Using Strategic Placement of Dredged Material to Develop Sustainable Navigation Solutions and River Island Habitat

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US Army Corps of Engineers
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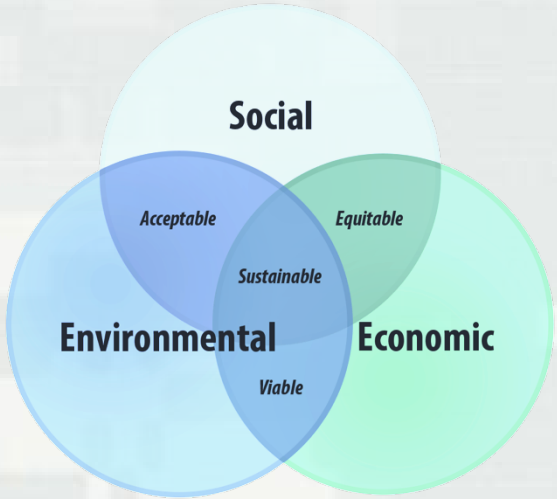
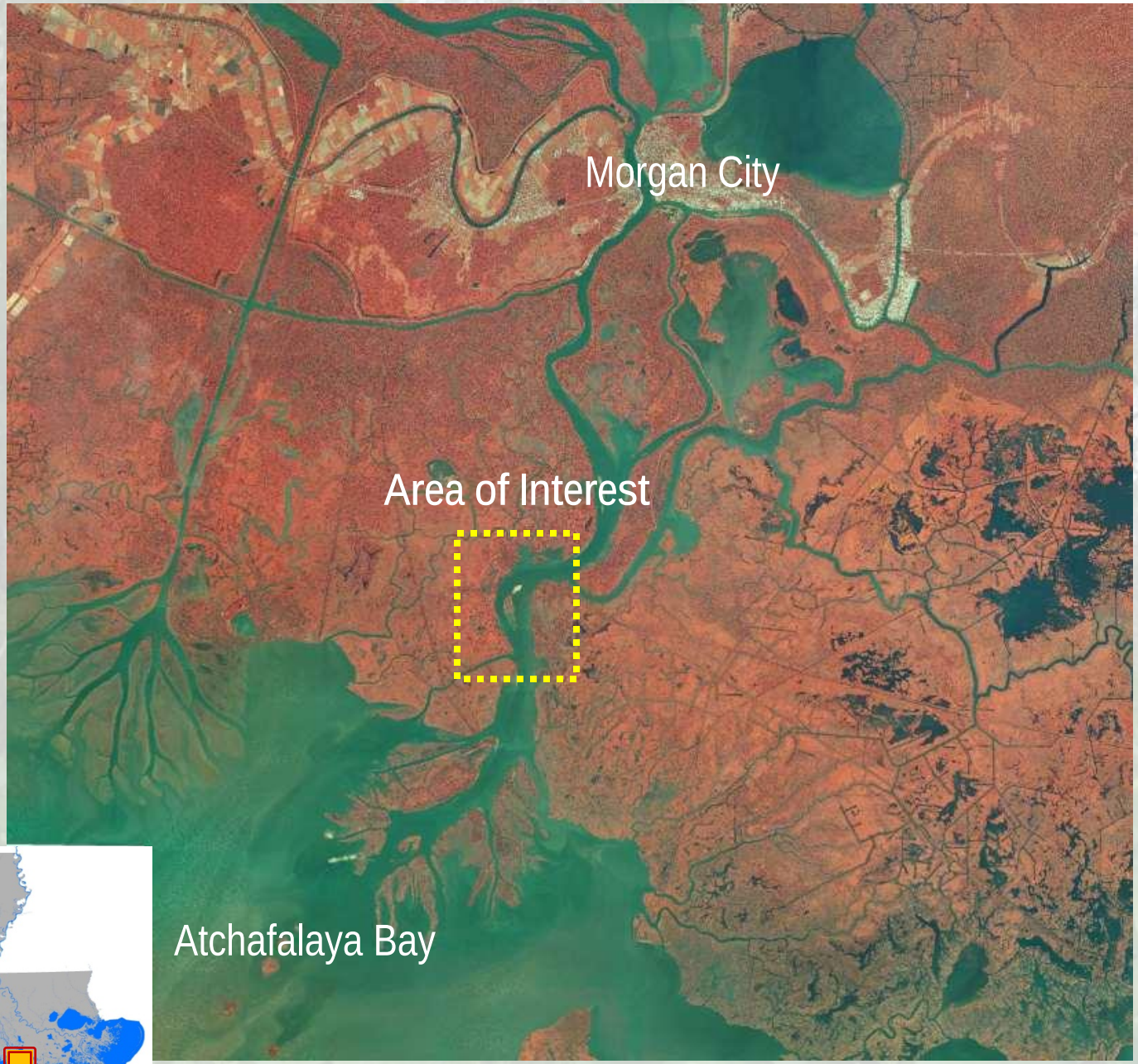
Engineering With Nature…

