US Army Corps of Engineers®

EWN®
Engineering With Nature

Engineering With Nature® (EWN) Using Island Restoration in Systemwide Approaches

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Overview

Introduction

EWN® Proving Ground

Discuss Seven Key Lessons

Three Case Studies that use Systemwide Approaches

Mississippi Offshore Barrier Islands

Dauphin Island, Alabama

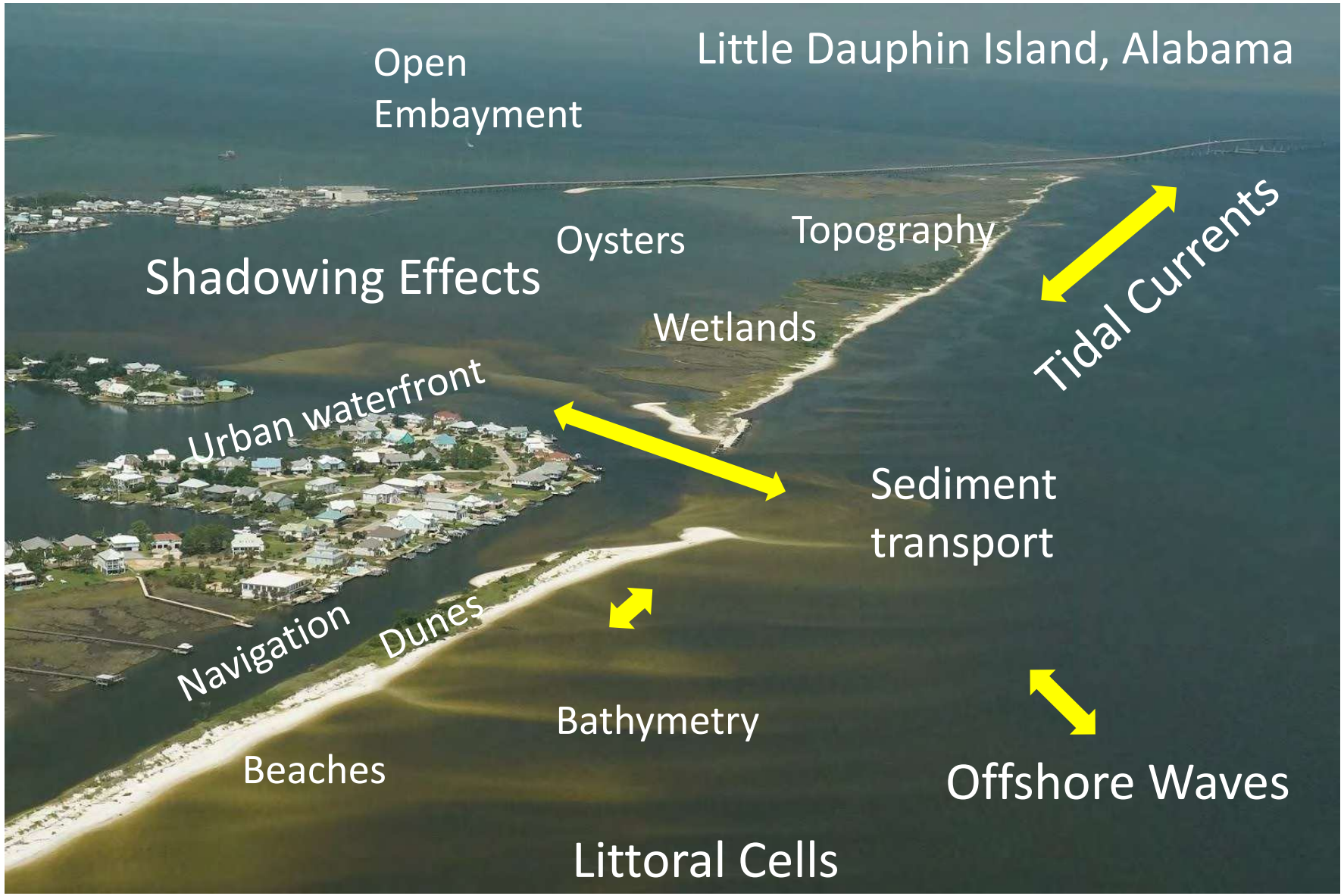
Deer Island, Mississippi

Lesson 1: Use a Systems Approach

Islands are made of a Hierarchy of **Subsystems** and can have Influences on the **Broader Systems** they are a part of

