Recent Applications and Advancements for the Strategic Use of Coastal Structures

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Acknowledgments:
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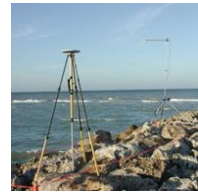
Doug Mann, P.E., D.CE, David Swigler, P.E., & Michelle Pfeiffer, P.E. (CB&I)

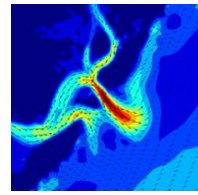
- FSBPA 2014 National Conference on Beach Preservation Technology, February 12-14, 2014 in Stuart, FL

"Examples And Design Guidance"

- Reintroducing Structures For Erosion Control
- Basic Types: seawalls, revetments, bulkheads, groins, breakwaters
- Littoral Transport Curve
- Advancements in permeability and adjustability





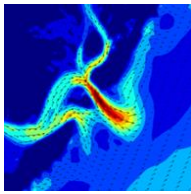
- Highly effective for beach stabilization

(1999) Groins built at Long Beach, NY

Source: City of Long Beach





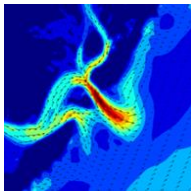
- Poor reputation for being overused and misunderstood.

(1969) Groins built at Wallops Island, VA

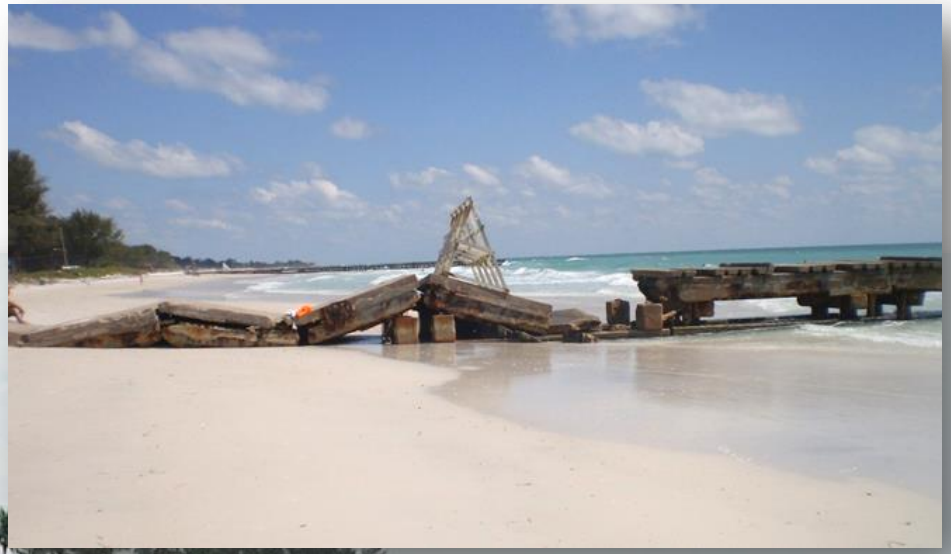
Source: USACE, 2010; Storm Damage Reduction Project Design for Wallops Island, Virginia (p.11)

