Short Course: NNBF for Coastal Resilience

- Application and Utility of Specific NNBF Types: Tidal Wetlands

  Presentation Outline

  Overview of Practice and Project Examples
  Share spectrum of NNBF solutions
  Highlight key messages:

  watershed/system approach
  have a process
  leverage natural processes
  scale matters
  placement matters
  form follows function
  multiple values added
  benefits of illustrative master plans

ICCE 2018

NNBF

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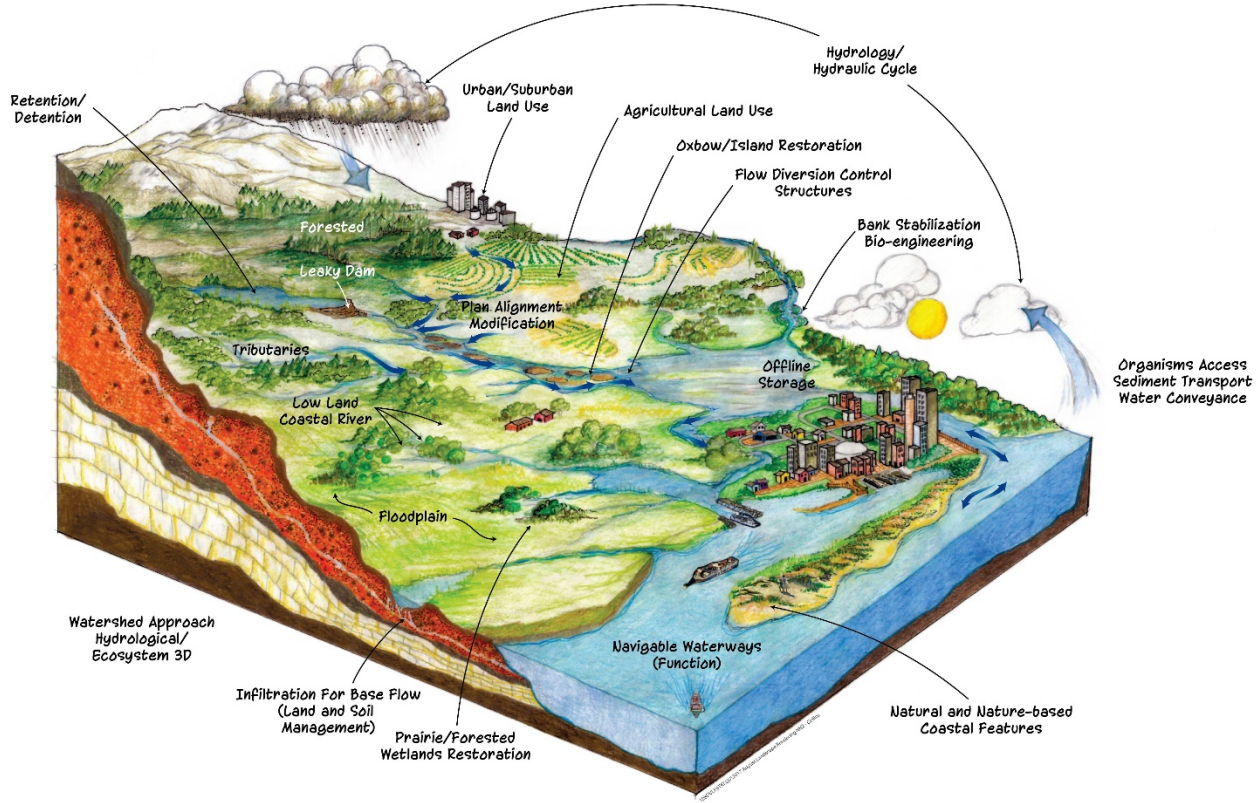
Intentional Alignment
Natural Process & Engineering Practice

- Evia Island Galveston Bay Texas

- supports sustainable practices, projects, and outcomes
- improves operational efficiency,
- uses nature & nature-based features to maximize benefits, and
- delivers economic, environmental, and social benefits through collaborative means.

Practice Overview: Take a Watershed/System-Scale Approach



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Practice Overview: Utilize a Process

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Practice Overview: Natural Processes are Already at Work-Leverage Them

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Using Coastal Ecosystems to Reduce Risk: Scale Matters

Man-made barrier island

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Tidal Wetlands:
Marshes
Maritime Forests
Mangroves

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Placement Matters: Low vs High Energy Locations: Living Shorelines

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Naturally Occurring Coastal Wetlands: Preserve Them

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A Basic Design Principal: Form Follows Function

Surge Protection?

Habitat Value?

