



Engineer Research and
Development Center

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

EWN/RSM IPR, Vicksburg, MS
22 July 2014

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

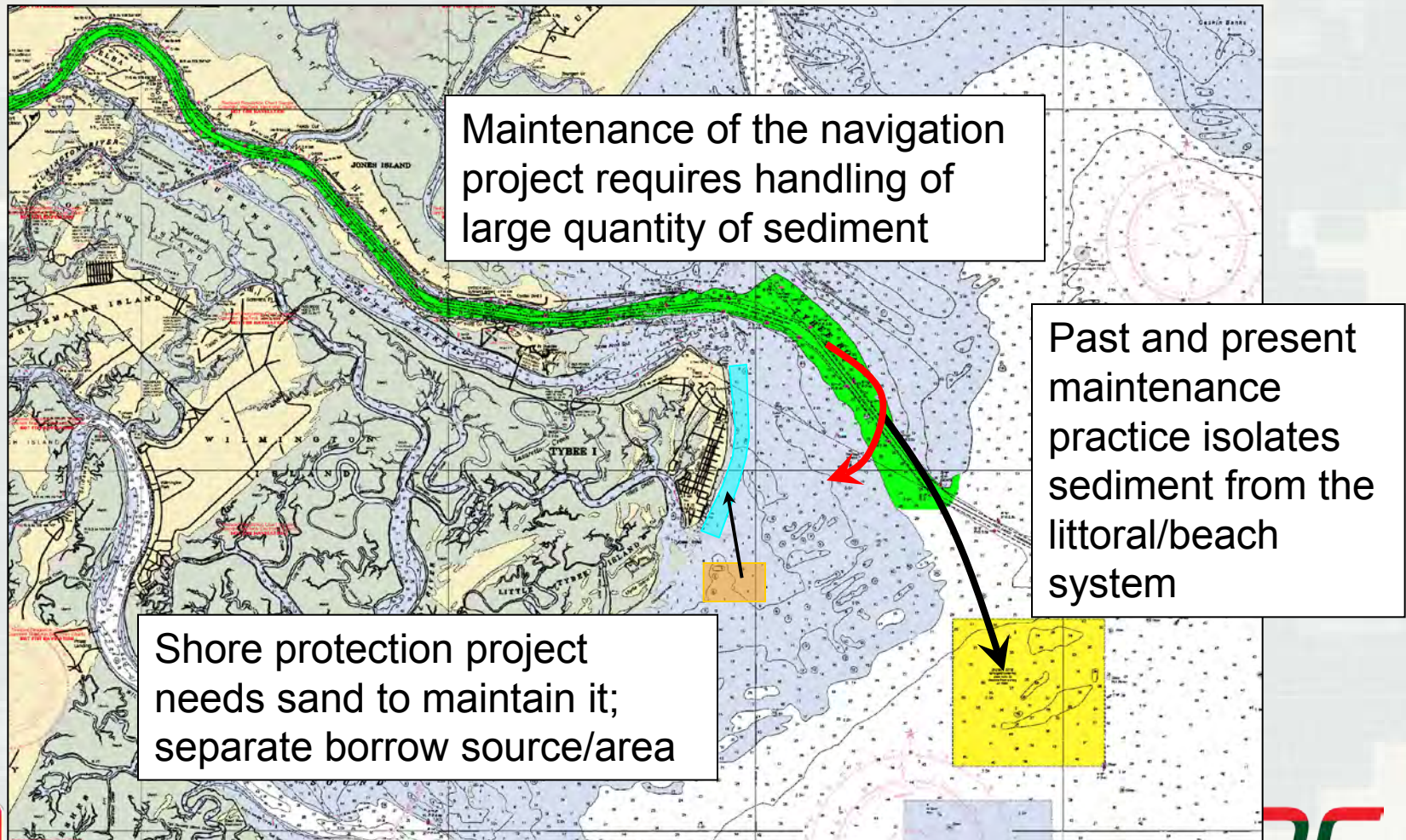


Objective

- 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

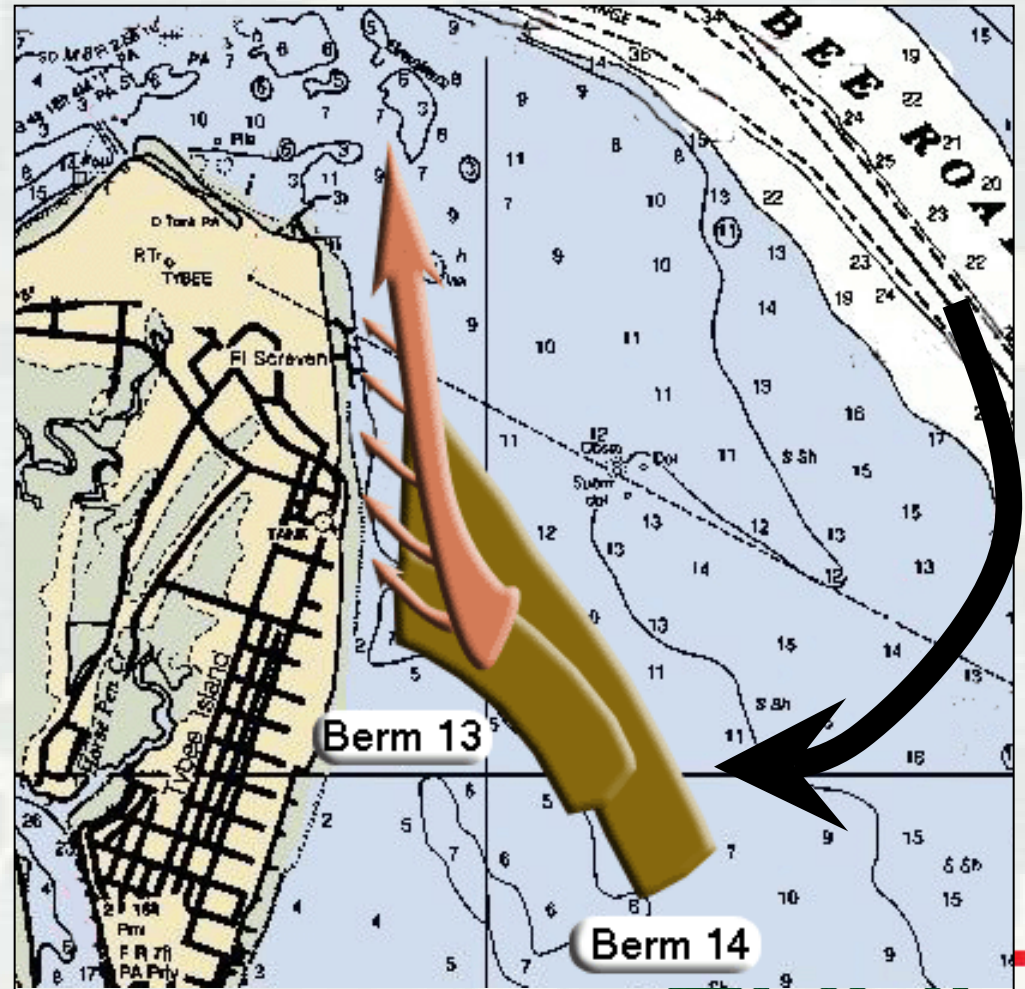