Scientific Investigations necessary to develop **Resilient Solutions**

Defining the System



Lesson 2: Develop Systemwide Goals and SMART Objectives

Specific, **M**easurable, **A**chievable, **R**elevant and **T**ime Bound

Well-written, **Systemwide Goals and Objectives**

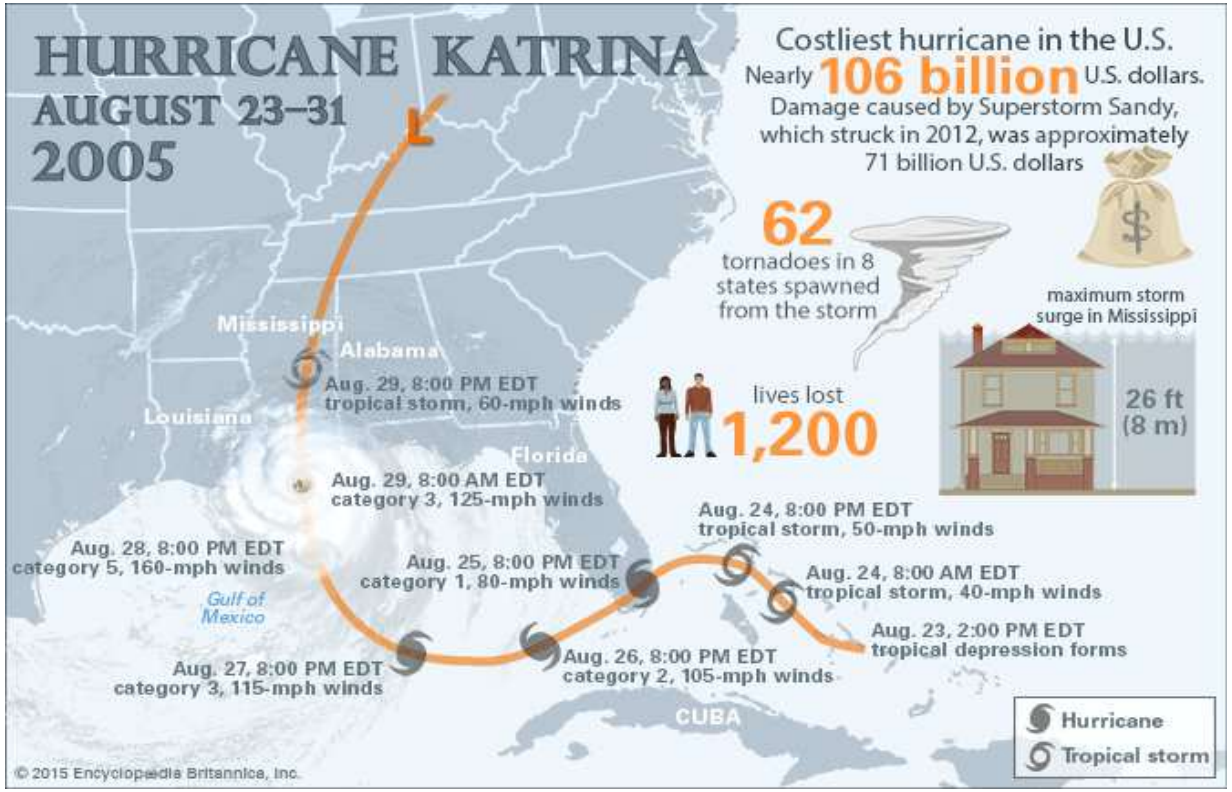
Help to identify **Comprehensive Solutions**

Case Study:
Mississippi Coastal Improvements Program (MsCIP)

P.L. 109-148, 30 December 2005

Comprehensive Planning to Address:

- *Hurricane and Storm Damage Reduction*
- *Salt Water Intrusion*
- *Shoreline Erosion*
- *Fish and Wildlife Preservation*
- *Other Water Related Resource Projects*



Case Study:
Mississippi Coastal Improvements Program (MsCIP)

Systemwide Goals:

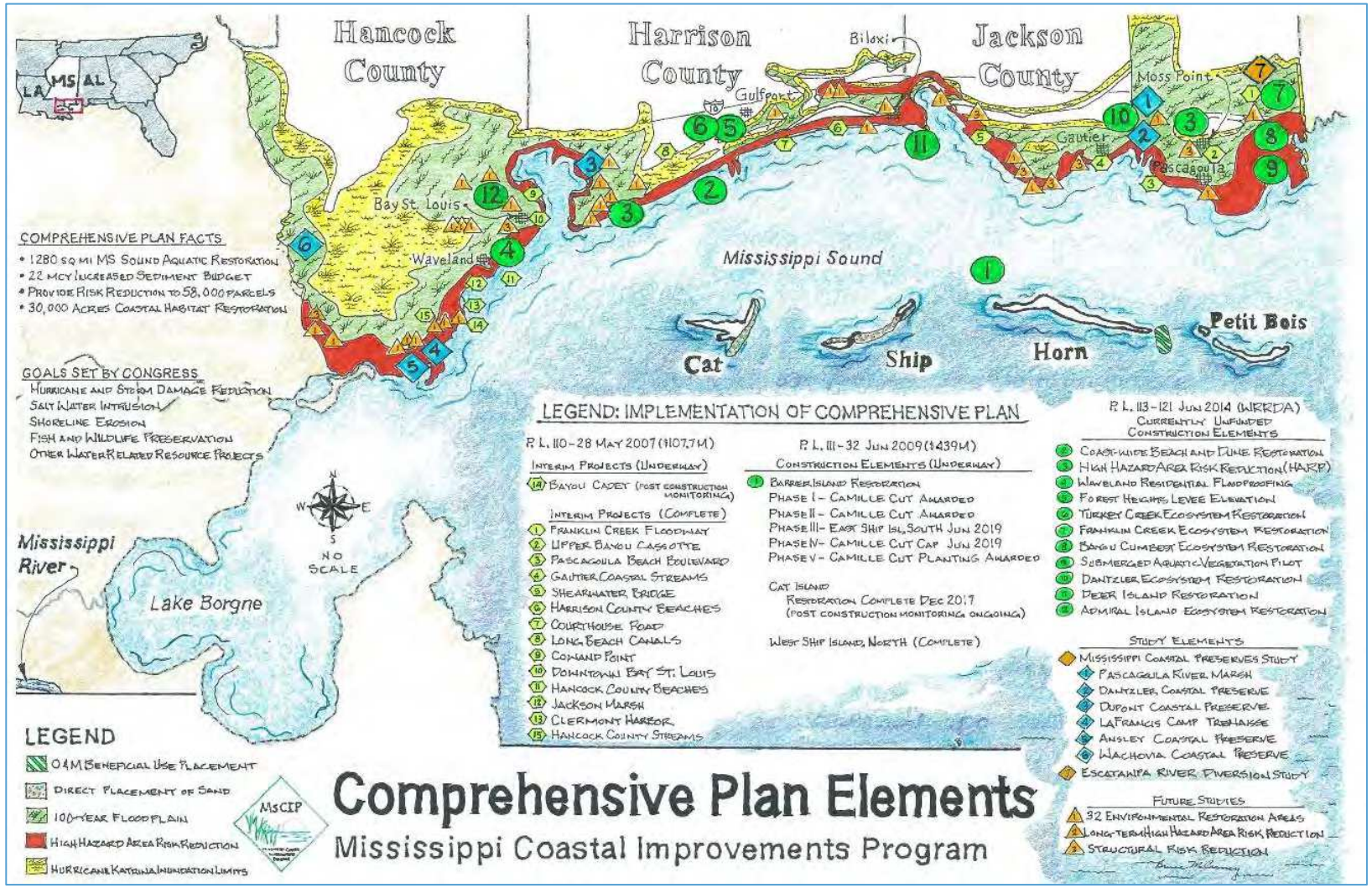
- Recommend cost-effective measures for restoration of nationally and regionally significant environmental resources within a context of long-term sustainability;
- Recommend cost-effective measures to reduce damages from hurricanes and storms without encouraging re-development in high-risk areas;
- Recommend cost-effective measures to mitigate damages caused by saltwater intrusion into nationally significant ecosystems;
- Recommend cost-effective measures to restore eroded coastal resources as part of a system-wide approach to develop a resilient coastline;
- Identify other water resource related programs and activities integral to the development of a comprehensive system-wide plan.