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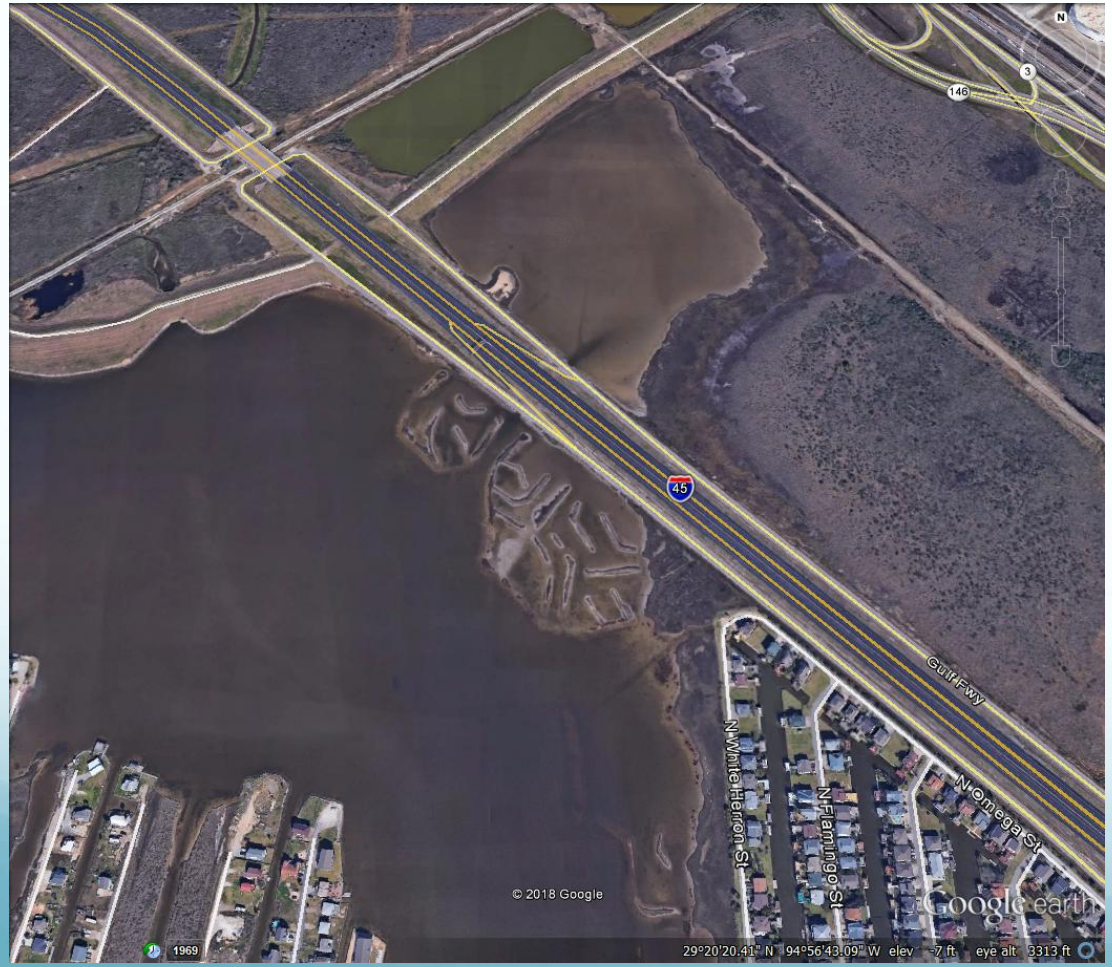
A Basic Design Principal: Form Follows Function



Shoreline Protection?

Water Quality Improvement?

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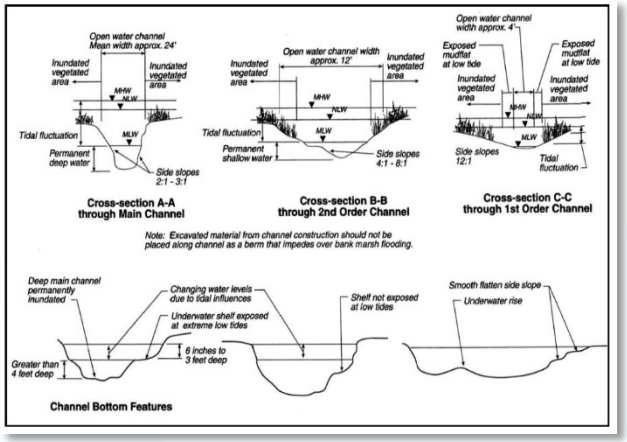
Constructed Tidal Marsh: Function Follows Form



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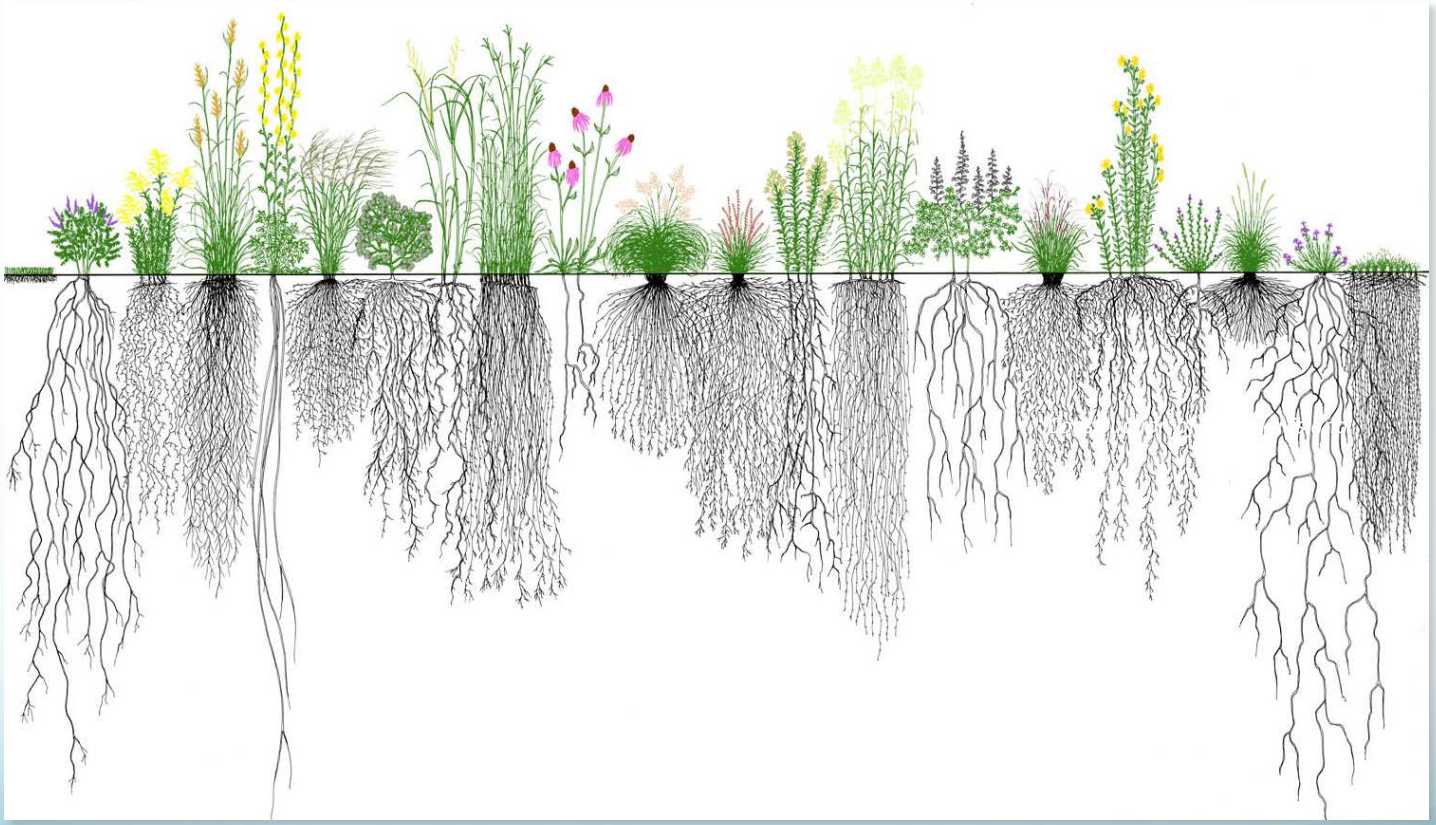
Tidal Marsh between Beach/Dunes/Flats: Multiple Values Added

