

TAMPA HARBOR MAINTENANCE DREDGING EGMONT KEY BENEFICIAL RE-USE

High Silt Content Material Placement Traditional Template vs. Cross Shore Swash Zone (CSSZ)

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Outline

• Background

- Ideal opportunity for R&D to address environmental concerns and regulations
- Egmont Key National Wildlife Refuge – “Sand Rule”
- Material is approx. 20% “fines” (passing 230 sieve)
- Definitions and Example Projects
- Beneficial reuse projects – 2001, 2006, and 2011
- Time series aerials

• Dredging and Placement

- Volumes and losses
- Compaction - Cone Penetrometer
- Mass Balance of “fines”
- Fines Content, Density, Munsell Color
- Light Attenuation and Turbidity

• Conclusions

- Traditional vs. Cross Shore Swash Zone Placement
- Acknowledgments





St. Petersburg

**North
Traditional
Placement**

**Cross Shore
Swash Zone
Placement**

Tampa Bay Entrance Channel

Egmont Key



Anna Maria Island

Definitions

- **Traditional Placement** – placement of material to “build a beach” using longitudinal dikes to increase settlement. This projects purpose is to create a wide flat dry beach berm.



Definitions

- **Cross Shore Swash Zone Placement (CSSZ)** – placement of dredged material by discharging material directly into the swash zone until a delta builds and then extending outfall shore perpendicular thus building a “point” (salient) feature.



21 Feb 15

29 Apr 15



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Images Courtesy of GLDD

Case Examples – Mayport 1972

- Cross Shore Swash Zone Placement (CSSZ)



Clean Water Act (CWA)



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Case Examples – Sand groynes Delfland 2009

- 3 concentrated nourishments 200k m³ each
- Uniformly redistributed over a stretch of coast of about 2.5km by the impact of waves and currents
- <https://publicwiki.deltares.nl/display/BWN/Building+Block+++Feeder+beaches+++Practical+Applications>



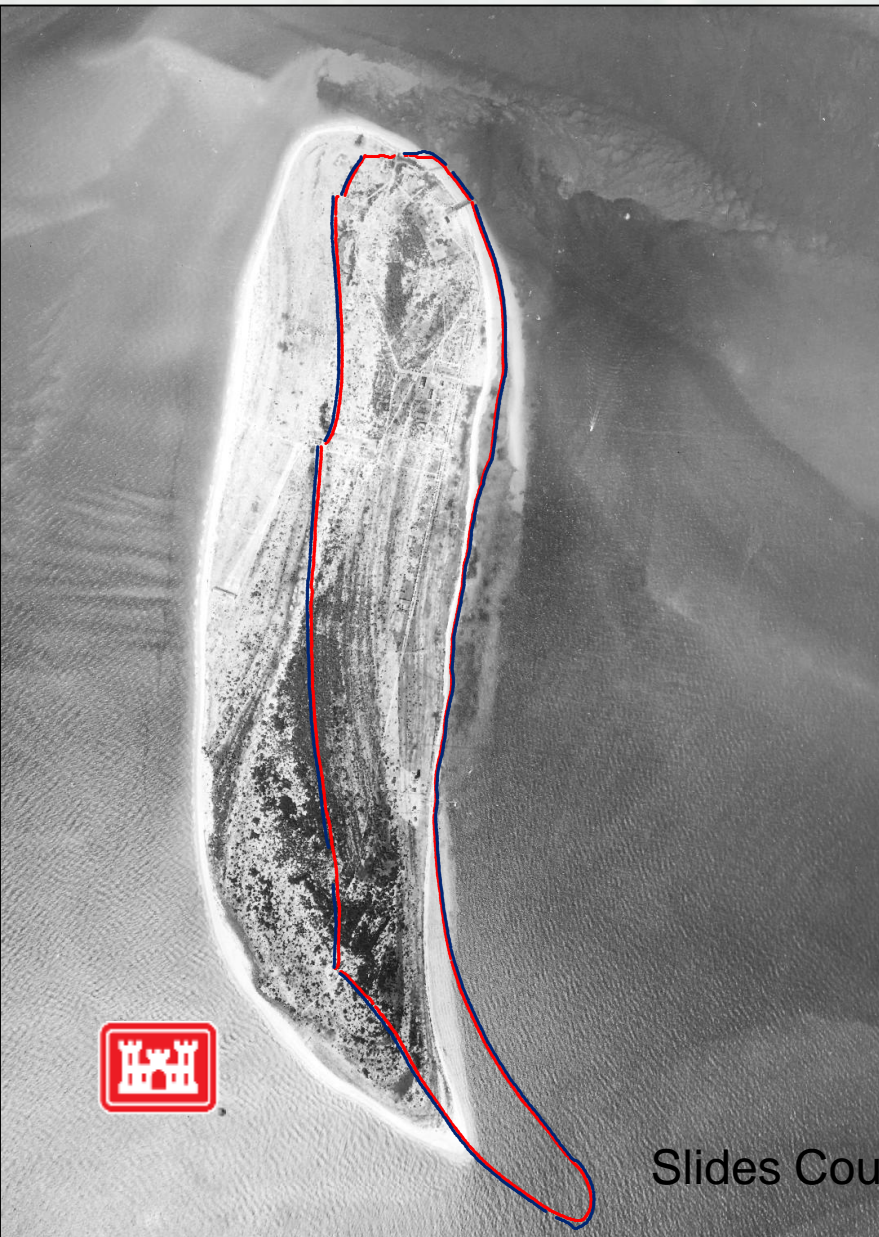
Case Examples – Delfland Sand Engine 2011