Case Study:
Mississippi Coastal Improvements Program (MsCIP)

System-Wide Objectives:

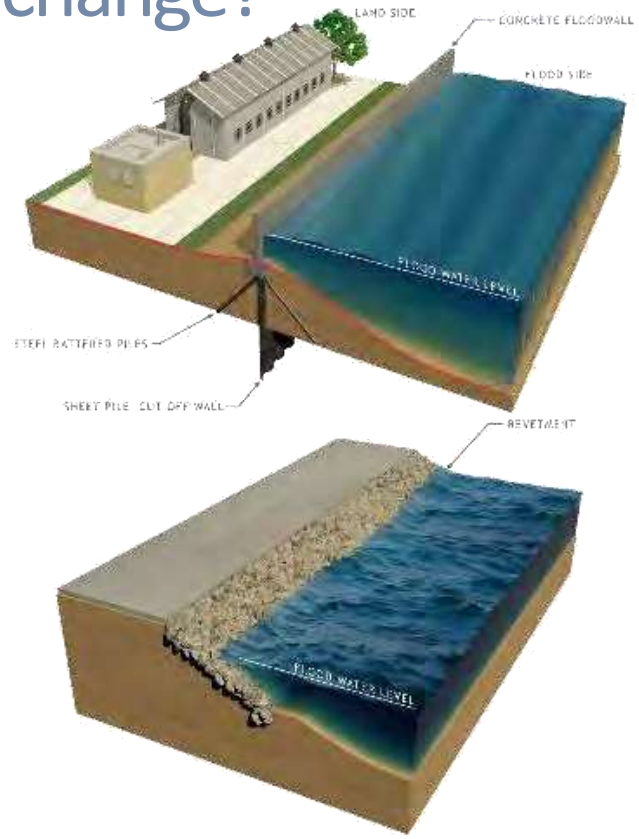
- Reduce damages caused by hurricane and storm surge by $150M-$200M annually
- Restore 10,000 acres of fish and wildlife habitat including coastal forests, coastal wetlands, wet pine savannah, submerged aquatic sea grasses, oyster reefs, and beaches and dunes by the year 2040;
- Manage seasonal salinities within the western Mississippi Sound such that optimal conditions for oyster growth (surrogate for other aquatic resources, 15 ppt during summer months) are achieved on an annual basis by 2015;
- Reduce erosion to barrier islands, mainland, and interior bay shorelines by 50%; Create opportunities for collaboration with local, state, and Federal agencies to facilitate implementation of programs and activities that maximize the use of resources in achieving the comprehensive goal.

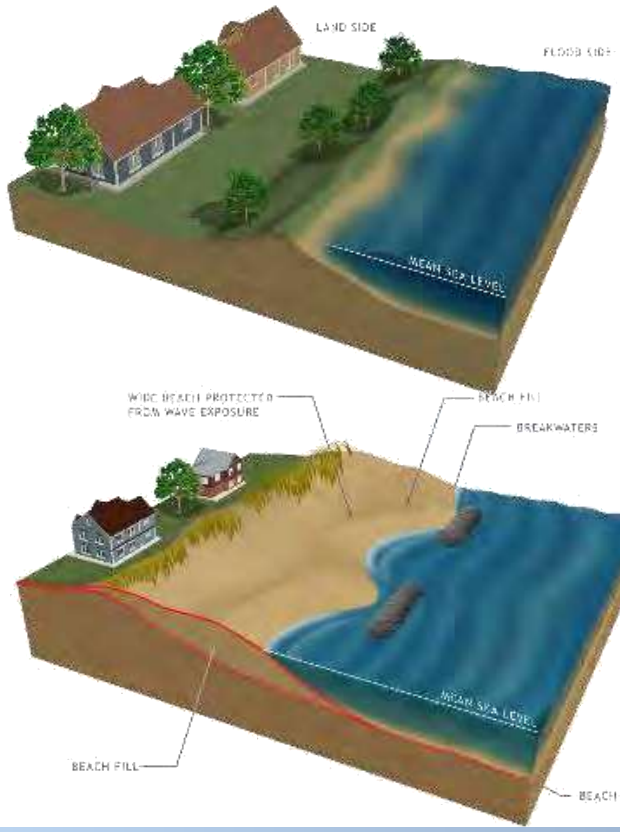
Case Study:
Mississippi Coastal Improvements Program (MsCIP)

