ENGINEERING APPROACHES TO SHORELINE PLACEMENT FROM COAST TO COAST

Comparing the Kings Bay Entrance Channel, Florida and Georgia with the Columbia River, Oregon and Washington

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AGENDA

- Columbia River project, Oregon and Washington
- King’s Bay project, Florida and Georgia
- General comparisons
- Share some general (and interesting) observations
- Conclusions

Photo: Mark Turney/U.S. Navy

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DEFINITIONS

Coastal Engineering – processes ongoing at the shoreline and construction in the coastal zone often directed at combating erosion of coasts or providing navigation access.

River Engineering – design and construction of various structures to improve and/or restore rivers for both human and environmental needs.

Both deal with the interaction of water and sediment

Regional Sediment Management – a systems approach to deliberately manage sediments in a manner that maximizes natural and economic efficiencies to contribute to sustainable water resource projects, environments, and communities.

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COLUMBIA AND LOWER WILLAMETTE RIVERS (C&LW)

- Least cost option
- Minimize return of sediment to the navigation channel
- Maintain engineering function of river structures
- Create habitat/prevent breaching and wash out of marsh

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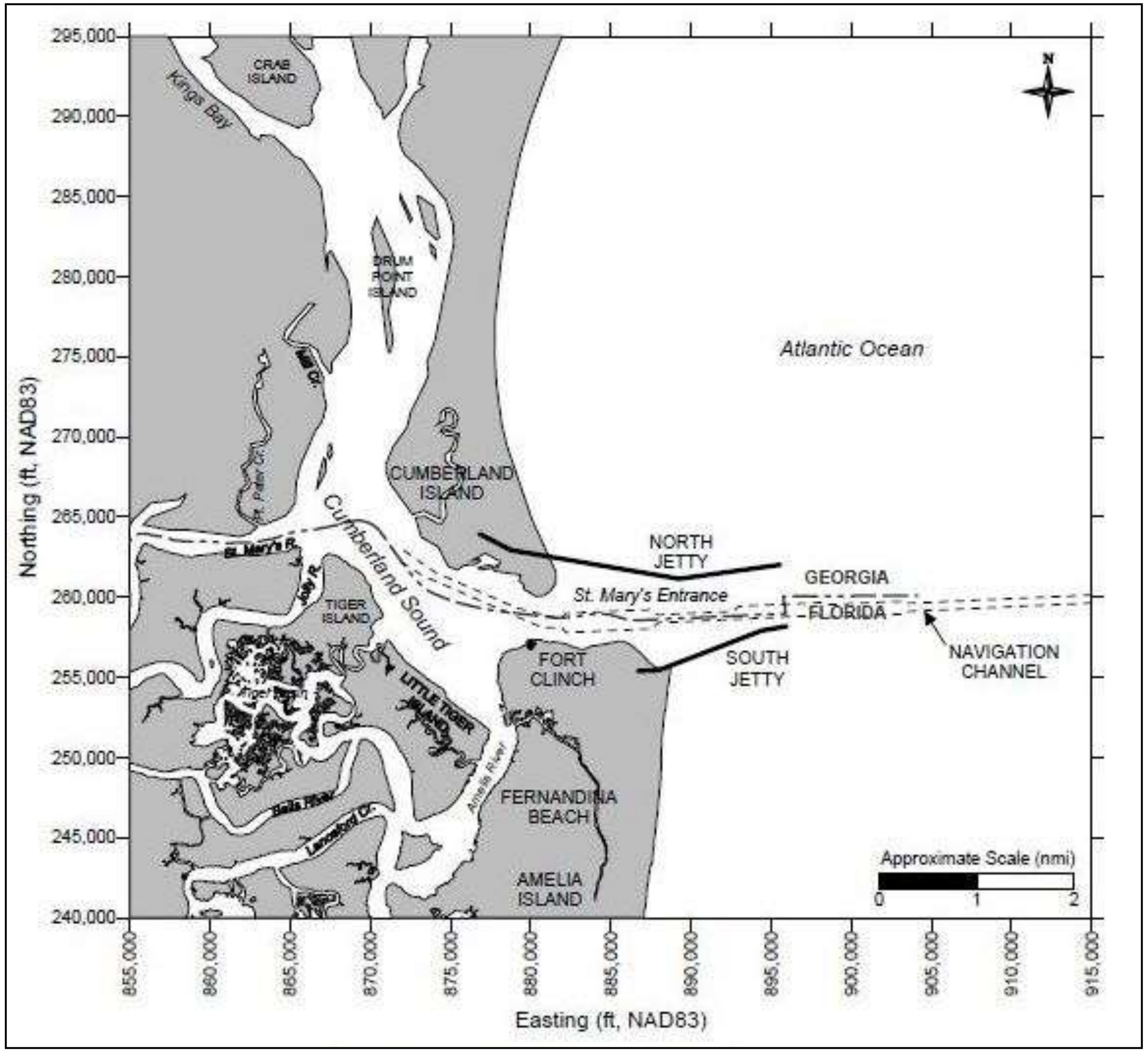
KINGS BAY ENTRANCE AND INNER CHANNEL (KBEC/KBIC)



