Expanding Benefits Associated with Navigation Infrastructure

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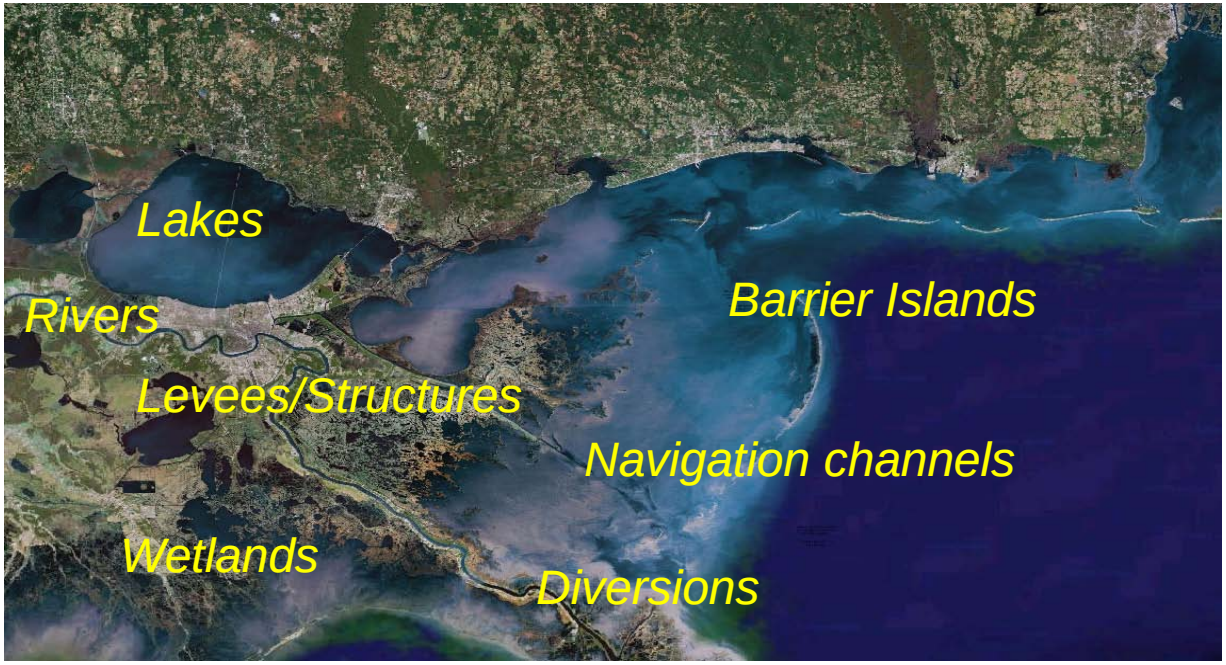
BUILDING STRONG®