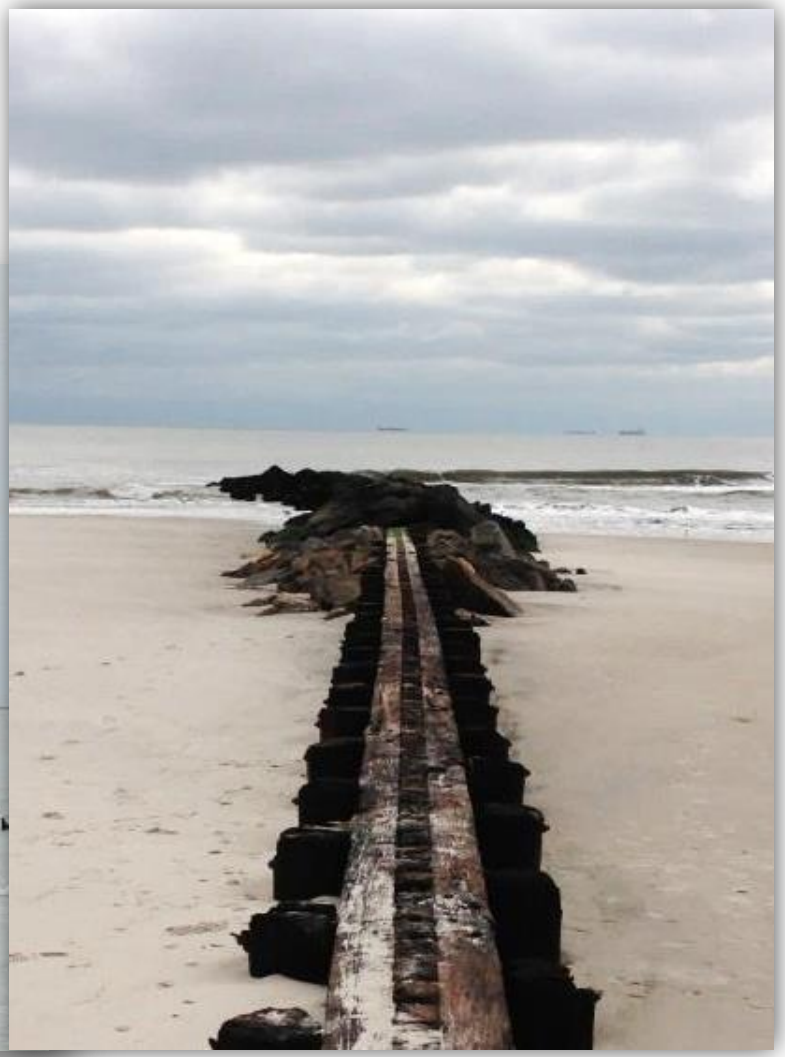




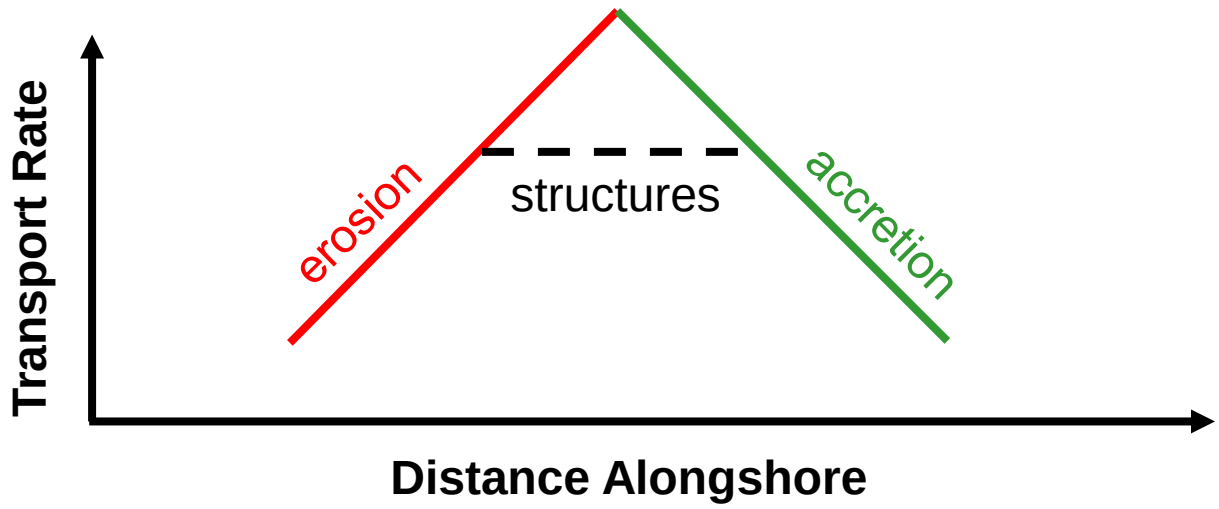
- Require maintenance for long term effectiveness

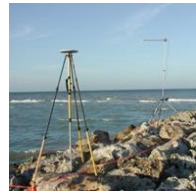




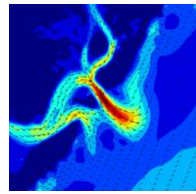
Littoral Transport Curve Analysis

- Measured volume changes annualized and summed alongshore to track sediment migration through an area of study.
- Adjust for inlet bypassing beach nourishment projects.
- Shape of the curve is most informative:
  - Increasing slopes are erosion
  - Decreasing slopes are accretional
  - Flat slopes are stable or structured







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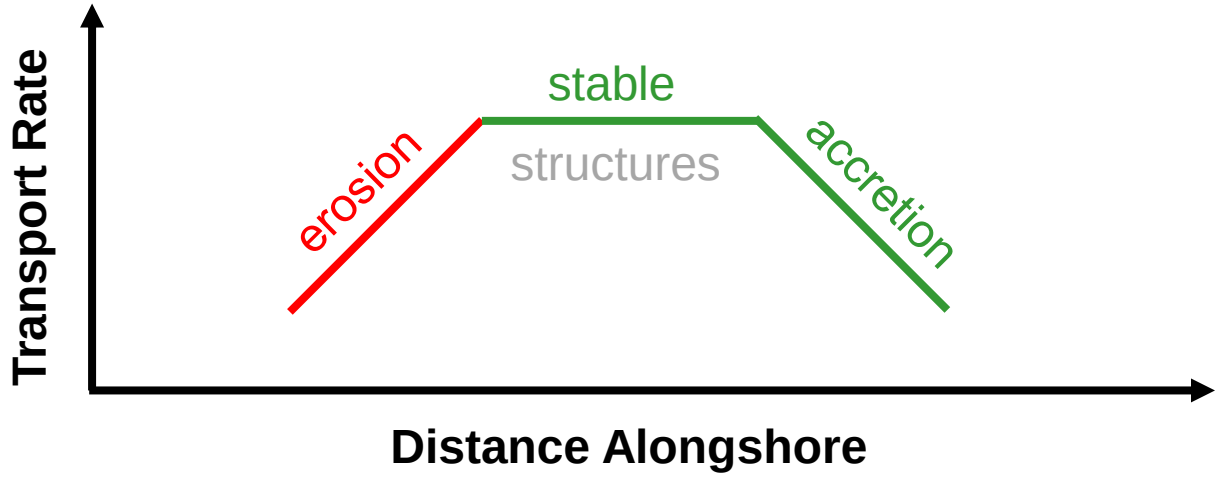
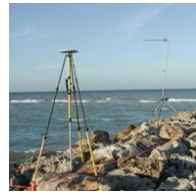
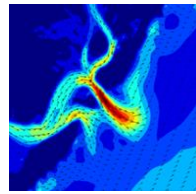




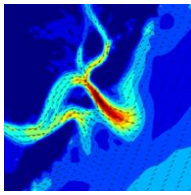


Conclusions from Part I

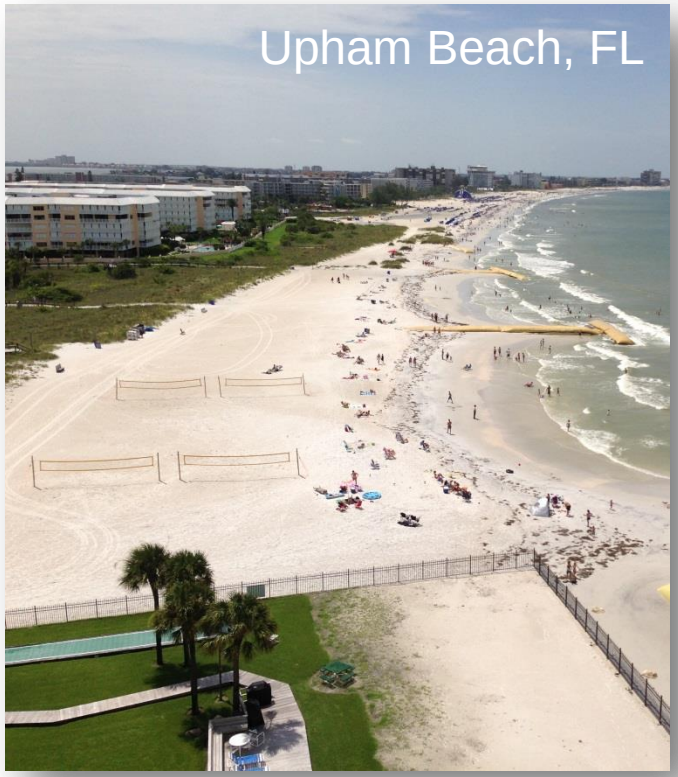
- Coastal structures have a place in contemporary beach nourishment projects.
- Should be used with care, based on past experience, engineering analysis and site specific needs.
- Cost savings due to hotspot control can be greater than the cost of installing structures, resulting in a net savings.
- Permeable / adjustable structures have additional advantages.

