Currituck Sound Ecosystem Restoration Study

SAV Partners’ Spring 2011 Meeting

USACE – Wilmington
Doug Piatkowski
Currituck Sound Ecosystem Restoration Study

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Currituck Sound Ecosystem Restoration Study

“Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that the Secretary of the Army is requested to review the report of the Division Engineer dated June 25, 1991, on Eastern North Carolina above Cape Lookout, North Carolina, and other pertinent reports, to determine whether modifications to the recommendations contained therein are advisable at the present time in the interest of water quality, environmental restoration and protection, and related purposes in Currituck Sound.”
Currituck Sound Ecosystem Restoration Study

State of North Carolina through the NC Environmental and Natural Resources - Division of Water Resources (NCDWR)
Currituck Sound Ecosystem Restoration Study

North Carolina Department of Environmental and Natural Resources - Division of Water Resources (NCDWR)
(non-federal Sponsor)
North Carolina Division of Marine Fisheries (NCDMF)
North Carolina Division of Water Quality (NCDWQ)
North Carolina Wildlife Resources Commission (NCWRC)
North Carolina Division Coastal Management (NCDCM)
North Carolina National Estuarine Research Reserve (NCNERR)
North Carolina Coastal Federation (NCCF)
Elizabeth City State University (ECSU)
US Fish and Wildlife Service (USFWS)
US Geological Survey (USGS)
Currituck County

Pasquotank River Basin Regional Council
Hampton Roads Planning District Commission
The Nature Conservancy (TNC)
Virginia Department of Environmental Quality
Virginia Department of Conservation & Recreation
National Audubon Society
National Oceanic and Atmospheric Administration (NOAA)
Local environmentalists and sportsmen
Albemarle Pamlico National Estuary Program
North Carolina Coastal Land Trust (NCCL)
Back Bay National Wildlife Refuge (BBNWR)
Mackay National Wildlife Refuge
Cape May Plant Materials Center
Virginia Department of Game and Inland Fisheries (VDGIF)
US Department of Agriculture
Background

- NE segment of Albemarle-Pamlico Sound
- Includes Currituck Sound, NC and Back Bay, VA and their surrounding watersheds
- Separated from the Atlantic by Outer Banks
- Sound is approximately 36 miles long, 3-8 mi wide and 153 mi² (~98,000 acres)
- Located predominately in Currituck and Dare Counties, NC and Virginia Beach County, VA
- Currituck Sound joins Back Bay in Virginia Beach, Virginia to the North and joins Albemarle Sound on the South
- Connected to the Atlantic Ocean through Albemarle Sound and Oregon Inlet
Background

2001 Scoping suggested that poor WQ was a driver of ecosystem degradation

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</table>
Background

- Collaborative multi-agency data collection initiative
- Developed a hydrologic/hydrodynamic and water quality monitoring and modeling group
- Data collection facilitated development of coupled hydrodynamic and water quality models of Currituck Sound and vicinity
  - ADCIRC, CH3D, CE-QUAL-ICM
Background

• **Wind driven Tide**
  - Wind direction, speed, and duration, are key factors in the tidal influence of Currituck Sound
  - Higher water levels result from a South wind and low water levels from North wind

• **Limited Flushing**
  - Simulated tracer concentrations in Currituck Sound were not influenced by Oregon inlet
  - Limited impact of the tributary inflows
Background

- Monitoring showed current nutrient loadings to the system are not as high as previously perceived and WQ is not as degraded as historically observed
  - Nitrogen and phosphorous values - within an acceptable range
  - Algal levels - normal
  - DO levels - low at times at certain locations but were not indicative of a major problem
  - Light penetration - reduced by the presence of solids and algae in addition to color in the water column
Background

• SS concentrations in the open water - higher than SS in the tributaries

• Source of the SS from within the Sound - result of sediment re-suspension caused by high energy wind-wave events

• Re-suspension associated with loss of SAV
Background

- Coordinated with USACE Engineering Research and Development Center (ERDC)
- Describes the general functional relationships among essential components of ecosystem
- Helped identify significant ecological resources; conditions governing resources
- Documented drivers and stressors
- Helped tell the story of “how the system works”
Background

Using GIS - it was determined that erosion is a significant problem within the Sound

