ERDC

Engineer Research and Development Center

Strategic Placement – an EWN/RSM Solution to Dredged Material Management

EWN/RSM IPR, Vicksburg, MS
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Joseph Z. Gailani

Cheryl E. Pollock

US Army Corps of Engineers®

Definitions

- **EWN: The intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaborative processes**

- **RSM: Managing sediment within a watershed to benefit a region; potentially saving money, allowing use of natural processes to solve engineering problems, and improving the environment.**

- **Strategic Placement: DM placement in a manner and at locations that permits natural forces to disperse the DM toward other locations where it can deliver benefits**
  - **Maximize benefits (FRM, Environmental, etc)**
  - **Minimize rehandling**
  - **Minimize negative environmental impacts**
  - **Reduced cost (vs. direct placement)**
  - **Increase beneficial use applications**

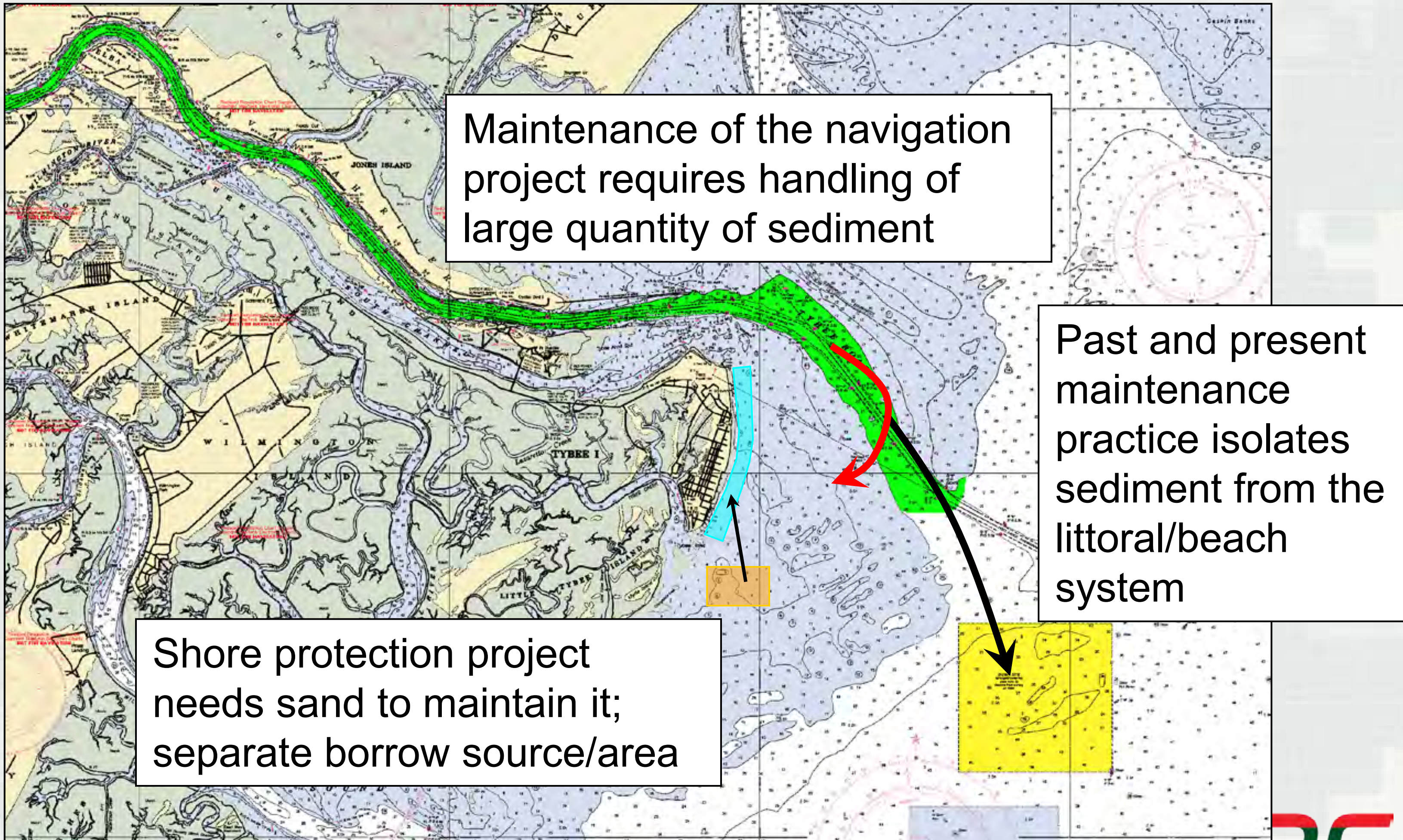
Objective

- Optimally, strategic placement is a sustainable solution to DM management
  - Sufficiently dispersive placement site
  - Receptors that require a continuing supply of sediment
  - Within budget constraints
- Strategic placement (vs. direct placement) provides opportunity to control dosing and sediment types
- Use engineering tools to support EWN/RSM solution development

Objective

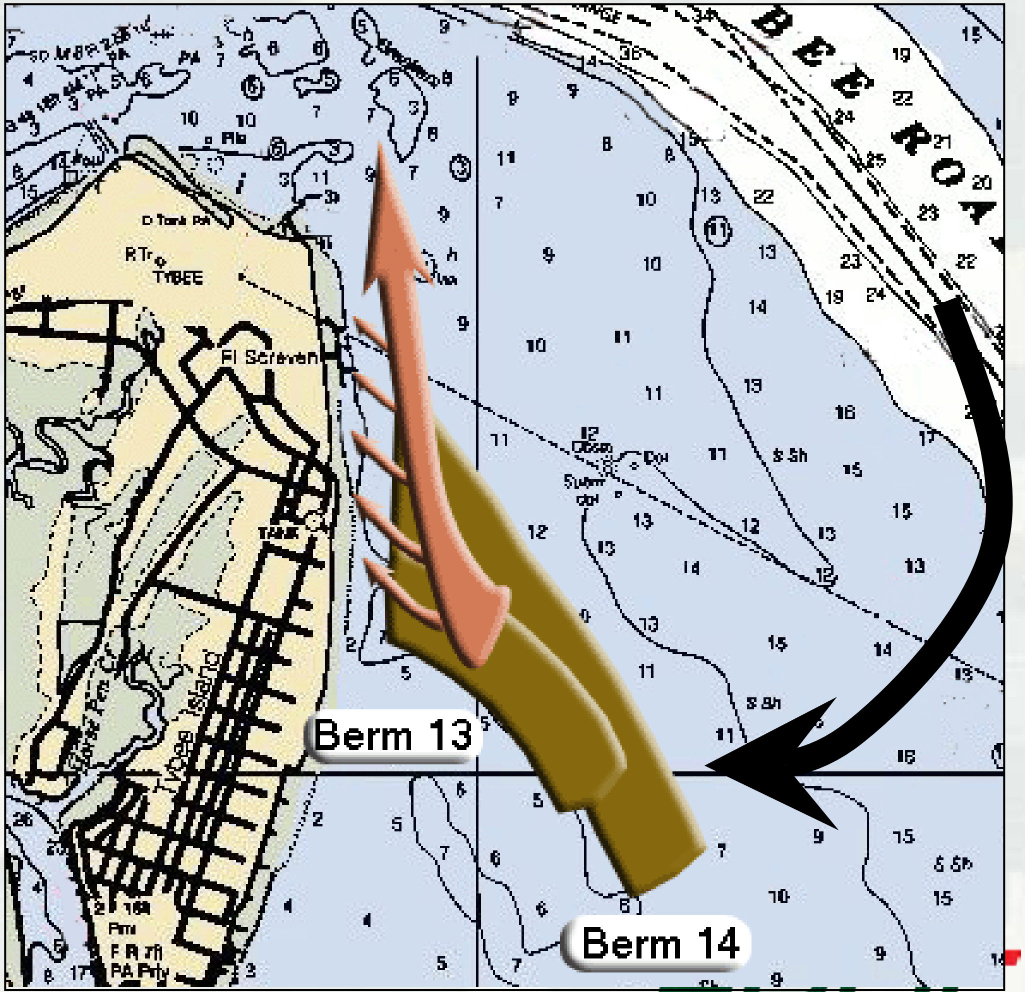
- Build appropriate tools to support application of strategic placement in diverse environments
  - ▸ Demonstration Projects
  - ▸ Process Understanding
    - Dredged material placement
    - Nearshore/shallow water transport
    - Sediment interaction with shallow water features/habitat
  - ▸ Predictive Tools and Models
  - ▸ Decision Support
    - Environmental Impacts
    - Cost/Benefit

Example EWN Solution for DMM



Example EWN Solution to DMM

- Place mixed sediment from channel into nearshore berms
- Allow natural winnowing to remove fine content
- Minimize rehandling
- Maximize sand to beach
- Longshore transport patterns will move sediment into north Tybee littoral zone



