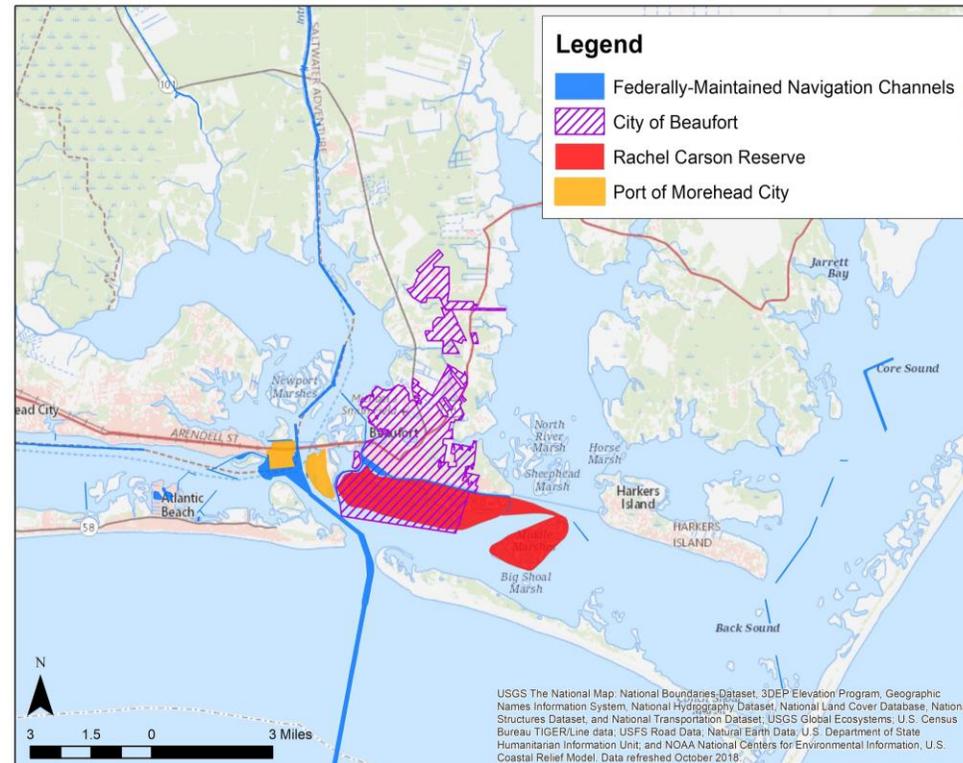
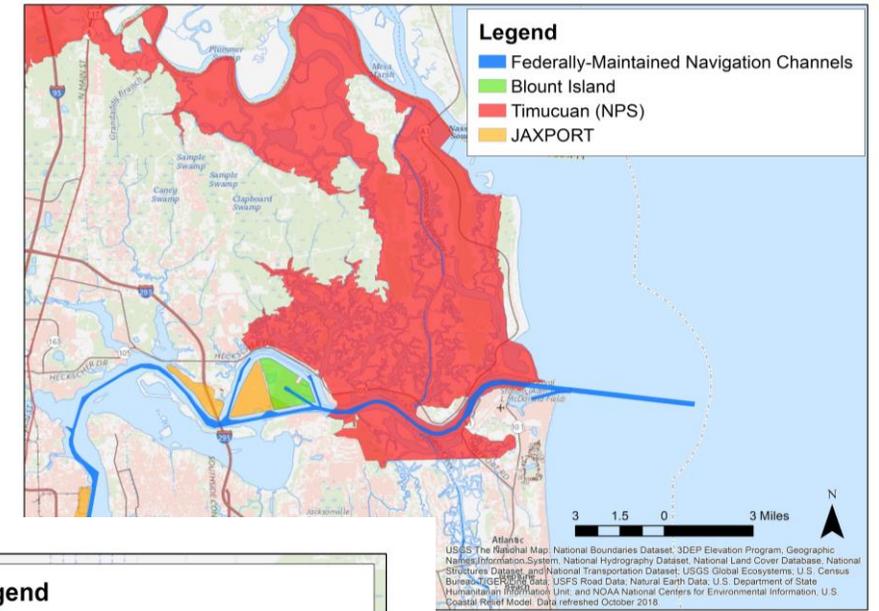
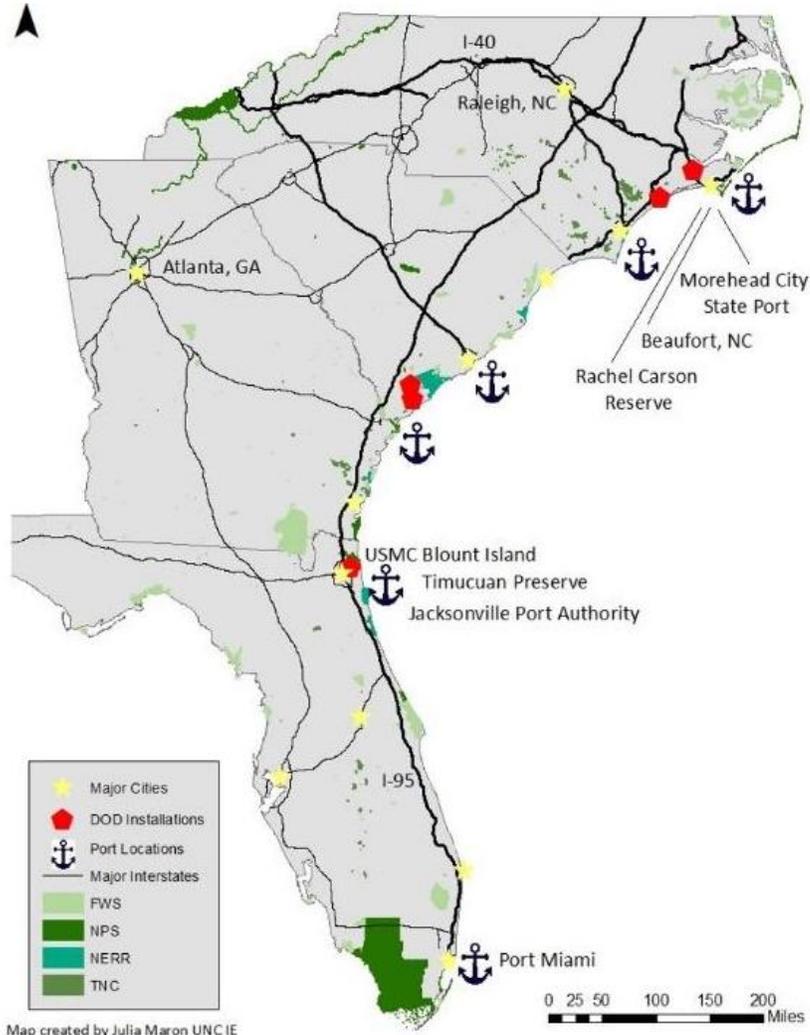
Develop and demonstrate a comprehensive approach for the beneficial reuse of dredged sediments with NNBFs, keeping the sediment in the system.