- Concentrated nourishments 28M m³
- Intertidal ponds were intentional for added habitat
- http://deltaproof.stowa.nl/Publicaties/deltafact/Sand_nourishments.aspx?pld=53#COSTS_AND_BENEFITS



Time-series aerial photos

1942



Slides Courtesy of USF

2011 1993 1982
2004

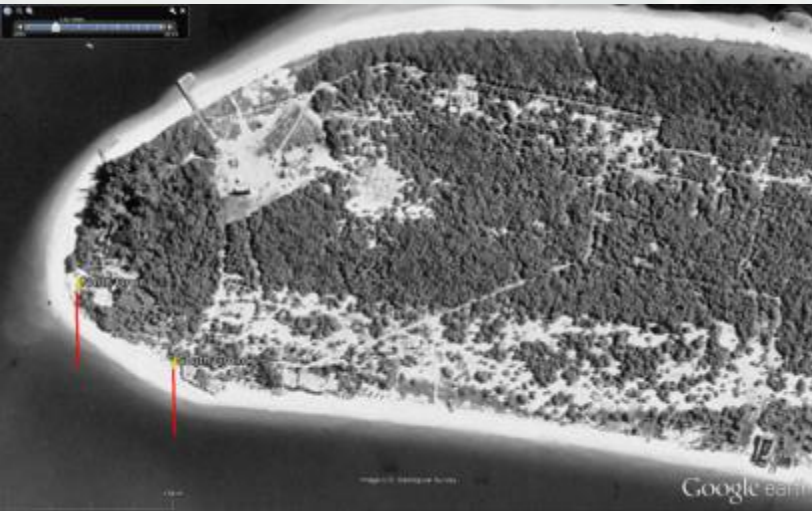


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Source: Esri, DigitalGlobe, GeoEye, IGN, USDA, USGS, AEX, Geomatics, AeroGRID, IGN, ICF, swisstopo, and the GIS User Community