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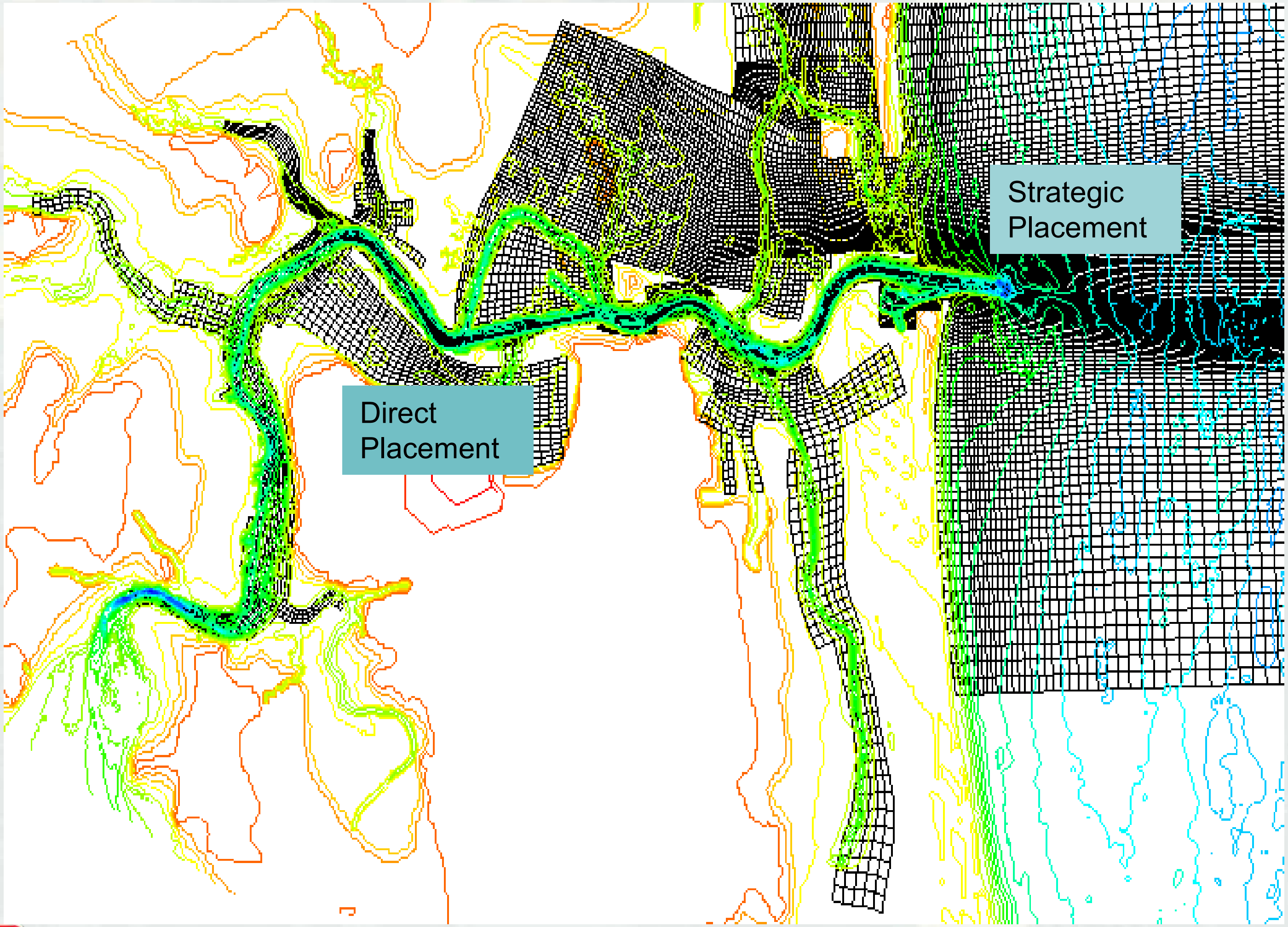
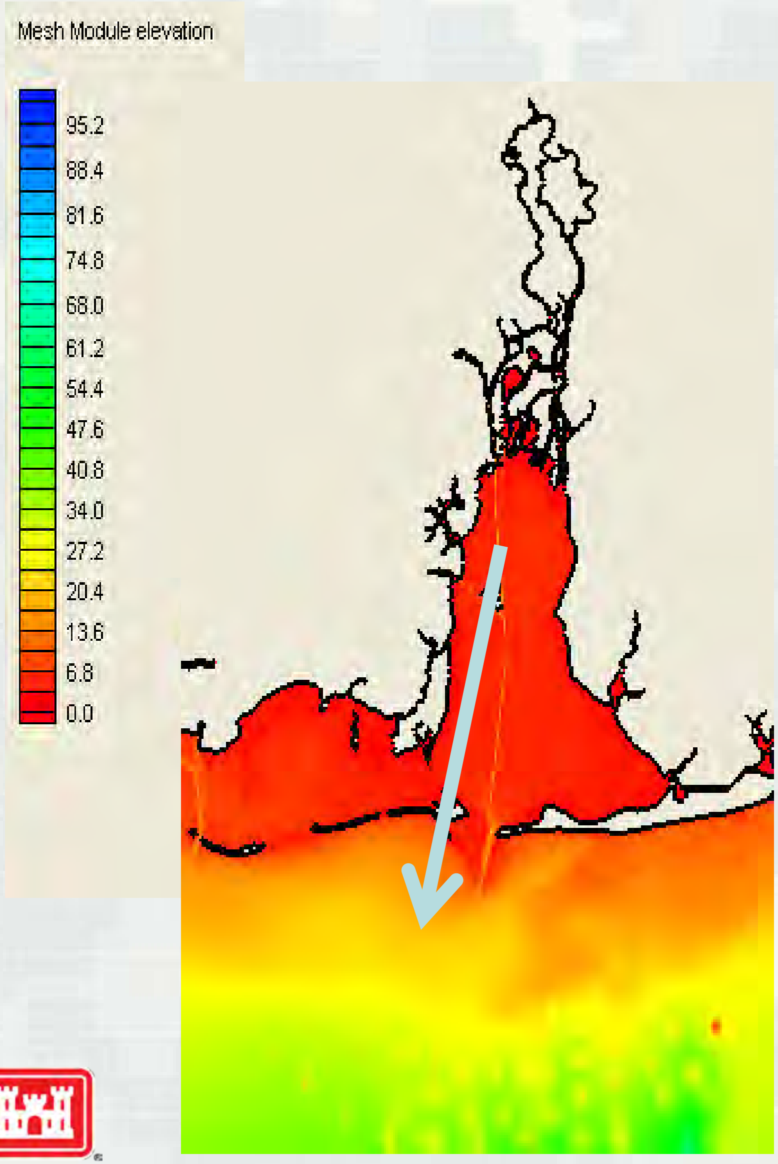
Example EWN Solution for DMM