Helmers, D. L. 1992. Shorebird Management Manual.
Western Hemisphere Shorebird Reserve Network,
Manomet, MA. 58 pp.

Natural Feature Benefits



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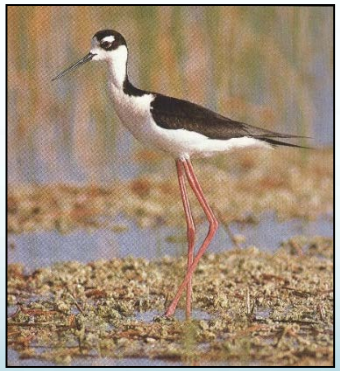
How to harness tidal wetland benefits for coastal protection



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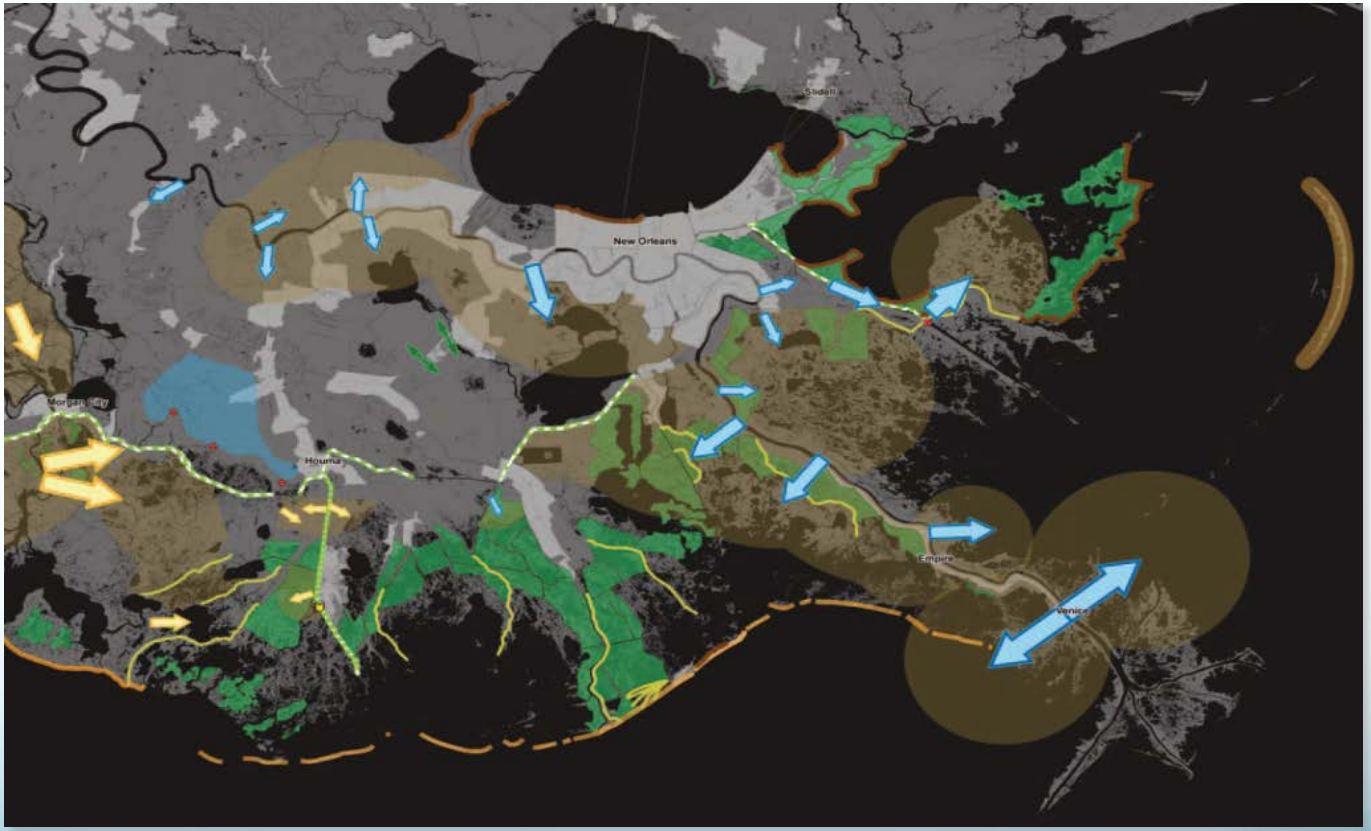
Increase Scale and Complexity