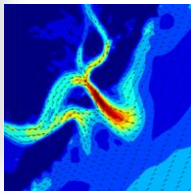




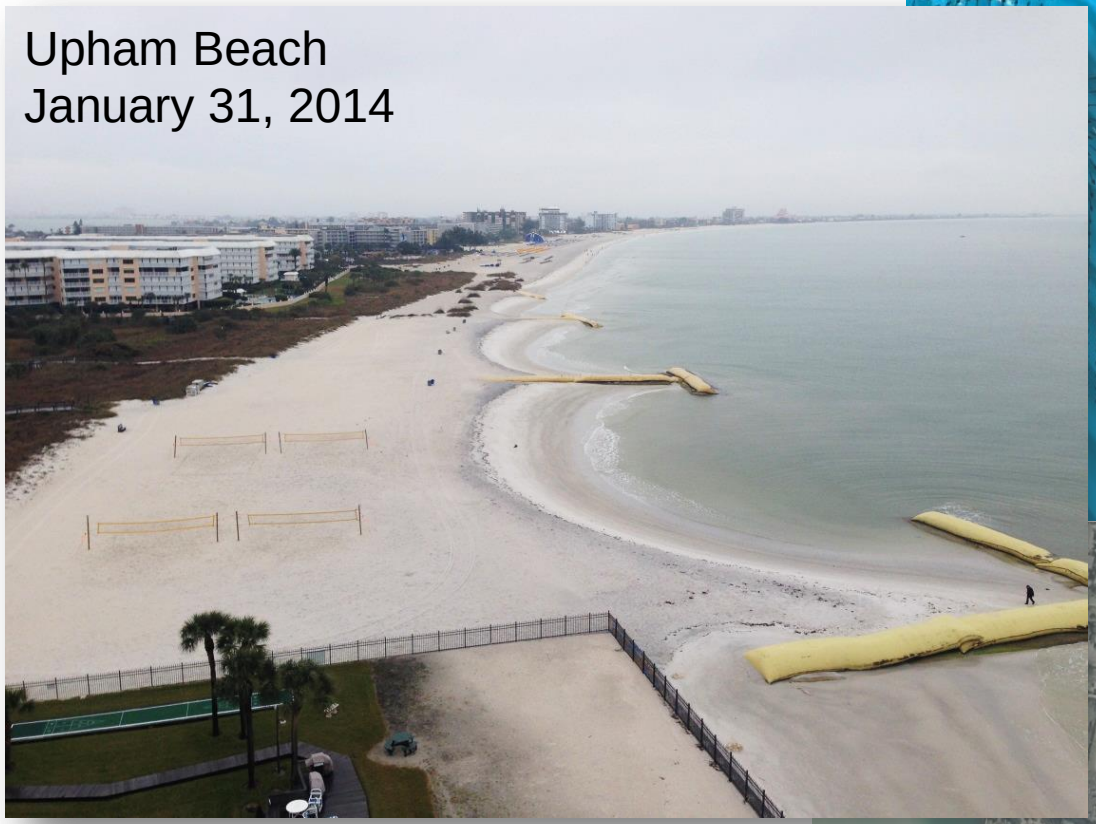



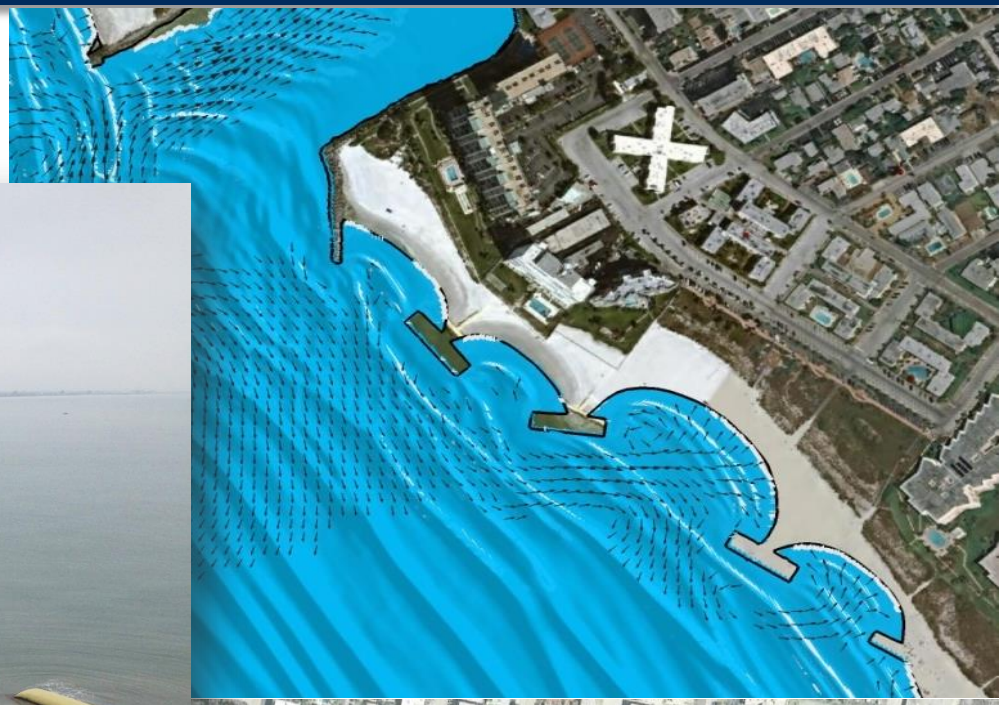
- Recent applications have focused more on:
  - Use in conjunction with beach nourishment
  - Addressing hotspot erosion
  - Prolonging the life of a beach project
  - Stabilizing a section of beach
  - Spreading erosion over a wider area
  - Economic advantages