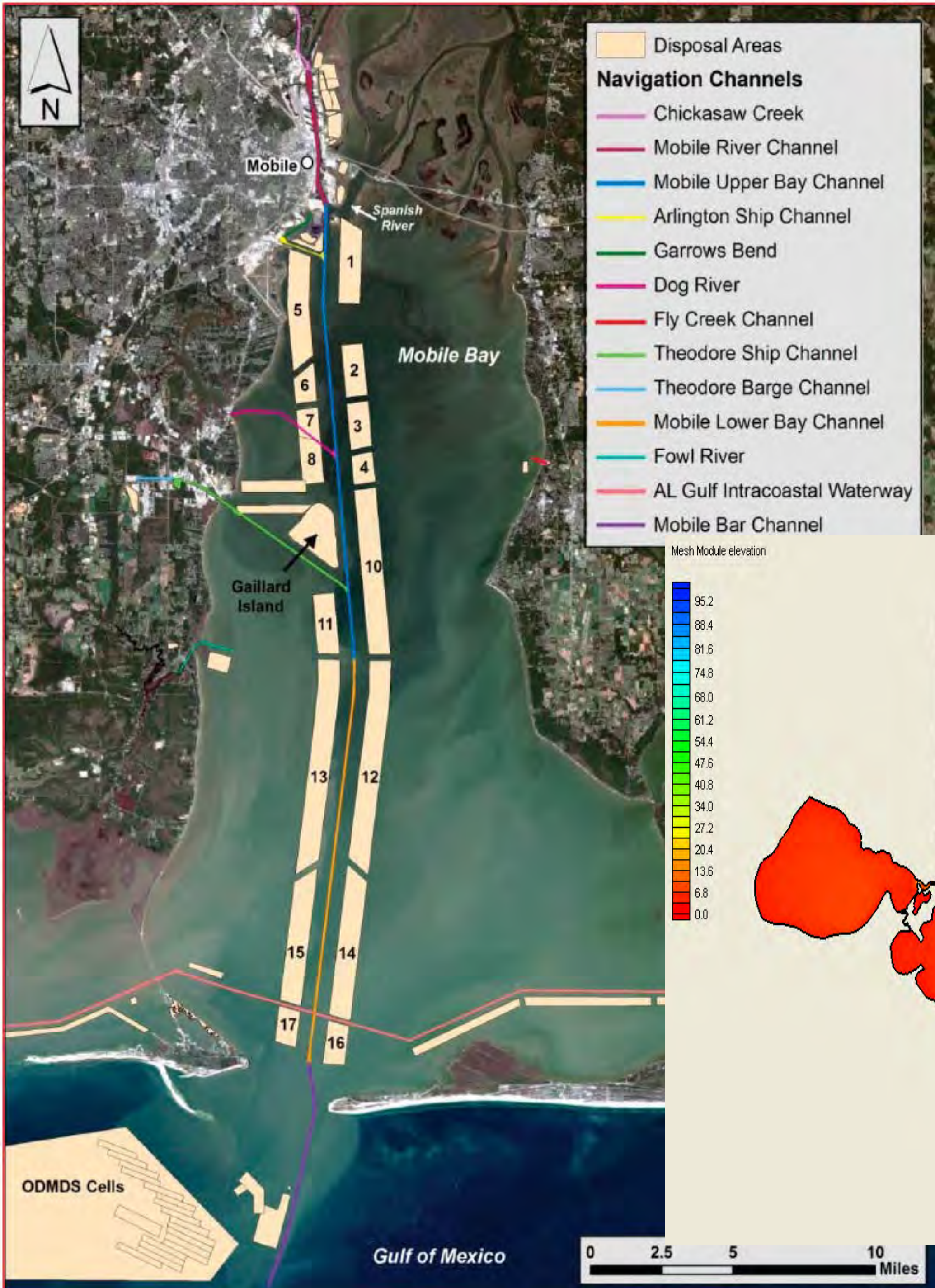


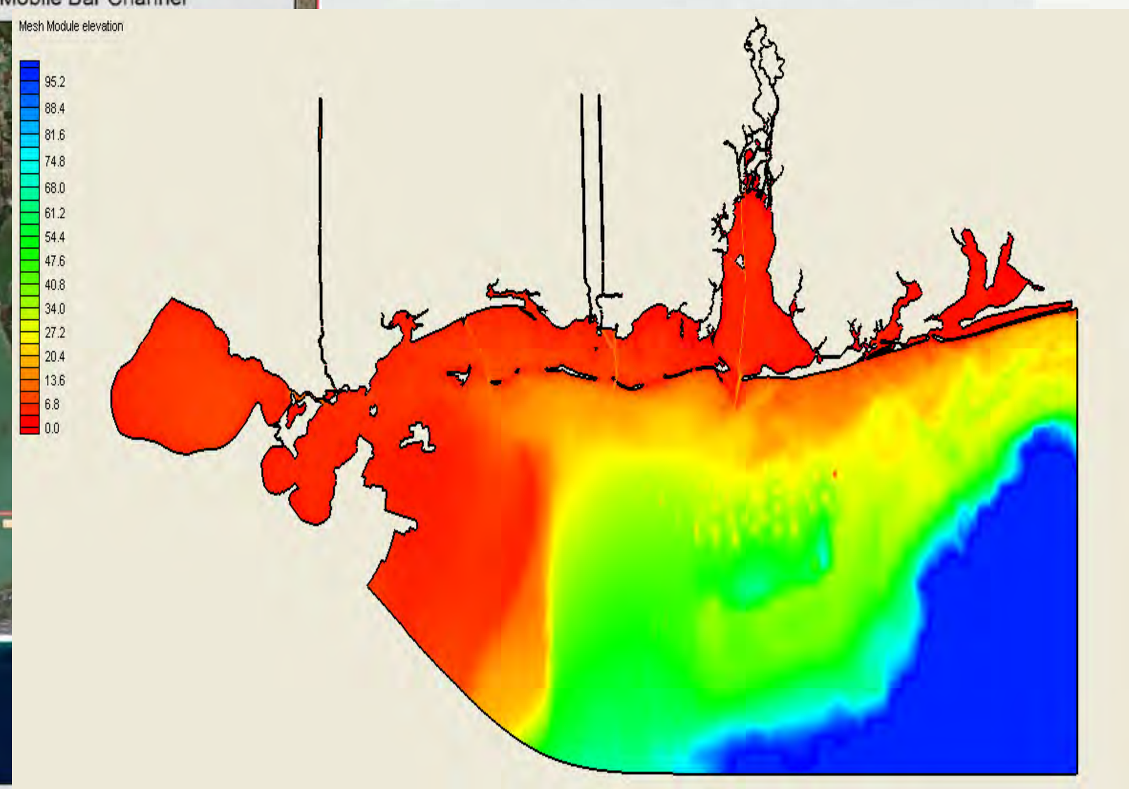
Mobile Bay Dredging Practices



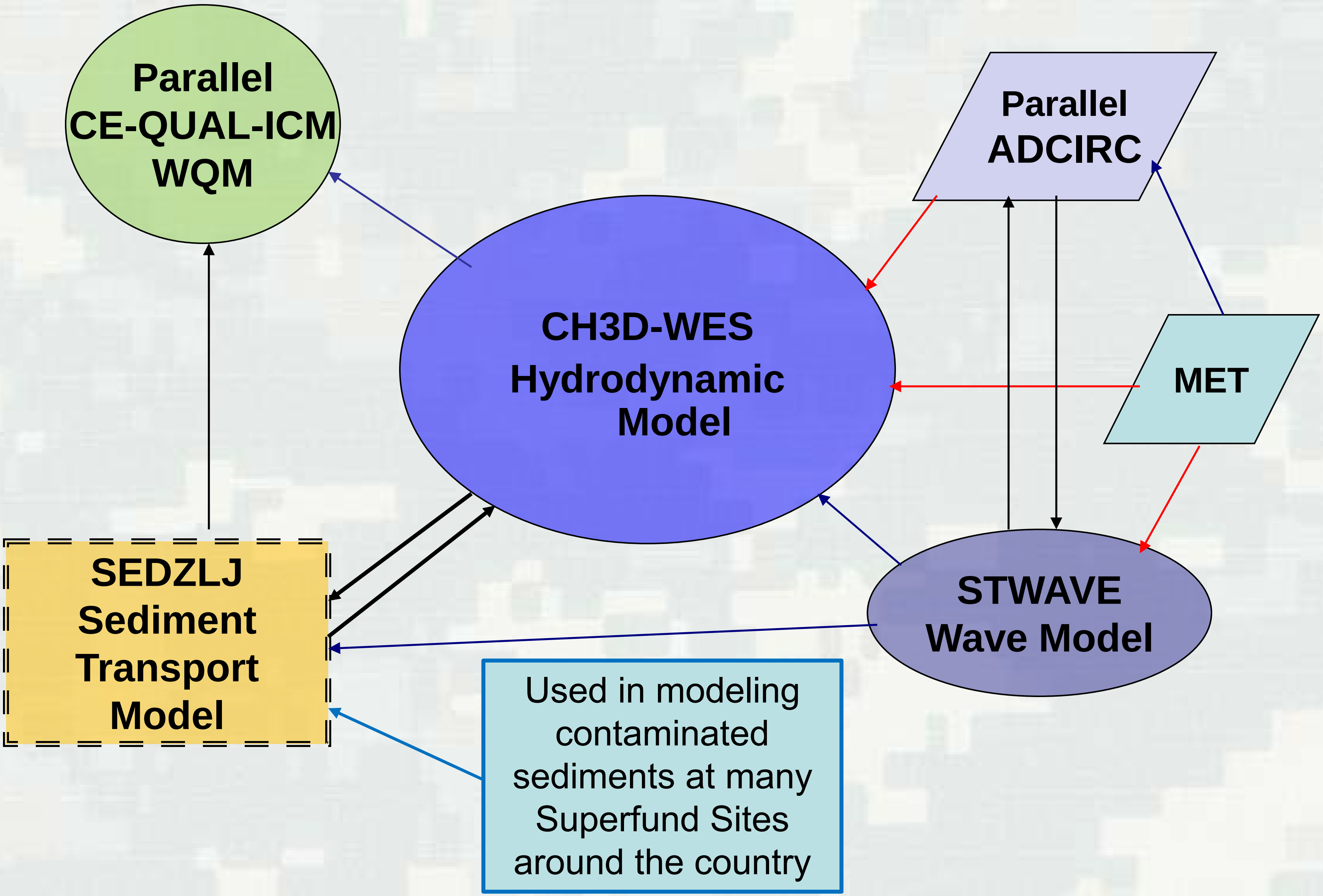
- Present dredging practice: remove sediment from bay to ODMDS
- This eliminates sediment from sediment-starved regional system (the Bay)
- Proposed practice: TLP within Mobile Bay to feed resources
- Issues: environmental impacts, rehandling, cost

To address rehandling and environmental impact issues, a 3-D modeling exercise of sediment transport in the Bay was applied