- 1952 imagery overlaid with 2005 imagery to measure the distance of eroding shoreline
- Analysis sites based on fetch, boat wakes, shoreline type, and exposure direction
- 905 erosion vectors created throughout the Sound
Background

Currituck Sound & Back Bay  
Shoreline Loss 1952-2005

- Island Shorelines
- Mainland Shoreline

Shoreline Location

- Hardened
- Internal Channel/ protected
- Exposed/Semi-exposed

Marsh Erosion
Background

Public Meetings - September 28 & 29, 2010

• Present study findings
• Solicit feedback on problems

NOI for preparation and release of a Draft EIS published in the *Federal Register* (volume 76, number 125) on June 29, 2011
### Background

The following problems were carried forward for further consideration:

- Sediment loading from upstream during high discharge events
- Loss of marsh sheetflow
- Loss of connectivity with the ocean through inlet closures
- Shoreline erosion – mainland marshes and islands
- Decline in wetlands – freshwater and coastal
- Blockage of coarse sediments from entering system
- Decline of SAV and other important habitat
- Decline in species biodiversity
- Decline in waterfowl
- Increase in exotic and invasive species

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**Screening Criteria (Y, N, Maybe)**

<table>
<thead>
<tr>
<th>Identified Problems</th>
<th>Nutrient Loading</th>
<th>Sediment Loading</th>
<th>Tidal Inlet Closure</th>
<th>Habitat Loss</th>
<th>Water Quality and Hydrologic Connectivity</th>
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<td>Is it Fixable?</td>
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**Water Quality and Hydrologic Connectivity**

- Sediment loading from upstream during high discharge events
- Loss of marsh sheetflow
- Loss of connectivity with the ocean through inlet closures
- Shoreline erosion – mainland marshes and islands
- Blockage of coarse sediments from entering system
- Decline in wetlands – freshwater and coastal
- Decline of SAV and other important habitat
- Decline in species biodiversity
- Decline in waterfowl
- Increase in exotic and invasive species

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**Nutrient Loading**

- Septic Leakage
  - Is it Fixable? YES
  - Is it a Problem? YES
  - Within Scope of the Study? YES
  - Problem Addressed by Others? MAYBE
- Princess Ann Road Causeway And Corey’s Ditch - Loss of Marsh Sheetflow
  - Is it Fixable? MAYBE
  - Is it a Problem? MAYBE
  - Within Scope of the Study? MAYBE
  - Problem Addressed by Others? YES
- Population Growth and Development
  - Is it Fixable? NO
  - Is it a Problem? YES
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Agriculture Land-use Practices
  - Is it Fixable? MAYBE
  - Is it a Problem? MAYBE
  - Within Scope of the Study? MAYBE
  - Problem Addressed by Others? YES

**Turbidity**

- Pulsed Upstream Sediment Loadings (i.e. High Rain Events) from Farming Development, etc.
  - Is it Fixable? MAYBE
  - Is it a Problem? MAYBE
  - Within Scope of the Study? MAYBE
  - Problem Addressed by Others? MAYBE
- Wind Driven Re-suspension of Sediment Within Currituck Sound
  - Is it Fixable? YES
  - Is it a Problem? YES
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Change in Sediment Composition (i.e. Organic Inputs from Erasian Milfoil Die-off)
  - Is it Fixable? MAYBE
  - Is it a Problem? MAYBE
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Sedimentation from Shoreline Erosion
  - Is it Fixable? YES
  - Is it a Problem? YES
  - Within Scope of the Study? YES
  - Problem Addressed by Others? YES
- Salinity
  - Dredging of Navigational Channels
    - Is it Fixable? NO
    - Is it a Problem? YES
    - Within Scope of the Study? NO
    - Problem Addressed by Others? NO
  - Great Bridge Lock
    - Is it Fixable? MAYBE
    - Is it a Problem? MAYBE
    - Within Scope of the Study? YES
    - Problem Addressed by Others? NO
  - North Landing River Lock
    - Is it Fixable? MAYBE
    - Is it a Problem? MAYBE
    - Within Scope of the Study? NO
    - Problem Addressed by Others? NO
  - Coinjock Canal
    - Is it Fixable? MAYBE
    - Is it a Problem? MAYBE
    - Within Scope of the Study? NO
    - Problem Addressed by Others? NO
  - Diversion of Freshwater Flows (Decrease Freshwater Input to the System)
    - Is it Fixable? MAYBE
    - Is it a Problem? MAYBE
    - Within Scope of the Study? NO
    - Problem Addressed by Others? NO
  - Drought
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    - Is it a Problem? MAYBE
    - Within Scope of the Study? NO
    - Problem Addressed by Others? NO
  - Saltwater Pumping
    - Is it Fixable? YES
    - Is it a Problem? NO
    - Within Scope of the Study? NO
    - Problem Addressed by Others? NO
  - Canal #2
    - Is it Fixable? MAYBE
    - Is it a Problem? MAYBE
    - Within Scope of the Study? NO
    - Problem Addressed by Others? NO
  - Diversion of Great Dismal Swamp Inputs
    - Is it Fixable? MAYBE
    - Is it a Problem? MAYBE
    - Within Scope of the Study? NO
    - Problem Addressed by Others? NO
  - Joyce Creek
    - Is it Fixable? MAYBE
    - Is it a Problem? MAYBE
    - Within Scope of the Study? NO
    - Problem Addressed by Others? NO
  - Freshwater Diversion and Withdrawals for Consumption
    - Is it Fixable? YES
    - Is it a Problem? NO
    - Within Scope of the Study? NO
    - Problem Addressed by Others? NO
- Connectivity