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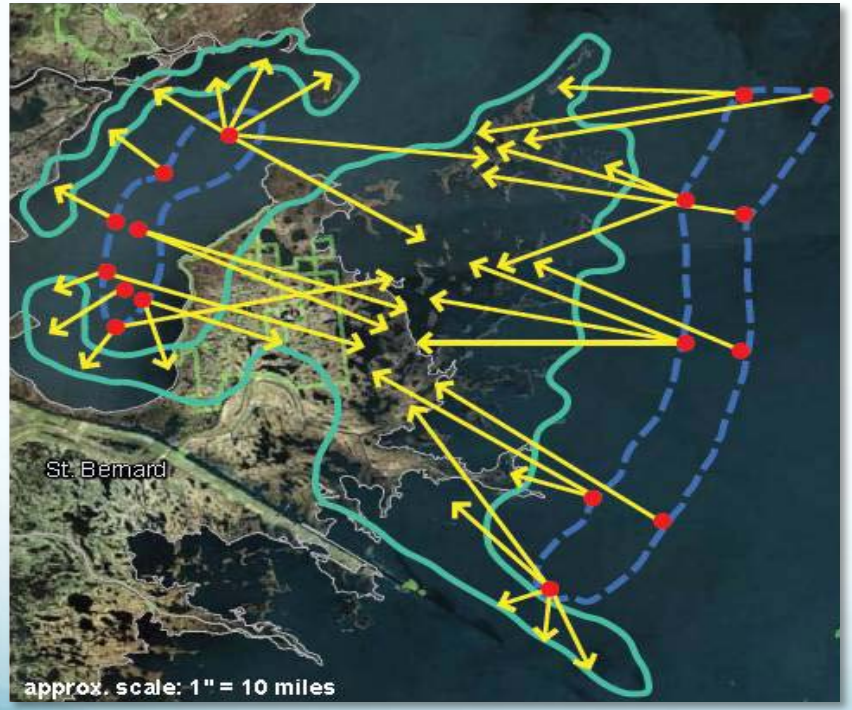
Link Protection and Restoration



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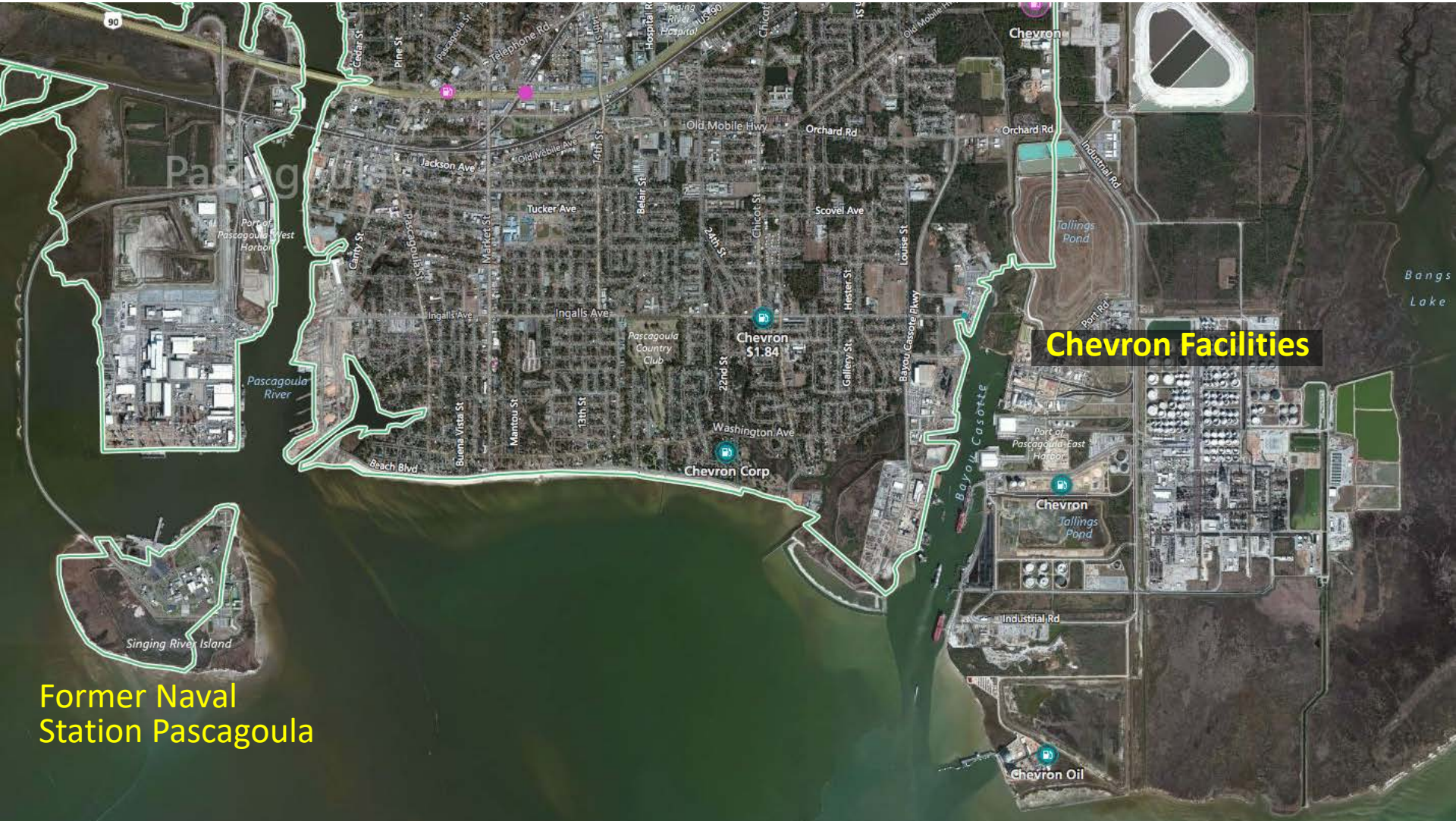
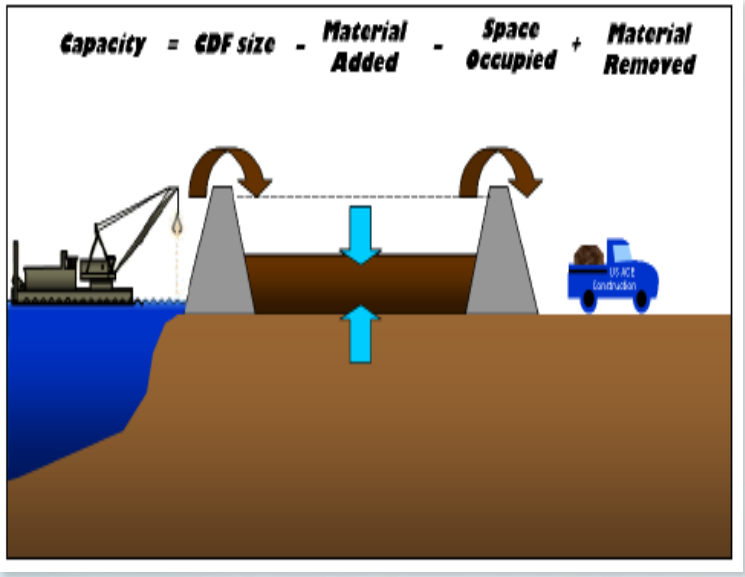
Seize Opportunities Near and Now