LTFATE Modeling Framework

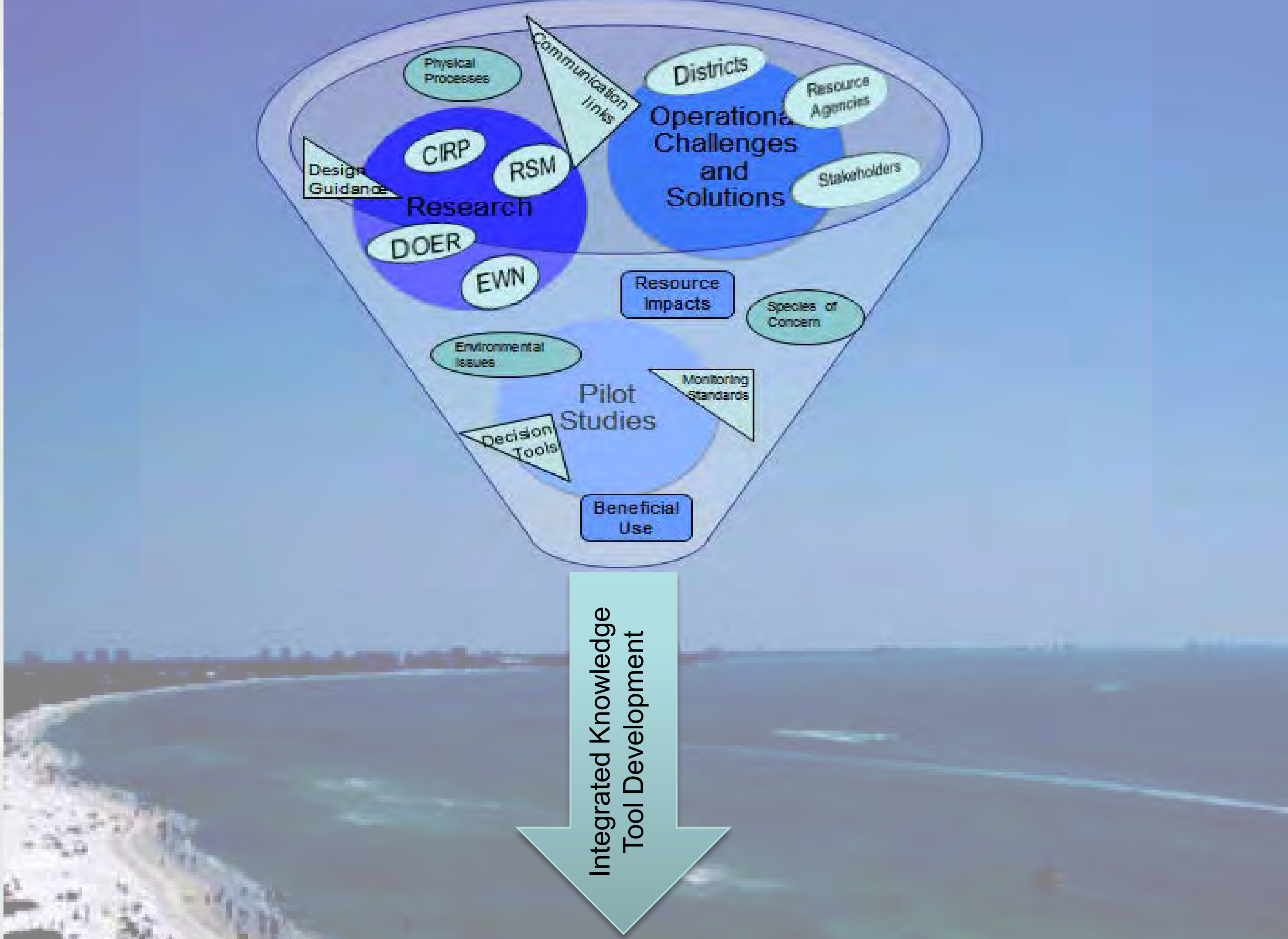


TLP Summary of Findings

Scenario Number	1	2	3	4
	TLP	Sensitivity Sim. 1	Sensitivity Sim. 2	Base Case (No-action)
Typical month	57%	104%	73%	100%
Active month	55%	105%	73%	100%
Hurricane Gustav	52%	103%	68%	100%
Hurricane Ida	53%	104%	70%	100%

- **Approximately 35% of the sediment that erodes from the designated disposal areas is transported and deposits in the navigation channel.**
- **The remaining 65% is widely dispersed throughout the bay by wind-, river-, and tide-driven currents.**
- **Sediment transport to habitat is still being evaluated**
- **Alternative in-Bay placement locations are being evaluated**

Strategic Placement of Dredged Material In Nearshore Berms

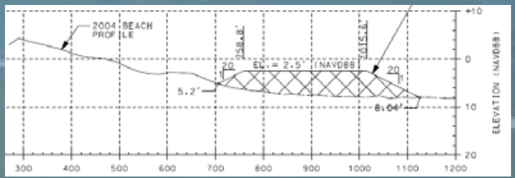


Nearshore Berm Optimization
Improved Communication with Stakeholders
Enhanced Beneficial Uses
Reduced Resource Impacts
Tools to Predict/Quantify Nearshore Berm Behavior
Guidance Documents

Nearshore Berms
What are they?

Sediment placed in nearshore, usually- long, linear, shore-parallel, mound-shaped geomorphic features that resemble naturally formed sand bars:

- Stable or inactive berms – sediment is stationary
- Feeder or active berms – sediments dispersed by waves and currents
- Berms can exhibit both feeder and stable characteristics



Nearshore berm

Purposes include:

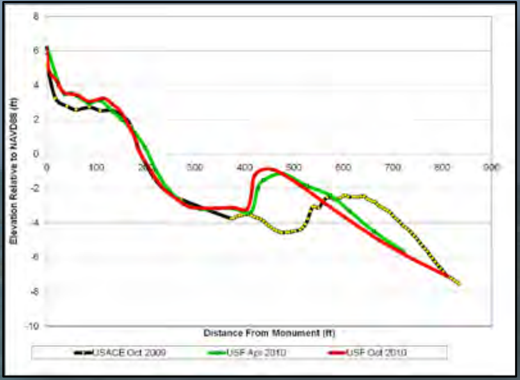
- Provide sand source to littoral system
- Dissipate waves
- Selectively sort sediment (fines offshore; sand onshore)
- Recreational feature
- Habitat development
- Storage area for future use
- Elevate seabed as foundation for future placements

Downdrift of Ft. Myers Inlet, FL
POC: Jim Lagrone, SAJ
Photo Courtesy Dr. Ping Wang, USF

Nearshore Berms

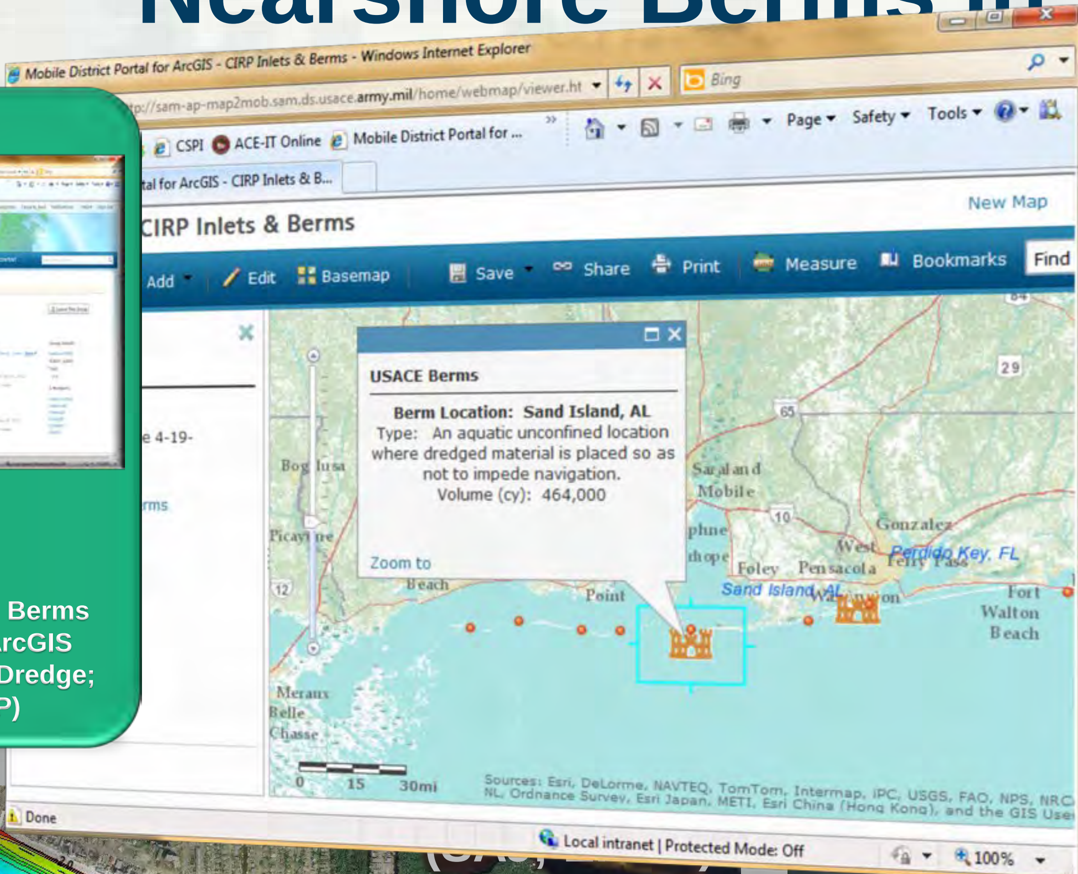
Why?