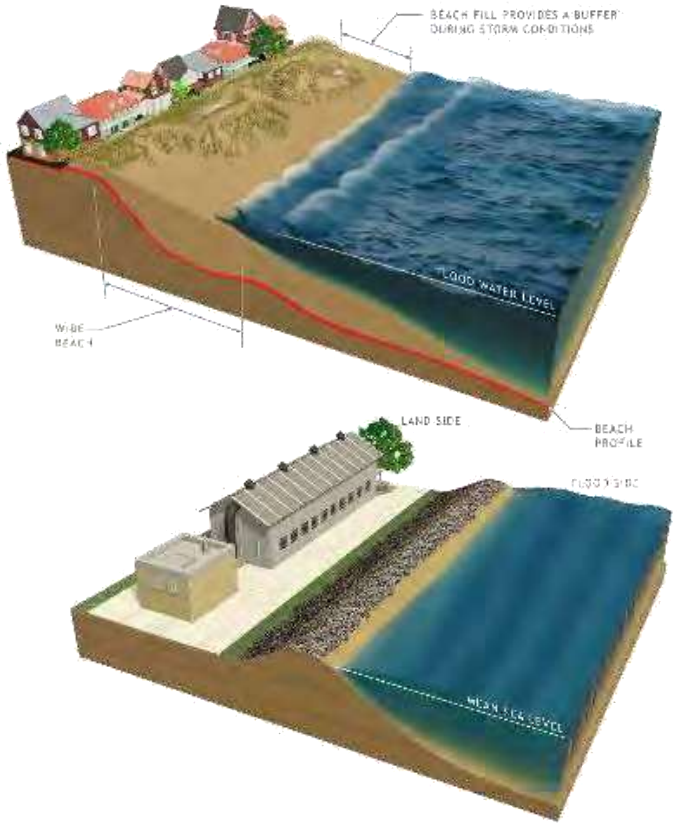


Case Study:
Mississippi Coastal Improvements Program (MsCIP)

If Goals or Objectives change how might the features in the plan change?







Lesson 3: Embrace Design Constraints

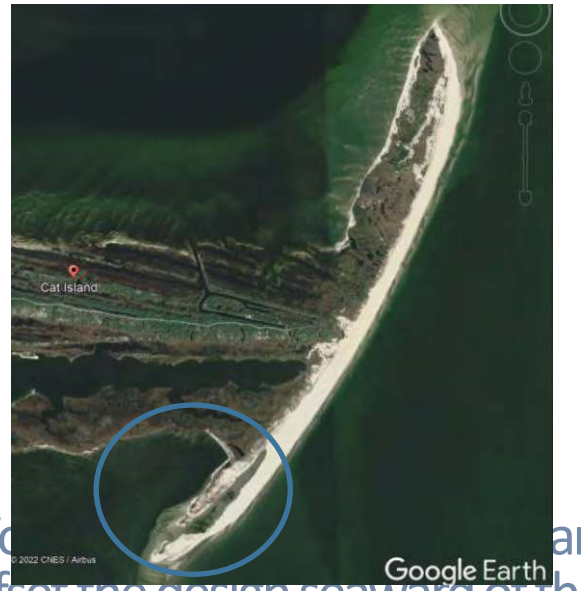
Each project is **unique** requiring balance often brought by **multidisciplinary teams**

Constraints identified early and communicated often have the best chance of finding a **balanced solution**.

Case Studies: MsCIP Cat Island, Ship Island and Deer Island

Cat Island

No fill authorized for direct placement on National Park Service owned land



Wo an offset the design seaward of the mean high waterline

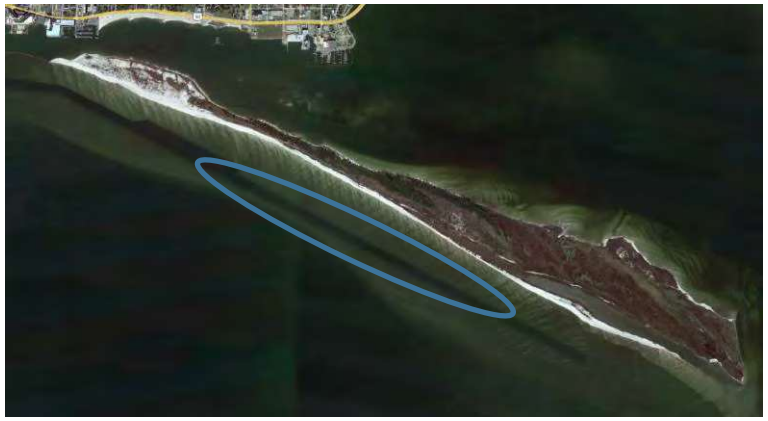
Ship Island

No adverse impact to Native American Burial Grounds.

Extensive tribal coordination which lead to design shifts and restricted areas for field work and construction equipment

Deer Island

Avoid adverse impact to Shellfish Reef and Aquaculture Farms



Working with State fishery resources to incorporate dredging offsets, equipment access corridors and design elements to benefit oysters.

Case Studies: MsCIP Cat Island, Ship Island and Deer Island

What type of typical constraints do you think apply to implementation of island features?