Use Dredged Material Beneficially

Harvest Dredged Material for Tidal Wetland Creation



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Eroding Coasts: Fight or Retreat?

Sand veneer gone & clay subsurface exposed

Cayo del Grullo

Clay dunes

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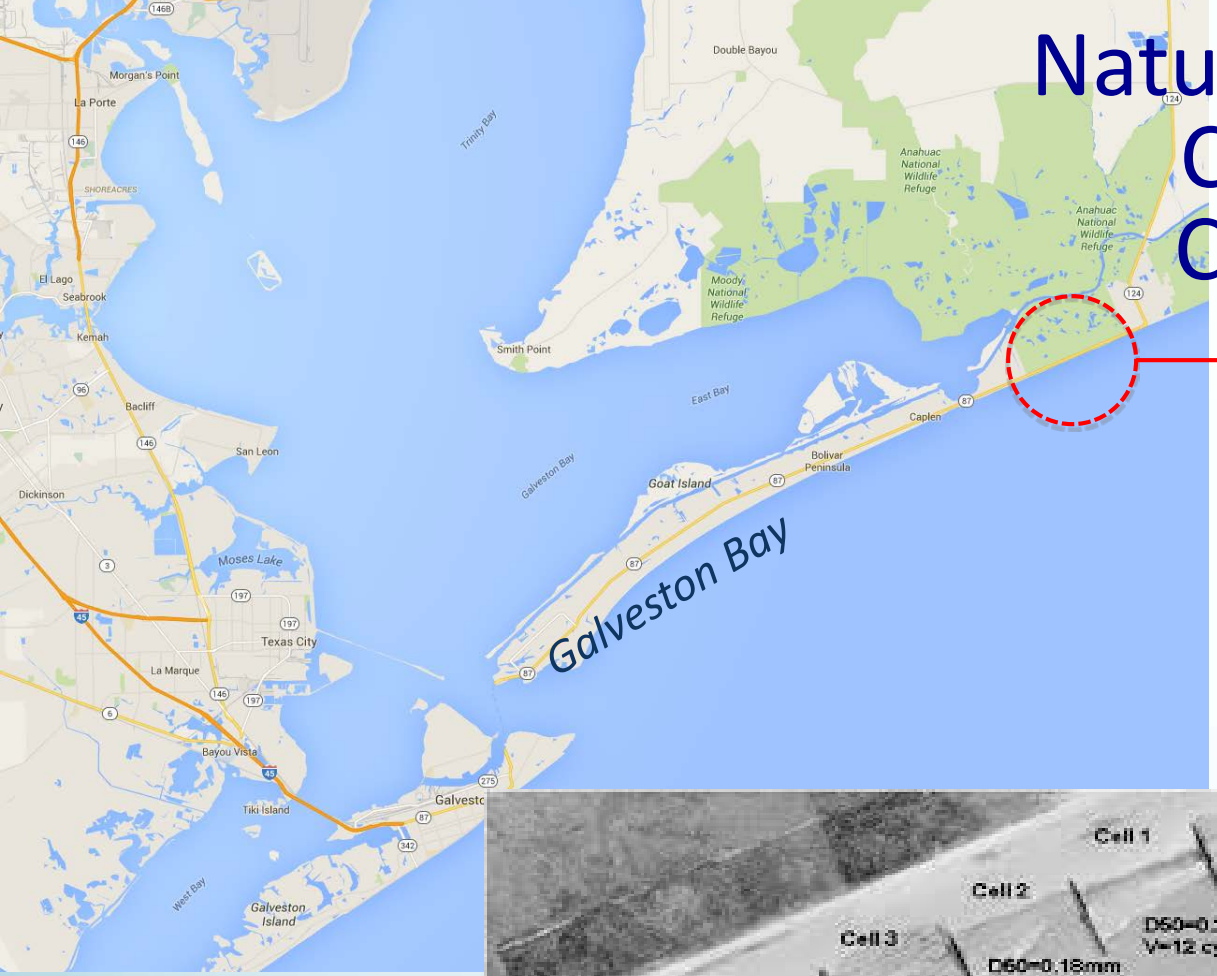
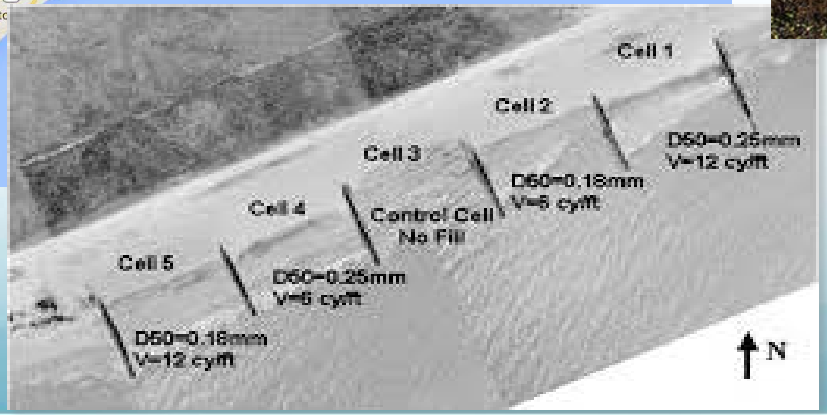
Nature-based Feature: Clay Core Sand Covered Dunes