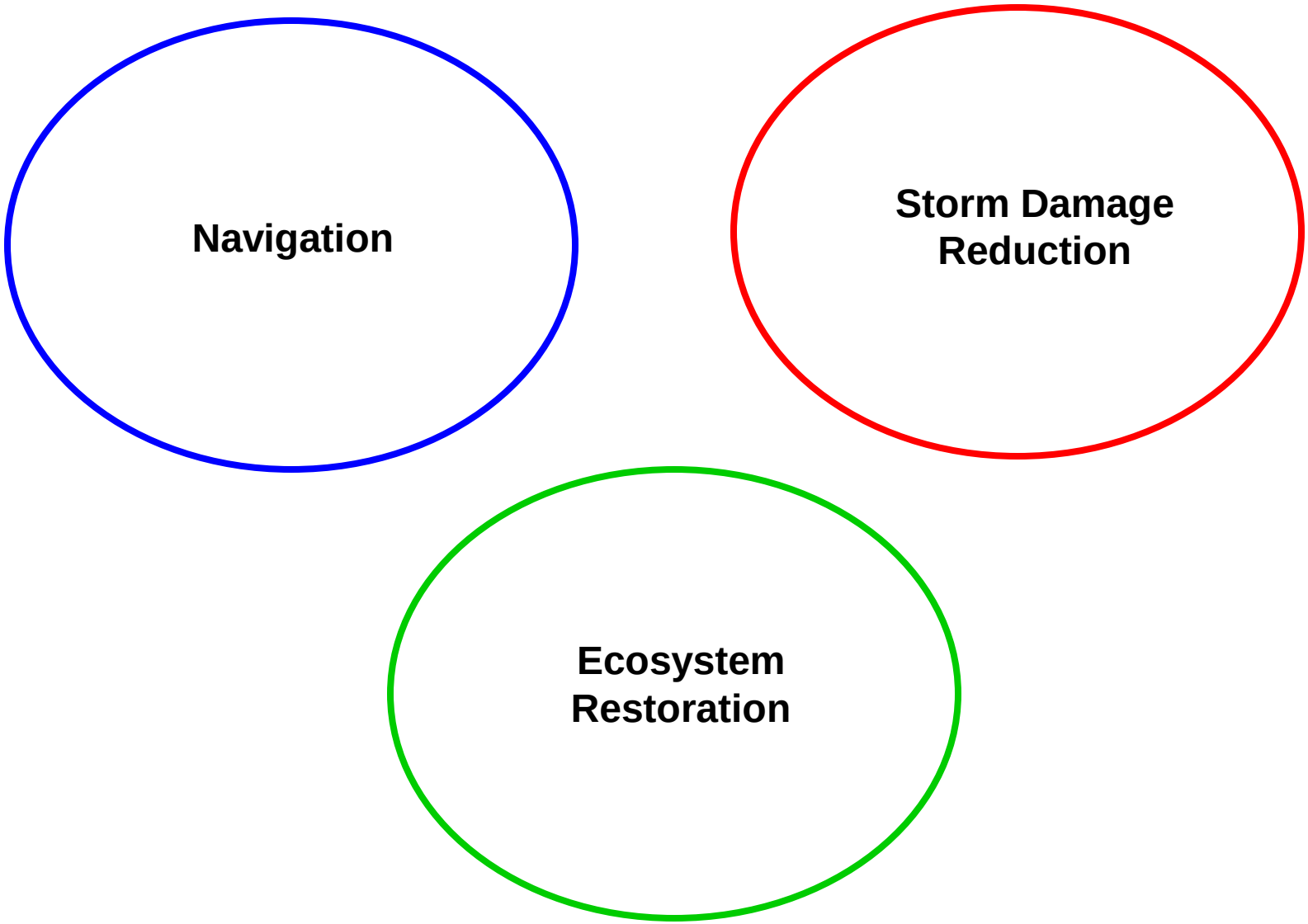
Systems Approach

Systems-based Analysis requires consideration of:

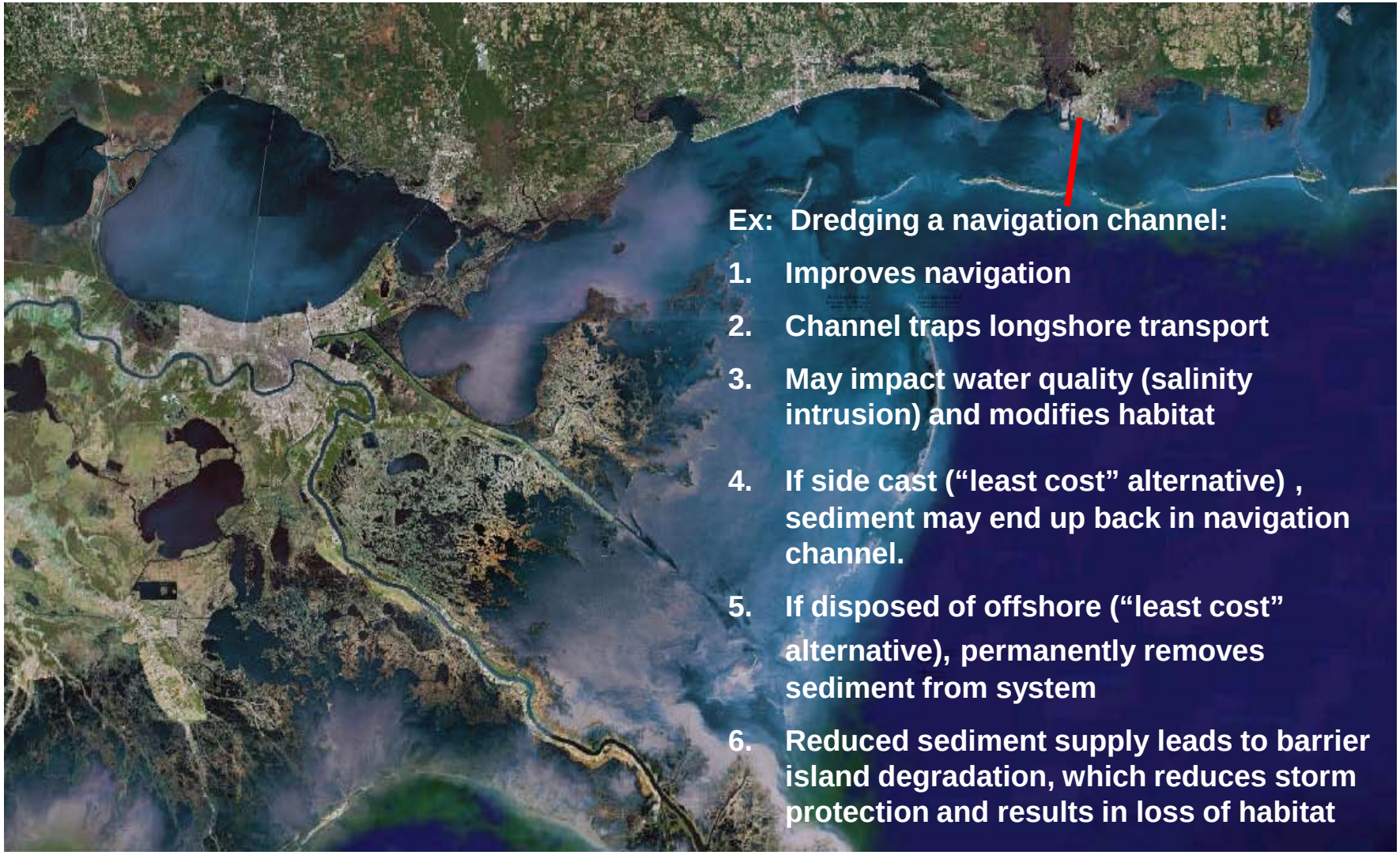
- Large Spatial Scales
- Long Temporal Scales
- Engineered System ⟷ Natural System (WwN)
- All mission areas and project types