- Keep sediment in the active system
- Reduce nourishment intervals of the Federal Shore Protection Project
- Mitigate down drift impacts of the inlet
- Protect historical sites
- Create habitat

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GENERAL COMPARISONS

	Columbia River	Kings Bay
Dredging Depth with advanced maintenance	-48 feet	-49 feet
Average Tidal Ranges	6.5 feet (lower river)	8 feet
Average annual dredge volumes	*350,000 to 500,000 cubic yards	50,000 to 400,000 cubic yards
Flow/transport	Bi-modal, predominately down river	Bi-modal in the inlet, Southward from GA to FL

*per location, C&LW 6-8Mcy/year

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BERM AND SHORE SLOPES

NW: 20'+ elev, flat berms, 1v:5h foreshore

SE: 13' elev, 1v:15h berms to 1v:25h foreshore

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SEDIMENT COMPOSITION

Mean grain sizes range from 0.20 to 0.50 mm

NW: volcaniclastics, pumice, quartz and oxides

SE: quartz and carbonates

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CONSTRUCTION METHOD

NW: Pipeline, Dredge OREGON

SE: Pipeline or Hopper with pump-out

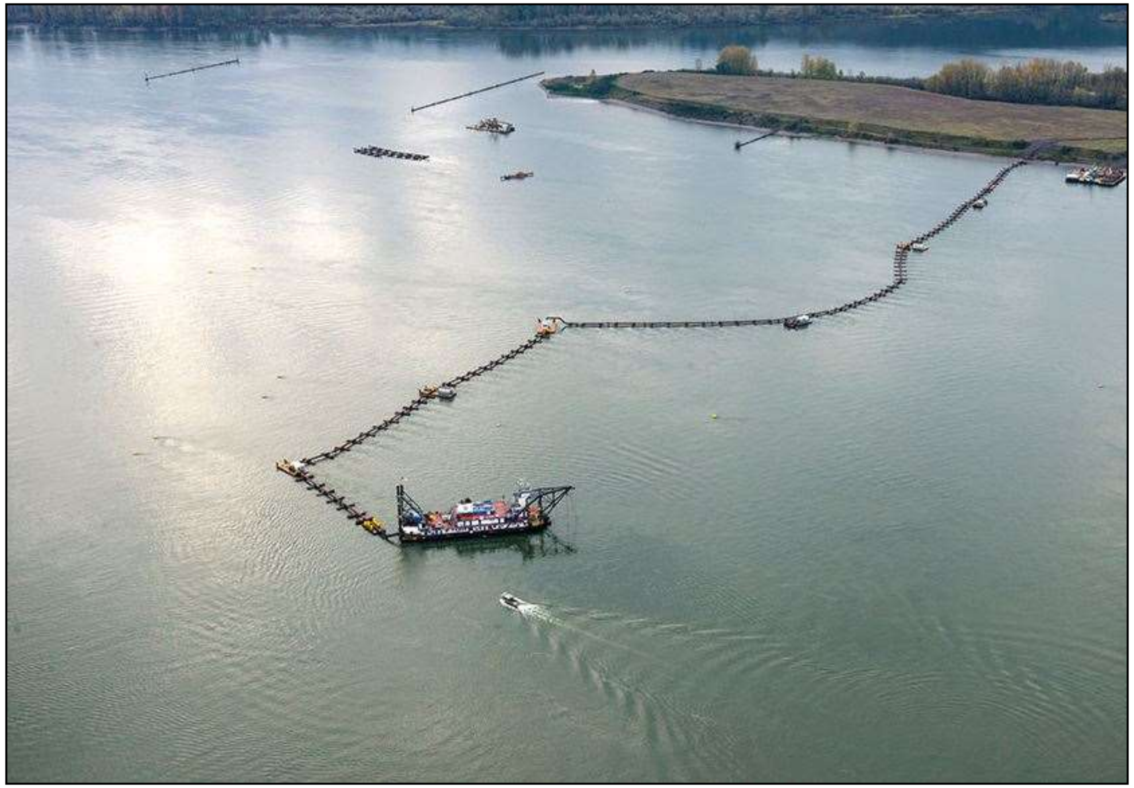

Photo: Port of Portland

Photo: Hodgens and Neves, 2015

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POST-CONSTRUCTION CONSIDERATIONS

NW: Dissuasion mounds

SE: scarping, tilling, sandboni

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HABITAT CREATION

Photo: Port of Portland

Photo: Amelia Island e-Magazine

Photo: J. Engle, USACE - SAJ

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GENERAL OBSERVATION

West Coast:
- tend to riverine structures – pile dikes
- water focused system management

East Coast:
- tend to coastal structures – groins
- sediment focused system management

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WATER FOCUSED SYSTEM MANAGEMENT

Pile Dikes:
- improve alignment
- reduce x-sectional area
- increase velocity in channel
- stabilize sand

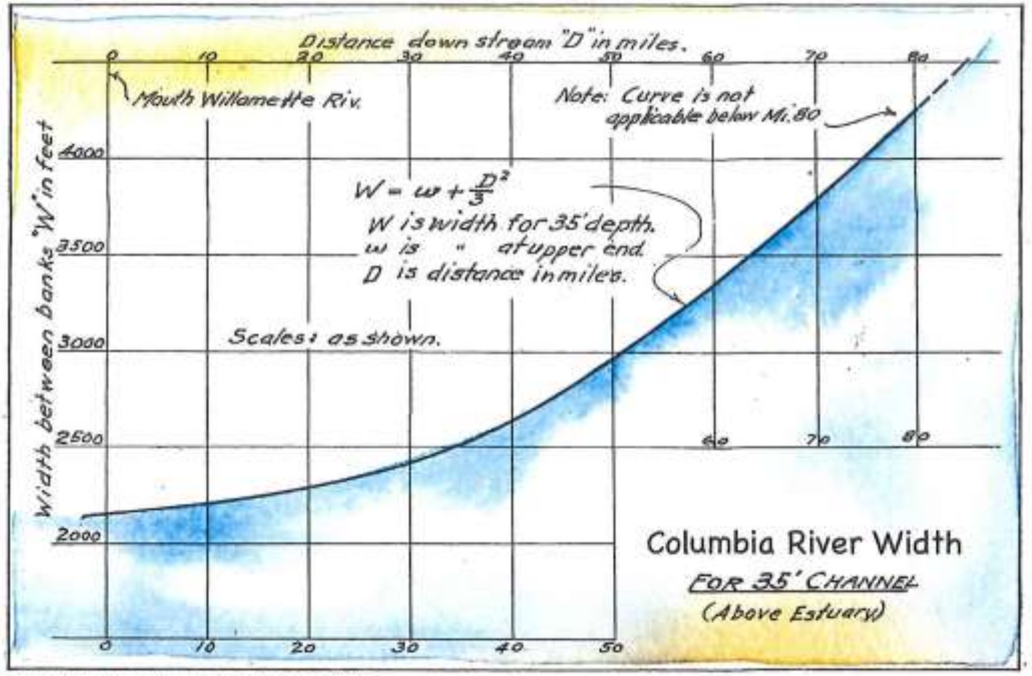

Figure 6: From Robert E. Hickson data, circa 1935.