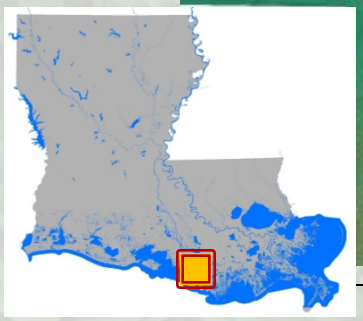
…the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaborative processes.

Key Elements:

- Science and engineering that produces operational efficiencies
- Using natural process to maximum benefit
- Broaden and extend the benefits provided by projects
- Science-based collaborative processes to organize and focus interests, stakeholders, and partners







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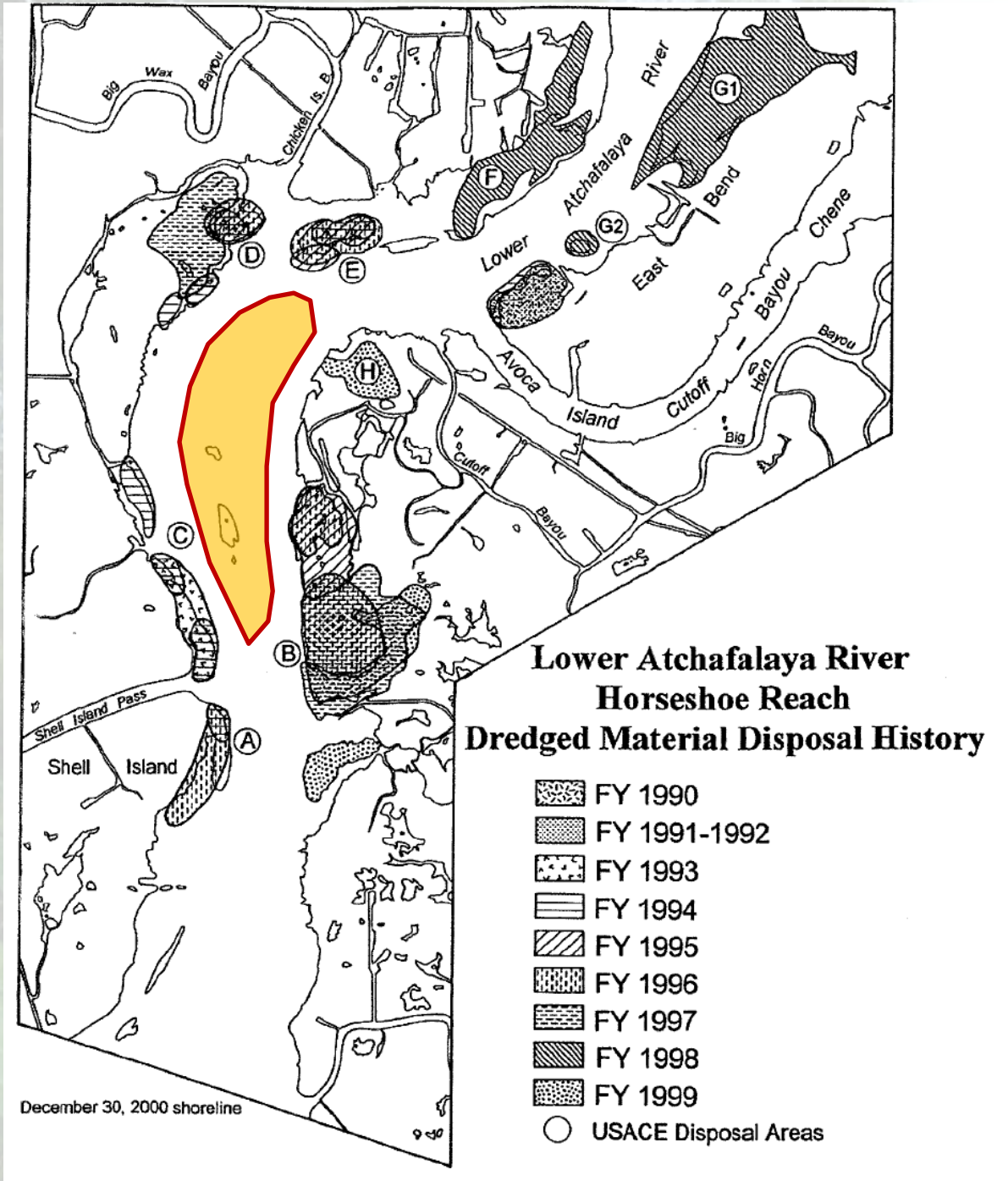