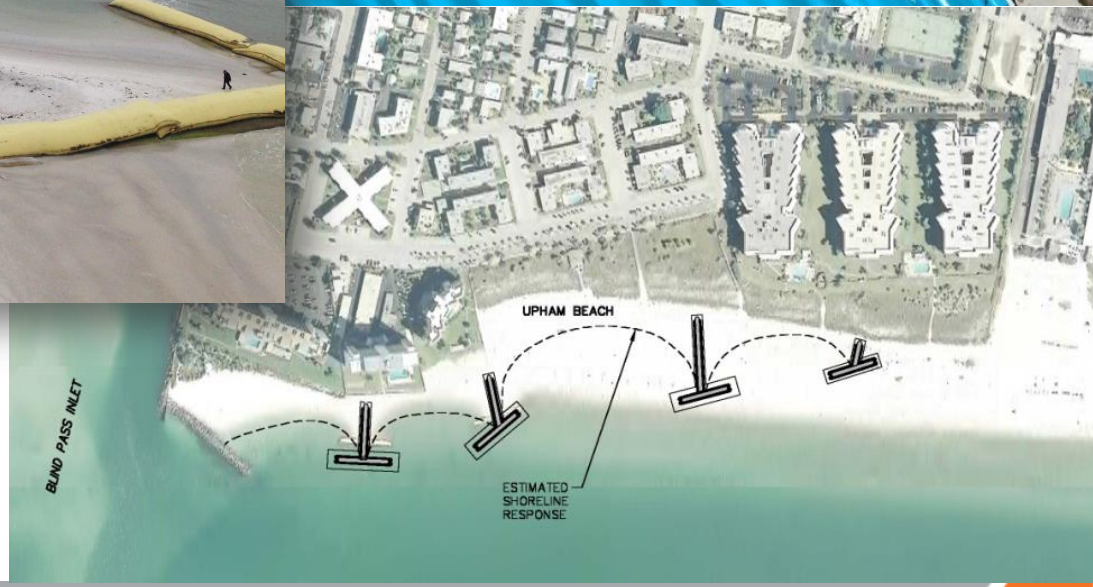




Temporary Geotextile Tubes







Permitted Permanent
Rock Structures

Upham Beach, Florida

Pinellas County
ENVIRONMENT AND INFRASTRUCTURE

From: *2014 Treasure Island and Long Key Beach Nourishment*
by John Bishop, Ph.D., Coastal Management Coordinator

Pre-Nourishment
1994

Pre-Nourishment
Sept 15, 2010

Post Nourishment
Nov 1, 2010

Upham Beach, Florida

- July 16, 2014 – Before USACE 2014 project

- 4 years since previous (2010) fill project
- Groin T2 damaged
- Public beach stabilized