**Wetland Loss**

- Mainland Shoreline Erosion- marshes
  - Is it Fixable? YES
  - Is it a Problem? YES
  - Within Scope of the Study? YES
  - Problem Addressed by Others? NO
- Marsh Island Erosion/Loss
  - Is it Fixable? YES
  - Is it a Problem? MAYBE
  - Within Scope of the Study? MAYBE
  - Problem Addressed by Others? MAYBE
- Wetland Conversion to Agriculture, Forestry, and Developed Lands
  - Is it Fixable? NO
  - Is it a Problem? MAYBE
  - Within Scope of the Study? MAYBE
  - Problem Addressed by Others? MAYBE
- Ditching and Draining of Wetlands
  - Is it Fixable? YES
  - Is it a Problem? MAYBE
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Decline in Freshwater Wetlands
  - Is it Fixable? YES
  - Is it a Problem? YES
  - Within Scope of the Study? YES
  - Problem Addressed by Others? NO
- Decline in Coastal Emergent Marsh
  - Is it Fixable? YES
  - Is it a Problem? YES
  - Within Scope of the Study? YES
  - Problem Addressed by Others? MAYBE

**Sediment**

- Minimal Flushing - Accumulation of Upland and Riverine Sediments
  - Is it Fixable? MAYBE
  - Is it a Problem? MAYBE
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Contaminated Sediments
  - Is it Fixable? MAYBE
  - Is it a Problem? MAYBE
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Anthropogenic Blockage of Coarse Sediment Influx to the System (i.e. Overwash Events)
  - Is it Fixable? YES
  - Is it a Problem? YES
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Historic Unconfined Disposal of Sediment (i.e. Sidecast Dredging)
  - Is it Fixable? YES
  - Is it a Problem? YES
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Need for Dredging to Fulfill Authorized Depths - Turbidity Associated with Vessel Activity
  - Is it Fixable? YES
  - Is it a Problem? NO
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- No Capacity Within Current Confined Disposal Facilities (CDF’s)
  - Is it Fixable? YES
  - Is it a Problem? NO
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Seasonal Die-Off of SAV
  - Is it Fixable? NO
  - Is it a Problem? NO
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Waterfowl Decline
  - Is it Fixable? YES
  - Is it a Problem? YES
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- SAV Decline
  - Is it Fixable? YES
  - Is it a Problem? YES
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Exotic Species (i.e. Phragmites australis, Eurasion watermilfoil)
  - Is it Fixable? YES
  - Is it a Problem? YES
  - Within Scope of the Study? MAYBE
  - Problem Addressed by Others? MAYBE
- Lack of Ecosystem Function (i.e. Connectivity Between Habitats)
  - Is it Fixable? YES
  - Is it a Problem? MAYBE
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Decline in Black Bass Populations
  - Is it Fixable? NO
  - Is it a Problem? NO
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Decline in Biodiversity
  - Is it Fixable? YES
  - Is it a Problem? NO
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  - Problem Addressed by Others? NO
- Decline in Nesting Island Habitat
  - Is it Fixable? YES
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- Blockage to Anadromous Fish Spawning Habitat
  - Is it Fixable? MAYBE
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  - Problem Addressed by Others? MAYBE
- Vessel Prop wash and Wake Impacts to SAV
  - Is it Fixable? YES
  - Is it a Problem? NO
  - Within Scope of the Study? NO
  - Problem Addressed by Others? NO
- Decline in Fish Habitat Diversity
  - Is it Fixable? YES
  - Is it a Problem? NO
  - Within Scope of the Study? YES
  - Problem Addressed by Others? NO