- identify areas where dredging needs align with coastal marsh vulnerability.
- develop, test, and refine guidance to synchronize maintenance dredging activities with marsh habitat restoration and creation opportunities.
- evaluate NNBF approaches to protect coastal infrastructure from shoreline erosion and SLR.

In other words... many coastal marshes may not have enough sediment to keep up with sea level rise, while sediment accumulates that can impede navigation. **Beneficial use of dredged material** for marsh restoration keeps sediment in the system by removing it from channels and adding it to marshes – can help to solve both problems.



Study sites in Florida and North Carolina - ports, DoD Installations, conservation areas, and cities



Coastal marshes (and ecosystem services) are challenged to persist due to the effects of climate change and sea level rise, in combination with an inadequate sediment supply.



University of Maryland Center for Environmental Science

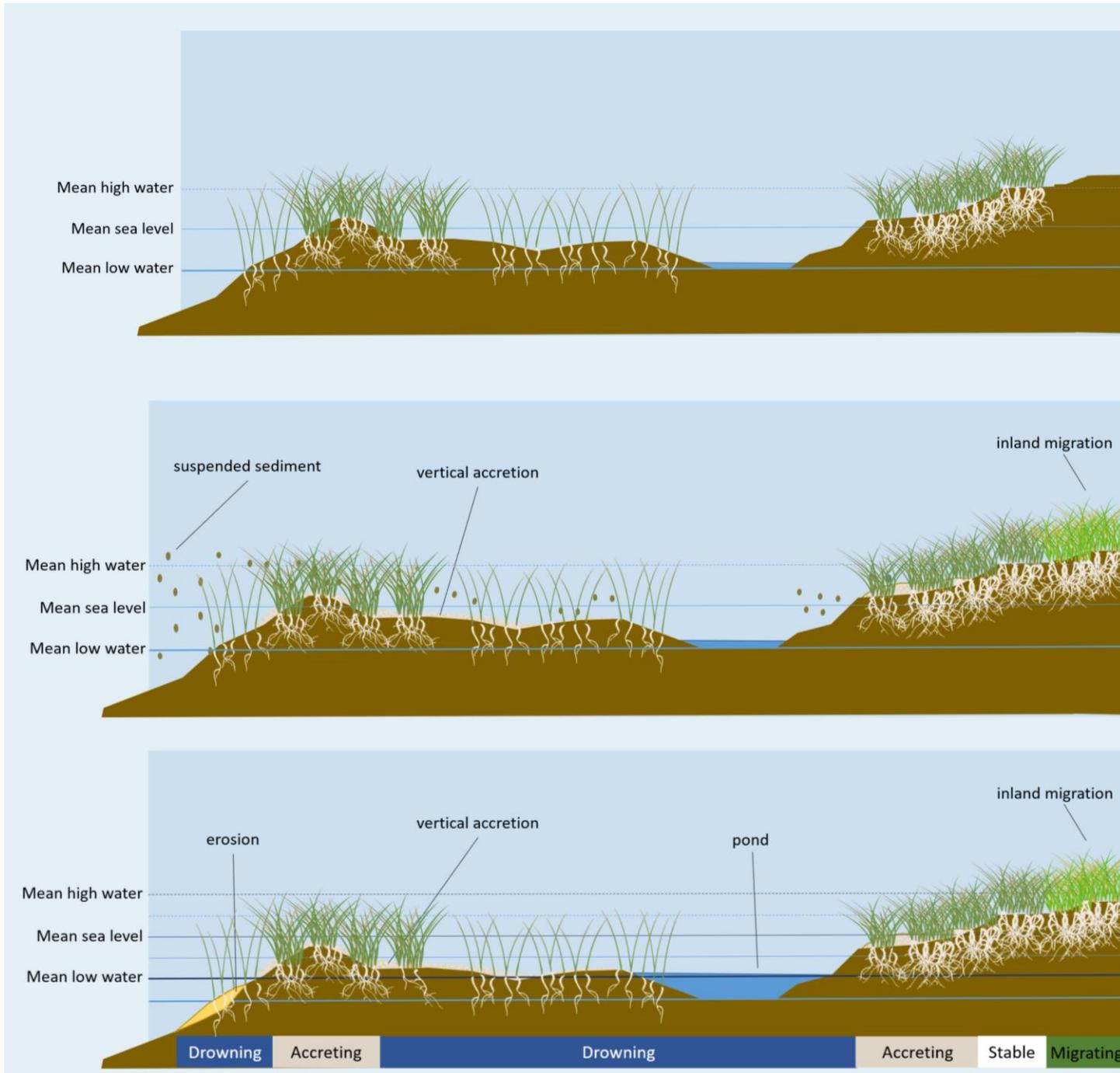
The need to keep navigation channels, ports, and national facilities open is complementary to ensuring the resilience of coastal marsh systems, providing both critical infrastructure protection and non-protective ecosystem and societal services.

How do marshes respond to SLR?

Coastal marshes grow where they are regularly inundated by tides, between mean low water and mean high water.