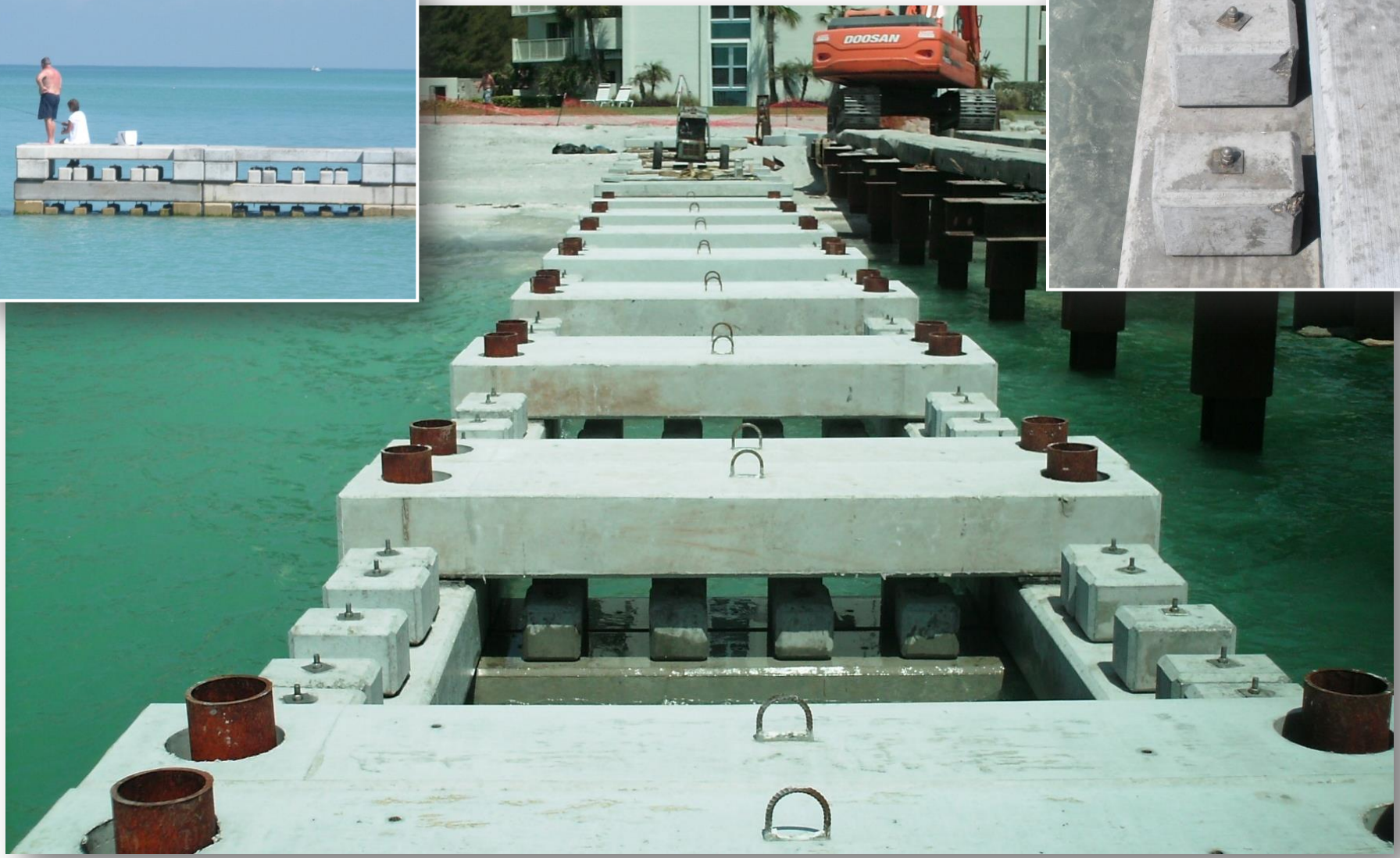
Upham Beach, Florida

- January 29, 2015 – 5 months post fill from USACE 2014 project

- Fill placement August 2014
- 157,000 cubic yards
- Egmont Shoals East borrow area

Innovative Designs for Flexibility and Adjustment

- Permeable Adjustable Groins (PAG)



- Islander Club Condominium PAGs: July 2, 2012 – Post TS Debby

Construction completed in 2010

North End PAGs Installation

- Started:

November 1, 2014

- 25% Complete:

(First Groin 50%)

- Est. Completion:

May 2015 (180 days)

- $2.0M:

Collage Design and Construction Group, Inc. / Construct Co. Inc.

North End PAGs Installation

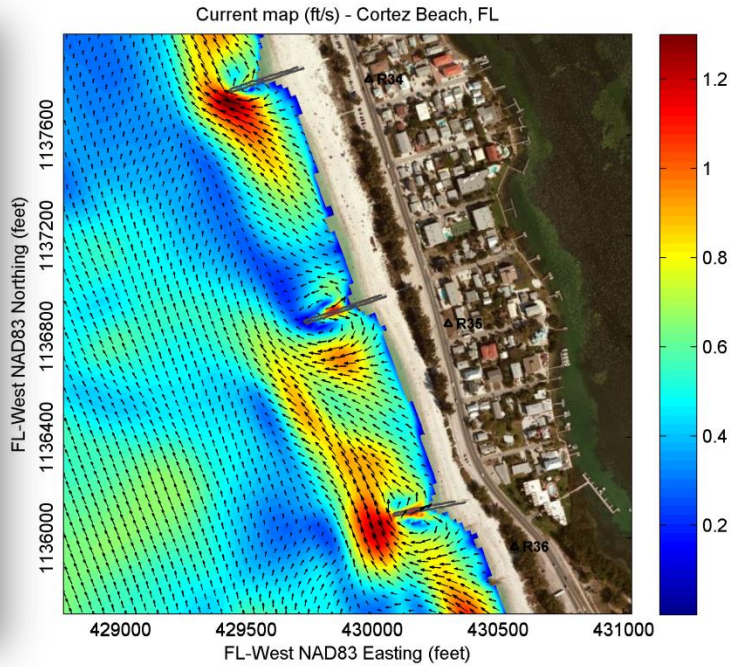
- Precast Operation
- Temporary Cofferdam

North End PAGs Installation

Precast Components:

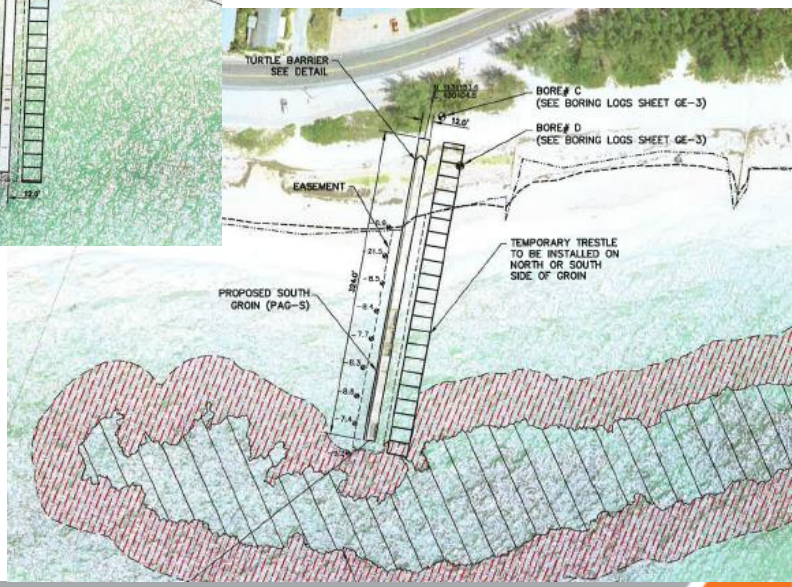
- Deck Slabs
- Deck Supports
- Crib Beams
- Removable Elements

- Cortez Beach:
  - Three permeable pier-type groins were installed in 1960s and 1970s.
  - Successful in stabilizing the beach.
  - Experienced deterioration and impacts of many tropical storms, leaving them dilapidated and unsafe.
  - Being replaced with permeable adjustable groins (PAGs).