**Biota**
Background

Alteration of the natural coastal processes in the CSER area has resulted in the creation of a unique wind-tide driven oligohaline back barrier ecosystem. This ecosystem, which once supported an abundance of submerged aquatic vegetation, coastal marshes, and islands and associated wildlife and fisheries, has been degraded as a result of anthropogenic activities in the Sound and surrounding watershed. Areal extent of these keystone habitats has declined, weakening their interconnectedness and altering energy regimes throughout the Sound thereby reducing their capacity for self repair. This facilitates a negative feedback that continues to destabilize the ecosystem by reinforcing change and causing continued site alteration.
Historic Overview

- Salt water system connected to the Atlantic Ocean by series of inlets
- Five known historic inlets from early 1600’s to early 1800’s
- Last inlet closed mid-1800’s (Caffey’s)
- Hydrology also affected by other anthropogenic (i.e. navigation channels) and natural events (storms)
Historic Overview

- Significant population and development in the northern portion of the study area and along the outer banks
- Predominance of historic and current agricultural land use throughout the watershed
- 2 major tributaries supply majority of freshwater to Sound:
  - North Landing River – drains 117 mi²; channelized entire length; part of AIWW
  - Northwest River drains 196 mi²
Historic Overview

• Upon closure of historic inlets >100 mi² of lunar tidal brackish marsh converted to wind tide driven fresh (<0.5 ppt) to oligohaline (0.5-5 ppt) system
• Transition to freshwater fisheries and increased waterfowl use
• Significant shifts diversity and abundance

• Now rare and nationally significant habitat
  • SAV/ Coastal Marsh and Shallow Water Complexes
    • Supports large sport fishing and hunting industry unique Currituck Sound
    • Only remaining wading bird rookery island provides critical nesting habitat
Historic Overview

- Back barrier marsh complexes - starved of coarse sediment loads from overwash & wind driven transport
- Sandy habitat for shorebirds - converted to a vegetated & stabilized community
- Loss of back barrier marsh and bird nesting habitat due to erosion
- Significant portions of marshes invaded by *Phragmites australis*
- Prior to the mid-1980s, NC had lost ~50% of original wetlands acreage.
Historic Overview

- Three significant declines in SAV since 1920’s
  - 1920’s: decline after lock opening & enlargement of Chesapeake and Albemarle Canal
  - Mid-1960’s: major decline of SAV in Back Bay
    - first observance of *Eurasian watermilfoil* (1964) - Dominate species (1967)
  - Late 1970’s: < ½ of early 1970’s population
    - Changes in biomass & distribution attributed primarily to increased turbidity & turbulence resulting from unusual weather during the early growing season of 1978
- Continued decline in SAV since the late 1970’s

![Submerged Aquatic Vegetation](chart)
Historic Overview

- The *Eurasian watermilfoil* boom –
  - Outcompeted native species
  - Short term habitat improvement
  - Increase in freshwater fish species abundance
  - Long term decline in habitat sustainability

- 1980’s Significant mass die-off of *Eurasian watermilfoil*
  - Substrate was left devoid of vegetation
  - More vulnerable to re-suspension of sediment
  - Organic load to the system
  - Increased clarity issues
Historic Overview

Habitat - Submerged Aquatic Vegetation

SAV present in the 1960's but absent in 2003

SAV present in 2003
**Historic Overview**

- Historically, gulls and tern nesting colonies were on natural beaches.
- Expansive beach development has degraded areas for nesting.
- New alternative estuarine island nesting sites resulted from island building for dredged material disposal.
- Most current nesting occurs in the estuary & almost half of all nesting sites are on man altered substrate since the 1970s.
Historic Overview

- Historically most heronries in coastal swamps
- Logging has degraded or eliminated areas for nesting
- It is believed historically - multiple wading bird nesting sites throughout Currituck Sound
- Monkey Island currently only remaining wading bird nesting habitat in study area
- Monkey Island -
  - 1952 - 8.4 ac,
  - 2005 - 5.1 ac
  - 2010 - 4.4 ac