- Active Littoral Nearshore Placements (designed to migrate/disperse)
- Ideally sited near a navigation project, (short haul and down drift beaches eroding)
- Alternative for placement of O&M sediment in nearshore instead of on beach or in deep water
- Beneficial placement of mixed sediment (silt, sand) unsuitable for beach placement
- Less Sediment Restrictions than beach fill (FL: sand with >10% fines cannot be placed on beach)
- Active Nearshore berms sites have renewable capacities
- Offshore disposal and Confined Disposal Facilities (CDFs) remove sediment from regional littoral system
  - Capacities are not renewable
  - Sediments are not ideal for reuse
  - CDFs are 4x cost of nearshore placement
  - Great Lakes CDFs at 80% capacity
- Goals:
  - Reduce O&M cost
    - Site authorization, reduced haul distance, reduced re-handling
  - Nourish adjacent beaches
  - Selectively transport fines offshore and sand onshore
  - Efficiently and beneficially utilize greater volumes of DM

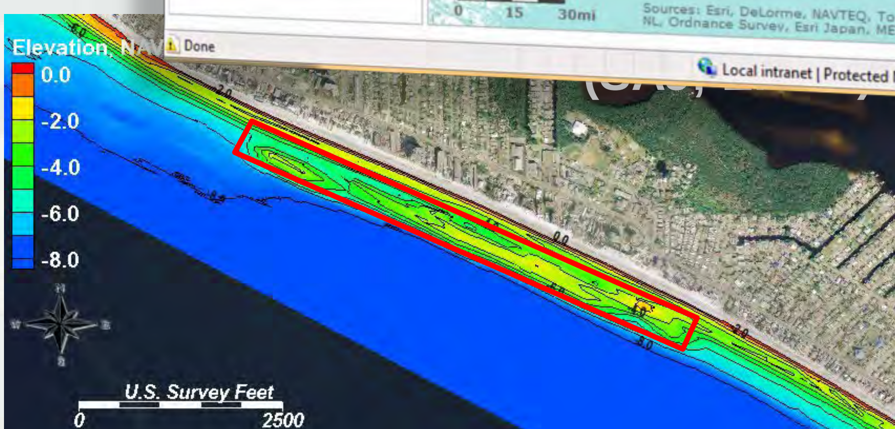


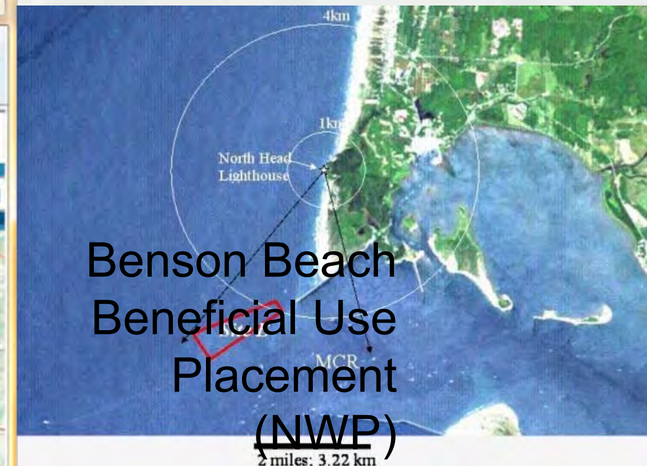
Downdrift of Ft. Myers Inlet, FL
POC: Jim Lagrone, SAJ
Photo Courtesy Dr. Ping Wang USF

Nearshore Berms in USACE

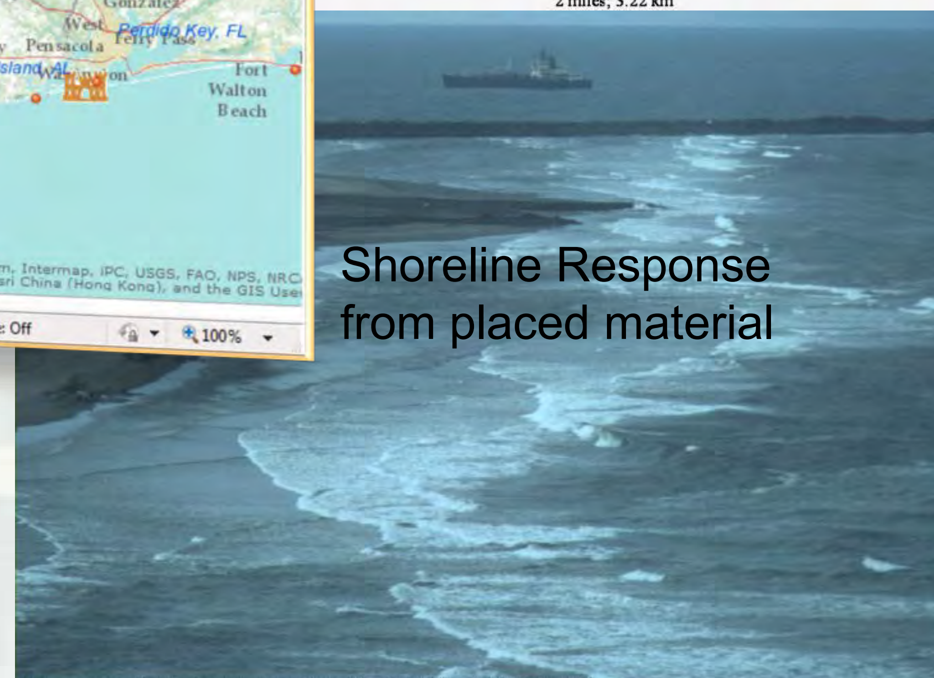


Historical Berms In CIRP ArcGIS Portal (CE-Dredge; NCMP)





Benson Beach Beneficial Use Placement (NWP)