Cortez Beach Groin Construction

- Bids opened November 25, 2014
- 7 responsive bids received
- Cayo, LLC (Fort Worth, Texas) $4.41M



- Construction expected to start in Mar 2015
- Contract time is 285 days

Anna Maria Island, Florida

Cortez Beach:

January 29, 2015

- Existing structures to be removed

King Pile and Panel Groin

Limited footprint
Customizable lengths and adjustable
Minimize sea turtle interactions
Ease of construction (offsite concrete casting)

King Pile and Panel Groin

Big Hickory Island

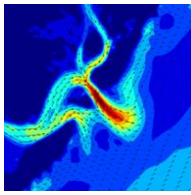
- Pelican Landing Community Association
- General public and hotel guests
- Approximately 65,000 visits to the beach in 2013

Pelican Landing Community Association Erosion Control Project at Big Hickory Island:

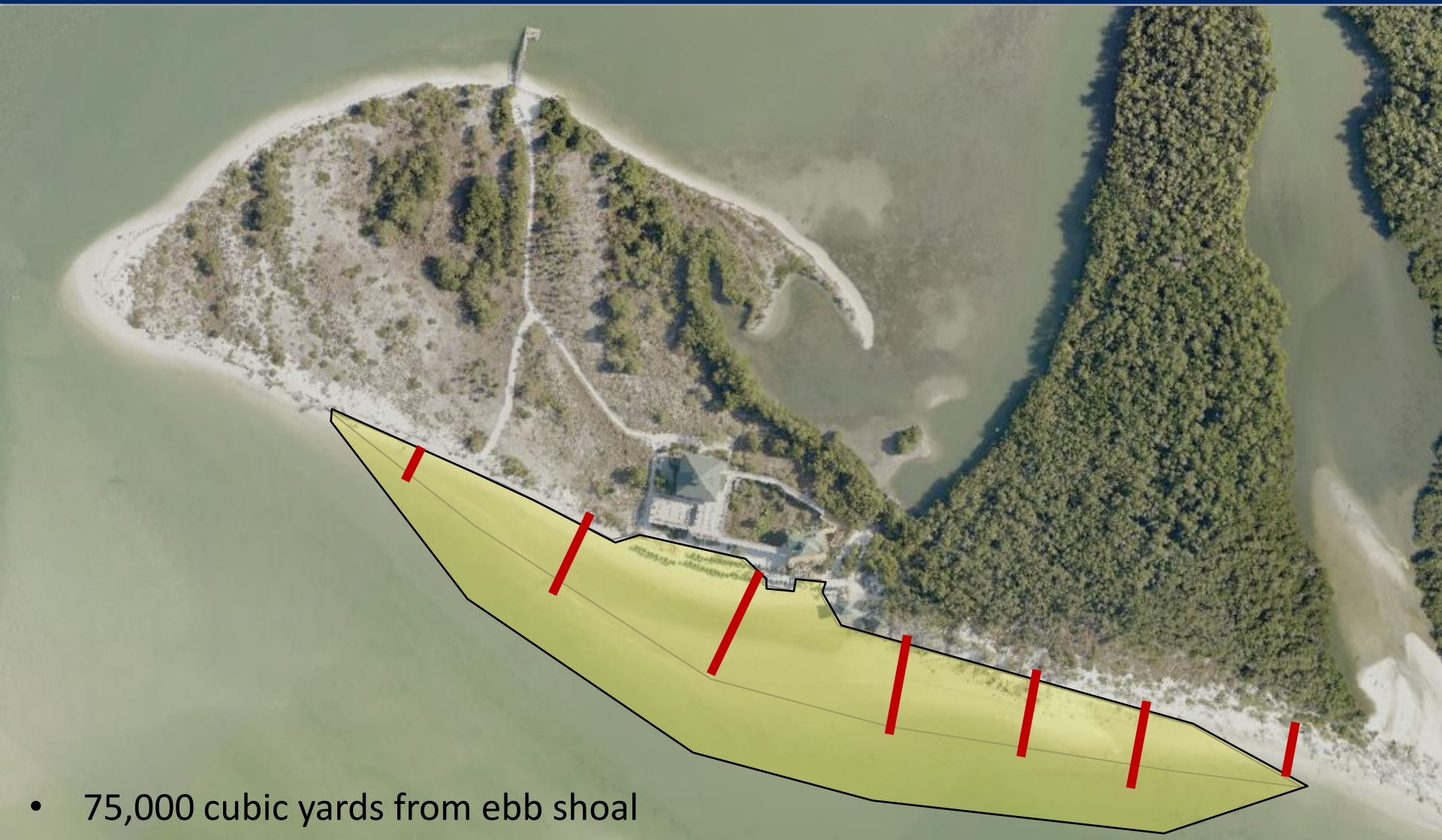
- Two viable alternatives for erosion control of BHI at Pelican Landing included:
  - Segmented breakwaters, dune fill, beach nourishment
  - Traditional groins, dune fill, beach nourishment
- Non viable alternatives:
  - Beach nourishment only
  - No action





Big Hickory Island



- 75,000 cubic yards from ebb shoal
- 600 ft long dune along the back of the new beach
- 7 king pile and panel groins to control the loss of sand

Groin Construction Methodology

Groin Construction Methodology

Big Hickory Island Groin Construction

$550,000 for installation of 7 groins
(mobilization covered by simultaneous beach project)
3 months construction time