Problem

Capacity of Bankline Disposal Areas Exhausted

Alternatives

~~Conversion of Wetland Disposal Areas into Upland~~

~~Open Water Disposal in Atchafalaya Bay~~

Mid-River Mounding of Dredged Material

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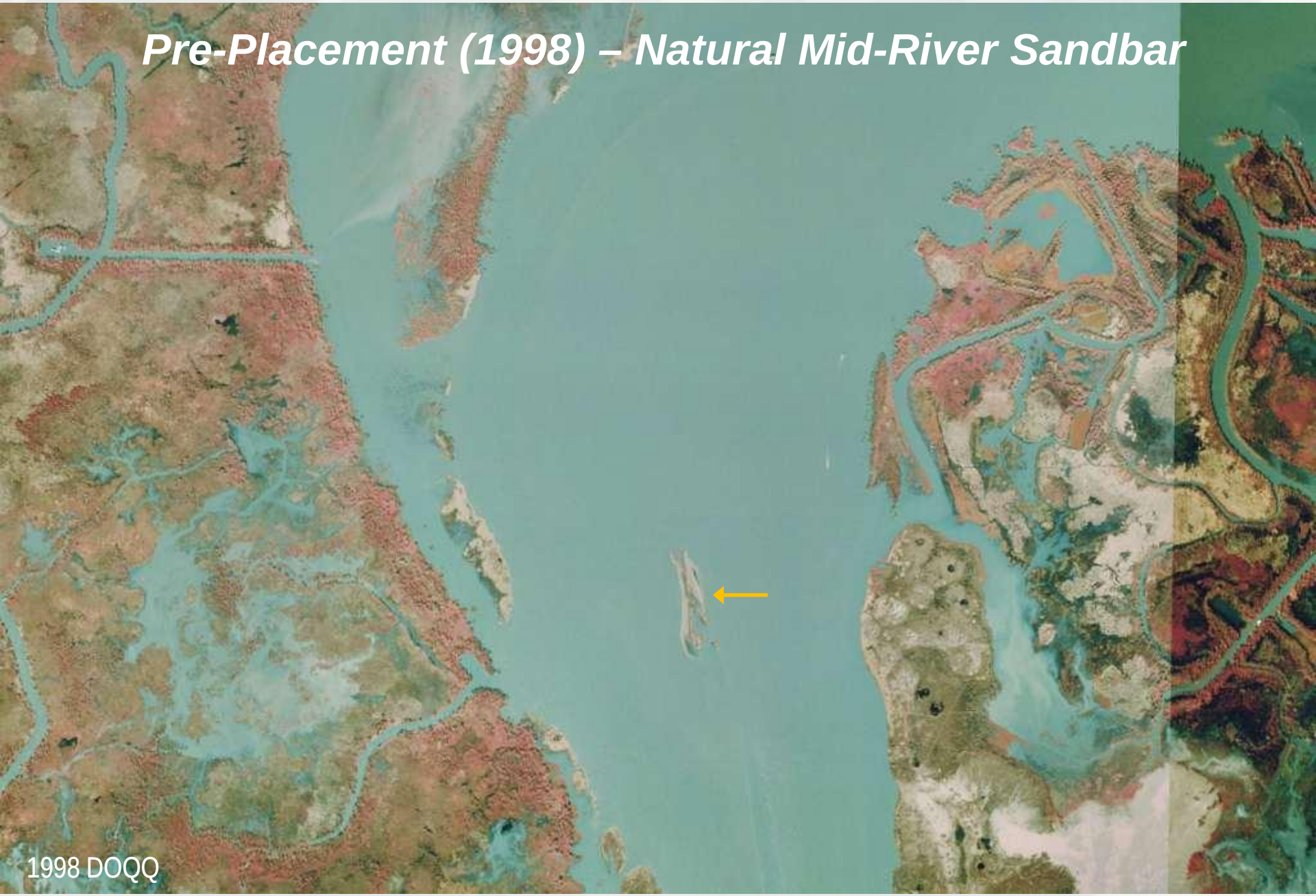
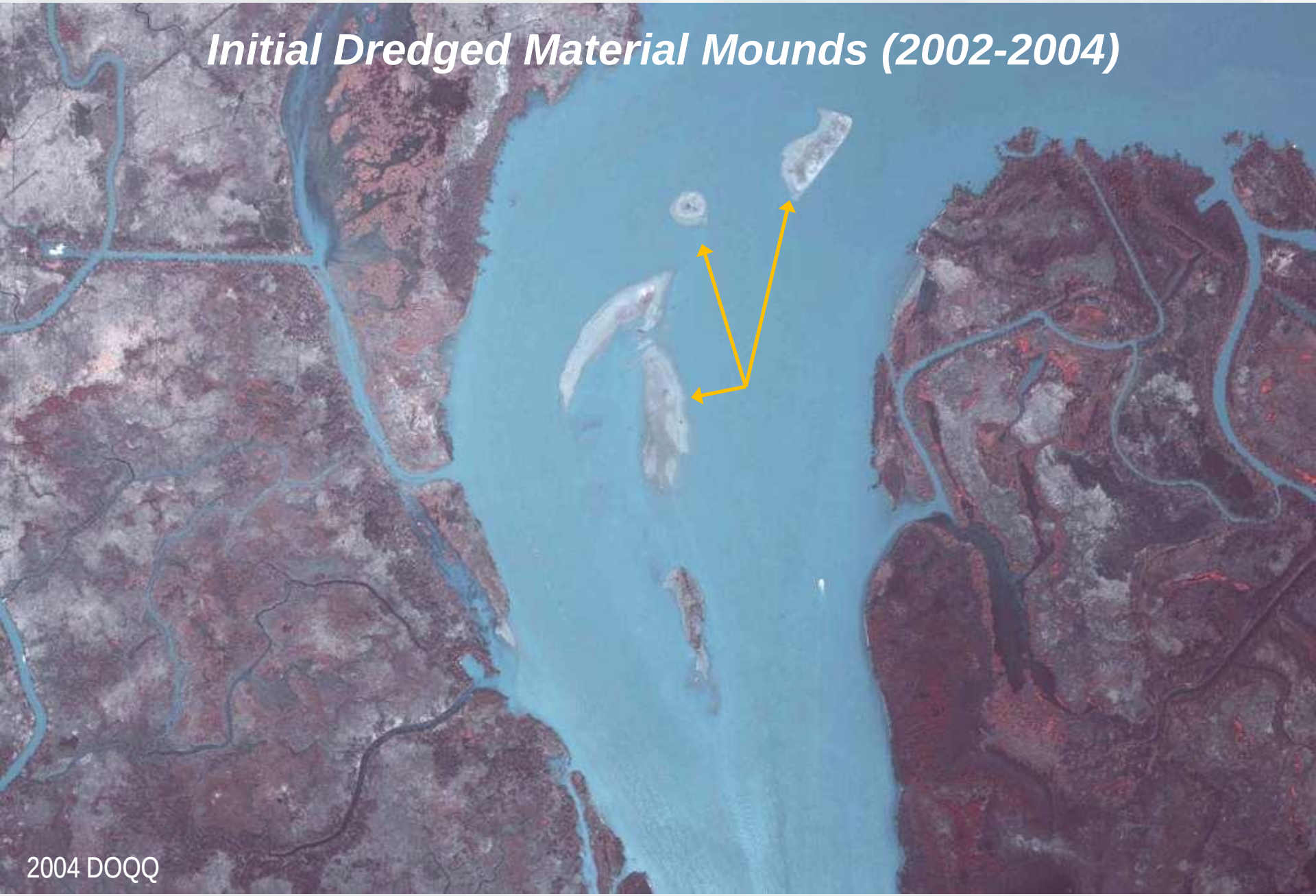
Pre-Placement (1998) – Natural Mid-River Sandbar