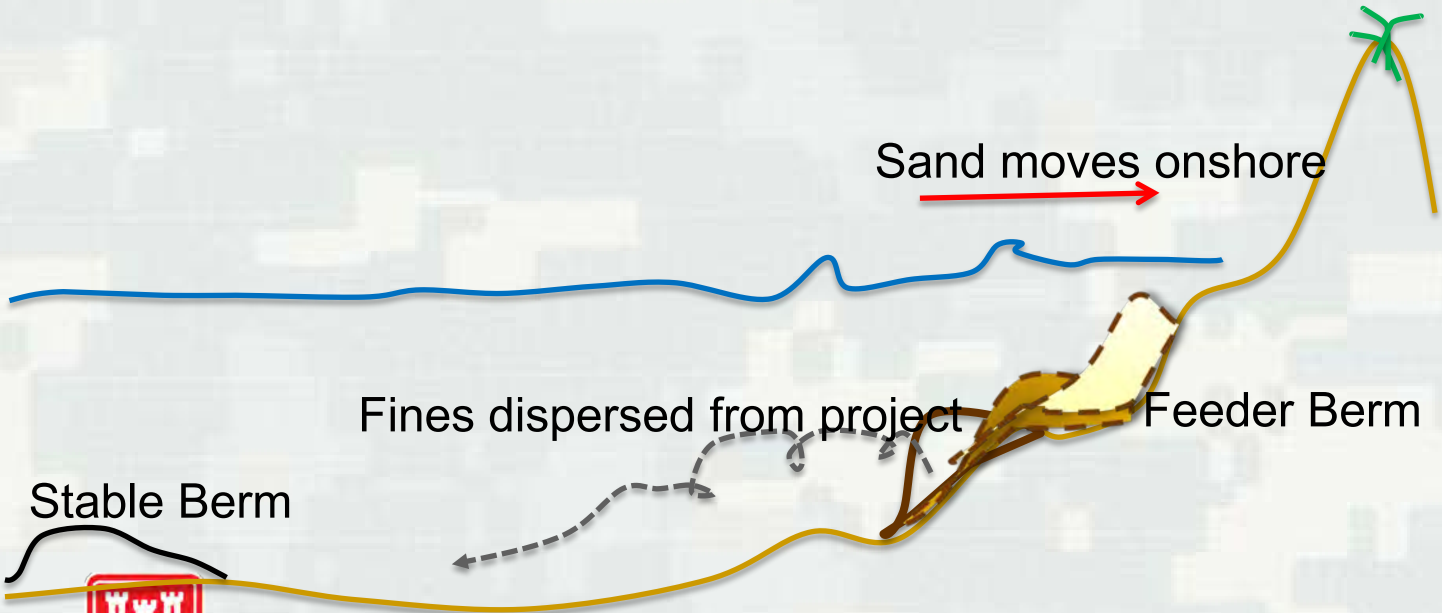
Shoreline Response from placed material

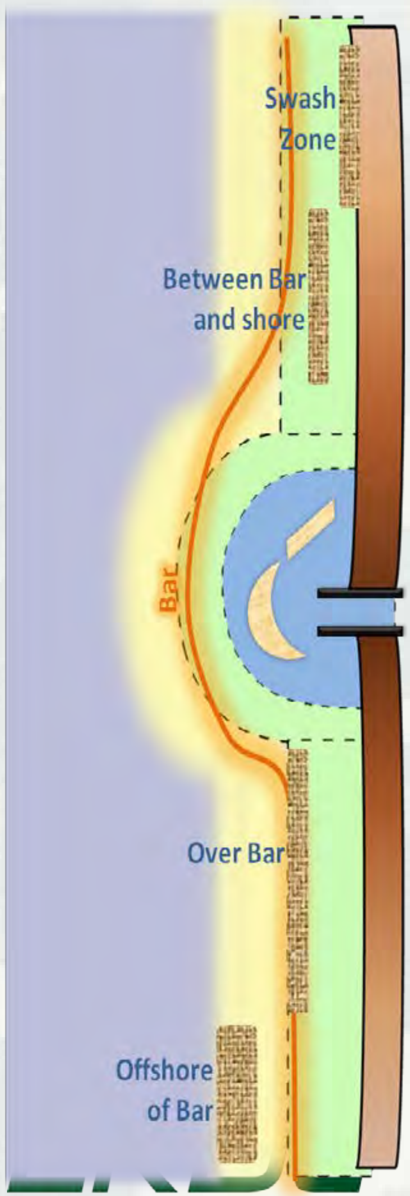
Berms

State of Understanding

Present design guidance is based on design goals:

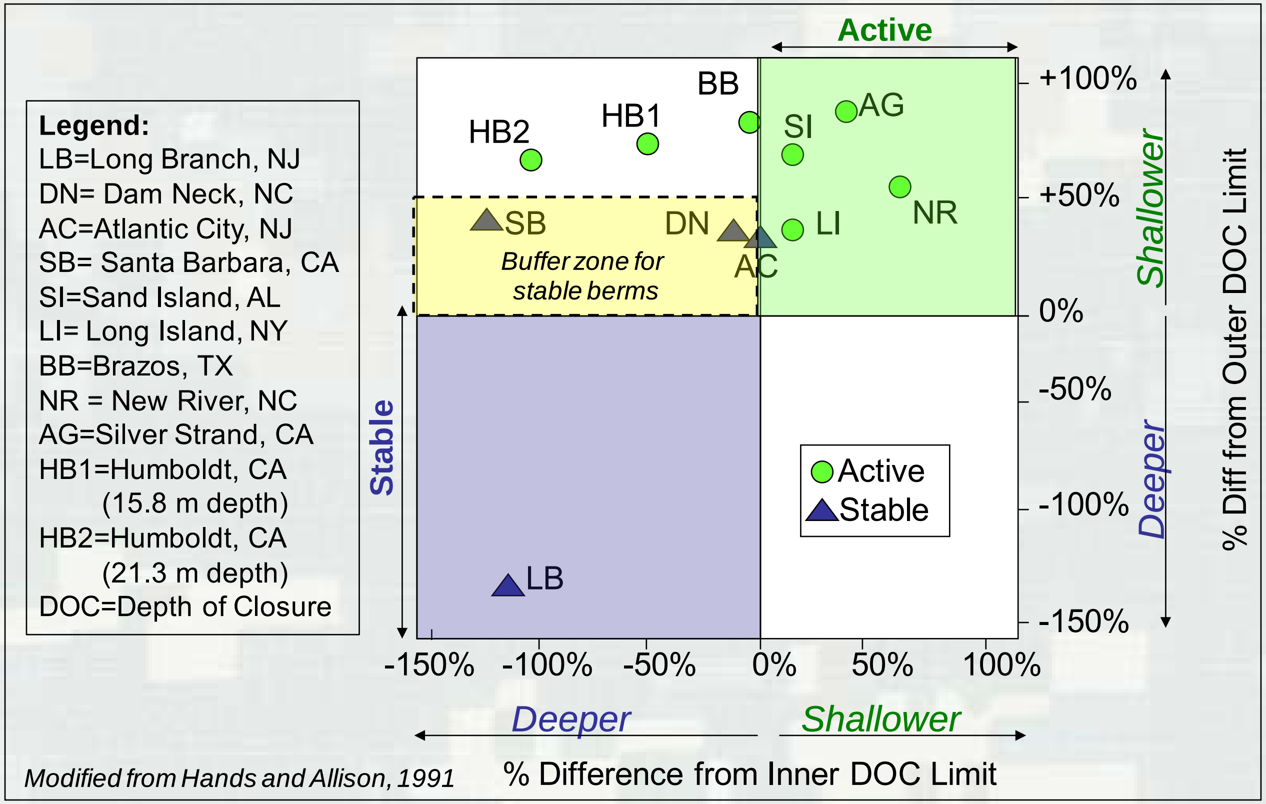
- Stable: stationary
- Active, Feeder, or Dispersive: feeding the beach or dispersing with time

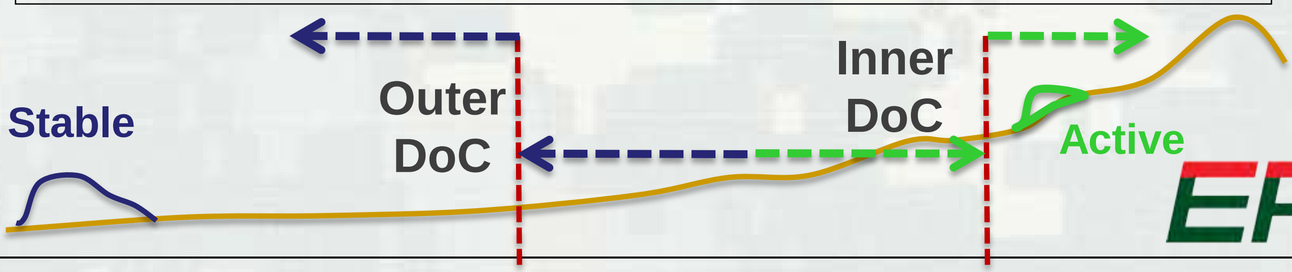




Berms

State of Understanding *(Hands and Allison 1991)*

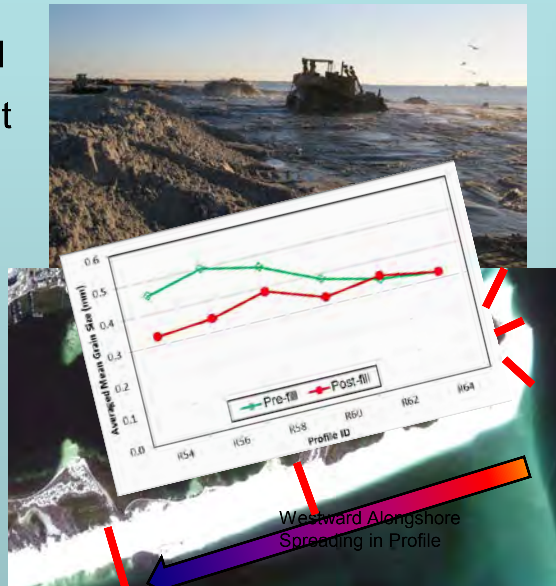


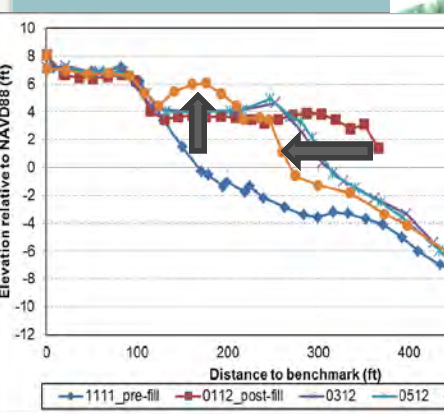


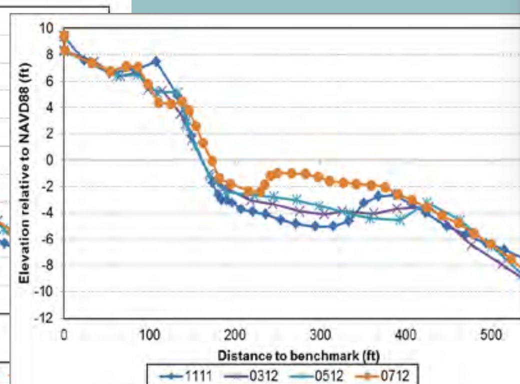
Highly Dispersive Berm Sites

Perdido Key Swash Zone

- Pumped and Pushed
- Winnowing, sediment grades coarser down-drift
- Profile nourished
- Down-drift beaches profile evolution