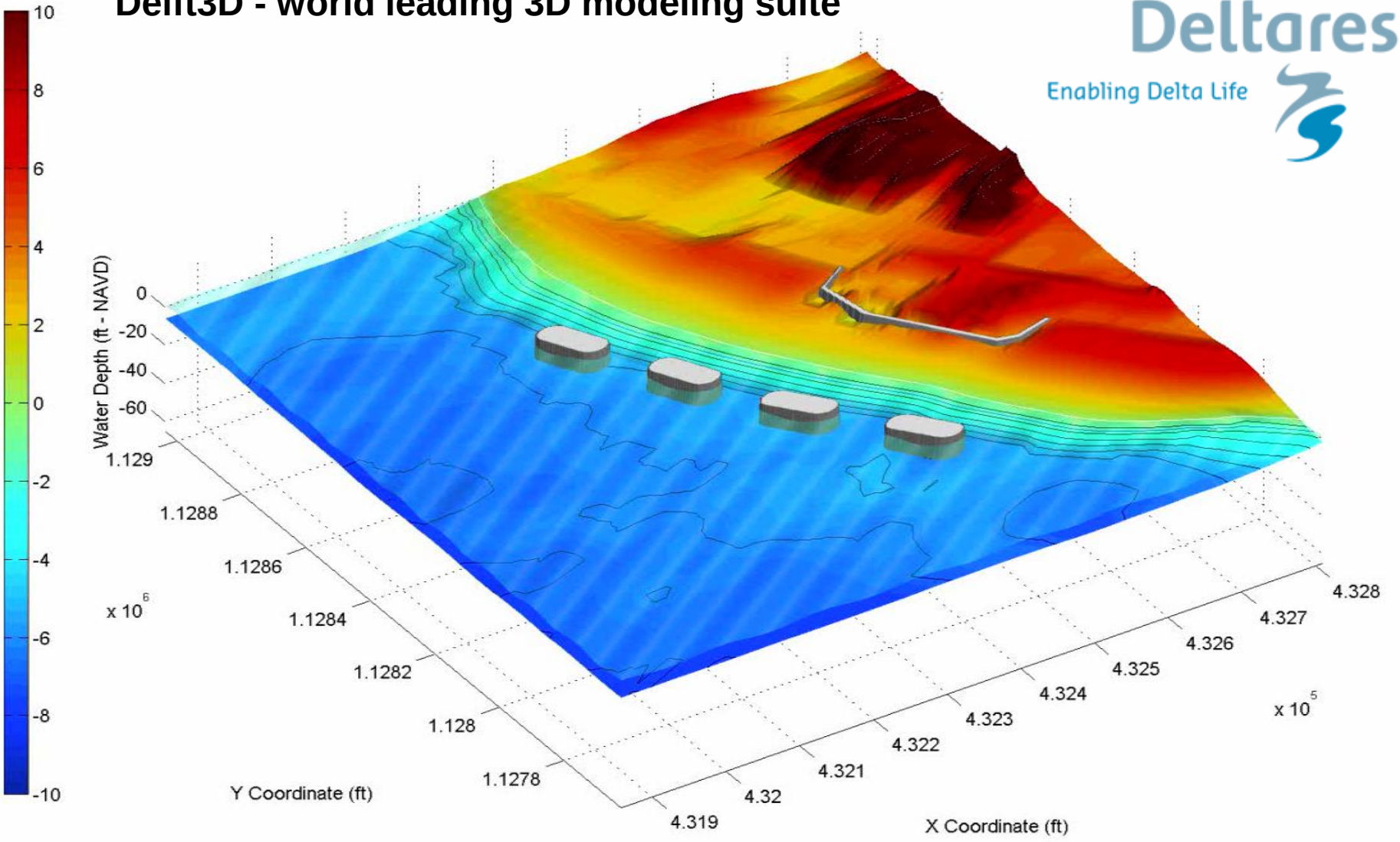
Big Hickory Island Groin Construction

Big Hickory Island Post Project

“Thank you, thank you, That is really cool. Yes, a picture is worth a thousand words and this one says it all! It doesn't tell us what it took to get here, but it perfectly lays out the goal. Thank you all who contributed to Pelican Landing reaching this point. You could have written "SUCCESS" in the sand.”
- Tom Moehring, PLCA resident and former Board Member.