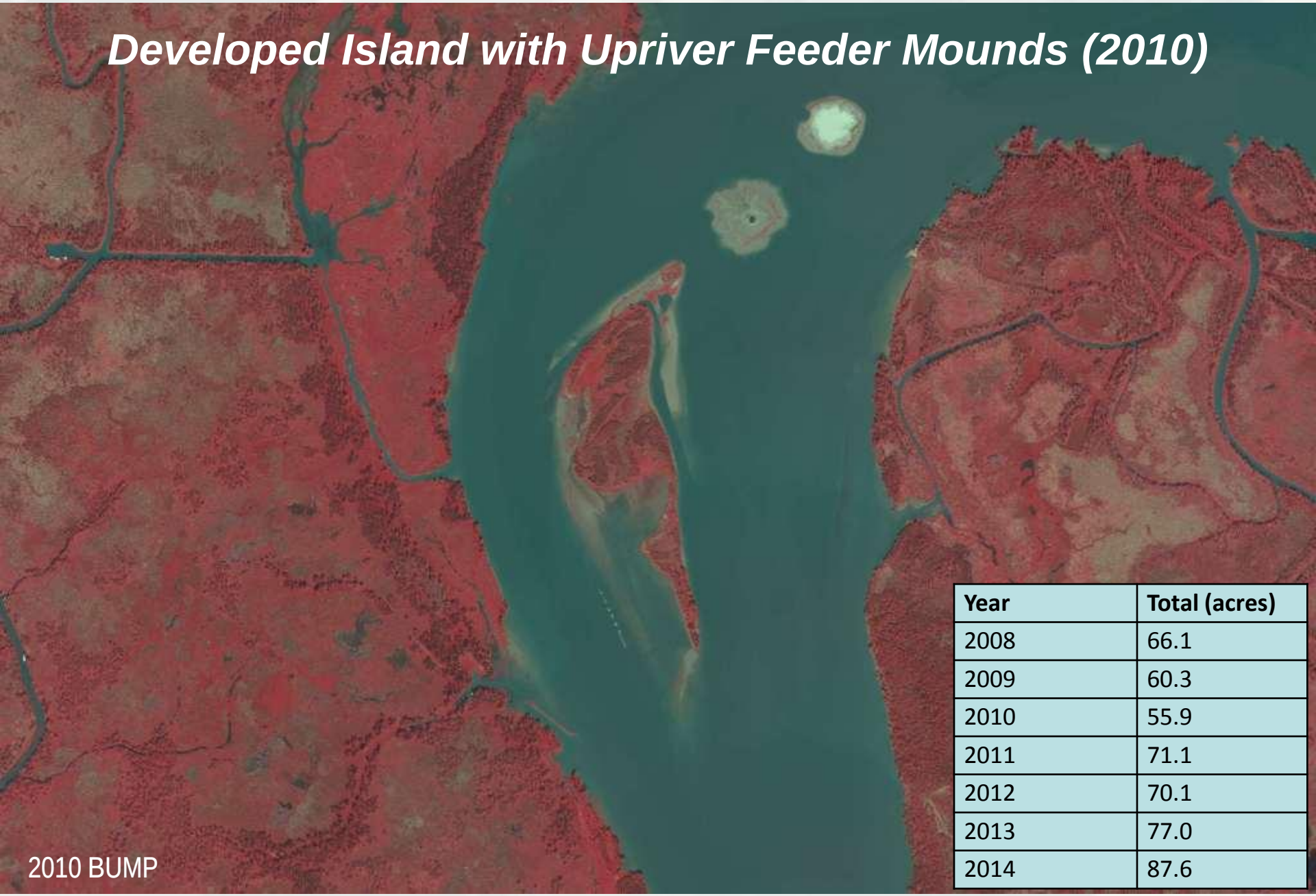


Initial Dredged Material Mounds (2002-2004)



2004 DOQQ

Developed Island with Upriver Feeder Mounds (2010)



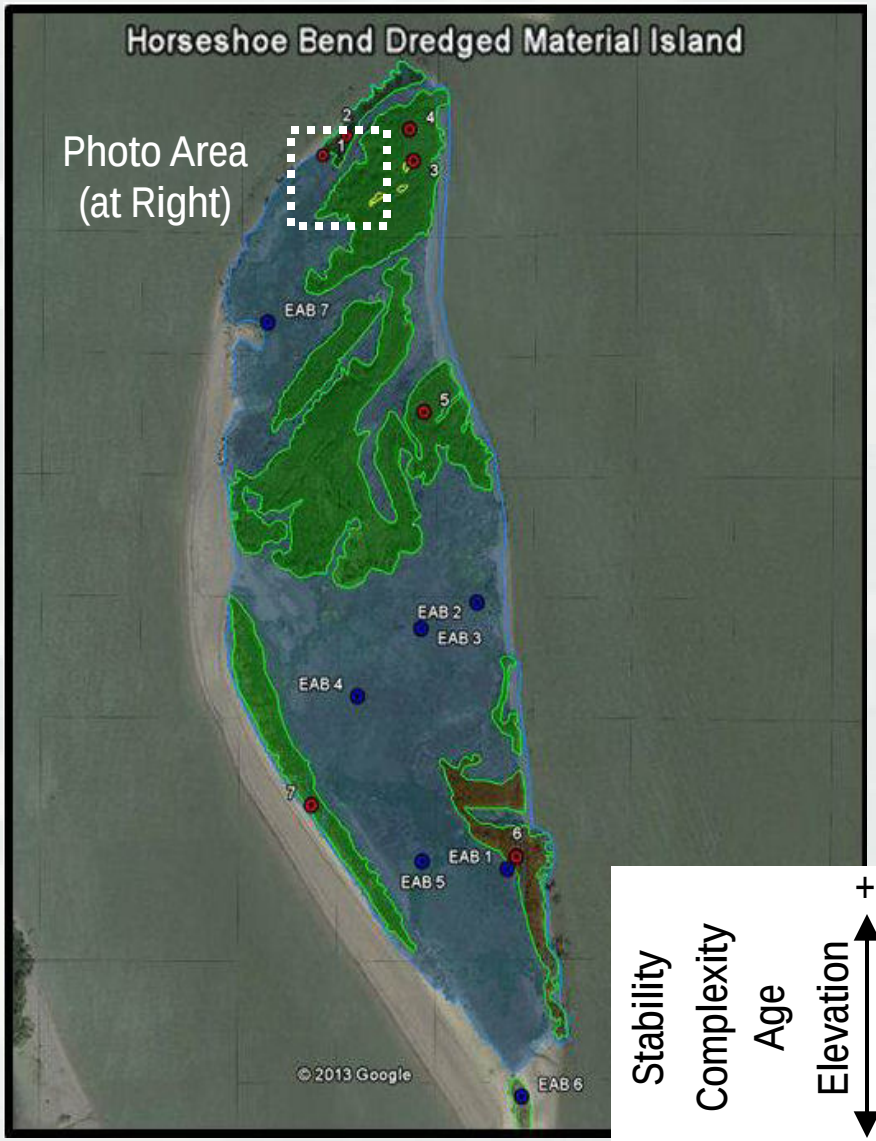
Year	Total (acres)
2008	66.1
2009	60.3
2010	55.9
2011	71.1
2012	70.1
2013	77.0
2014	87.6