- Budget
- Avoid, minimize, or mitigate any negative impacts to T&E species
- Comply, to the maximum extent practicable, with State Coastal Management Plans
- Meet the guidelines for maintenance of State Water Quality standards
- Consistent with the Regulations Implementing NEPA and other applicable environmental laws and regulations

Lesson 4: Evaluate the Design

Highly Complex and **Dynamic** Across

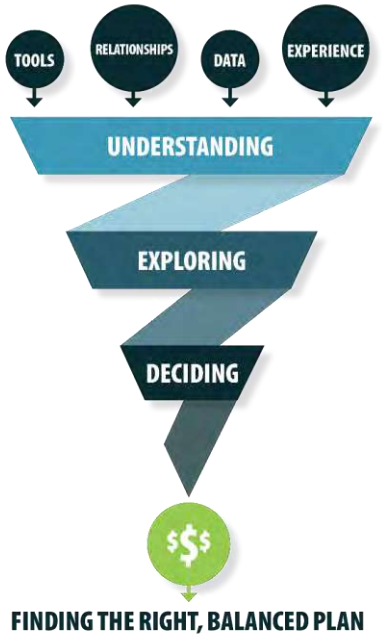
Time and Space

Coastal Issues that require

Scientific Investigation to develop a

Resilient Solution

Design Process



Existing Conditions Assessment

Field data Collection

- Hydrodynamic Modeling
- Sediment Transport/Morphological Modeling

Identification of Design Alternatives

- Identify project components
- Engineering with Nature Toolkit
- Qualitatively Evaluate Pros and Cons

Design Analysis

- Perform design analysis for selected alternative components
- Beach, Maritime Forest Marsh, Living Breakwaters, Reefs, Oysters

Performance Analysis

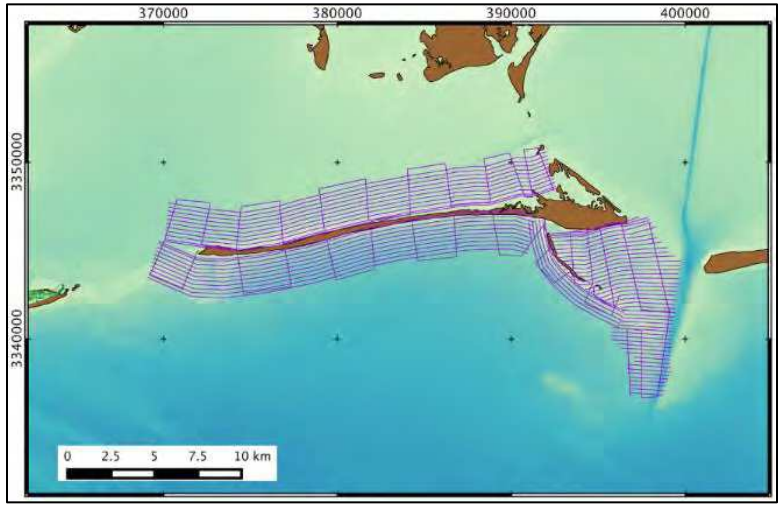
- Evaluate performance under Extreme Events and Sea Level Rise
- Use Numerical models for the analysis