Example EWN Solution for DMM

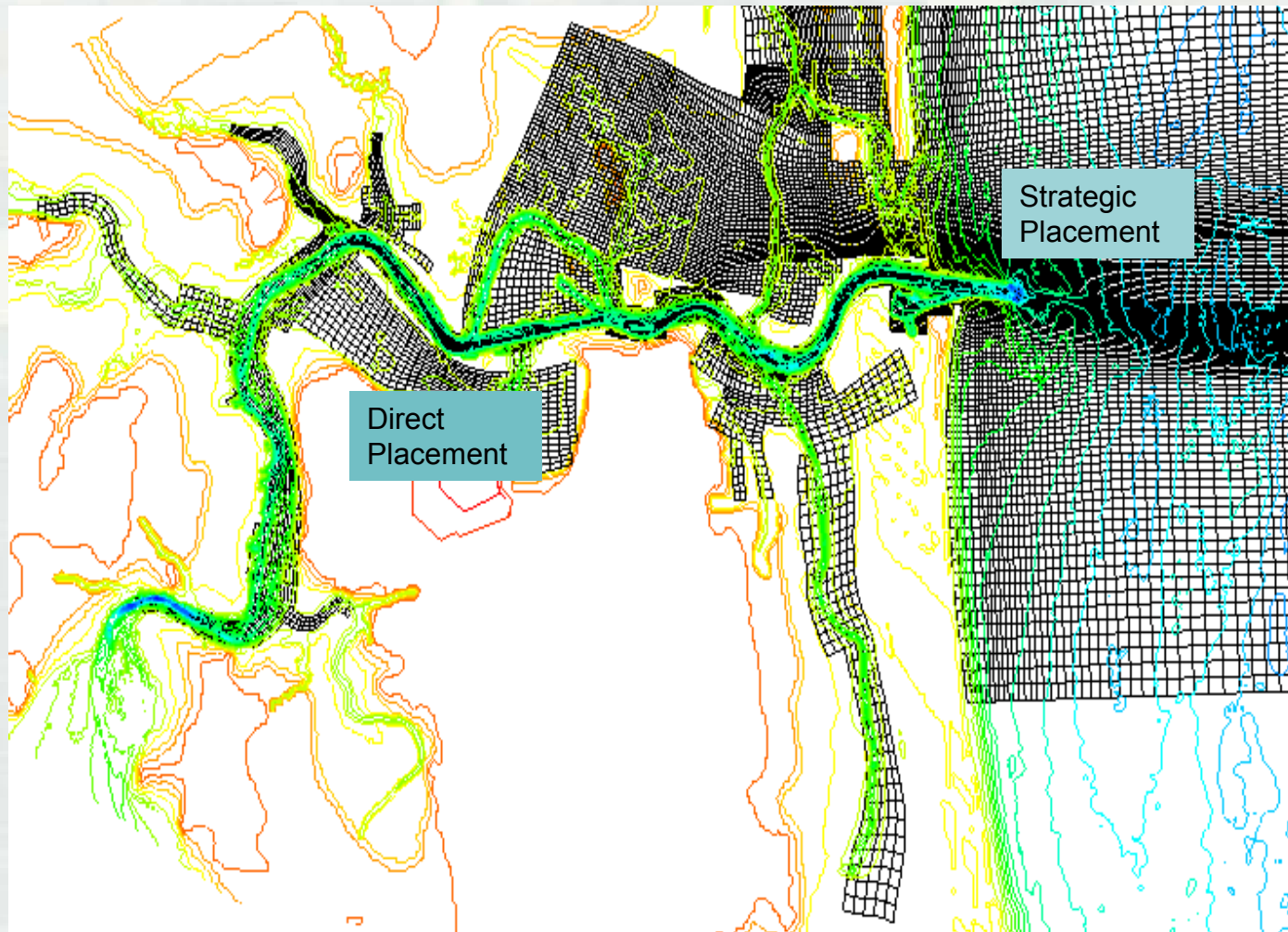


Example EWN Solution to DMM

- 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



Example EWN Solution for DMM



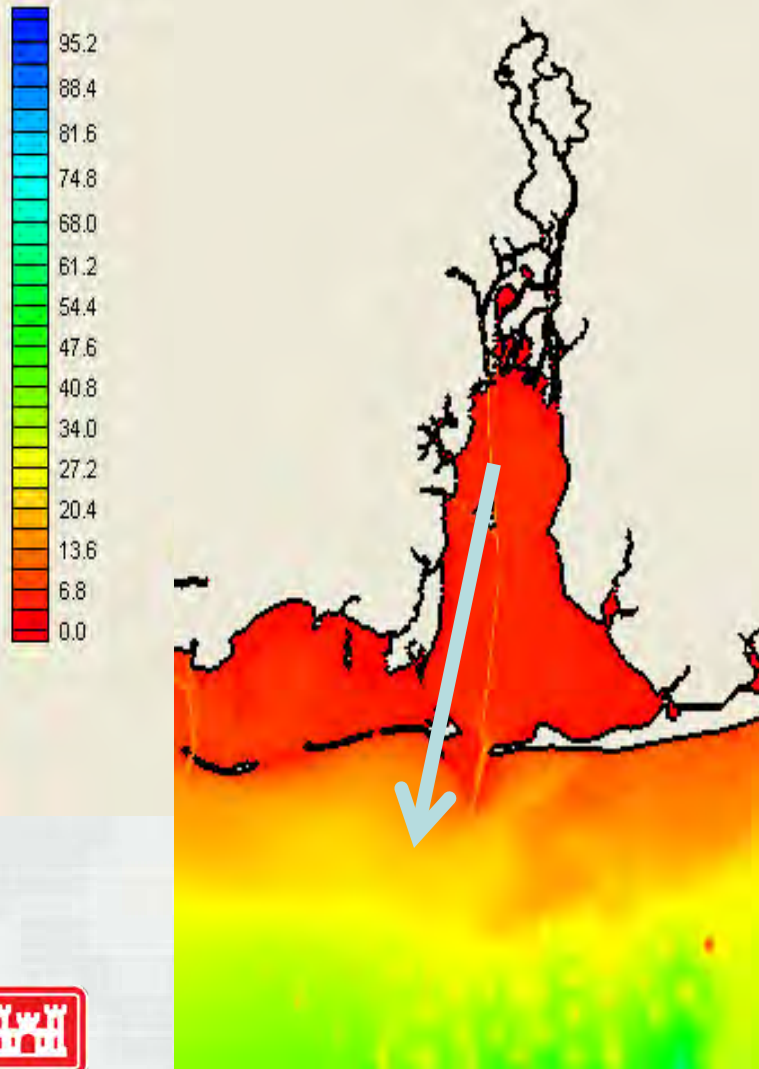
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Mobile Bay Dredging Practices