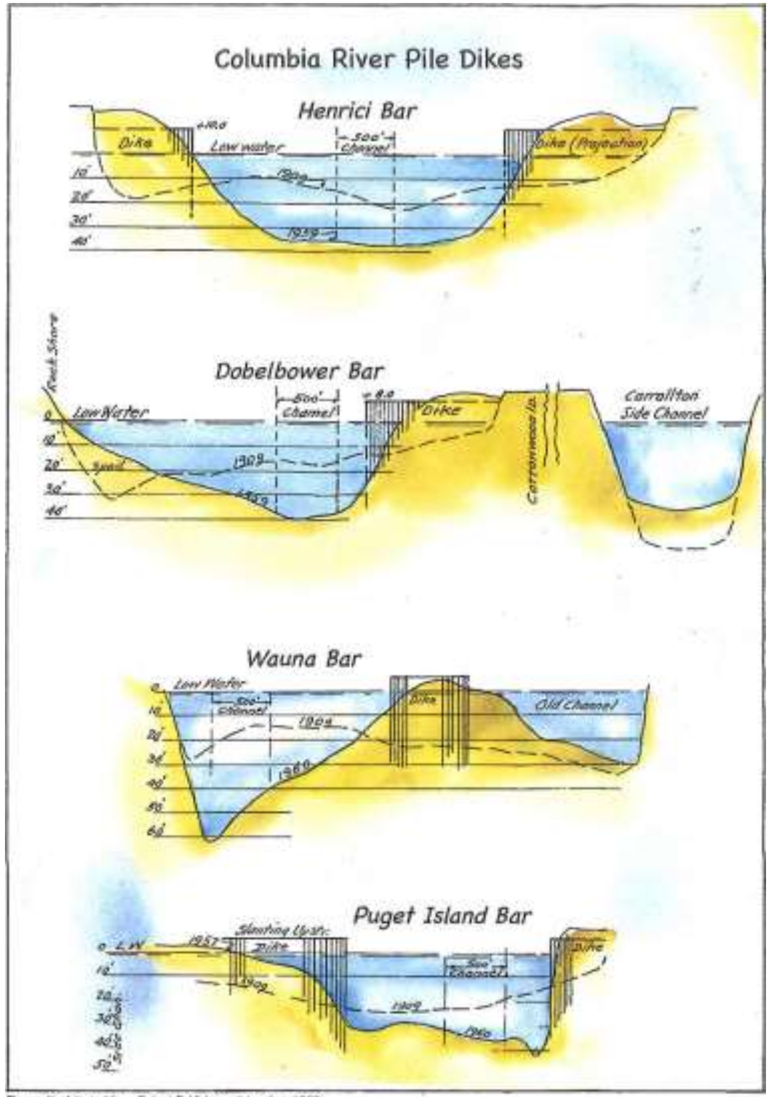

Figure 7: Adapted from Robert E. Hickson data, circa 1960.