Previous Placement Events

1999



2002



2005



2007

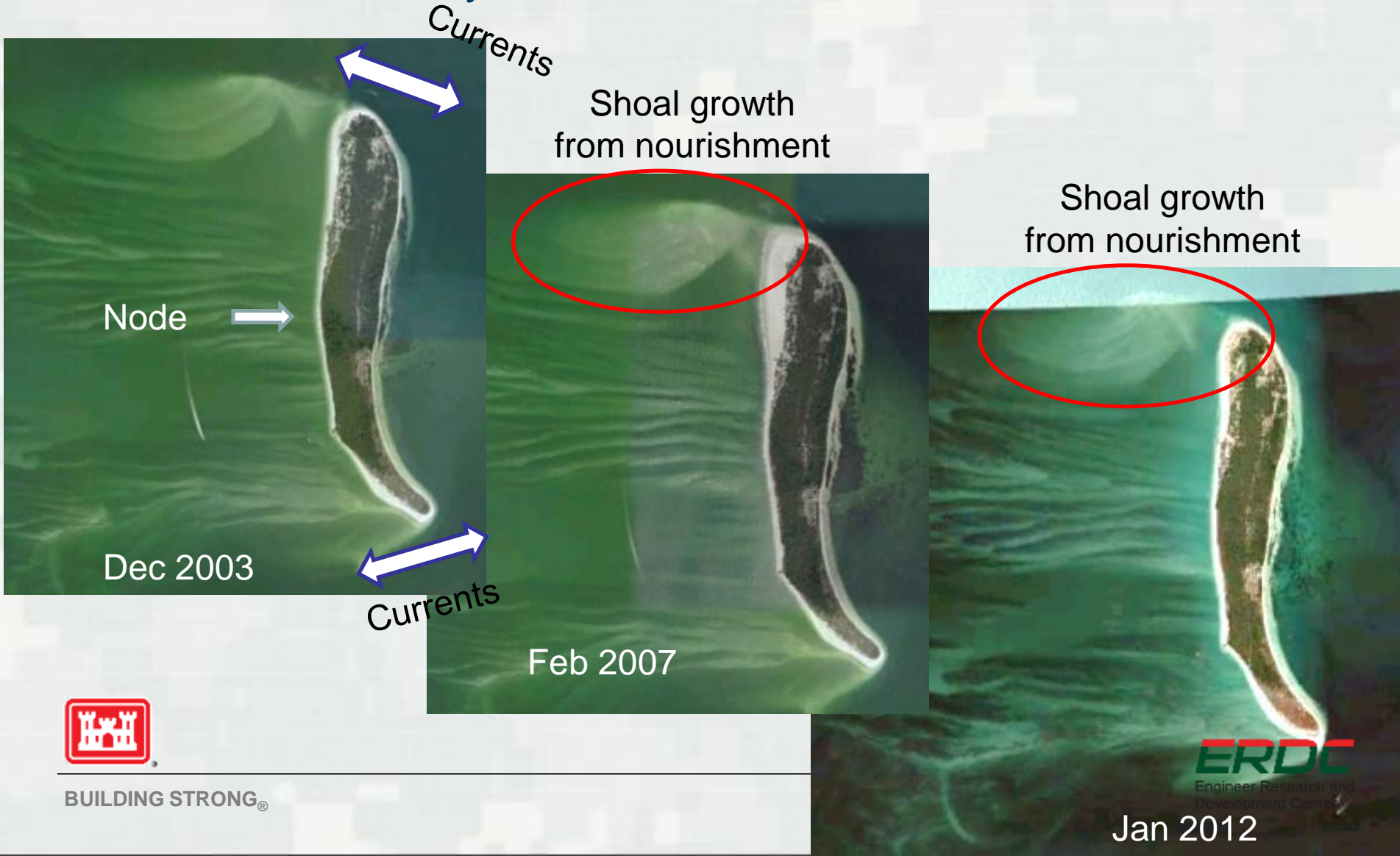


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Previous BU – Egmont Key 2001, 2006 & 2011

- Ebb dominated system



Dredging and Placement



UAV flight aerial 16 March 2015



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Dredging and Placement Volumes

Traditional (North) Placement Area:

| | Cubic Yards (cy) | % of Total |
|---------------------------|------------------|------------|
| Dredged in Channel | 500,037 | 100.0% |
| Pumped to Beach | 319,712 | 63.9% |
| Surveyed on Beach | 222,068 | 44.4% |

Cross Shore Swash Zone Placement Area:

| | Cubic Yards (cy) | % of Total |
|---------------------------|------------------|------------|
| Dredged in Channel | 180,512 | 100.0% |
| Pumped to Beach | 107,225 | 59.4% |
| Surveyed on Beach | 68,479 | 37.9% |



Project Monitoring



Cone Penetrometer

USF Line 17 • Pre-Placement

| Depth (in) | 0"-6" | 6"-12" | 12"-18" |
|--------------|-------|--------|---------|
| Min (psi) | 100 | 100 | 198 |
| Max (psi) | 580 | 700 | 617 |
| Avg (psi) | 293 | 406 | 457 |
| Median (psi) | | | |
| (psi) | 295 | 431 | 515 |
| # samples | 19 | 19 | 19 |
| Refusals | 1 | 4 | 5 |
| % Refusal | 5% | 21% | 26% |