2010 BUMP

Quantification of the Environmental Benefit

- Identify and Classify Distinct Habitat Types
- Catalogue Plants and Animals
- Evaluate Soil Horizons

Habitat Classification

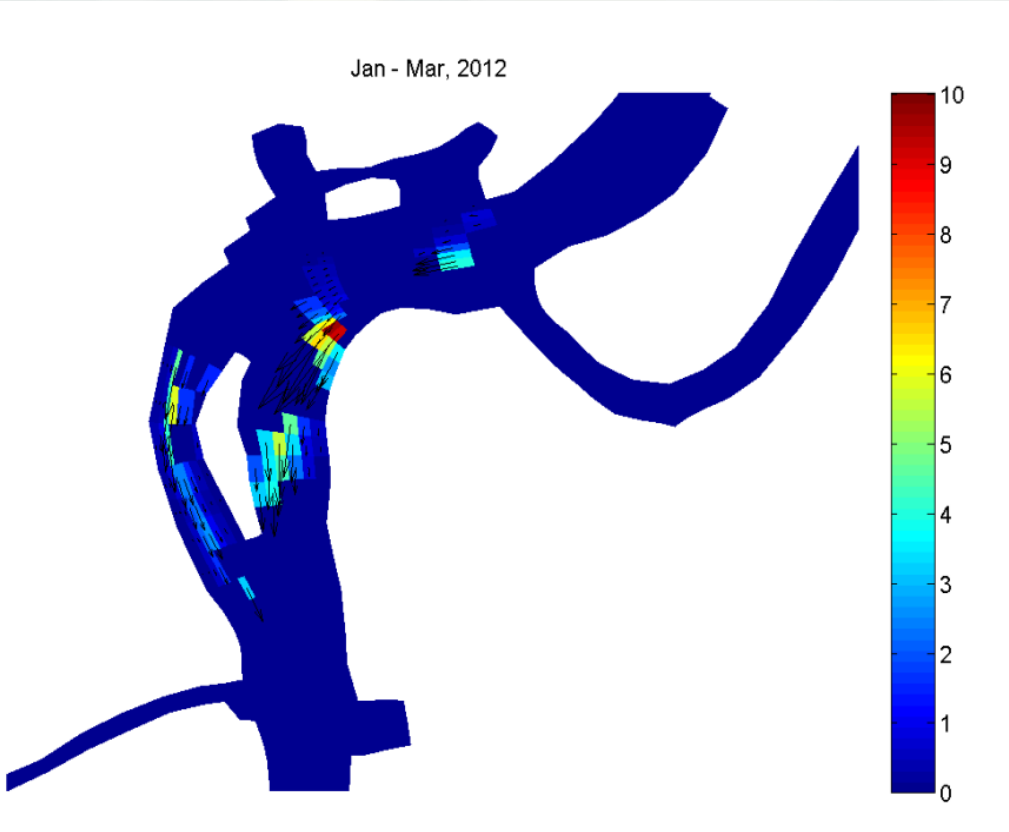


Stability
Complexity
Age
Elevation
+
–

- Mature Forested & Scrub-Shrub Wetlands
- Young Forested & Scrub-Shrub Wetlands
- Emergent Wetland Transition Zone
- Aquatic Bed Features