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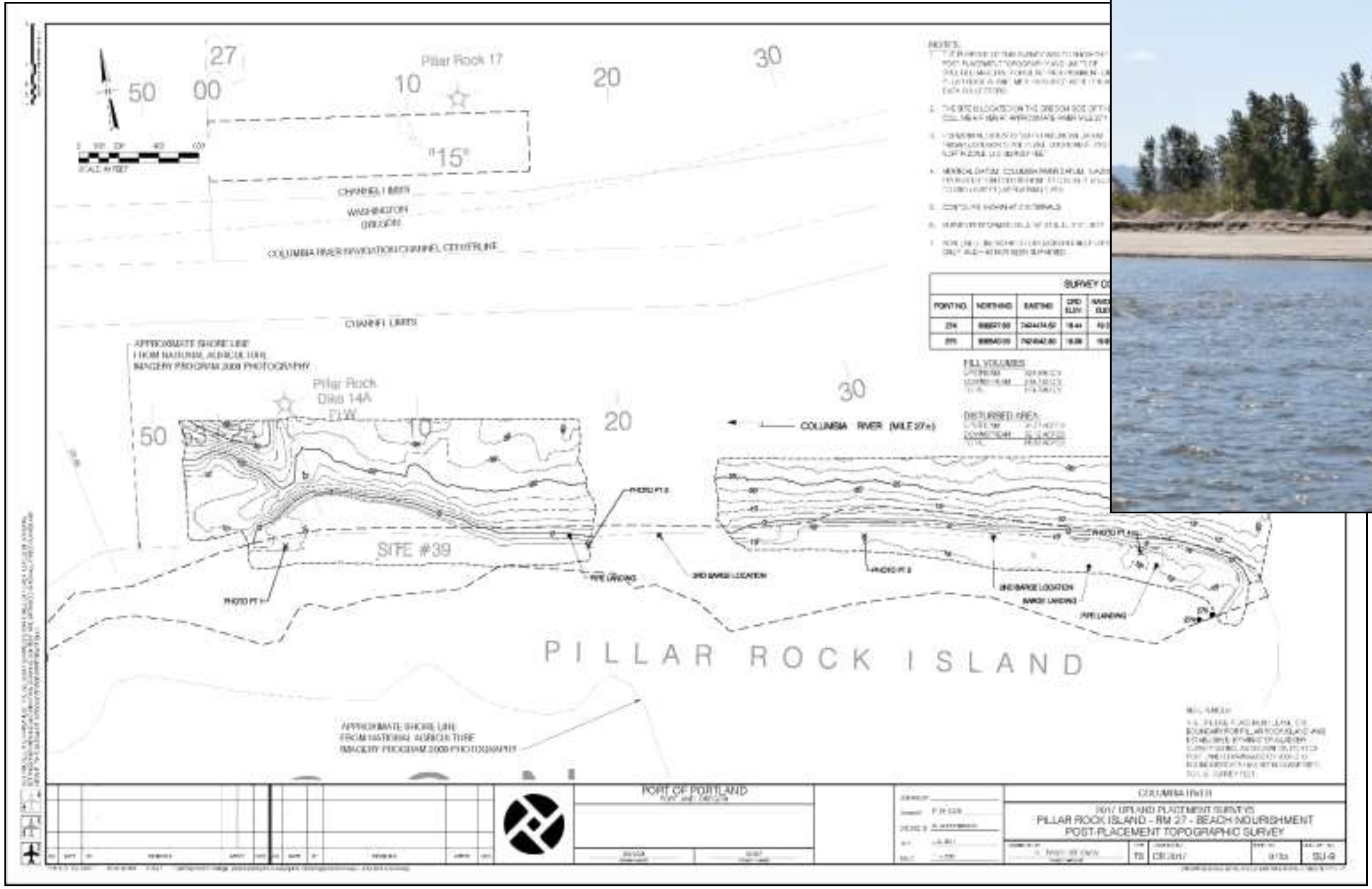
NW PILE DIKE ATTACHMENT



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SE CONSIDERATION

- Series of T-head groins and beach fill
- The shoreline is relatively stable, the depths within the adjacent inlet growing steeper and threatening the foundation of the groins.
- Want to deflect water flow away from groin