Mesh Module elevation



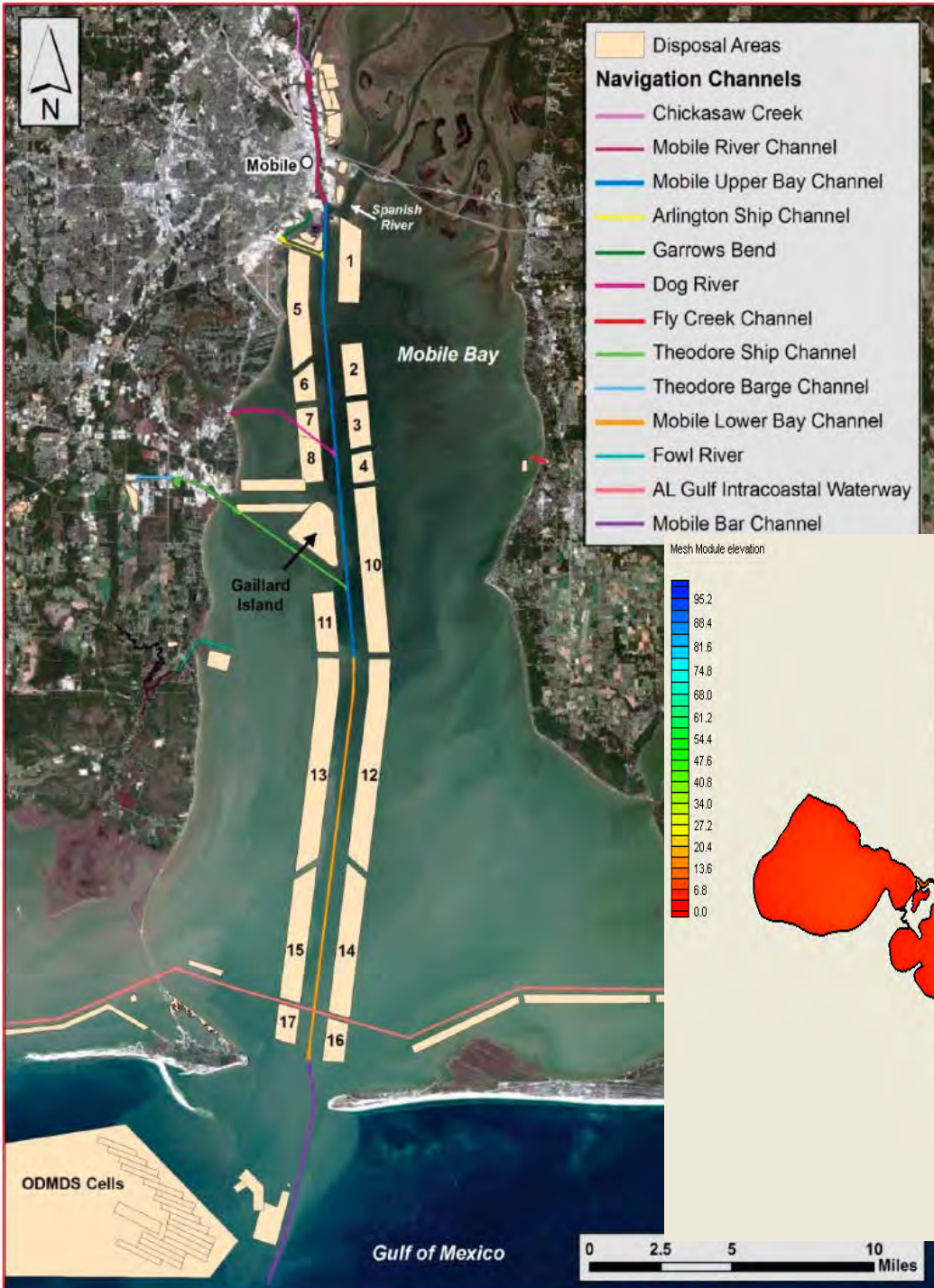
- Present dredging practice: remove sediment from bay to ODMDS
- This eliminates sediment from sediment-starved regional system (the Bay)
- Proposed practice: TLP within Mobile Bay to feed resources
- Issues: environmental impacts, rehandling, cost



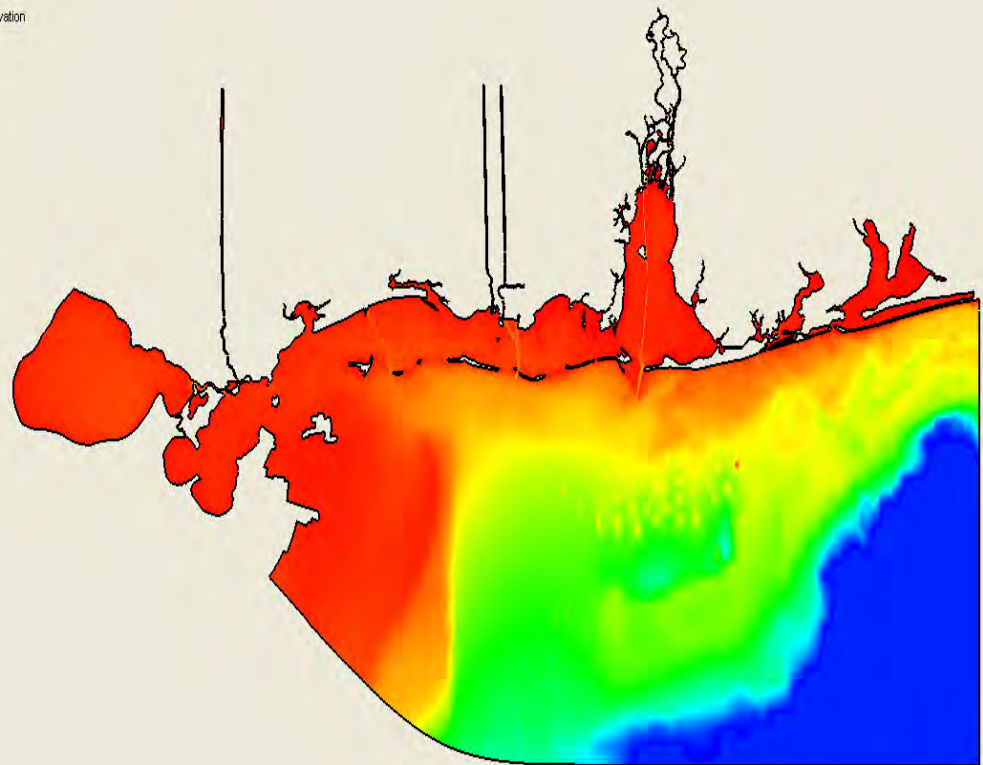
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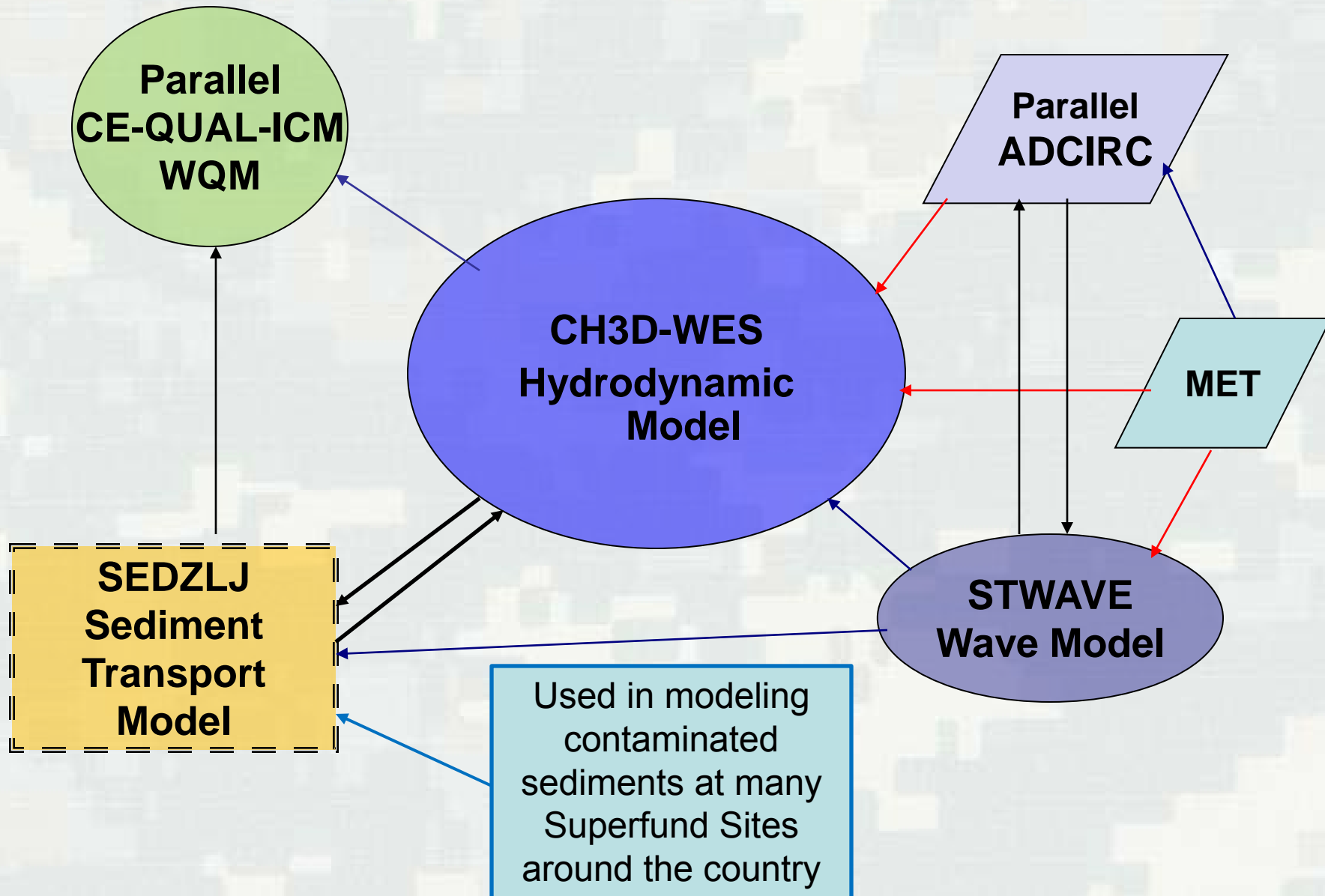
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To address rehandling and environmental impact issues, a 3-D modeling exercise of sediment transport in the Bay was applied