Corps Mission Areas



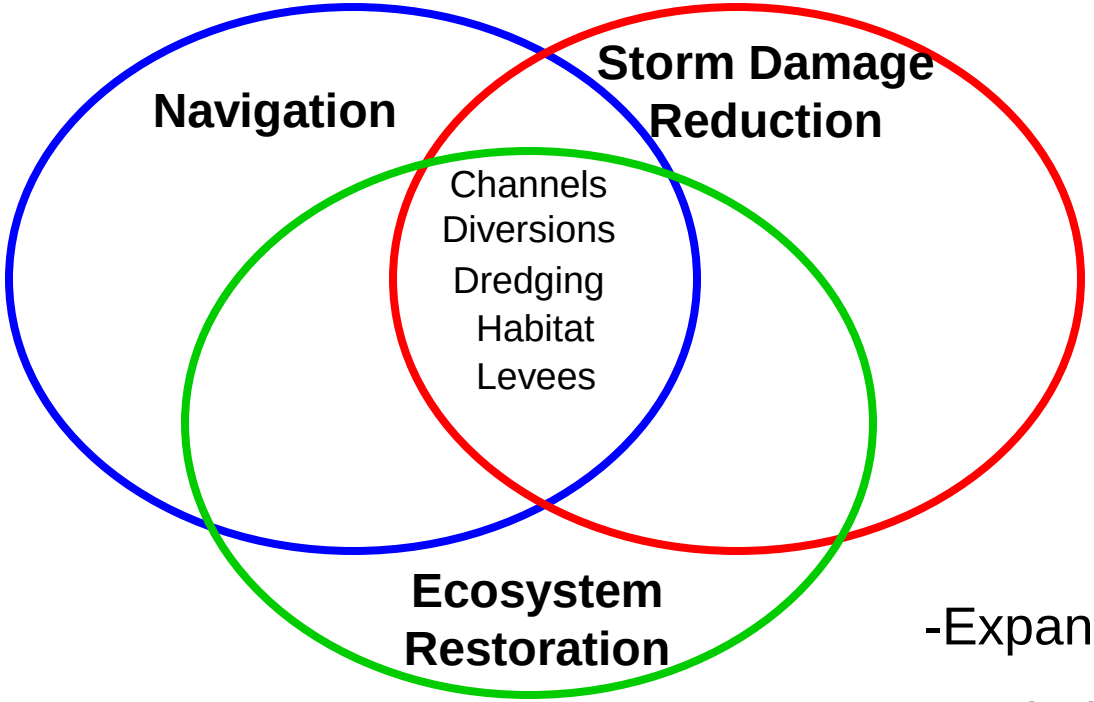
Systems Approach



Ex: Dredging a navigation channel:

1. **Improves navigation**
2. **Channel traps longshore transport**
3. **May impact water quality (salinity intrusion) and modifies habitat**
4. **If side cast (“least cost” alternative) , sediment may end up back in navigation channel.**
5. **If disposed of offshore (“least cost” alternative), permanently removes sediment from system**
6. **Reduced sediment supply leads to barrier island degradation, which reduces storm protection and results in loss of habitat**

Systems Approach



Corps Mission Areas

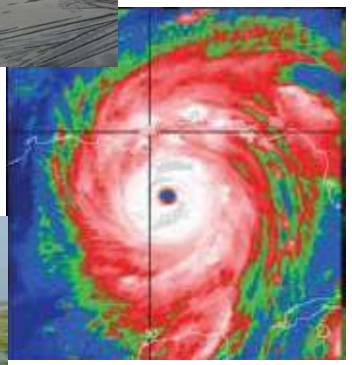
-Expanded Benefits

-Technical Issues

-Policy and Funding Issues

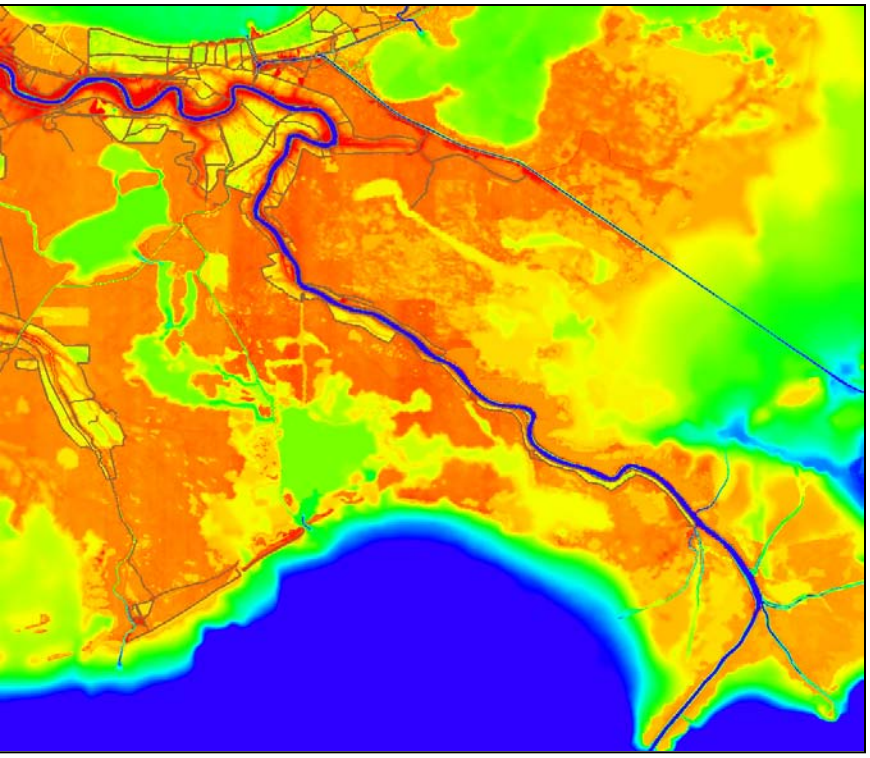
Expanded Benefits

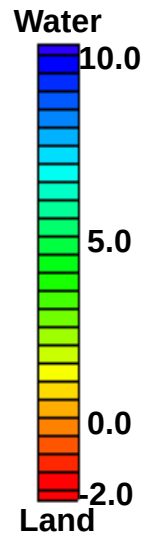
- Shoreline protection
- Storm damage reduction
- Habitat creation/restoration
- Water/sediment quality
- Recreation