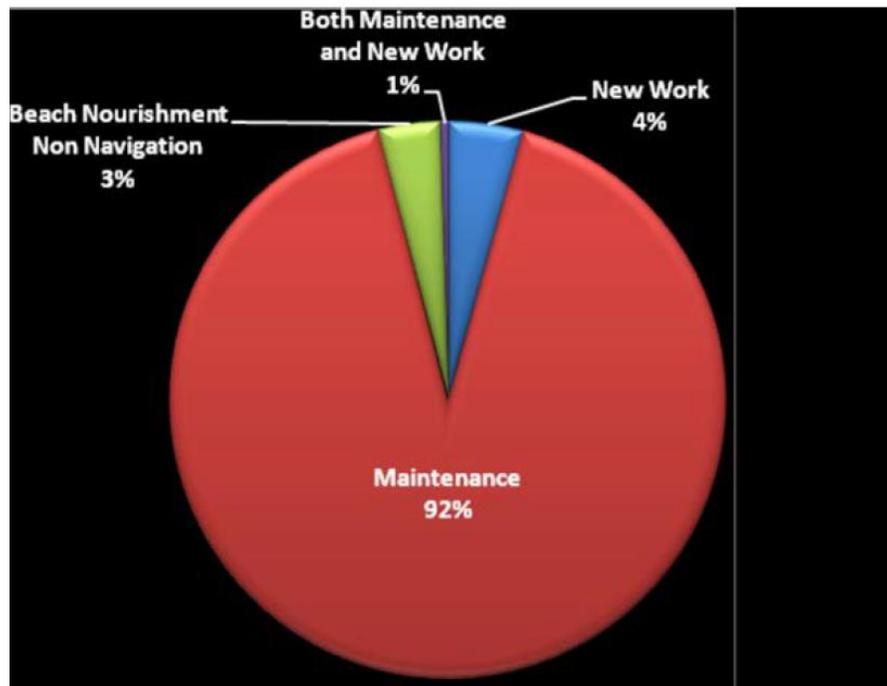
There are a few ways that coastal marshes respond to sea level rise. They can accrete or build up vertically, or migrate inland

When marshes can't keep up with sea level rise through accretion or migrate, they are likely to drown. This can lead to erosion along the front edge of marshes and the creation of ponds in marsh interiors.



- 41 States (including all east of the Mississippi River) are served by Corps ports and waterways
- Nearly 12,000 miles of inland and intracoastal shallow-draft waterways (9- to 14-foot draft) and 13,000 miles of greater than 14-foot-deep channels, for a total of 25,000 miles are operated and maintained for commerce
- The Intracoastal Waterway alone is 1,089-miles from Norfolk, Virginia, to Miami
- 400 ports in the United States are maintained for commerce

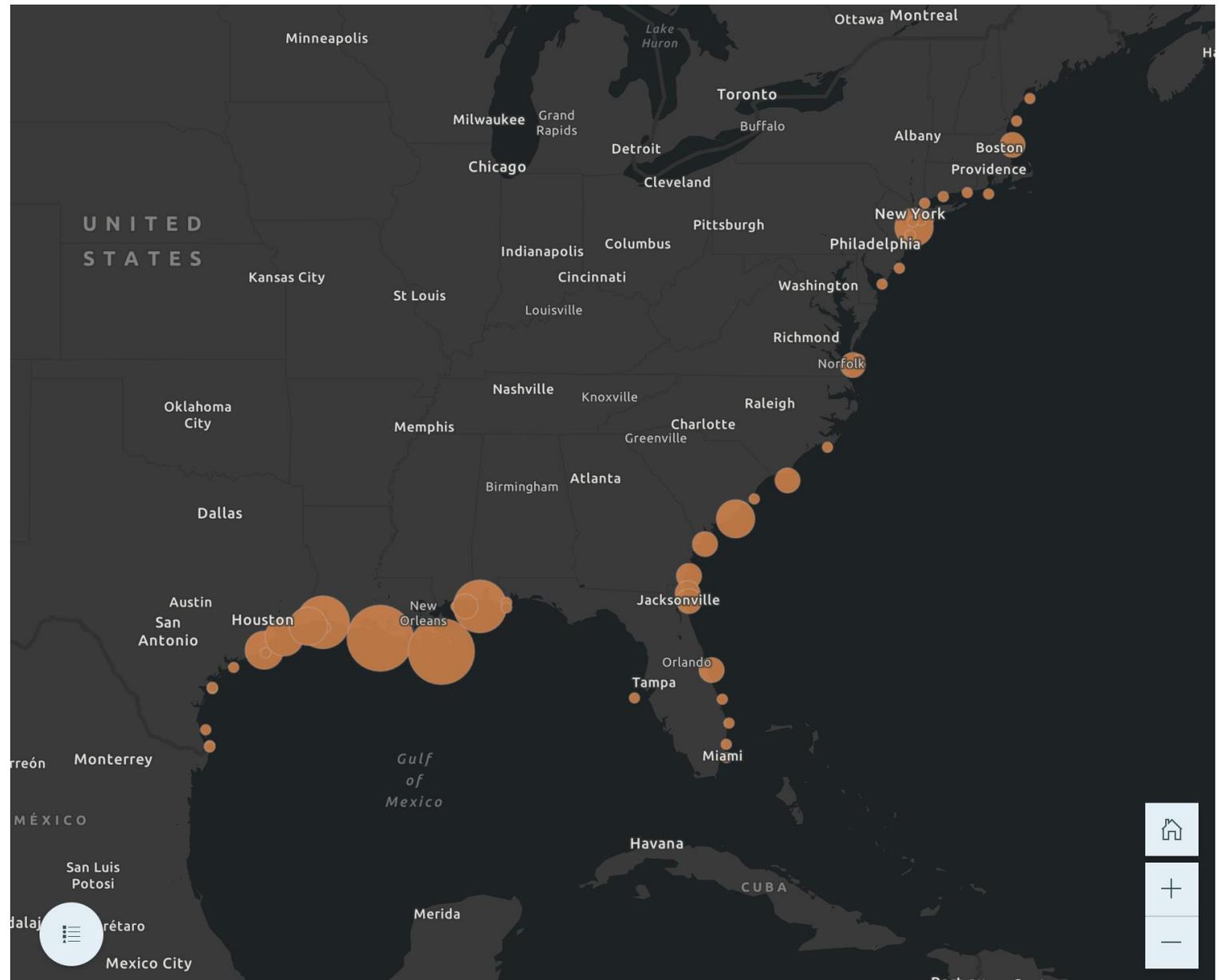
We dredge a lot!