LTFATE Modeling Framework



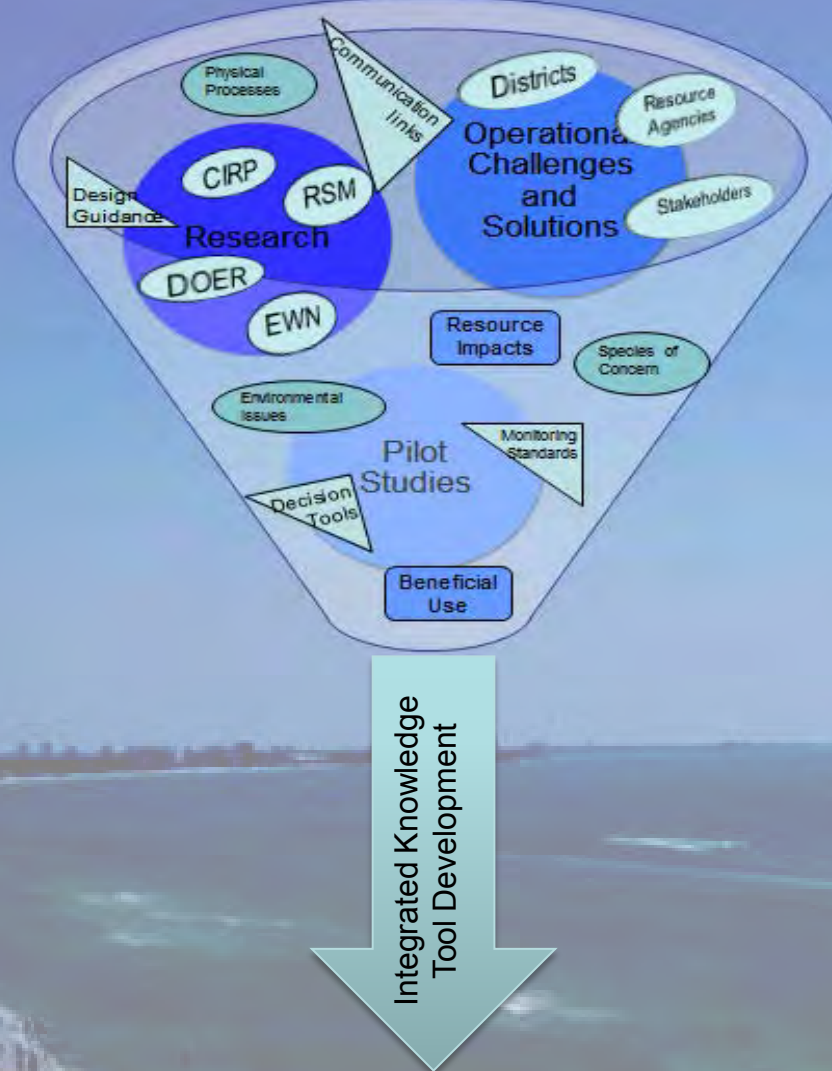
TLP Summary of Findings

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



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Nearshore Berms

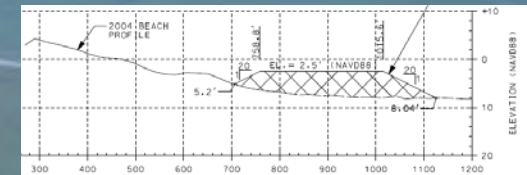
What are they?

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

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



Nearshore berm

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

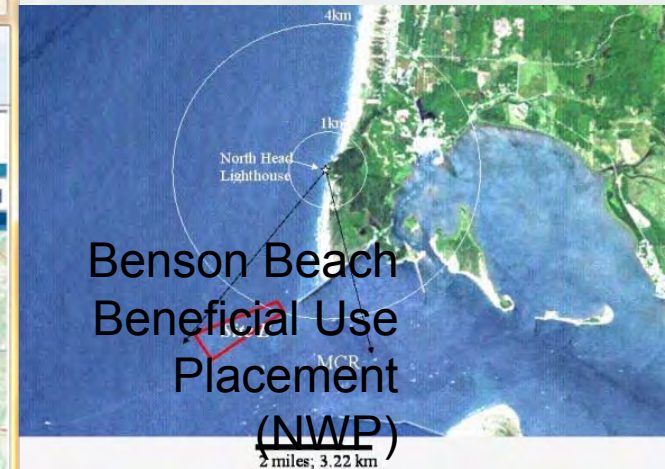
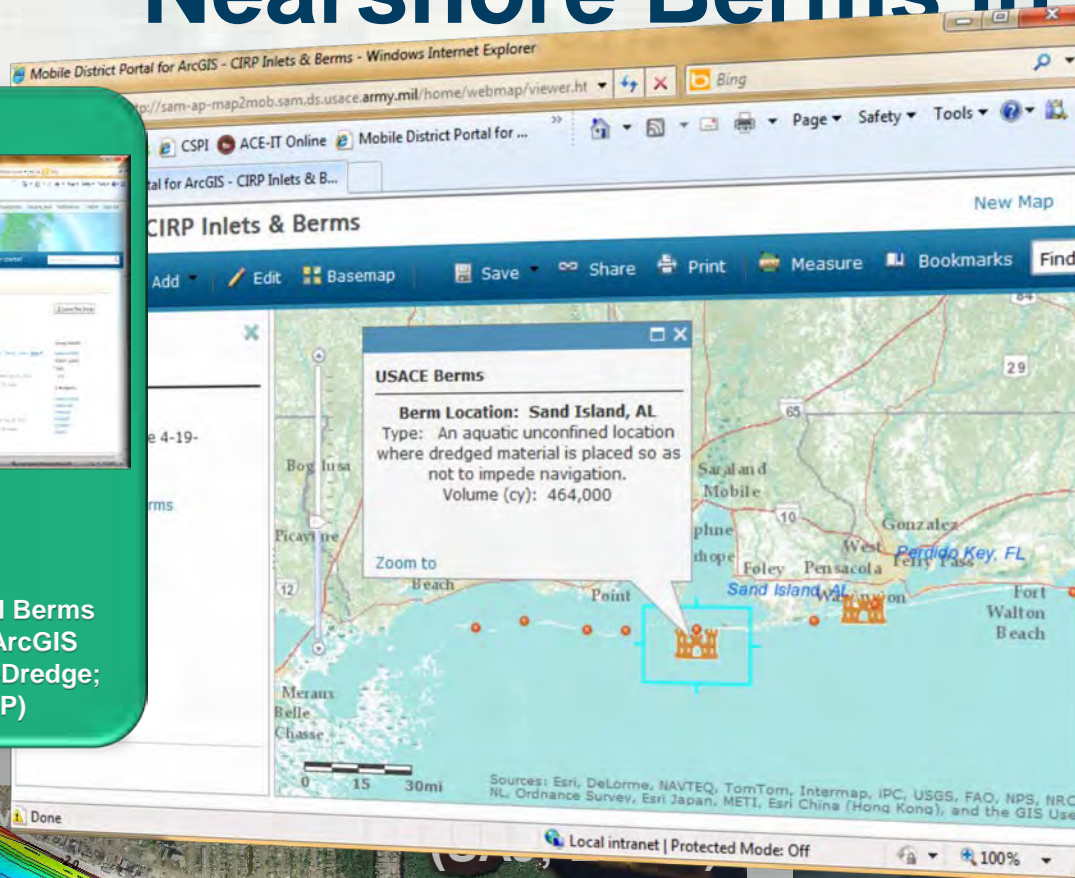