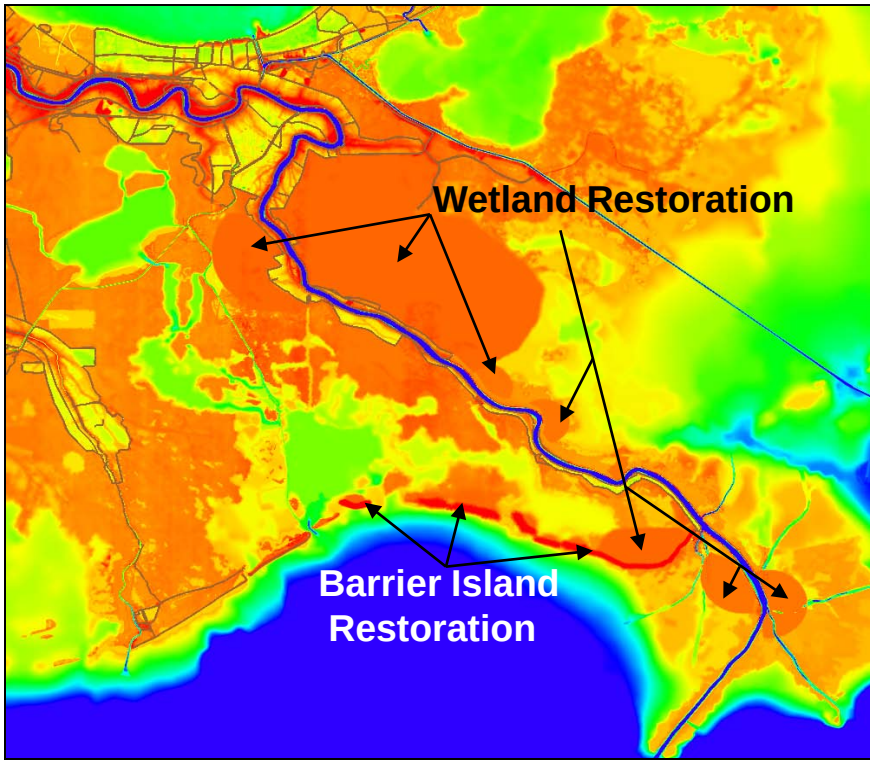


Science and Engineering Support

- Modeling
  - ADCIRC + STWAVE (storm surge and waves)
  - CH3D + SEDZLJ + ICM (water quality, sediments)
  - ADH