Post-Placement

| Depth (in) | 0"-6" | 6"-12" | 12"-18" |
|--------------|-------|--------|---------|
| Min (psi) | 50 | 125 | 200 |
| Max (psi) | 600 | 700 | 600 |
| Avg (psi) | 328 | 482 | 436 |
| Median (psi) | | | |
| (psi) | 300 | 500 | 500 |
| # samples | 21 | 21 | 21 |
| Refusals | 3 | 6 | 10 |
| % Refusal | 14% | 29% | 48% |

| Post-Construction Cone Penetrometer | | | |
|-------------------------------------|---------|---------|-----------------|
| 1/21/2015 | 0'-6" | 6'-12" | 12'-16" |
| 1 | 320 | Refusal | |
| 2 | 550 | Refusal | |
| 3 | Refusal | | |
| | 600 | Refusal | |
| | 350 | Refusal | |
| 3/19/2015 | 0'-6" | 6'-12" | 12'-16" |
| | | | 500 |
| | | | Refusal |
| | | | 500 |
| | | | Refusal (shell) |
| | | | 200 |
| | | | Refusal |
| | | | 500 |
| | | | Refusal (shell) |
| | | | 300 |
| | | | 400 |
| | | | 600 |
| | | | Refusal |
| | | | 200 |
| | | | 600 |
| | | | 400 |
| | | | 500 |
| | | | 10 |
| | | | 48% |



| Pre-Construction Cone Penetrometer | | | |
|------------------------------------|---------|---------|-----|
| USF Line 4 Berm | | | |
| 0'-6" | 6'-12" | 12'-16" | |
| 150 | 250 | 500 | |
| 250 | 280 | 540 | |
| 250 | 230 | 530 | |
| 200 | 270 | 500 | |
| 300 | 280 | 490 | |
| 250 | 230 | 450 | |
| 250 | 230 | 450 | |
| 250 | 230 | 450 | |
| Avg. | 325 | 273 | 198 |
| USF Line 17 Foreshore | | | |
| 0'-6" | 6'-12" | 12'-16" | |
| 340 | 700 | 500 | |
| 280 | 650 | 630 | |
| 310 | 640 | 450 | |
| 290 | 660 | 560 | |
| 300 | 660 | 500 | |
| 250 | 670 | 450 | |
| Avg. | 295 | 663 | 515 |
| USF Line 17 *Dune | | | |
| 0'-6" | 6'-12" | 12'-16" | |
| 570 | 570 | 730 | |
| Refusal | 400 | 600 | |
| 60 | 700 | 670 | |
| 350 | Refusal | 550 | |
| 200 | Refusal | 700 | |
| 200 | Refusal | 450 | |
| Avg. | 466 | 557 | 617 |

*Dune is a relic fill, now a soil with higher elevation vegeta



• Increase in refusals due to shell hash areas



Mass Balance – Egmont Key 2014

Tampa Harbor MD - Egmont Key 2014

| | # of Samples | Sample by weight Fines (passing 230 sieve) |
|------------------|--------------|--|
| In-situ Channel | 80 | |
| Discharge Slurry | 27 | |
| Swash zone | 27 | |
| Beach samples | 22 | |

- Assumptions

- 100% slurry water conveyed to beach
- Slurry and swash zone sampling

- Relationships

- Swash Zone samples carried 1/3 the beach template, thus leaving



*Sampling methods at discharge slurry not ideal

Fines Content and Density

| Tampa Harbor MD - Egmont Key 2014 | | |
|-----------------------------------|--------------|---------------------------------|
| | # of Samples | Avg. % by wt. passing 230 sieve |
| In-situ | 80 | 20.7 |
| pre-Beach | 6 | 0.03 |
| post-Dredged | 21 | 0.51 |
| Traditional | 14 | 0.52 * |
| CSSZ | 7 | 0.49 * |



* Sampling occurred within 72 hours of placement completion

| Tampa Harbor MD - Egmont Key 2014 | | | |
|-----------------------------------|--------------|--------------------|-----------|
| | # of Samples | Value avg. (kg/m3) | % Greater |
| Density | | | |
| pre-Beach | 7 | 1405.1 | 0.0% |
| post-Dredged | 17 | 1471.6 | 4.7% |
| Traditional | 11 | 1476.0 | 5.0% |
| CSSZ | 6 | 1463.5 | 4.2% |



Munsell Color

| Tampa Harbor MD - Egmont Key 2014 | | |
|-----------------------------------|--------------|------------|
| | # of Samples | Value avg. |
| In-situ | 80 | 4.36* |
| pre-Beach | 13 | 5.9 |
| post-Dredged | 24 | 5.3 |
| Traditional | 16 | 5.0 |
| CSSZ | 8 | 5.9 |



*Munsell color value < 5 unacceptable for beach placement in Florida

NOTES: Triplicate measurements of hue, value, and chroma were collected from three areas on each moist sand sample using a digital colorimeter (CR-400, Konica Minolta, Osaka, Japan).