*Downdrift of Ft. Myers Inlet, FL
POC: Jim Lagrone, SAJ
Photo Courtesy Dr. Ping Wang
USF*

Nearshore Berms in USACE



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



Shoreline Response
from placed material

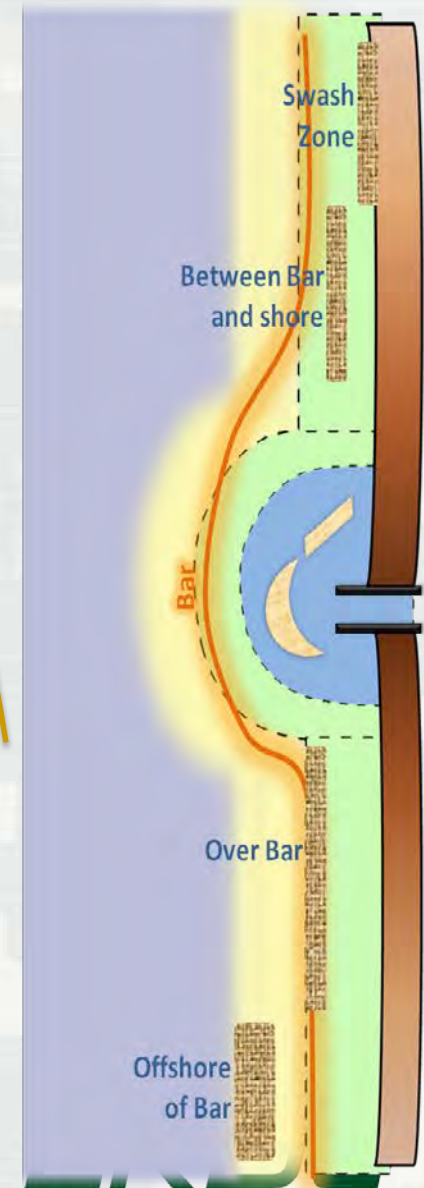
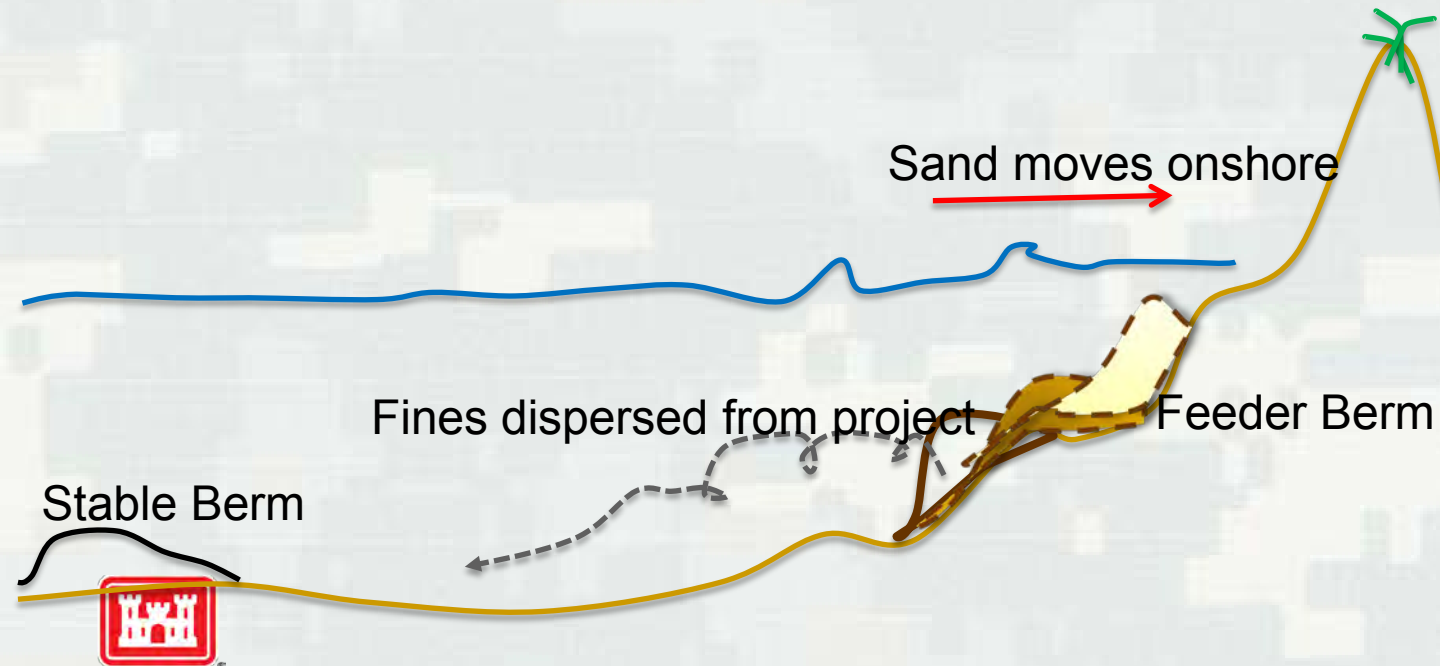