Design Plans and Specs

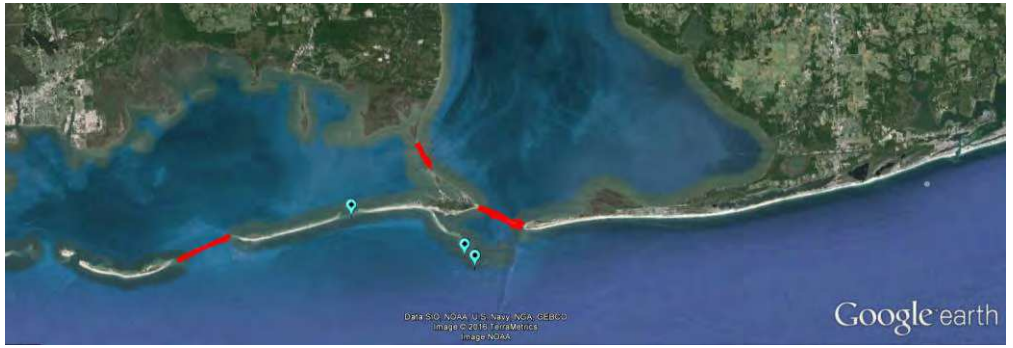
- Prepare Plans, Sections and Specs

Field Data Collection

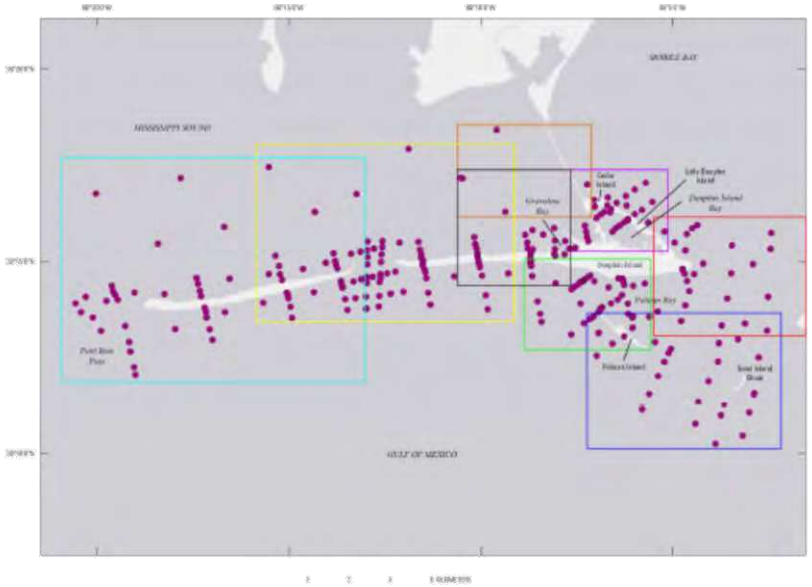
Bathymetric Data



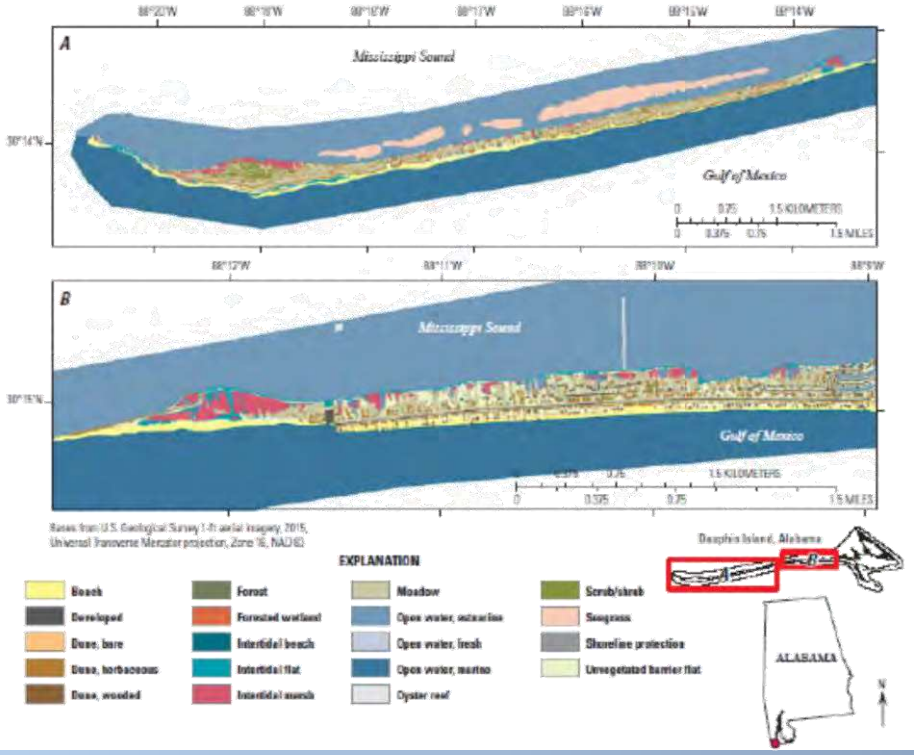
Wave and Current Data



Sediment Data



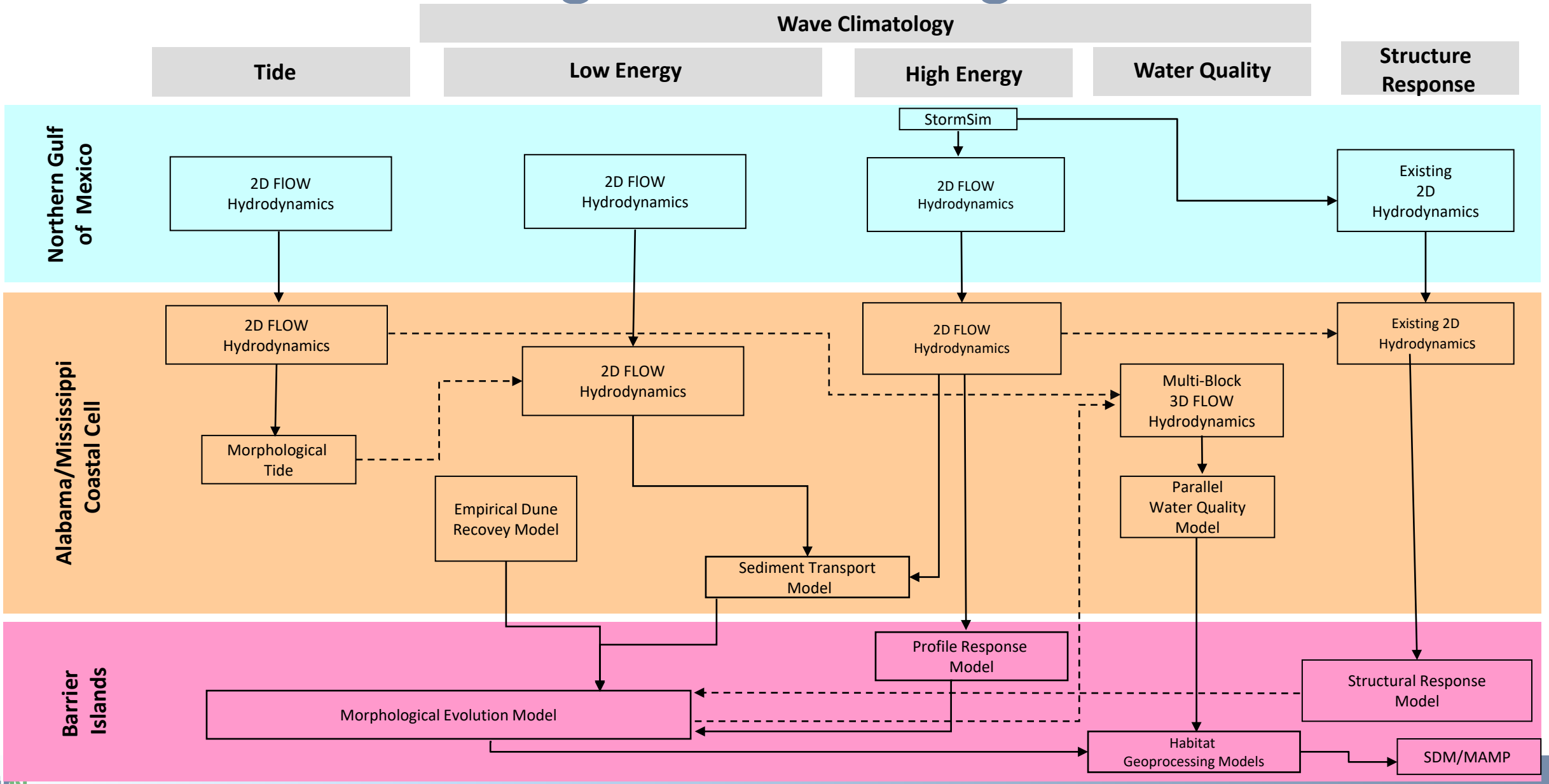
Habitat Data



Water Quality Data

	Supporting Data Collection Efforts	
All	Measured	Observations
	Samples	In-Situ
Temperature		X
Salinity		X
Fixed Solids	TSS	
Other Phytoplankton	CHl	
Labile DOC	DOC	
Labile POC	POC=TOC-DOC	
Ammonium	NH4	
NO2+NO3	NO3	
Labile DON	DON=DKN-NH4	
Labile PON	PON=TON-DON	
Total Phosphate	TIP=TP-TOP, or DIP	
Labile DOP	DOP	
Labile POP	POP=TOP-DOP	
DO		X
Dissolved Silica		

Integrated Modeling



Lesson 5: Manage Tradeoffs

Some **project objectives** and **design criteria** may seem in **conflict**.

Factor in **resiliency metrics** for features today and in the future to help inform **trade off analysis**

Case Studies: Dauphin Island, Alabama and Ship Island, Mississippi

Dauphin Island

Attenuate waves and minimize island over wash or recognize some over wash is needed for natural island building?

Dauphin Island

Attenuate waves, minimize island over wash, improve salinity for oysters and seagrasses in the lee or recognize some over wash is needed for natural island building?

Ship Island

Overbuild to reduce breaching, attenuate waves, and reduce occurrence of overtopping with future sea level or match elevations to habitat functional needs today and adaptively manage in the future?