Percentage of Average Annual Yardage of Dredged Material FY 2008-2012, Including both USACE and Contractor Dredging, Broken Down by Class of Work

There are two options for dredged sediment:
disposal removes the sediment from the system, and
beneficial use places the sediment where it is needed, such as on beaches or marshes.

In total, >2 billion cubic yards of sediment has been placed in off-shore sites, enough to fill the largest enclosed NFL stadium(AT&T Stadium in Arlington, TX) more than 519 times!



Location of dredge material placed in ocean disposal site between 1976 and 2019.

One emerging technique for building coastal marsh resilience is the **beneficial use of sediment** removed from channels by dredging to restore existing marsh or create new marshes.

Thin-layer placement is one of those techniques and involves adding a thin layer of sediment to existing marshes to build up their elevation. Sediment can also be used to fill ponds in fragmented marsh or create new marsh islands in shallow areas.



Brief History of Thin layer application of Dredged Material for Coastal Wetland Restoration

- Experimental work in GA and LA in the 70's
- Large-scale projects in LA and NC in the 80's and 90's
- Generally successful, some missteps, but recovery seen with 10-20 cm thickness over established marsh
- Many projects implemented or planned in last 3 years nationwide

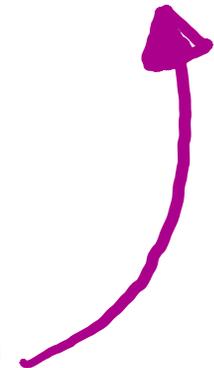


Why Greater Emphasis Now?

- Deeper ports, more dredging, increasing disposal costs
- Sand as a limited resource
- SLR and storm impacts to coastal communities
- Natural and nature-based infrastructure role in coastal resiliency
- Science supports Elevation Capital for wetland sustainability
- **RUNNING OUT OF CHEAP PLACES TO PUT THE SEDIMENT**

Challenges

- Permitting and regulatory protection, Clean Water Act, Rivers and Harbors
- Engineering the application
- Regional planning
- Thin Layer Placement and Dredge Projects can't be married at the last minute
- Building SLR into the equation becomes problematic – especially in micro-tidal areas
- Typically, there is much more dredge material to be disposed of than is needed for restoration



Visual comparison of imagery from 2020 and 2012 suggests that this section of shoreline has receded measurably.