Berms

State of Understanding

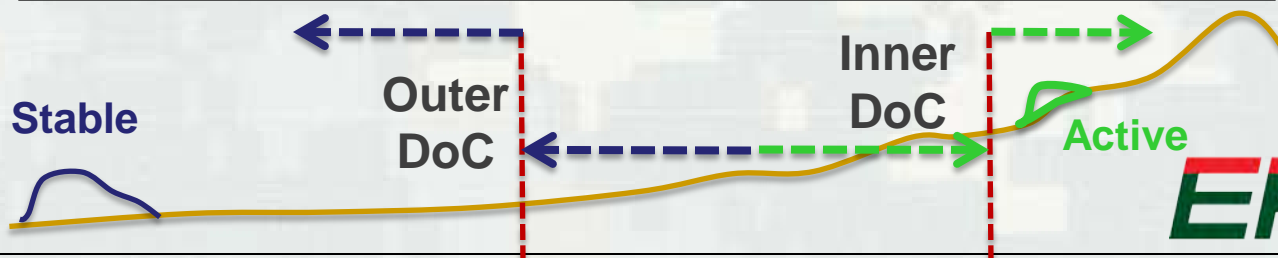
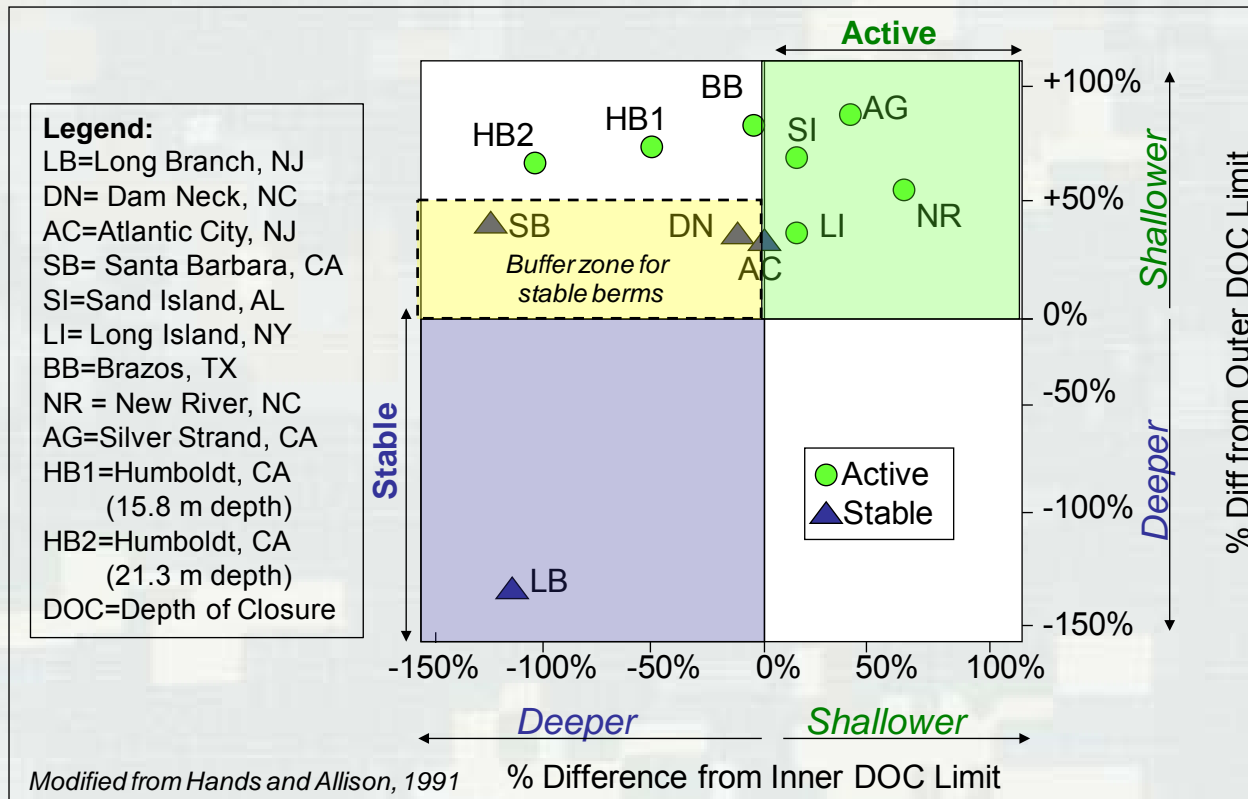
Present design guidance is based on design goals:

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



Berms

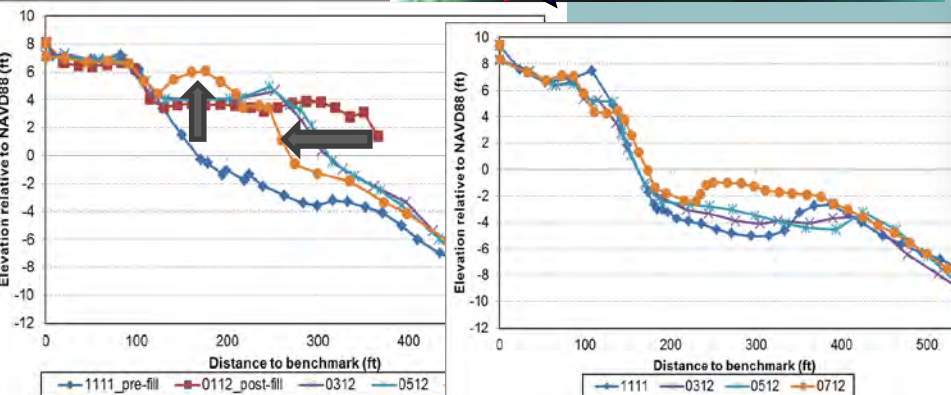
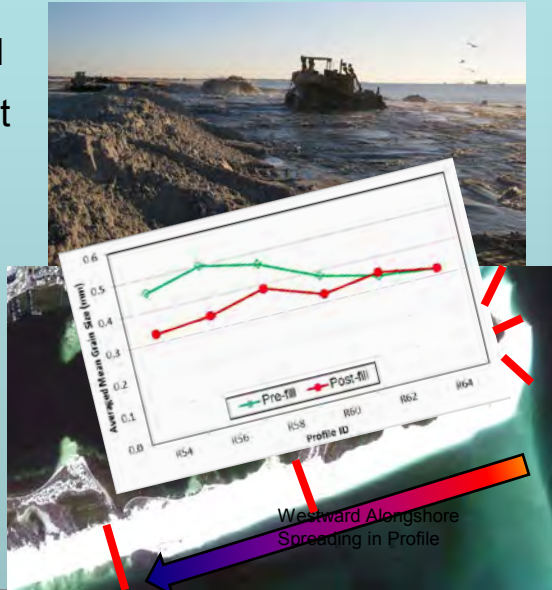
State of Understanding (Hands and Allison 1991)



Highly Dispersive Berm Sites

Perdido Key Swash Zone

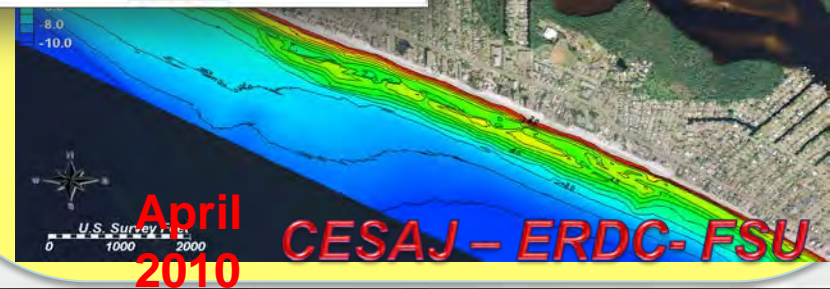
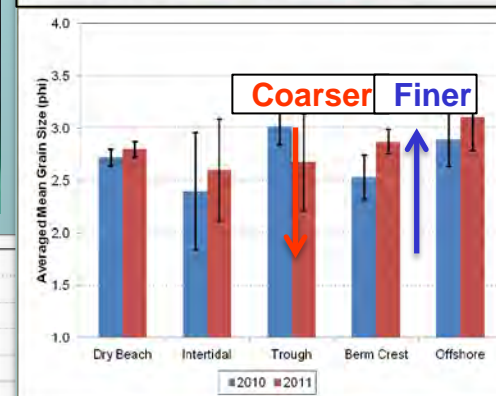
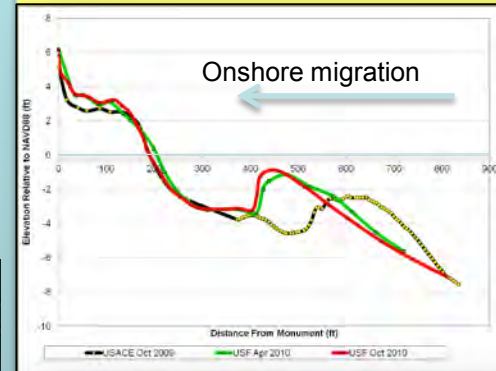
- Pumped and Pushed
- Winnowing, sediment grades coarser down-drift
- Profile nourished
- Down-drift beaches profile evolution