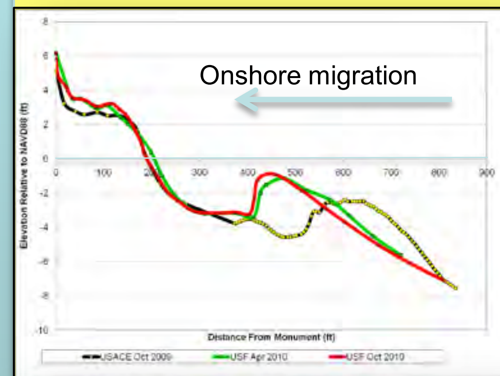


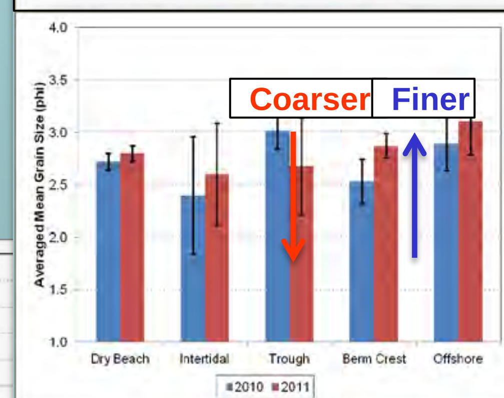


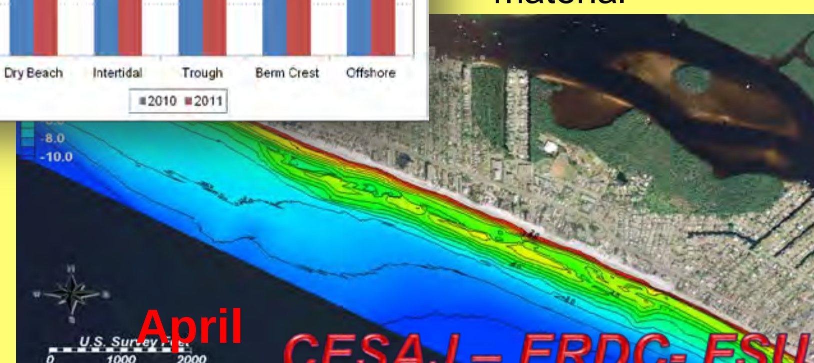
CESAM – ERDC-FSU

Ft Meyers NB, Shallow Placement

- Hopper and pumping
- Onshore and longshore migration of mound and gaps
- Characteristic asymmetric movement
- Winnowing, sorting, dispersing
- Fines offshore movement
- Grain size distribution on berm and landward winnowed toward matching the native material







CESAJ – ERDC- FSU

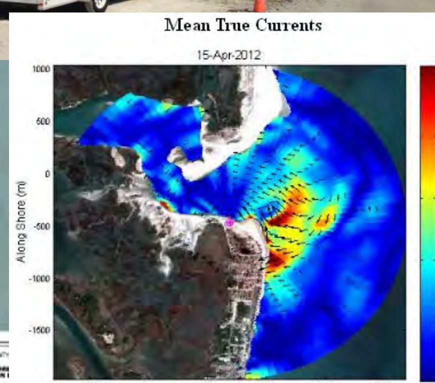
Unique Monitoring

New Smyrna, RIOS Monitoring

RADAR INLET OBSERVING SYSTEM:
Remotely acquired waves, currents, and bathymetry

- No measurable wave effects at berm
- Berm was dispersive over nearshore area

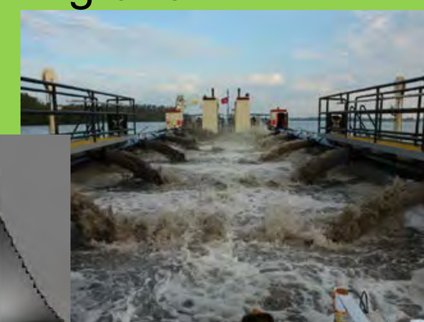
CESAJ- ERDC
http://www.offshoreswell.com

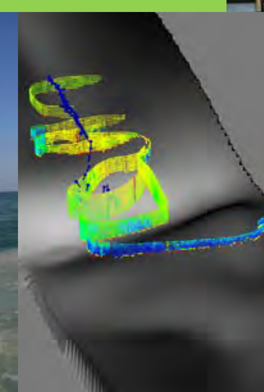


Egmont Key, dredging and nearshore placement

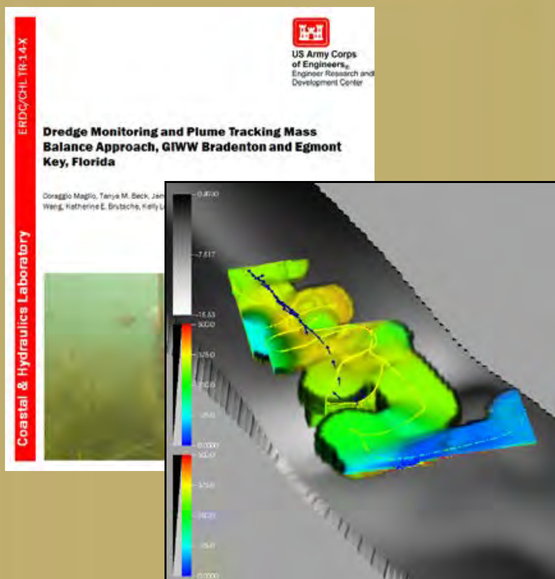
- Mass balance of sediments
- Ship to Shore sediment changes
- Plumb tracking (dredging & disposal)
- Turbidity compared to Light Attenuation
- Bathymetry, material migration
- Waves and currents

CESAJ- ERDC-FSU



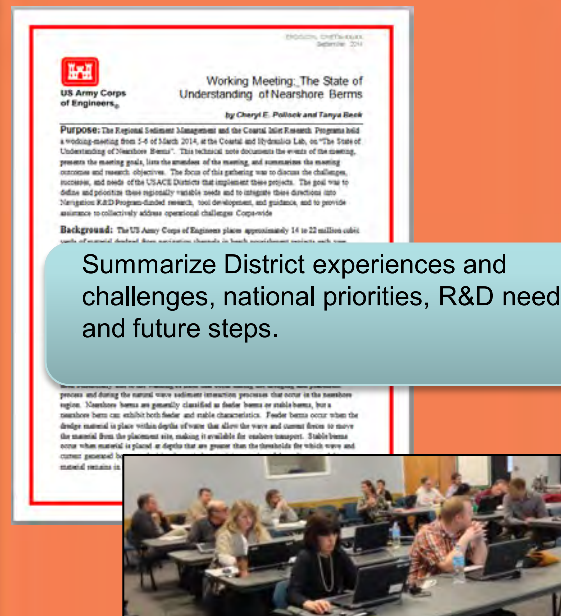


Research Activities



TR: Dredge Monitoring and Plume Tracking Mass Balance

POC: Coraggio Maglio



Summarize District experiences and challenges, national priorities, R&D needs, and future steps.

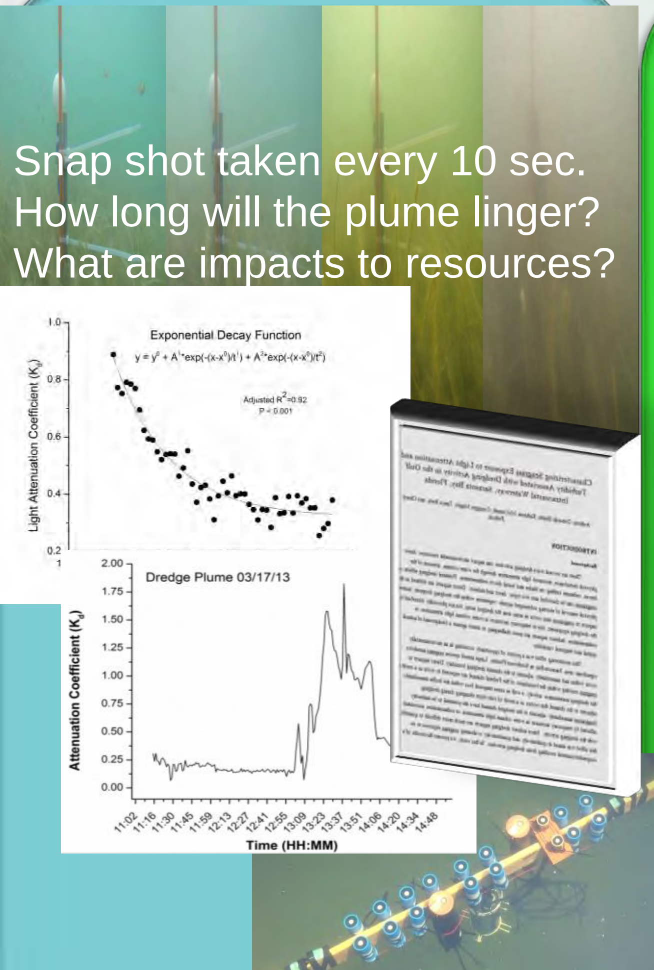
CHETN: Nearshore Berm Working Meeting Summary