Delft3D - world leading 3D modeling suite

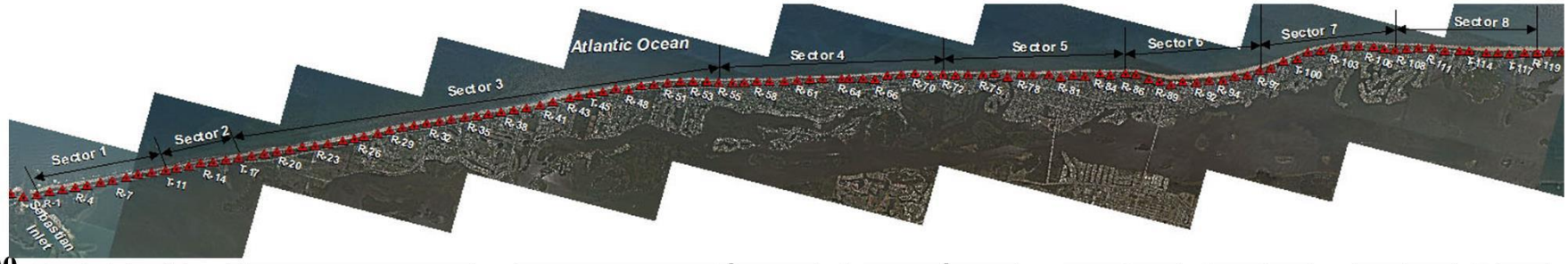
Deltares
Enabling Delta Life

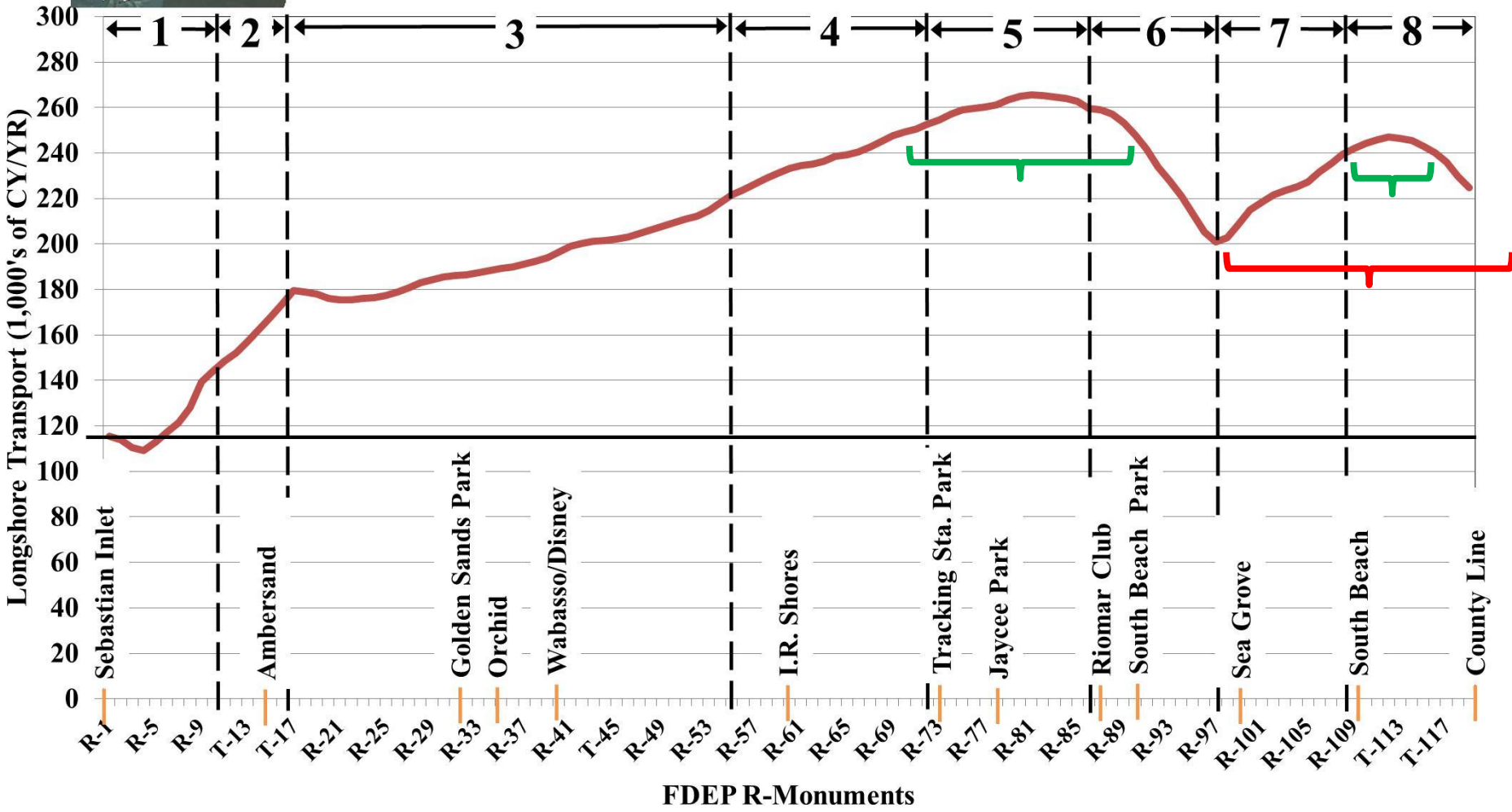


Indian River County Beach Preservation Plan (2014 Update)

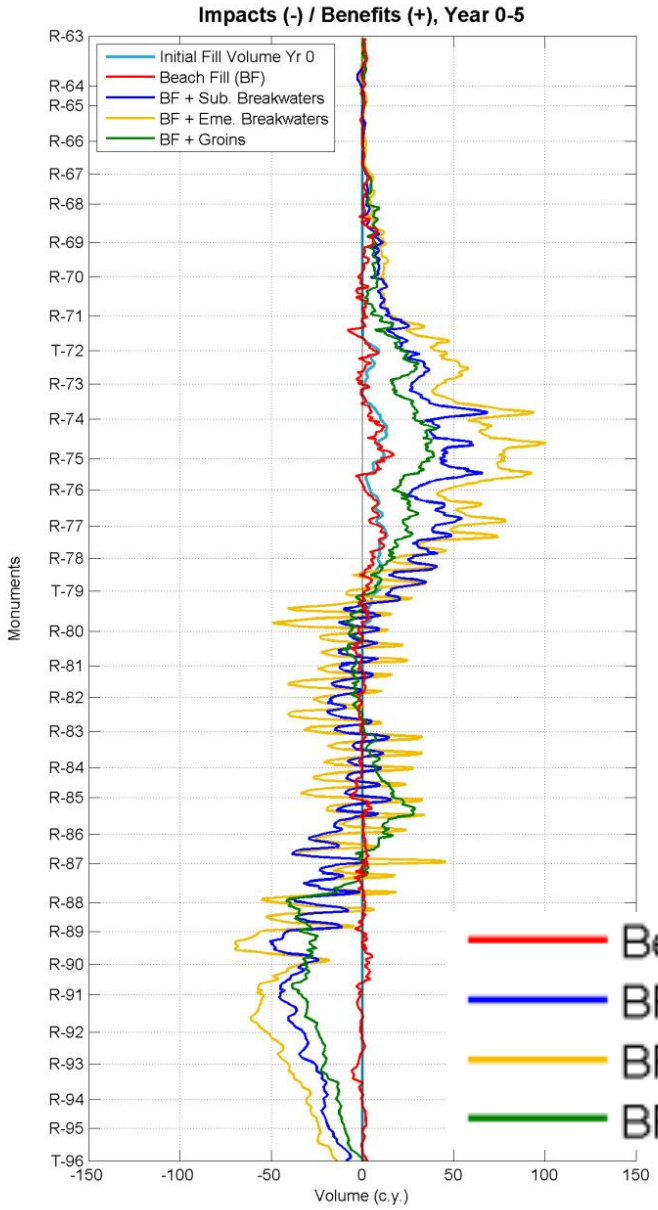
- Fill placement limited by presence of nearshore hardbottom
- Structural objectives:
  - Improve beach fill performance
  - Minimize downdrift impacts
  - Limit to areas deemed “critically eroded” by the State
- Littoral transport curve analysis
- Beach fill, groins & breakwaters considered
- Design optimized with Delft 3D modeling

Indian River County, Florida – Littoral Transport





Indian River County, Florida – Modeling of Alternatives



- Delft3D modeling analysis
- All alternatives included beach fill

Beach Fill (BF)
BF + Sub. Breakwaters
BF + Eme. Breakwaters
BF + Groins

Indian River County Beach Preservation Plan (2014 Update)

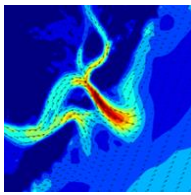
- Structural options were evaluated with Delft3D in an iterative process to optimize spacing and locations.
- Recommended plan did not include structures but answered questions about feasibility of installing structures.
- Comments from the Shore Preservation Advisory Committee being addressed for plan adoption by the County Commission.
- In this case, structures were not deemed to be cost effective.

Conclusions

- Coastal structures should be considered in contemporary beach nourishment projects.
- Structures are highly effective but there is no “one-size fits all” application.
- Where applicable, installations should be customizable, permeable and/or adjustable.
- Numerical models should be used to compare alternatives and refine designs.
- Let the cost/benefit analysis be your guide.





Thank You!

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