Note: For constructed wading bird nesting islands, a size range of 5-25 ac is recommended
Historic Overview

Comparison of 1952 to 2005 shorelines at Monkey Island using aerial imagery and measurement of erosion vectors.
### Historic Overview

**Monkey Island, Currituck Sound NC**

#### Number of Nests by Species

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<td>278</td>
<td>123</td>
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<td>Glossy Ibis</td>
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<td>84</td>
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<tr>
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#### Average Number of Nest

- **Y-axis:** 0, 200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800
- **X-axis:** 1970s, 1980s, 1990s, 2000s

#### Habitat – Wading Bird Nesting
Systems Context

- Altered hydrology & landforms
- Altered water quality
- Altered substrate
- Decreased water clarity
- Increased water energy
- Increased erosion & wetland loss

Change in SAV abundance & distribution

Conceptual Model of Ecosystem Interactions
As a consequence of the intricate interactions and dependencies of the SAV and coastal marsh habitats, degradation and/or loss of one habitat has a huge negative implication to the other and to system quality. As a result, they cannot be considered as separate systems.

For this Study – these systems will be referred to as Submerged Aquatic Vegetation/ Coastal Marsh and Shallow Water Complexes
Existing Conditions

- SAV - significant natural resource in the study area
- SAV habitat - close to shore and among marsh islands
- Majority on the back side of the barrier beaches - associated with the lee-side of the marsh communities
- 9,857 acres of SAV Back Bay and Currituck Sound in 2001
- Back Bay - approximately 5% of its SAV distributions of 25 years ago
Existing Condition

Within the study area, large areas of marsh that once provided wind breaks (which reduce fetch and calm shallow waters), bird rookeries, and aquatic habitat have eroded away.

Documentation of Land Loss
• 1951-52 USGS aerial photography
• 2005 Satellite images
• 3 high quality image pairs analyzed

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Type</th>
<th>1952-53 Acres</th>
<th>2005 Acres</th>
<th>Acres lost</th>
<th>Percent Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faraby Island</td>
<td>Marsh Island</td>
<td>14</td>
<td>1</td>
<td>13</td>
<td>93%</td>
</tr>
<tr>
<td>Porpoise Point</td>
<td>Mainland Marsh</td>
<td>278</td>
<td>225</td>
<td>53</td>
<td>19%</td>
</tr>
<tr>
<td>Monkey Island</td>
<td>Wooded Island</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>38%</td>
</tr>
</tbody>
</table>
Existing Conditions

Development, beach driving, and associated disturbance factors on Currituck Banks have eliminated the piping plover and American oystercatcher from the study area and significant declines in least tern numbers are also evident

• In 1992 – 4 least tern colonies existed with 3-6 nests at each site; 2004 – 2 nests; and in 2010 – 1 nest.

Terns generally prefer bare or nearly bare substrates
Existing Conditions

- Monkey Island supports herons, egrets, and ibis
- Often holds the largest little blue heron colony in the state
- Continued erosion of Monkey Island is currently decreasing the amount of available nesting habitat
- Nest crowding is apparent and is increasing.
- Increased accumulation bird feces could kill vegetation through soil acidification reducing appropriate nesting trees
- Monkey Island supports tidal wetlands and shelters about 3 acres of SAV from wind and wave attack
Future Without Project

• Based on coastal land loss tends ~ 430 ac of estuarine marsh could be lost in the Currituck Sound Study Area every 6 years, or 3,600 acres over a 50 year period of analysis.

• The possibility of submergence and marsh loss due to increased sea level and/or land subsidence has been identified as a concern for the marshes of the project area as well as the lower meso-tidal and micro-tidal marsh environments of the surrounding region.

• In Currituck Sound and Back Bay wind and wave erosion is causing extensive wetland shoreline and marsh island loss which is expected to worsen with continued sea level rise.

  • In Back Bay the SLAMM model suggests that due to the effects of increased salinity water depth, and wind fetch 2000 ac of estuarine marsh could be lost by 2050 (FWS).
Future Without Project

- Continuation of current SAV population trend of relatively stable populations well below historic potential

- Without a increased and /or sustainable "native" SAV population throughout the Sound, future *Eurasian watermilfoil* events could cause significant disruption to the system due to its boom/bust habit
Future Without Project

- Assuming a continued erosion rate of 0.14 ac/year and 2015 project construction date, Monkey Island would be expected to be less than 4 acres at the beginning of a federal project and under a no action scenario the island could be gone within the 50 year period of analysis.