Modeling Hydrodynamics

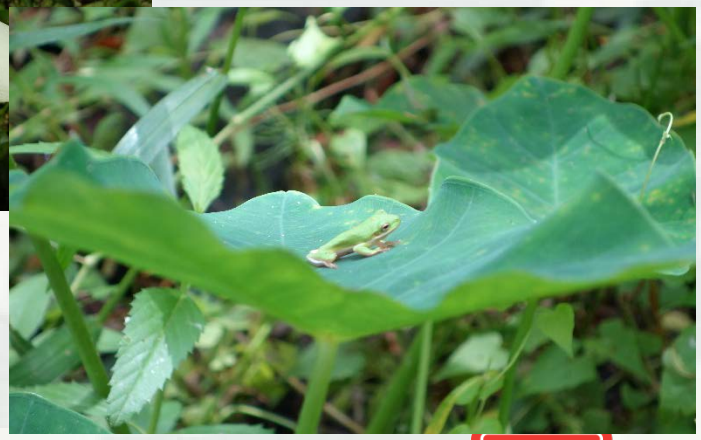
Mean suspended sediment transport volume rate during January - March 2012 ($m^3/m/s$)



Environmental Benefits

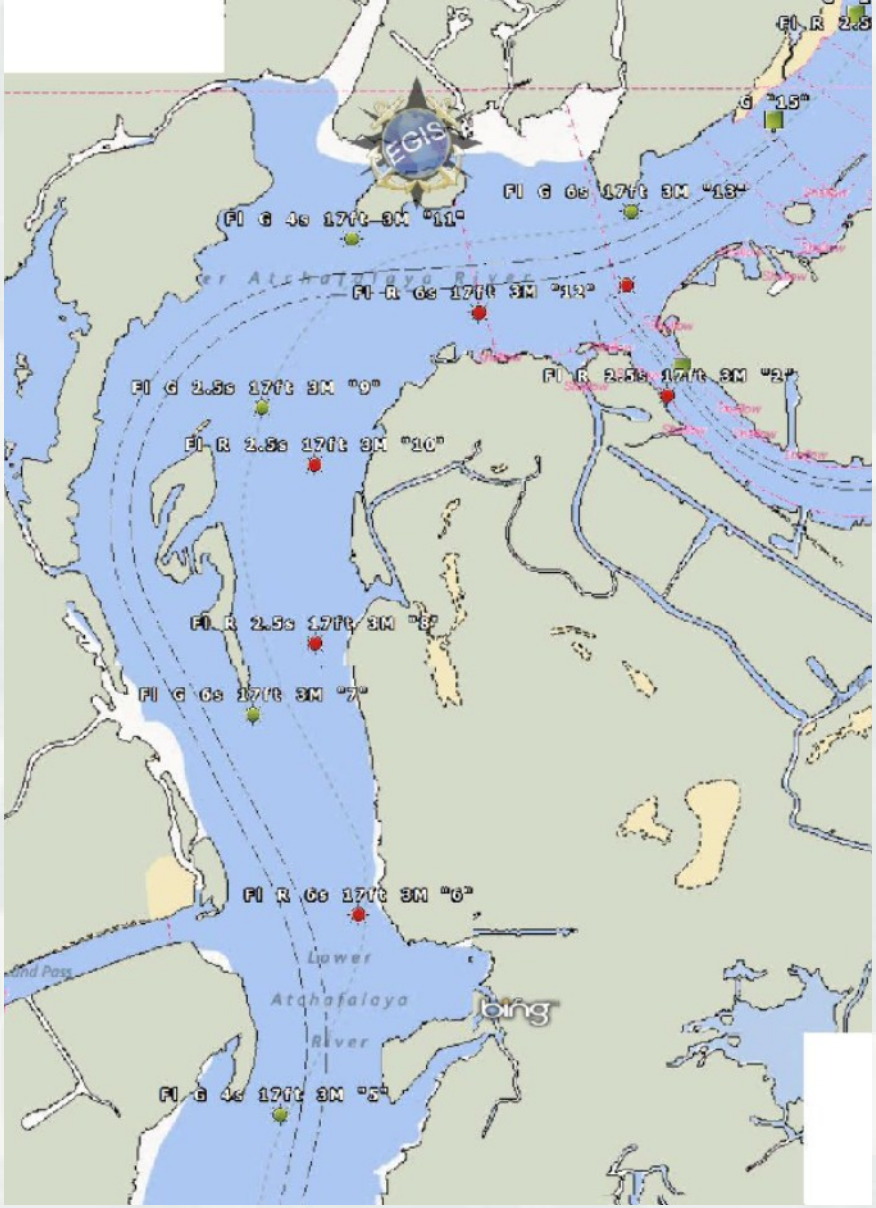
Created island supports:

- 35 ha habitat
- Four distinct habitat types
- 80 + plant species
- 20 + animal species
- Large wading bird rookery