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:

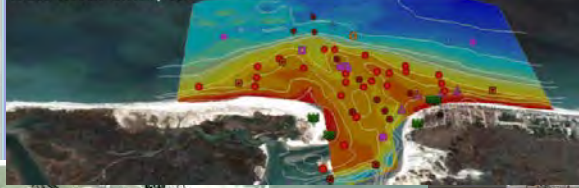
Remotely acquired waves, currents, and bathymetry

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

CESAJ- ERDC

<http://www.offshoreswell.com>

ONR Inlets DRI/RIVETS
New River Inlet, NC

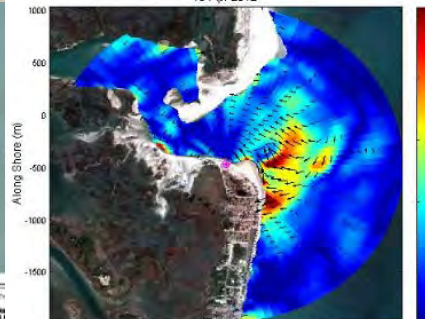


RIOS



Mean True Currents

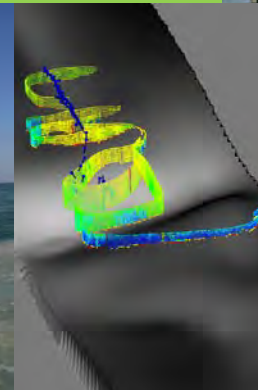
15-Apr-2012



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

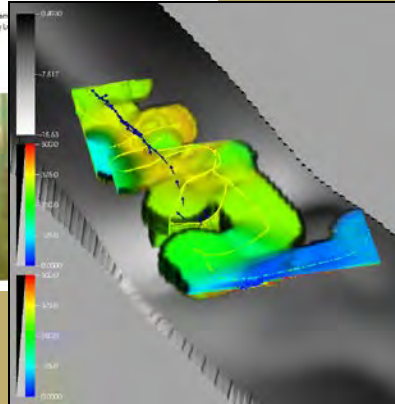
Coastal & Hydraulics Laboratory

ERDC/CHL TR-14X



Dredge Monitoring and Plume Tracking Mass Balance Approach, QIWW Bradenton and Egmont Key, Florida

Coraggio Maglio, Tanya M. Beck, Jan Wang, Katherine E. Brutsche, Kelly L.



TR: Dredge Monitoring and Plume Tracking Mass Balance
POC: Coraggio Maglio



Working Meeting: The State of Understanding of Nearshore Berms

by Cheryl E. Pollock and Tanya Beck

Purpose: The Federal Sediment Management and the Coastal Best Research Programs held a working meeting from 1-4 of March 2014, at the Coastal and Hydraulics Lab, on "The State of Understanding of Nearshore Berms". This technical note documents the events of the meeting, presents the meeting goals, lists the attendees of the meeting, and summarizes the meeting outcomes and research objectives. The focus of this gathering was to discuss the challenges, successes, and needs of the USACE Districts that implement these projects. The goal was to define and prioritize these regularly-occurring needs and to integrate these findings into the ongoing R&D Program-based research, tool development, and guidance, and to provide assistance to collectively address operational challenges Corps-wide.

Background: The US Army Corps of Engineers places approximately 14 to 22 million cubic yards of material in the berm area annually (based on beach nourishment projects only).

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



CHETN: Nearshore Berm Working Meeting Summary
POC: Cheryl Pollock

Morphological Evolution of a Submerged Artificial Nearshore Berm along a Low-wave Microtidal Coast, Fort Myers Beach, West-central Florida, USA

Katherine E. Brutsche¹, Ping Wang², Tanya M. Beck³, Julie D. Reuss⁴, and Kelly K. Legath⁵



Morphological evolution of a submerged artificial nearshore berm along a low-wave microtidal coast, Fort Myers Beach, west-central Florida, USA

Katherine E. Brutsche¹, Ping Wang², Tanya M. Beck³, Julie D. Reuss⁴, Kelly K. Legath⁵

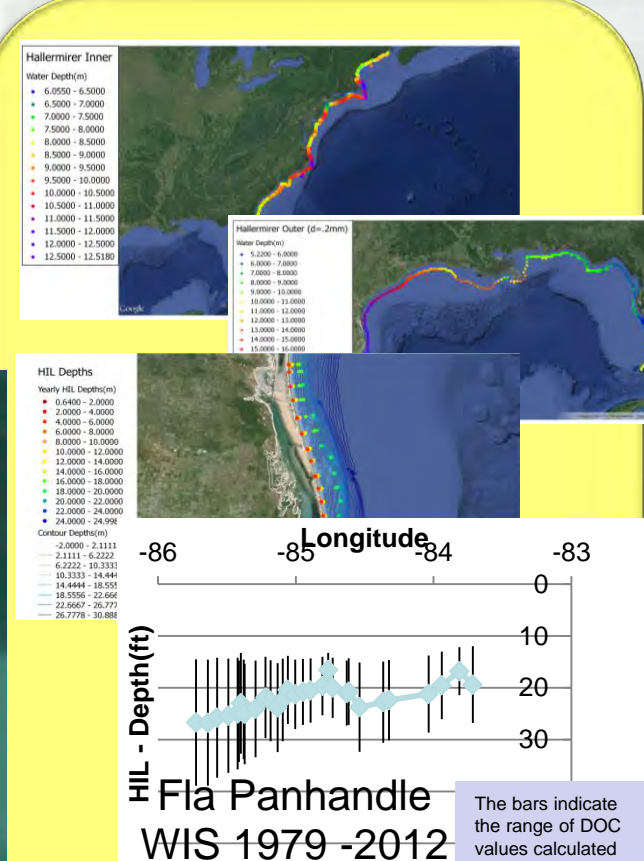
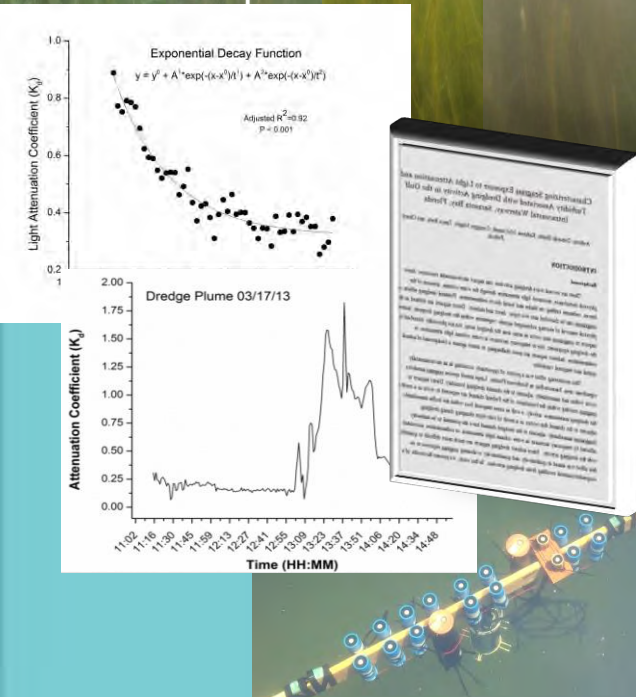
¹USACE, Hydrologic Engineering Center, 4901 L Street, Sacramento, CA 95824; ²USACE, Hydrologic Engineering Center, 4901 L Street, Sacramento, CA 95824; ³USACE, Hydrologic Engineering Center, 4901 L Street, Sacramento, CA 95824; ⁴USACE, Hydrologic Engineering Center, 4901 L Street, Sacramento, CA 95824; ⁵USACE, Hydrologic Engineering Center, 4901 L Street, Sacramento, CA 95824