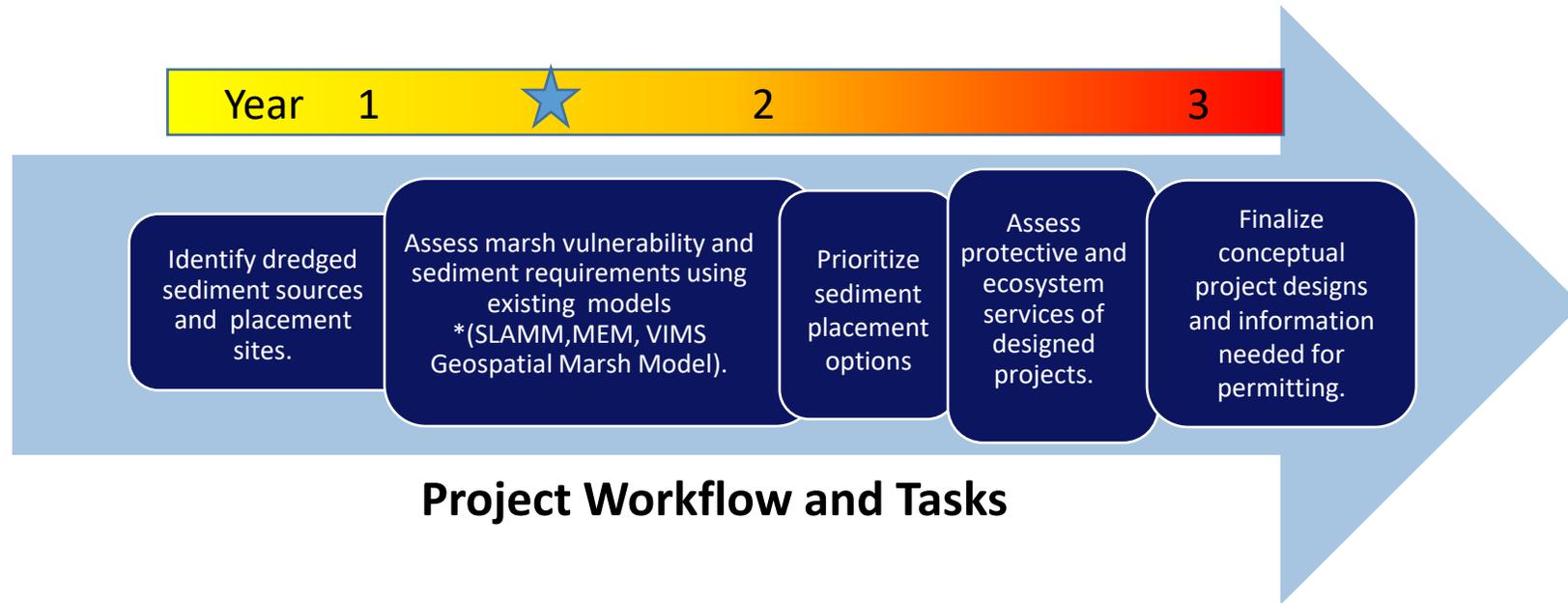


Why Michael J. Smith Airport?

- It represents critical infrastructure in Carteret County (and beyond)
- The proximity of the airport to dredge events
- Loss of critical marsh over time and in an area vulnerable to SLR, storms, and wave energy

The Ask

- Permission to use the Michael J. Smith Airport as a field site
- To work with partners interested in resilience, and the protective services of marshes for infrastructure and ecosystem benefits



The Deliverables (August 2023)

- An assessment of the current vulnerability of the airport infrastructure and model predictions of future marsh resilience
- A shovel ready project design to enhance marsh resilience to SLR
- Maybe a permit.....
- At project end, we can team up to find funding to implement the project design
- Guidance for other managers, developed from the project field sites

The goal is to link partners in a region and match sediment supply with coastal resilience needs, meeting the management goals of multiple organizations.

Resources

<https://storymaps.arcgis.com/stories/746072c88ec7488a8ab0f9b39f0dd435>

<https://coastalscience.noaa.gov/project/keeping-it-in-the-system-beneficial-use-of-dredged-sediment-to-increase-resiliency-of-coastal-marshes-in-the-southeast/>

Susan Cohen susanac@email.unc.edu