Lesson 6: Expect the Unexpected

Implementation Risks can not always be determined

Anticipate, Evaluate and **Manage** Project **Risks**

Case Study: MsCIP Ship Island

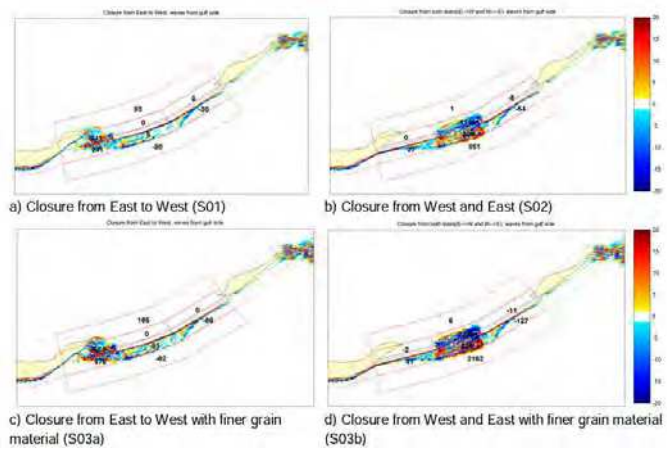
Access

Restrictive shallow water and access areas due to sensitive resources.

Evaluated bathymetric data, held industry days, conducted cultural surveys and allowed flexibility for start up pumping and direction of work in contract.

Sequencing

Construct East to West or West to East or both East to West. Fill the whole template or partial template? What are the potential sediment losses?



sediment transport modeling to inform risk with breach closure sequencing.

Suspended Sediments

Nearby sensitive seagrass beds along East and West Ship Islands

Conducted flushing and suspended sediment transport modeling. During initial breach closure incorporated biodegradable turbidity booms around seagrass beds.

Lesson 7: Inform Future Decision Making

Monitoring and Adaptive Management

Evaluate **performance,** determine **success**
or **adaptive management** needs

Case Study: MsCIP Barrier Islands Monitoring and Adaptive Management

Maintain the estuarine ecosystem and resources of the Mississippi Sound.

- Flow Patterns
- Water Quality
- Submerged Aquatic Vegetation
- Benthic and Infaunal Species
- Gulf Sturgeon

Preserve the natural and cultural resources of the Mississippi barrier islands.