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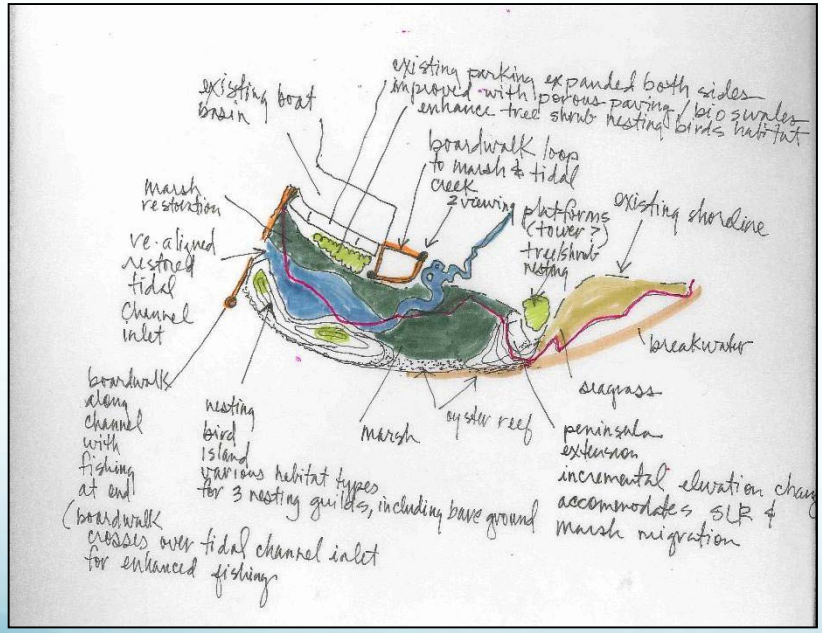
Benefits of Illustrative Master Plans: Lightning Point Living Shoreline