POC: Cheryl Pollock

Nearshore Berms Movement - 2 Journal Papers Coauthored

POC: Tanya Beck

Research Activities

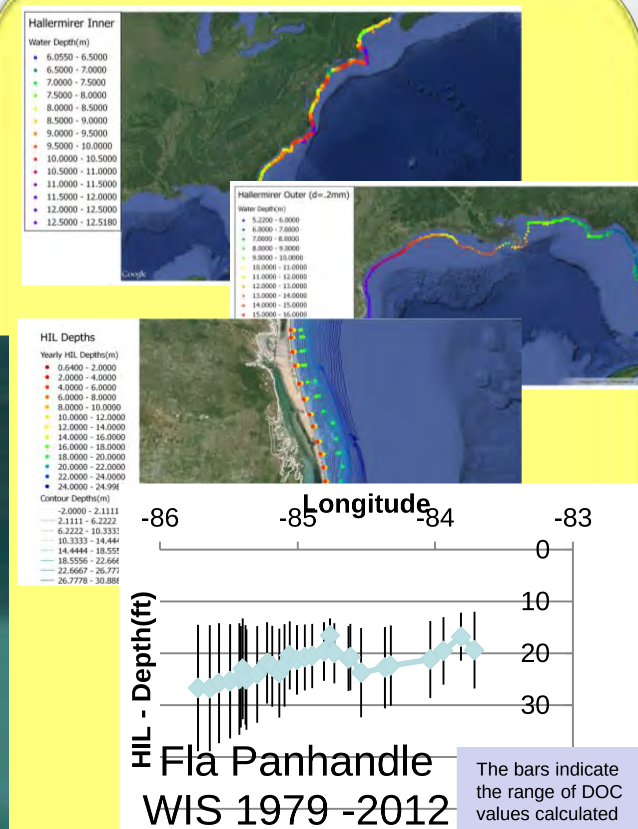


Photosynthetically Active Radiation (PAR)

POC: Cheryl Pollock/ Deborah Shafer

Cross Shore Swash Zone Placement (CSSZ)

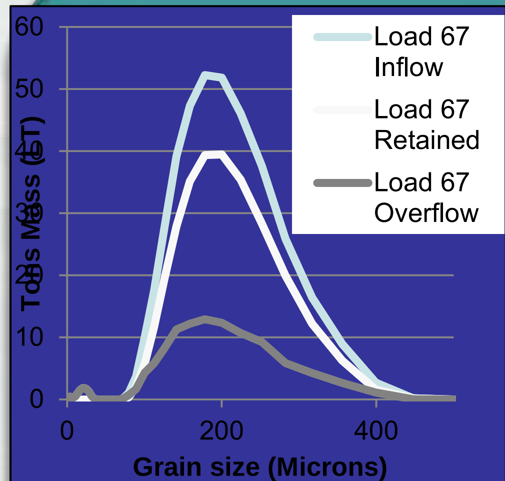
POC: Coraggio Maglio

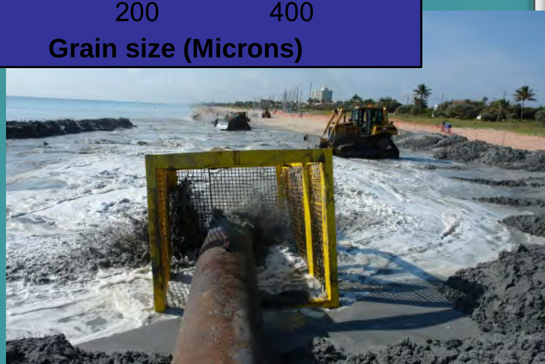


Depth of Closure Maps West Coast Lit Review JP Drafted

POC: Jay Rosati/ Cheryl Pollock

Research Activities





- Although berm material was transported downdrift:
  - Sand stayed in the surf zone
  - Sand accumulation was observed on the beach and shoreline due to the presence of the nearshore placed material

Ship to Shore Sediment Coarsening
POC: Coraggio Maglio/Jase Ousely

Berm Physical Modeling
POC: Ernie Smith

Large Scale Physical Modeling Duck, NC
POC: Julie Rosati

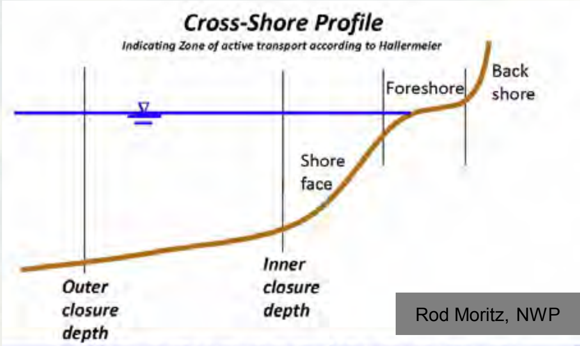
Working Meeting Out-takes

Identify Challenges

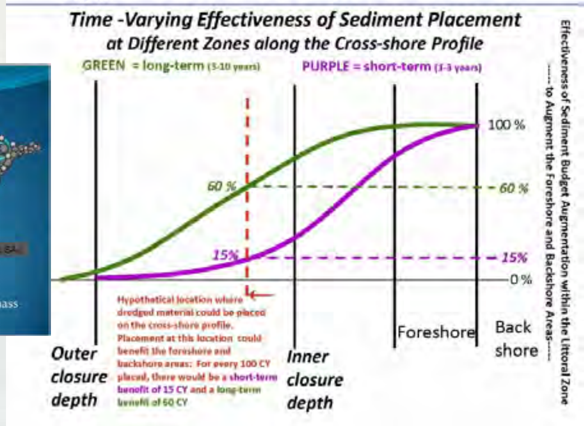
1. **Material Mobility-** Will material move?
2. **Material Migration-** Fate of fines?
3. **Time scales applied to material movement –** Short-term, Long-term
4. **Benefits and Impacts to Resources**
5. **Risk and Re/De-regulation**
6. **Transport Zone, Standardized vocabulary and definition**
7. **Communication with stakeholders**

Road Show (Support Districts):

- **Template for Placement Site Trade-offs**
- **Standardize criteria and communication tools**
- **Educate on physical processes of sediment-wave interaction**
- **Explain potential berm benefits**
- **Address environmental issues**
- **Demonstrate analysis and evaluation tools**
- **Provide overview of regulations and laws**
- **Demo case studies, their successes and lessons learned**

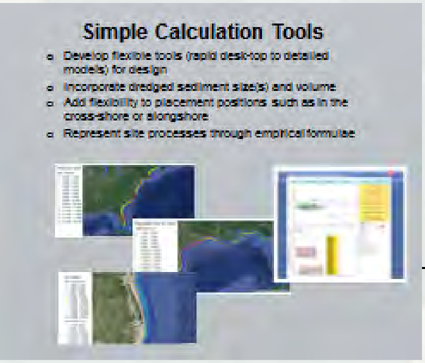


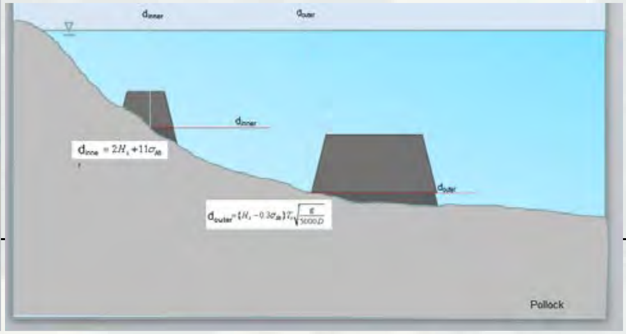
Rod Moritz, NWP

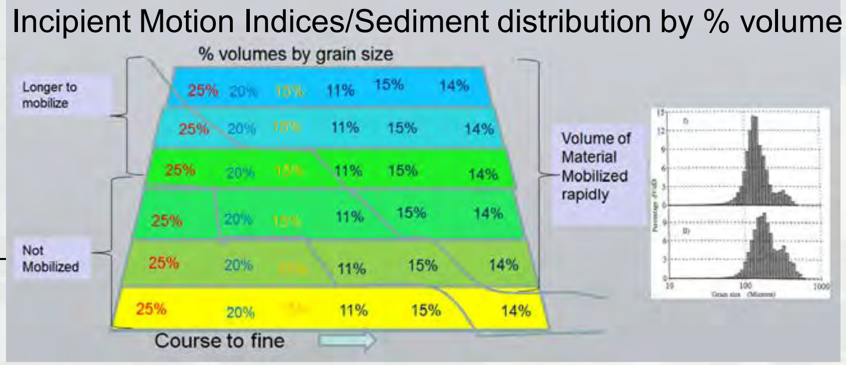


Newly Suggested Method for Reporting the Fate of Sediment and the Rate of Fate of Sediment Movement for Nearshore Berm

	1-3 years	4-10 years	Stable	Reporting Standard
Sediment added to transport zone	50%	30%	20%	50/30/20 berm or 80% Feeder berm
Sediment added to beach	10%	10%		20% beach feeder berm







Questions?