Light Attenuation Long-term Monitoring

Egmont Key, FL
Long-term
Deployment Map
14 Nov – 15 Dec

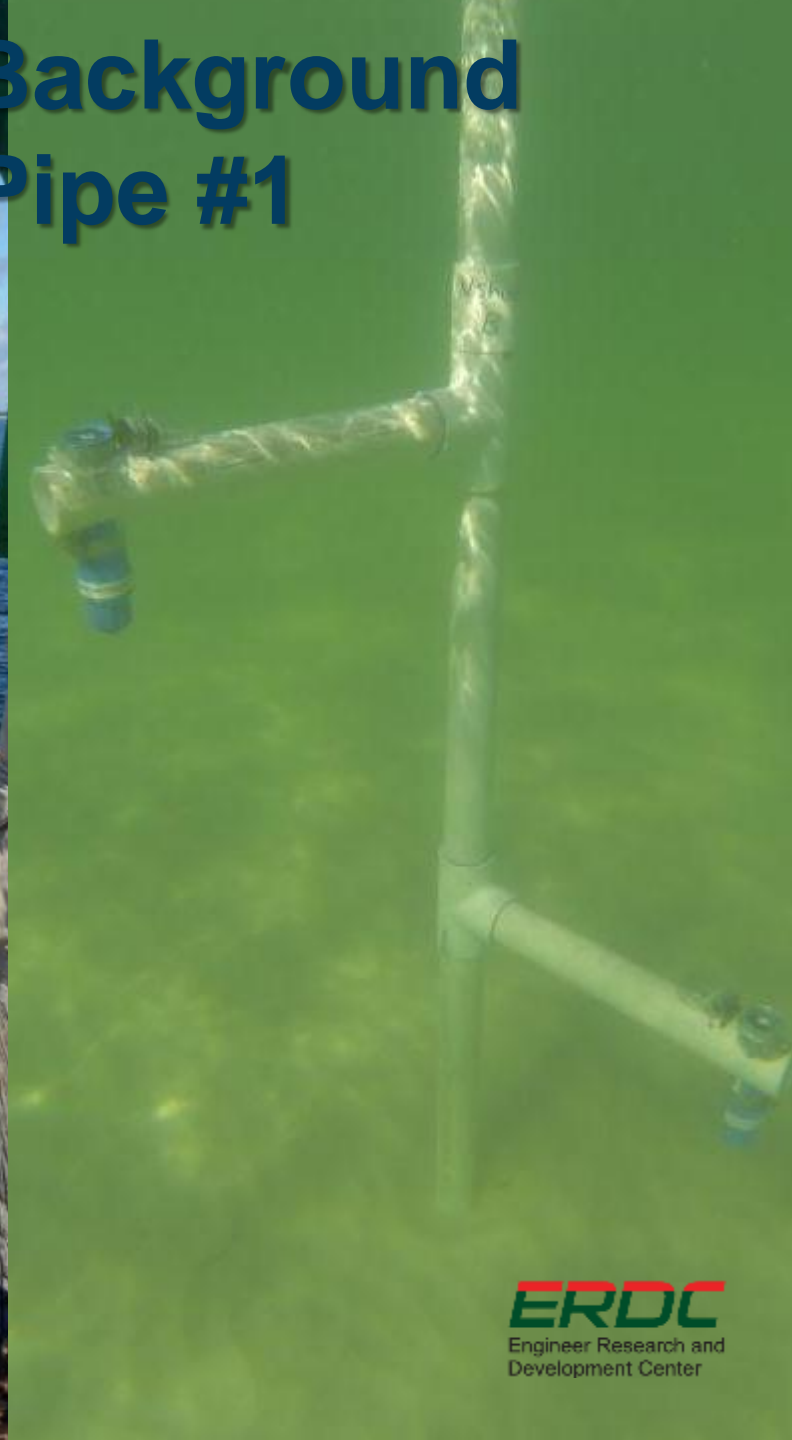


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