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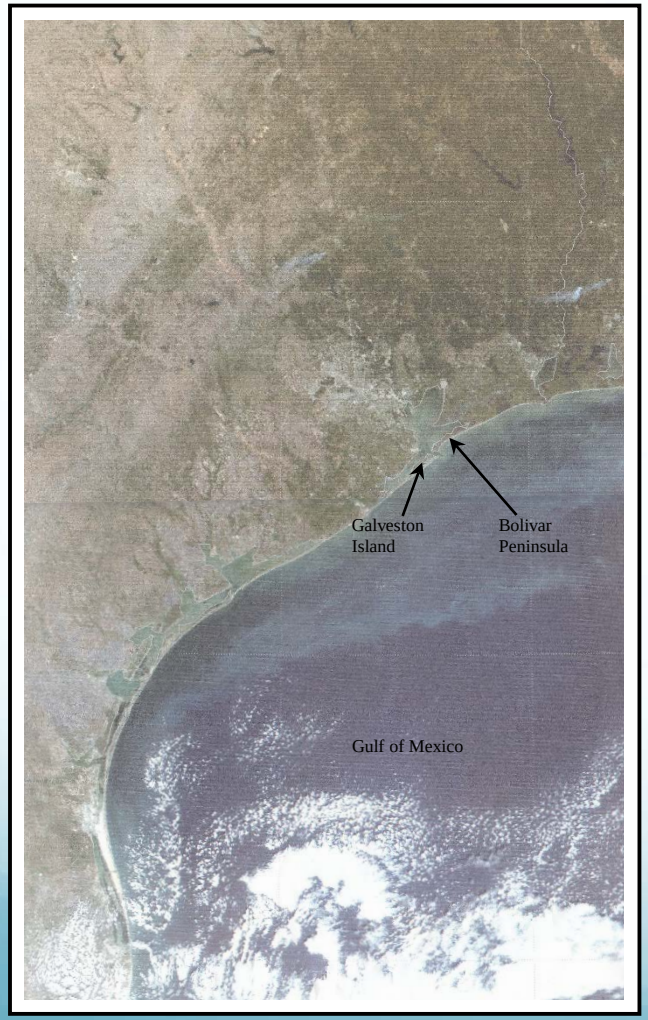
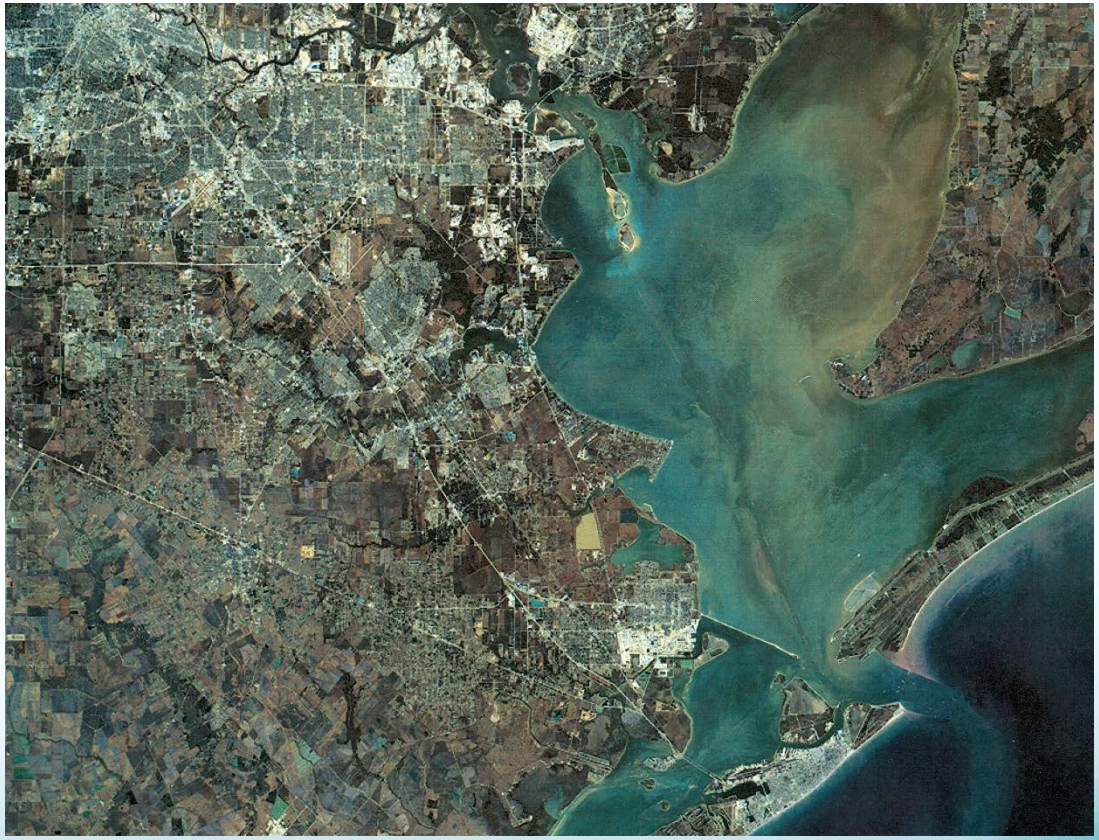
Application and Utility: Texas Gulf Coast





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Increasing Coastal Vulnerabilities

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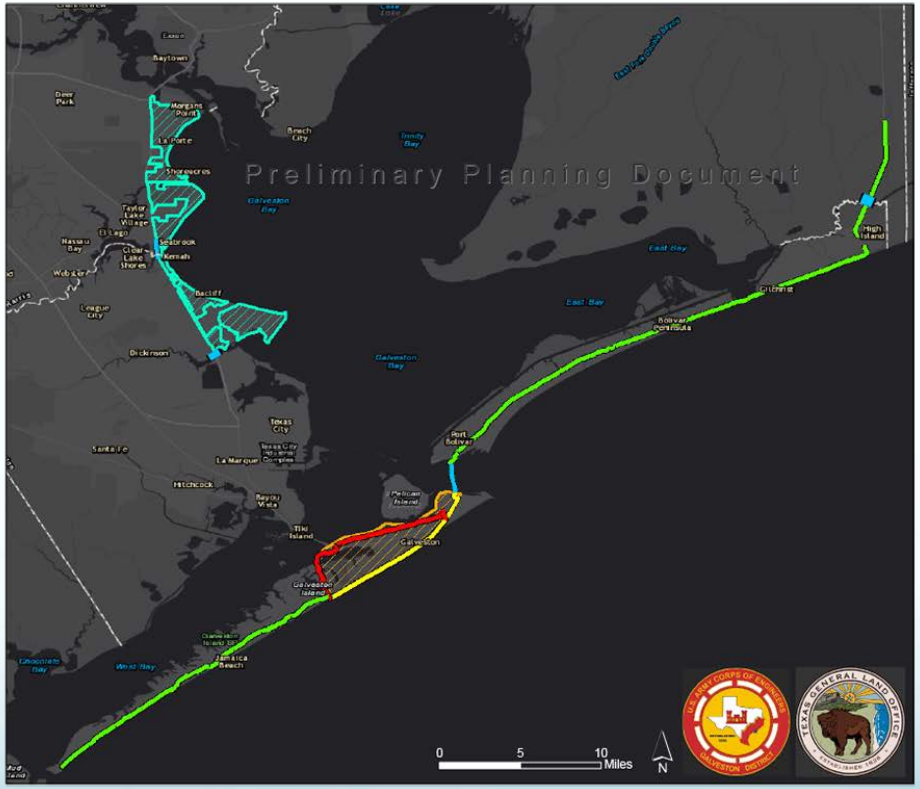
Texas Coastal Protection and Restoration Alternative A Plan