Base Condition

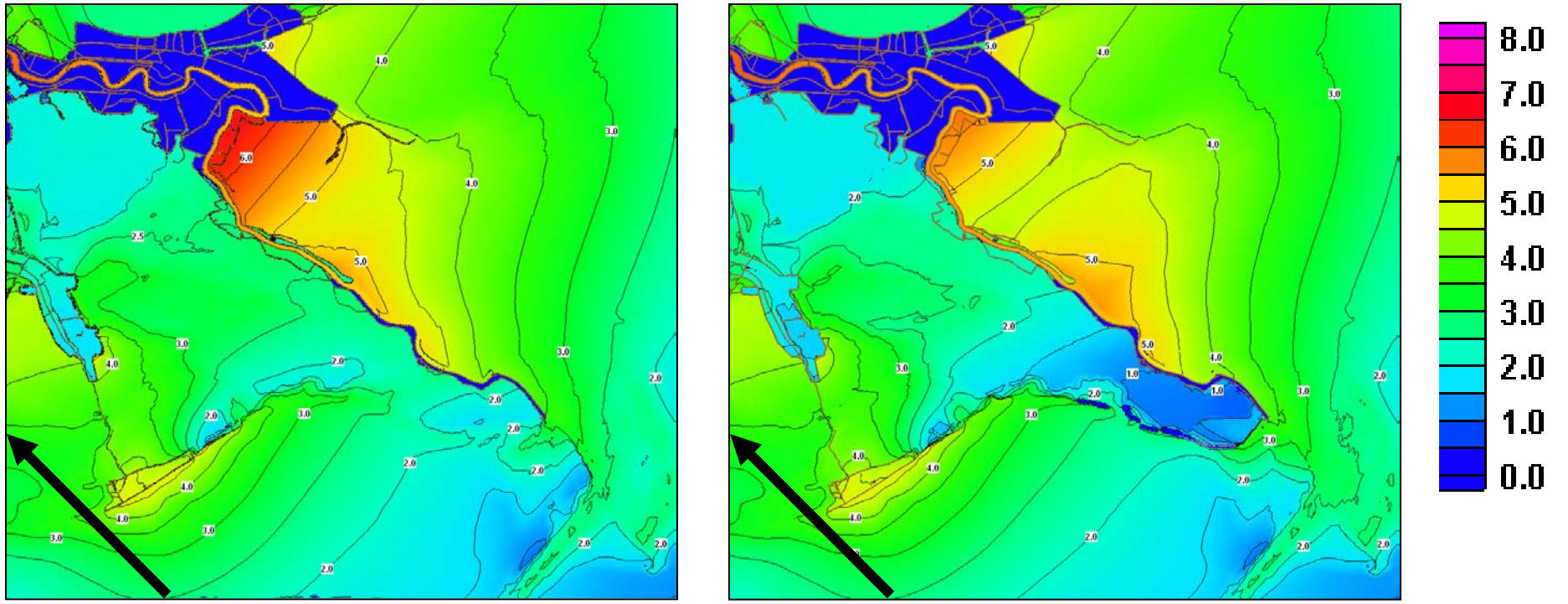
Restored Condition

Science and Engineering Support

Storm: Cp= 900 mb

Rm= 17.7 nm

Vf= 11 knots

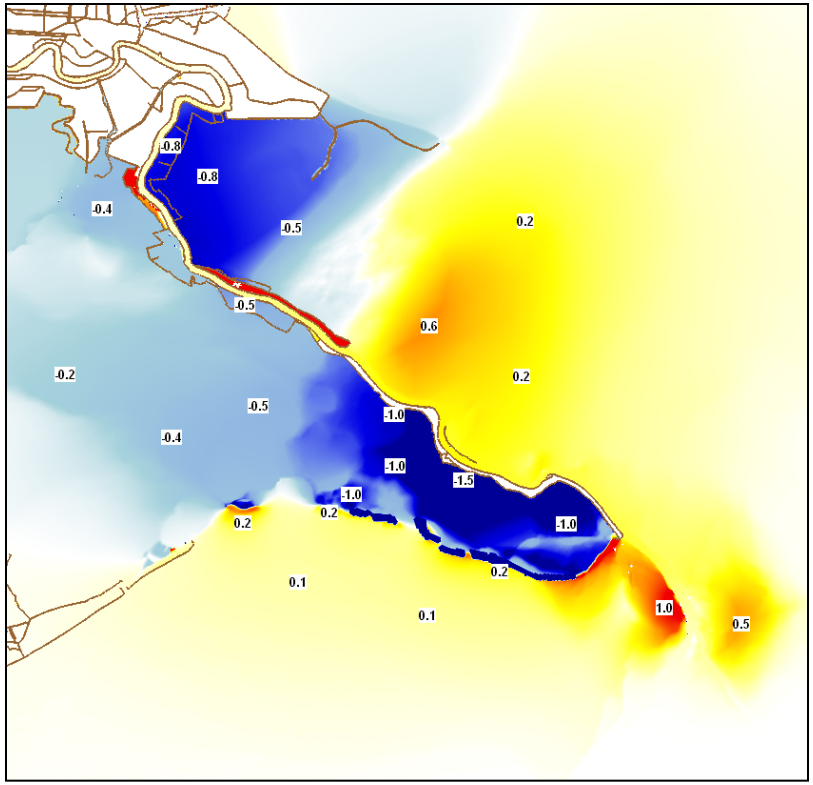


Base Condition

Restored Condition

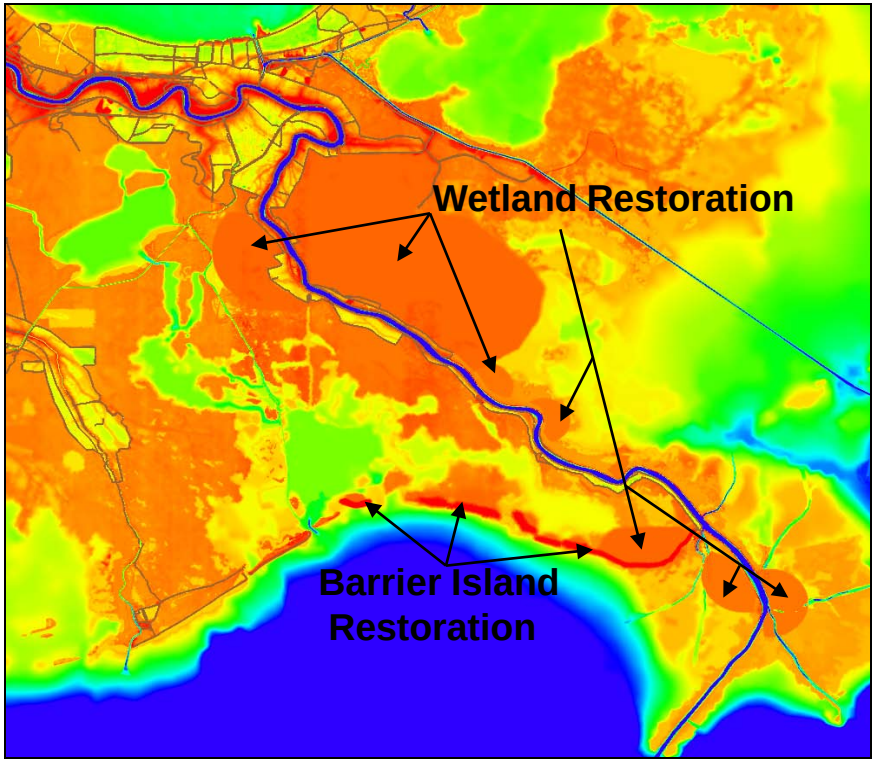
Peak Surge

Science and Engineering Support



Peak Surge: Restored - Base

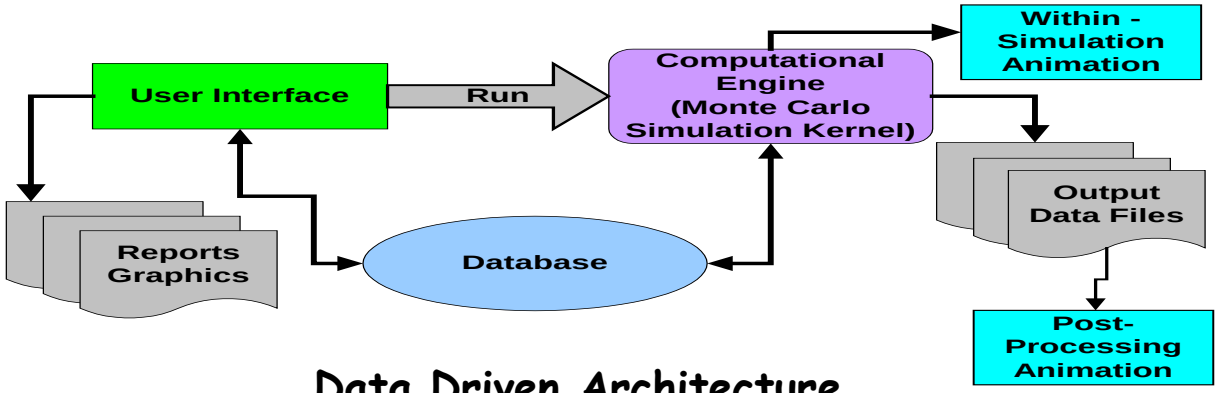
Restored Condition



Note: Does not include morphologic evolution

Science and Engineering Support

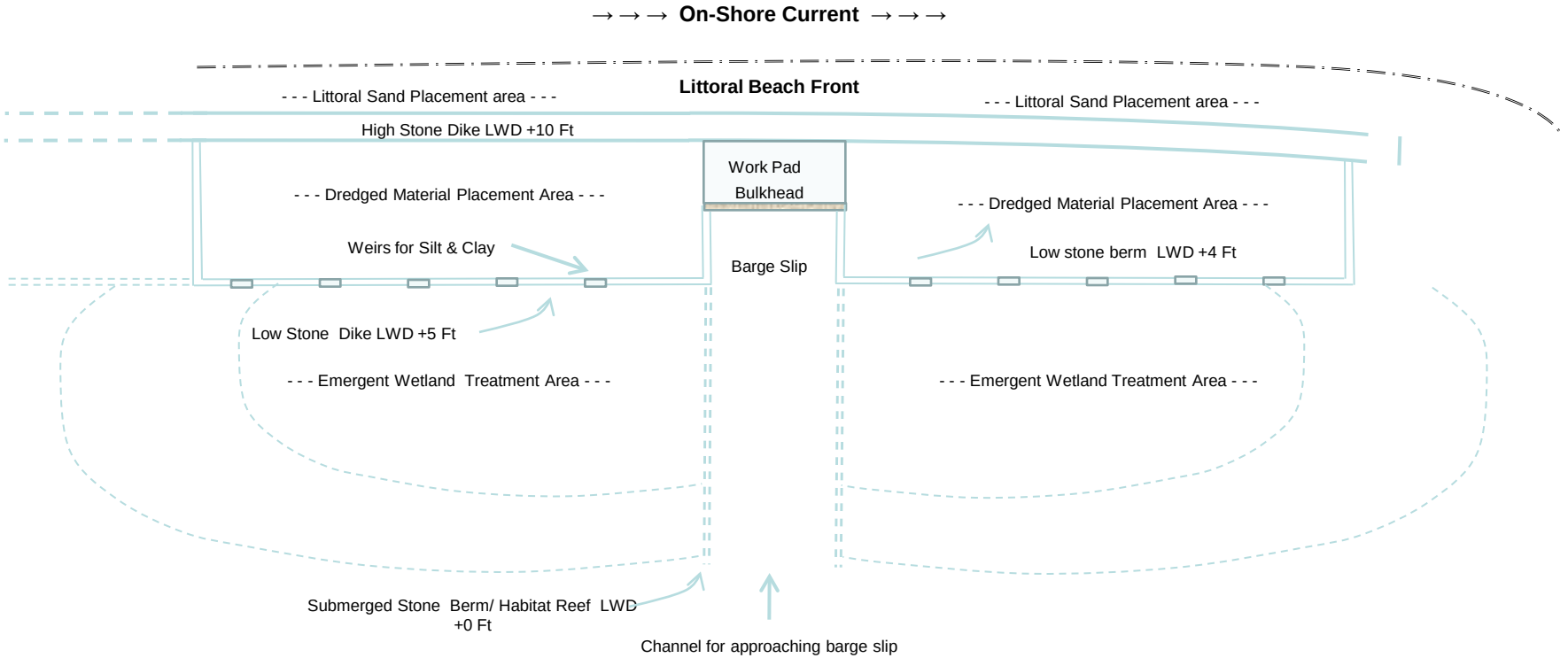
- Life-Cycle Modeling for Quantifying Benefits
  - Beach-fx – Framework for Beach Nourishment Projects
    - **Event-Driven Monte Carlo Simulation Model**