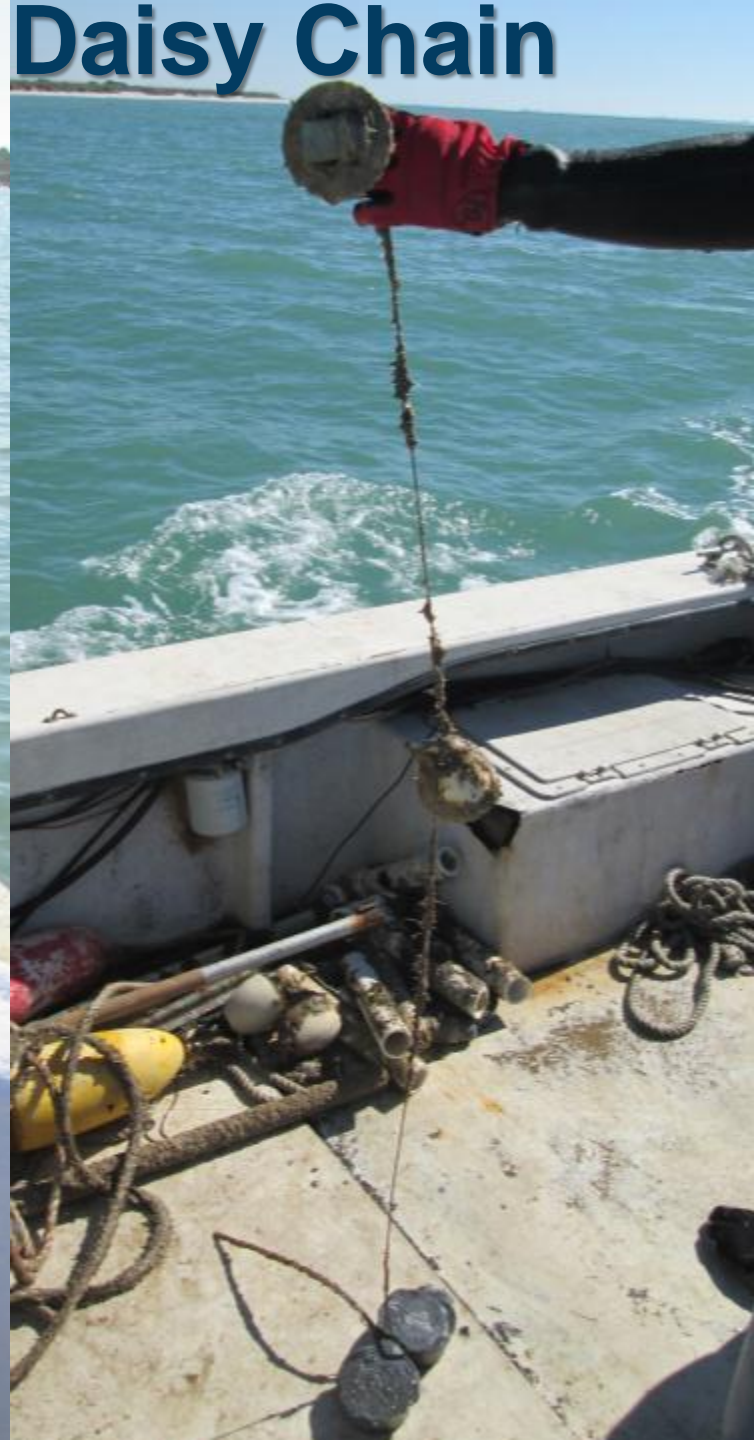
Image Courtesy of GLDD

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Light Attenuation Background Monitoring – Pipe #1