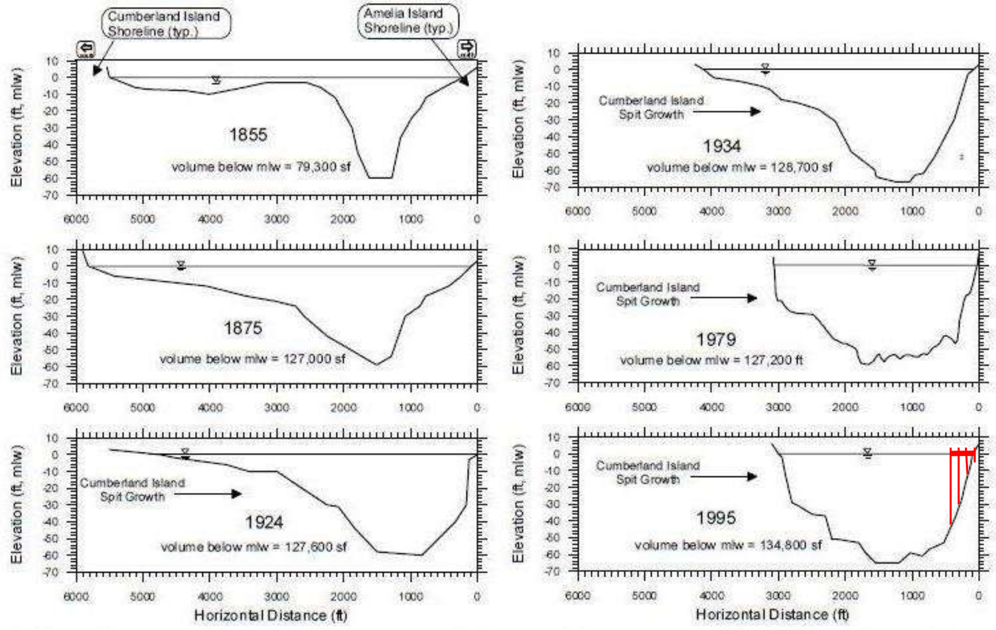

Figure 10 – Controlling bathymetric cross-sections at the throat of St. Mary's Entrance between Fort Clinch and Cumberland Island. Historical shoreline positions are also depicted in order to illustrate the relationship between the growth of the Cumberland Island spit and southerly channel migration. (From Raichle *et al.* 1995)

Photo: Olsen and Associates, 2004

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SEDIMENT FOCUSED SYSTEM MANAGEMENT

Groins:
- maintain minimum dry beach width
- control the amount of sand movement
- anchor the beach as a terminal structure for the littoral cell

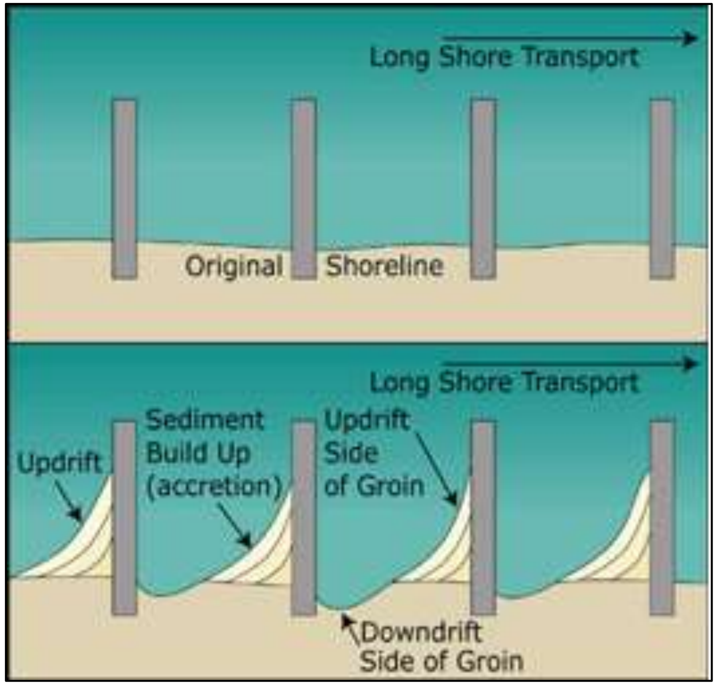

Image: nccoast.org

Photo: southernfriedscience.com

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SE TERMINAL GROIN

- Reduce end losses
- Recapture over 150 acres of park
- Reduce winter flooding of the maritime forest
- Create shorebird and turtle nesting habitat
- Increase recreation

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NW CONSIDERATION

- Terminal groin or tighten the dike to become impermeable out some distance
- Force sediment by-passing further into river to prevent shoaling

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CONCLUSION

It is perhaps not intuitive to apply coastal or riverine engineering practices across the disciplines, but…

Fundamental approach:

- Sediment control or water control
- Addressing issues like scouring or shoaling
- Affords us a much larger tool box

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