- Continued erosion of Monkey Island will decreased the amount of available nesting habitat for wading birds

- Without action to stop island loss, impacts would be expected to result initially in fewer nests and eventually in rookery abandonment, when potential tree nesting site were no longer available.
<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>OPPORTUNITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of Submerged Aquatic Vegetation / Coastal Marsh and Shallow Water</td>
<td>Re-establish native SAV bed by planting and/or seeding</td>
</tr>
<tr>
<td>Habitat Complexes</td>
<td>Reclamation of lost acres of back barrier and mainland marsh and marsh islands within the Sound or the creation of new marsh habitat</td>
</tr>
<tr>
<td></td>
<td>Protect the shorelines of existing, restored, and created marshes</td>
</tr>
<tr>
<td></td>
<td>Establish multi-functional habitats and dredged material disposal islands that allow proper maintenance of the AIWW and provide</td>
</tr>
<tr>
<td></td>
<td>protected areas to establish SAV</td>
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<tr>
<td></td>
<td>Control and manage the invasive species, <em>Phragmites australis</em> and <em>Myriophyllum spicatum</em> (Eurasian Watermilfoil), in order to sustain</td>
</tr>
<tr>
<td></td>
<td>a diverse native habitat</td>
</tr>
<tr>
<td>Loss of Estuarine Islands and Waterbird Nesting Habitat</td>
<td>Protect and restore existing significant wading bird nesting habitats (i.e. Monkey Island).</td>
</tr>
<tr>
<td></td>
<td>Reclaim lost acres of back barrier and mainland marsh or create new marsh shorebird habitat</td>
</tr>
<tr>
<td>Historic Decline in Water Quality and Clarity</td>
<td>Restore native SAV beds and stabilize sediment and cycle nutrients</td>
</tr>
<tr>
<td></td>
<td>Create riparian buffers to help improve water quality by reducing turbidity, suspended solids, and nutrient loading</td>
</tr>
<tr>
<td></td>
<td>Create/restore marsh island and back barrier marsh features to help reduce fetch and minimize wave induced re-suspension of sediment</td>
</tr>
</tbody>
</table>
Site Selection

SDSS was used to identify areas which no longer contain these habitats & present high opportunity for restoration

GIS-based method for scaling, weighting, and combining multiple, spatially explicit variables for the purpose of identifying distinct areas within a larger landscape that present good opportunities for restoration of a particular resource.

Marsh Focus Areas

Nesting Island Focus Areas
Meetings were held with Federal, state, and local agencies, and stakeholders to obtain input on restoration needs and opportunities.
Site Selection

Locations:
• most degraded
• posing an opportunity
• need for restoration by the stakeholders

Overlaid on the map of areas identified as “high opportunity” for restoration by the SDSS

From the regions of overlap, general restoration opportunity areas were identified
Site Selection

- Web-meeting held with agency and non-governmental organizations
- Present the results of the SDSS
- Obtain assistance in further distinguishing degraded functions & values & opportunities within the identified sites
- Participants identified very specific restoration opportunities within each general area
Restoration Measures

Nonstructural:
- Habitat restoration
  - Control of Phragmites
  - Vegetative Plantings

Structural:
- Sediment Supply and Distribution (Marsh, Sand Island, Nesting Island)
  - Channel Dredging and Placement
  - Sediment Delivery from Distant Sources
- Shore Protection
  - Breakwaters
  - Marsh toe protection structures
  - Sills
- Hydrologic Restoration/Connectivity
  - Removal of existing impediments to sheetflow
  - Removal of existing impediments to overwash
  - Reestablish tidal exchange through the creation of inlets
  - Culverts
Restoration Alternative Formulation

Additional information is currently being collected for each site. Once this information is obtained, all possible measures and combination of measures that meet our objective and engineering requirements will be analyzed to identify the best combination of measures for each restoration site.

These site-specific combinations will form the basis for the assembly of preliminary alternatives and will be evaluated further in the evaluation and analysis of alternatives leading to determination of the Tentatively Selected Plan.
Questions