Light Attenuation Base Daisy Chain Station

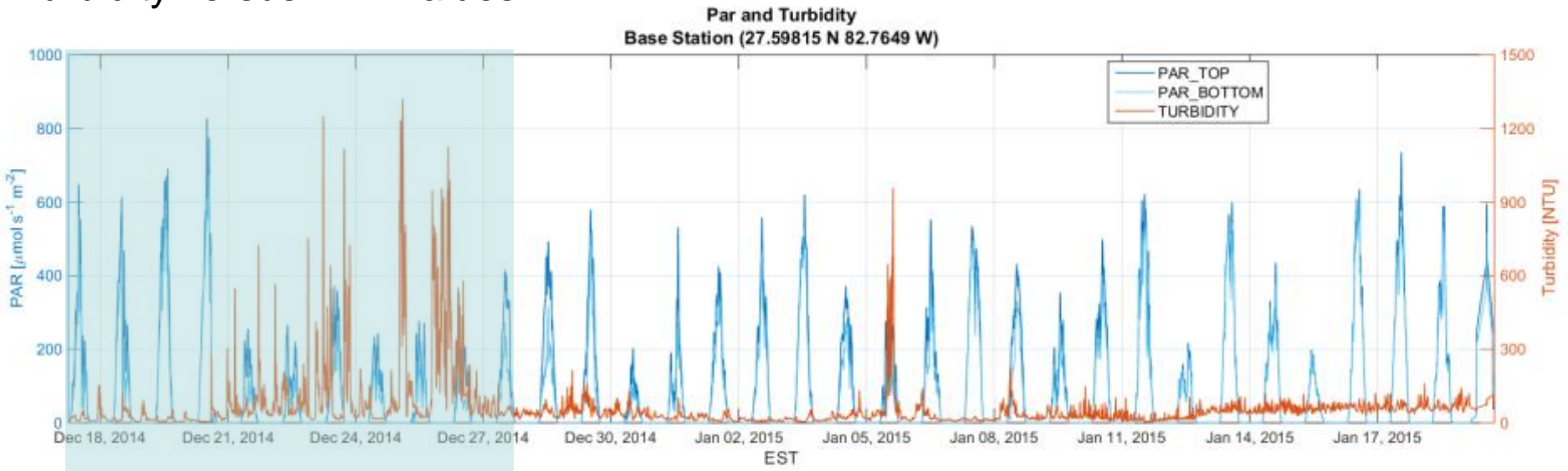


Light Attenuation Monitoring – Tire



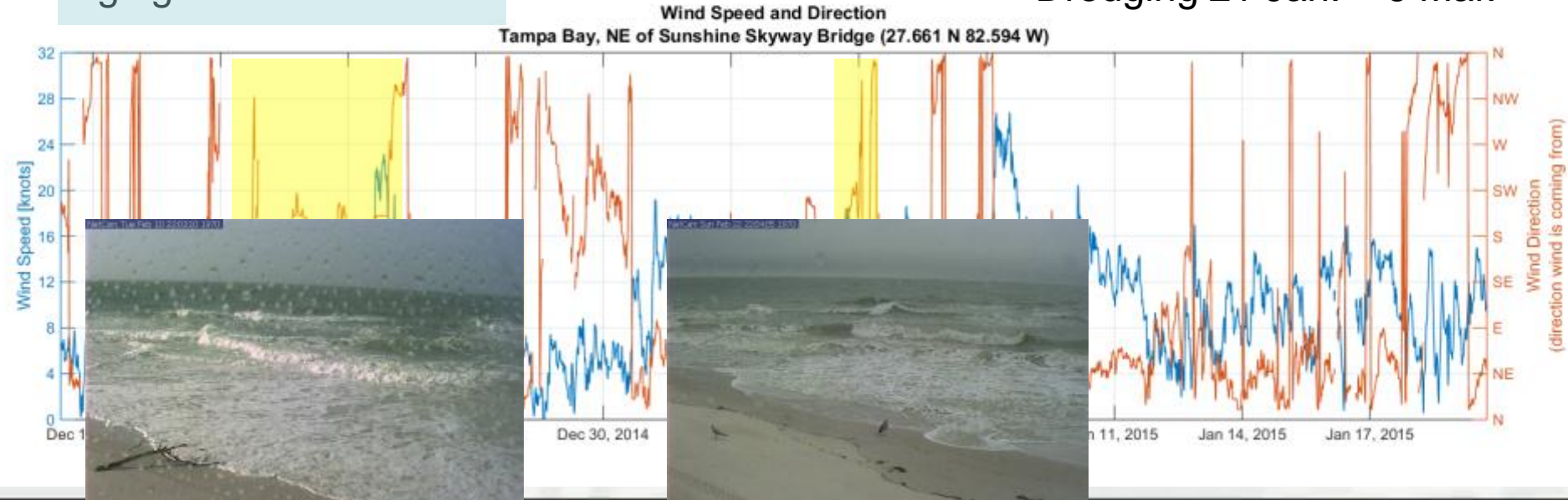
Light Attenuation Long-term Monitoring

Turbidity versus PAR values



Dredging 19 Nov. – 28 Dec.

Dredging 21 Jan. – 6 Mar.



CSSZ Drawbacks vs. Traditional Placement

• Issues

- Material is not immediately visible to public
- Remediation for unacceptable material far more difficult
- Egmont Key not identical to other projects, low energy, with inlets
- Each contractor has different operations: longitudinal dike length, equipment, and methodology

• Risks

- If parameters imposed on nearshore placement are more restrictive this placement method could become more expensive than traditional beach placement
- Project shutdowns for turbidity



CSSZ Benefits vs. Traditional Placement

- **Less linear feet of beach impacted for equivalent volume**
- **Reduced environmental Impacts**
 - Turtle nest relocations
 - Ponding
 - Cementation
 - Munsell Color
 - Shorebird impacts
- **Lower cost**
 - Construction – less beach equipment
 - Reduced pipeline extensions
 - Maintenance – less escarpment, tilling
- **Reduced beach traditional use impacts**
 - Sunbathing and Water sports
- **Another tool in the BU toolbox**
- **Purely performance based regulations**
 - More beneficial reuse
 - Lower costs - better bids due to more equipment able to perform work