- Habitat Composition
- Sea Turtles
- Shore & Nesting Birds
- Cultural Resources

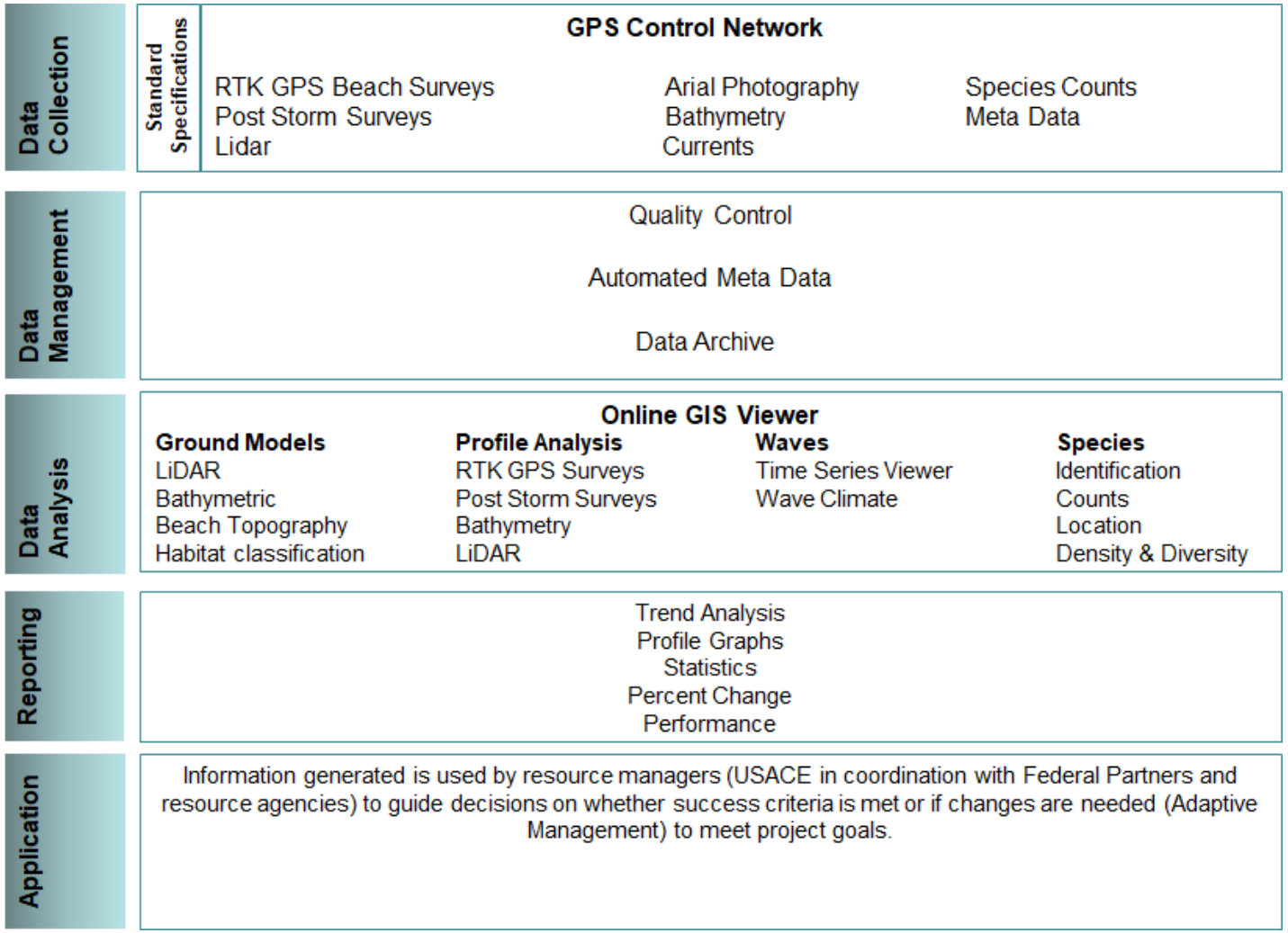
Restore the barrier islands structure to reduce storm damage impacts on the mainland coast.

- Morphology & Shoreline Change
- Wave Height & Energy Reduction

Enhance the long-term littoral drift system for the Mississippi barrier islands.

- Sand Transport Pathways & Rates
- Channel Sedimentation/Shoaling
- Dredged Material Placement

Case Study: MsCIP Barrier Islands Monitoring and Adaptive Management



Gaps and Future Direction

- Document the case studies and integrate the science from monitoring and adaptive management
- Use Story boards to tell the story: https://cesamusace.maps.arcgis.com/apps/MapSeries/index.html?appid=ea29cd4e1f3b432e8c520df3fb7a9f8b
- Continue to enhance the tools to determine the benefits and better

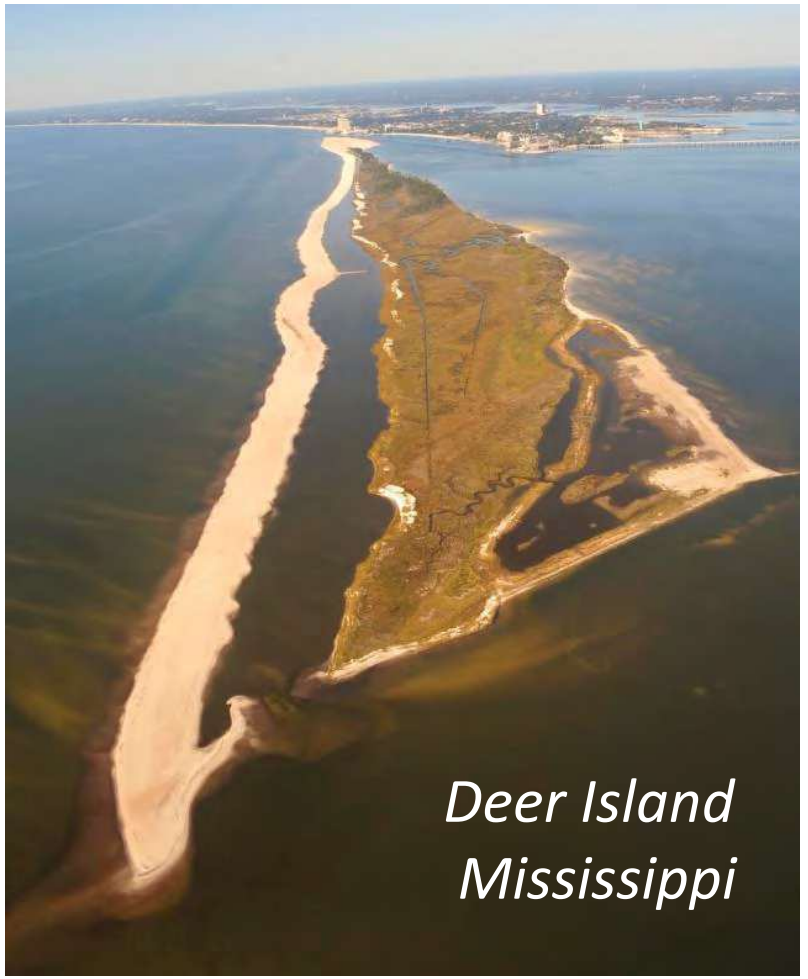
  integrate in multiple types of habitats
- Continue to advance tools capable of evaluating island influences

Any Questions?

Please email:

ewn-cadre@usace.army.mil

U.S. Army Corps of Engineers
USACE Engineering with Nature Practice Leads



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