ABSTRACT: Nearshore berms are a common coastal defense feature. They are typically constructed as low, wide, flat areas of sand or sediment that extend from the shoreline into the nearshore. They are designed to absorb wave energy and reduce the impact of waves on the beach and dune system. This paper describes the morphological evolution of a submerged artificial nearshore berm along a low-wave microtidal coast, Fort Myers Beach, west-central Florida, USA. The berm was constructed in 1992 and has since been monitored and maintained. This paper presents the results of a long-term monitoring program that was initiated in 2002. The program includes regular bathymetric surveys, sediment transport measurements, and visual inspections of the berm. The results show that the berm has evolved significantly since its construction. It has become wider and higher, and its shape has changed. These changes are attributed to a combination of factors, including sediment transport, wave action, and human intervention. The paper discusses the implications of these changes for the berm's effectiveness as a coastal defense feature and provides recommendations for future monitoring and maintenance efforts.

Nearshore Berms Movement - 2 Journal Papers Coauthored
POC: Tanya Beck

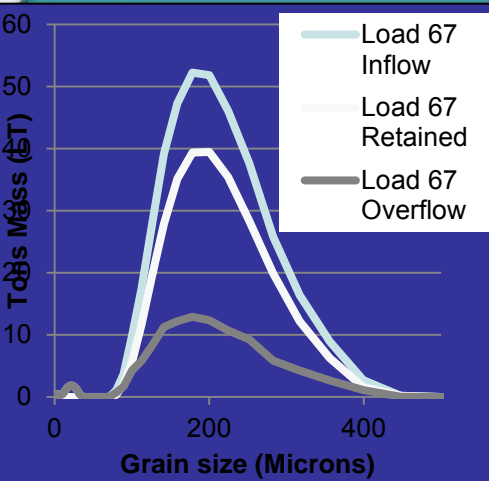
Research Activities

Snap shot taken every 10 sec.
How long will the plume linger?
What are impacts to resources?

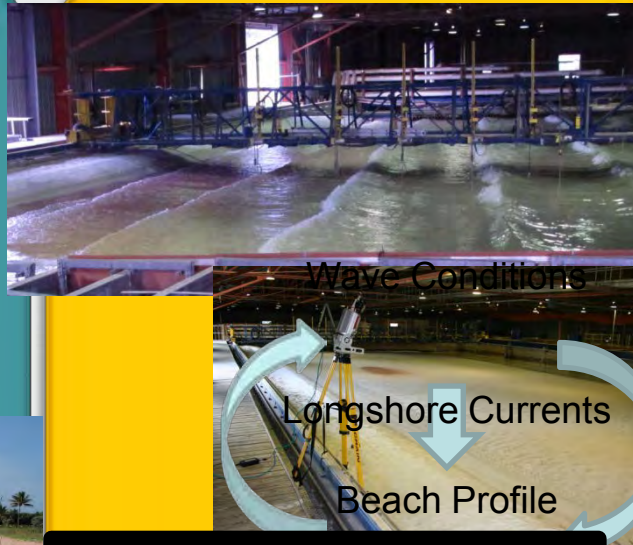


Depth of Closure Maps
West Coast Lit Review
JP Drafted
 POC: Jay Rosati/ Cheryl Pollock

Research Activities



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



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

**Berm Physical
Modeling**
POC: Ernie Smith



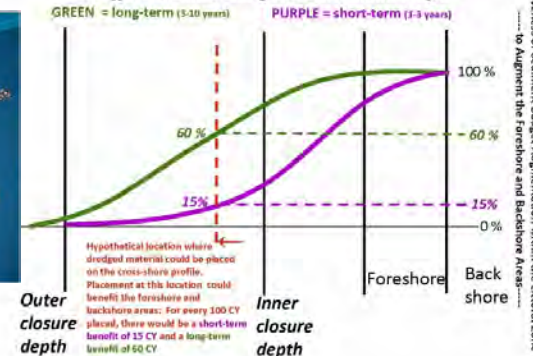
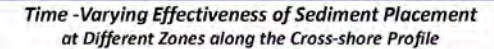
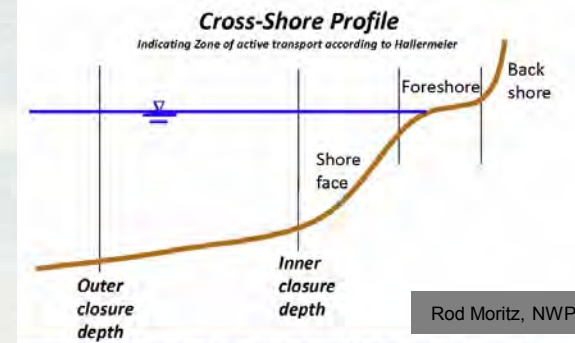
**Large Scale Physical
Modeling Duck, NC**
POC: Julie Rosati

Identify Challenges

- ### Road Show (Support Districts):

- ## Simple Calculation Tools

-
- Diagram illustrating the relationship between beach width and dune width. The beach width is given by $d_{beach} = 2N_s + 11C_{D0}$. The dune width is given by $d_{dune} = 11N_s(1 - 0.3\alpha_0)^{1/2} \sqrt{\frac{g}{5000D}}$. The diagram shows a cross-section of a beach and dune with labels for d_{beach} and d_{dune} .
- Pollock

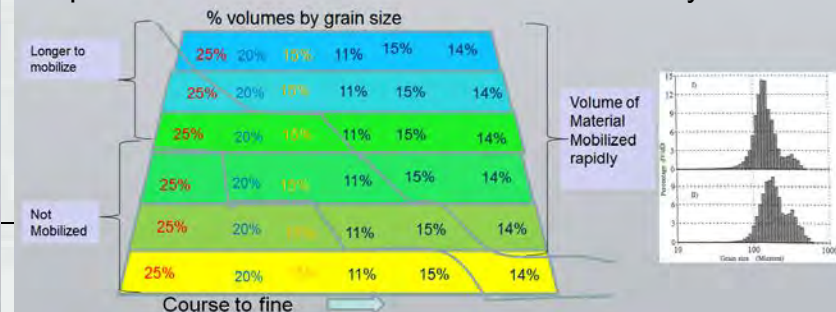


----- to Augment the Foreshore and Backshore Areas -----

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

Incipient Motion Indices/Sediment distribution by % volume



Questions?



Cheryl.E.Pollock@usace.army.mil

Joe.Z.Gailani@usace.army.mil



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