Image Courtesy of GLDD



Conclusions

- CSSZ placement operations within intent of “Sand Rule” – reasonable assurance
- Grain Size sampling indicates significant “fines” losses
 - 2.4% of original (in-situ) “fines” remaining on beach = 0.5% total
 - 98% of “fines” lost
- Munsell Color and Compaction similar to pre-conditions
- Better RSM practice, better environmental practice, and better economic practice
- Engineering with Nature (EwN)



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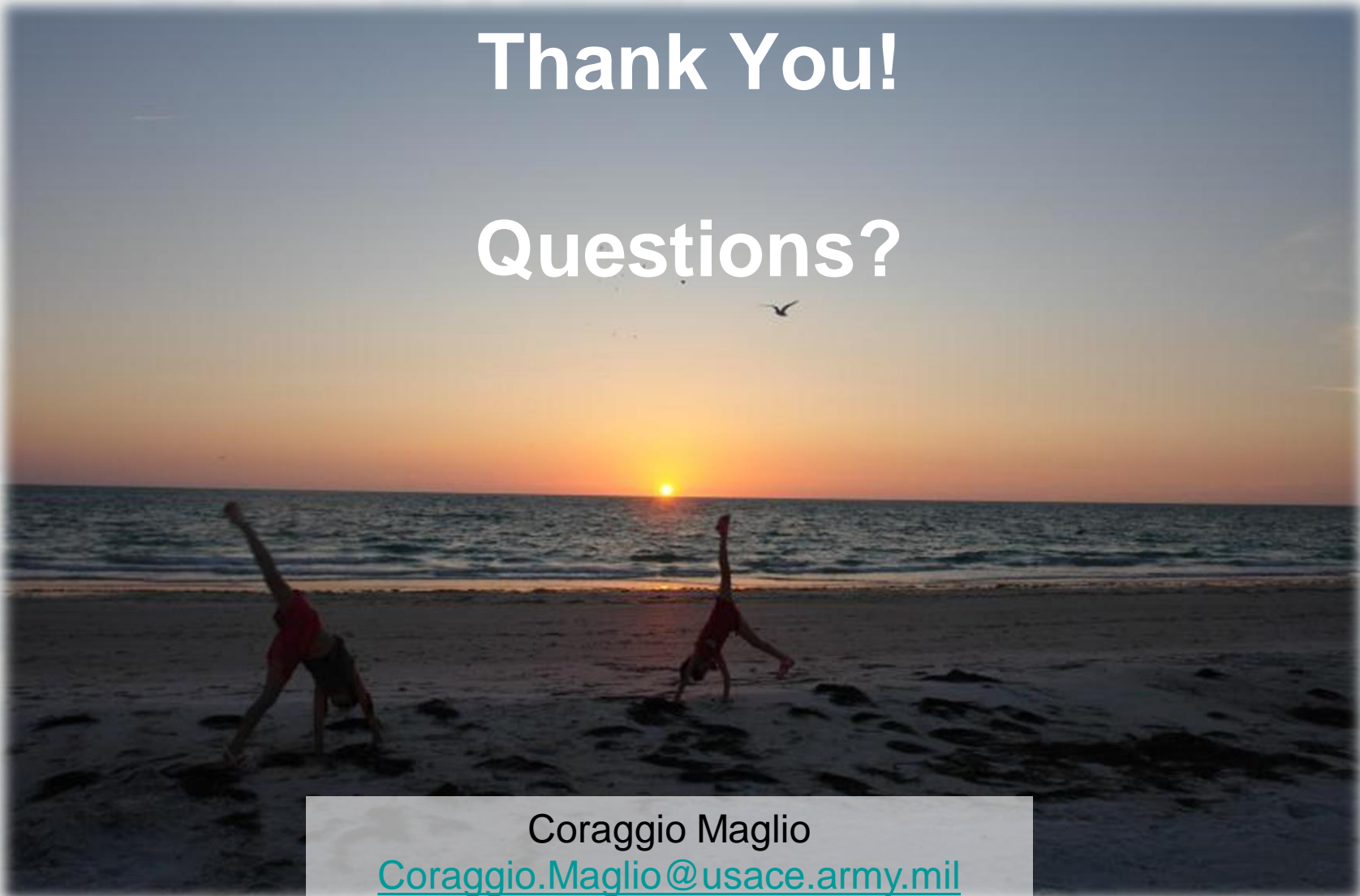
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Thank You!

Questions?



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