Geomorphology and Nutrient Cycling

- Formation of dark, organic rich surface soils
- Resultant chemical reduction
  - Carbon sequestration
  - Nutrient cycling
  - De-nitrification



US Coast Guard Ship Channel Realignment

Navigation and Climate Benefits

- Island formation reduced dredging requirements
- Natural channel formed east of the island due to self-scouring
- US Coast Guard realigned channel (red circles, left)
  - channel length reduced
  - sharp bends eliminated
  - improved navigation safety
- Reduction in long-term dredging requirements
- Resultant carbon savings and reduced air pollution

Marketable Gains per Service Realized from the Formation of Horseshoe Bend Island

Service	Horseshoe Bend amount	Conversion	Value	Units
Carbon sequestration	6.15 ha emergent (15 acres)	86 g-C/m^2 each year over 100 years	5220 kg	Average C per year
Water purification	35 ha wetland (85 acres)	7% reduction estimated for 10,093 acres	0.059%	Nitrogen reduction in Gulf
Climate regulation	49 liters (13 gal)/trip fuel savings each year	49 liters (13 gal)/trip and 1,400 trips/year made by tugs and cargo ships	186	Metric tons of carbon dioxide equivalent (MTCO2e)
Educational support	4FY research support range $125K - $250K	$850K/4 yrs	$213K	2015 US$
Navigation	$22.9M -$10M over 3 yrs	$12.9M/3 yrs	$4.3M	2015 US$

What Have We Learned?

- Four distinct wetland habitats within a small area (35 ha), supporting a larger than expected variety of plants and animals
- Over 80 plant species observed on island, compared to 53 plant species noted for natural wetlands along the lower river
- Soils are active, function to cycle nutrients and sequester carbon
- Allowing the island to “self-form” is key to creating comparatively improved wetland habitat relative to the two reference areas
- Multiple benefits realized: environmental, economic, navigation, etc.

Take Away Points

- Effective waterways management practices are being implemented as part of maintenance dredging projects
- Many such practices are relatively unknown/not widely disseminated or publicized
- Communication essential to promote these good practices
- Lessons learned so innovative approaches can be more broadly applied
- Utilize nature's energy

Island Building in the Atchafalaya River, Louisiana USA

An Engineering with Nature Demonstration Project

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Introduction

Over the past several years, the US Army Corps of Engineers (USACE) New Orleans District has been using dredged material to nourish a small island that began forming naturally in the Atchafalaya River, Louisiana (LA). This effort has involved placing sediment dredged from a Federal navigation channel during routine maintenance in low relief mounds upriver of the island since 2002 (Figure 1). The mounded material has been dispersed by natural river currents to self-design the island. Prior to 2002, dredged material was being placed directly into shallow depressions along the river's banks to nourish existing wetlands, but continued placement into these areas was not sustainable because high quality wetlands would be converted into upland habitat.

Consequently, the alternative beneficial use to place material upstream of the small natural island was conceived. Until recently, only visual inspections have been conducted of the developing biological community on the island, thus benefits the island was creating remained largely unknown. As part of the Engineering With Nature initiative within the USACE, we have recently begun an investigation to use the island as a demonstration project to quantify the biological benefits and otherwise improve our understanding of the physical maturation of this beneficial use of dredged material within the Atchafalaya Basin.

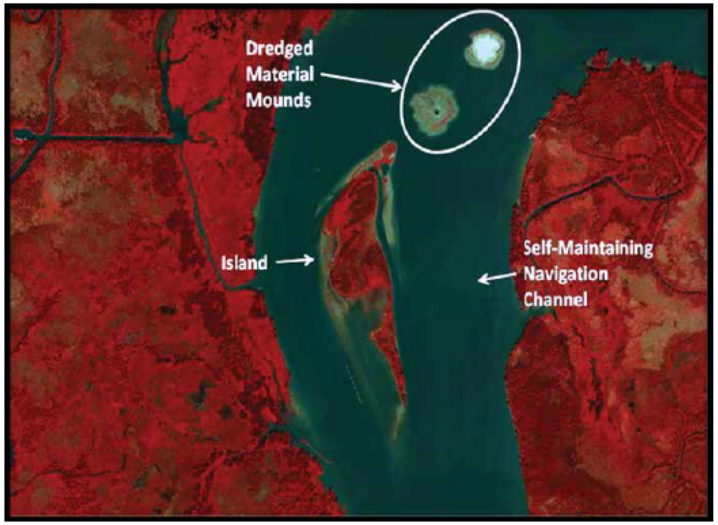

Figure 1: December 2011 aerial infrared photograph of the Atchafalaya River island after multiple years of upstream mounding of dredged material. The island's formation has reduced the overall cross sectional area of the river, increasing river flow through the navigation channel to the east sufficient to reduce shoaling and maintenance dredging requirements.