Coastal Texas Protection and Restoration Feasibility Study

Alternative A

- Navigation and Environmental Gates
- Levee/Floodwall
- Galveston Ring Levee*
- Galveston Seawall Improvements
- Galveston Island * Nonstructural Improvements
- Nonstructural Improvements

* One or both of these features may be selected.



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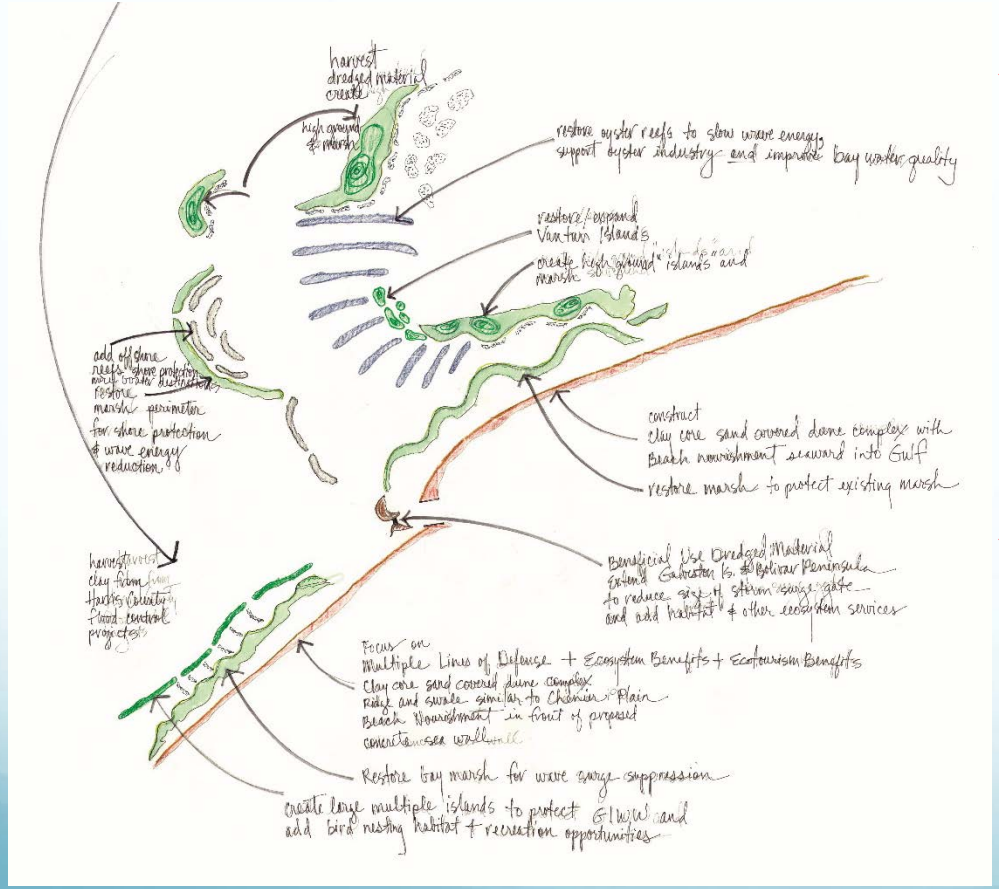
Galveston Bay Texas NNBF Concept Plan



- Plan elements
  - Perimeter Fringe Marsh
  - Dune and Beach in front of Proposed Seawall
  - Breakwaters
  - Oyster Reefs
  - Strategically Located Bird Nesting Islands
  - BU -extend Gal Island and Bolivar shortens surge gate
- Community & stakeholder engagement
  - current planning efforts in Texas on coastal protection lacks NNBF and addressing other project goals
  - getting stuck for lack of community support on current proposed traditional engineering only solutions.

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Tidal Marsh Surge Protection

- Fringe Marsh around majority of the 232 miles of Bay perimeter would add additional storm surge protection while providing ecological and commercial fisheries value.

- Wamsley et al 2009 indicated wetlands have potential to reduce surges dependent upon surrounding coastal landscape condition and storm forcing.

  - 1 meter reduction per 20 km of marsh, 1 m decrease per 23 km marsh nearby same Cat 3 hurricane as measured in Louisiana. Measured surge attenuation rates varied from 1m per 25 km to 1m per 4 km.

  - Range is 1 m per 60 km to 1 m per 4 km dependent upon bathymetry, structures, wetland character and storm character (size, speed, track, intensity). See also Coastal Risk Reduction and Resilience USACE 2013.

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Recap Application and Utility of NNBF Tidal Wetlands

- Clear understanding of all the issues
- Provides added benefits
  - Extends life span of structural approaches
  - Reduces O&M costs
  - Buys time before managed retreat
- Have sound process, think creatively, large scale, yet one size does not fit all
- Leverage previous successes and natural processes/features
- Know the client, site, stakeholders to match your proposal to their vision/mission/budget
- A picture is worth a thousand words