      - **Meteorologic / Coastal Process (long-term, background and short-term storm response) / Economics**
      - **Management Measures (Planned / Emergency)**
    - **Probabilistic Storm Sequence Generation**
    - **Determine Coastal Morphology Response**
    - **Calculate Damages**
      - **Erosion / Wave / Flooding / Land Loss**



Data Driven Architecture

Science and Engineering Support

- Innovative techniques / operations
  - Integration of dredged material management with storm protection, and habitat creation as an alternative to CDFs and Open Lake Placement: Engineered wetland breakwater

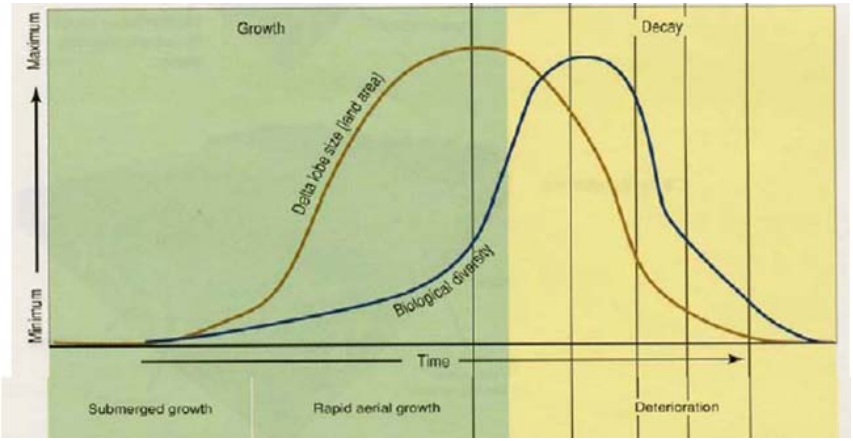


Benefits: treatment and remediation of toxicity in sediment, flood and erosion protection, wetland habitat creation

Science and Engineering Support

- Innovative techniques / operations
  - Continuous sediment removal to simulate effect of river diversion or to better accomplish beneficial use and accomplish dredging mission

Diversion Conundrum



Adapted from Gagliano and Van Beck (1975)

Existing diversion in Louisiana has not build land yet

AND

Increased shoaling in the navigation channel

Science and Engineering Support

- Innovative techniques / operations: Fixed or mobile bypass plant
  - If a river shoal is a renewable source, fixed bypassing plants similar to those applied at coastal inlets could be employed on rivers.
  - Nerang - ~650K cu yd bypassed annually at ~$1 /yd

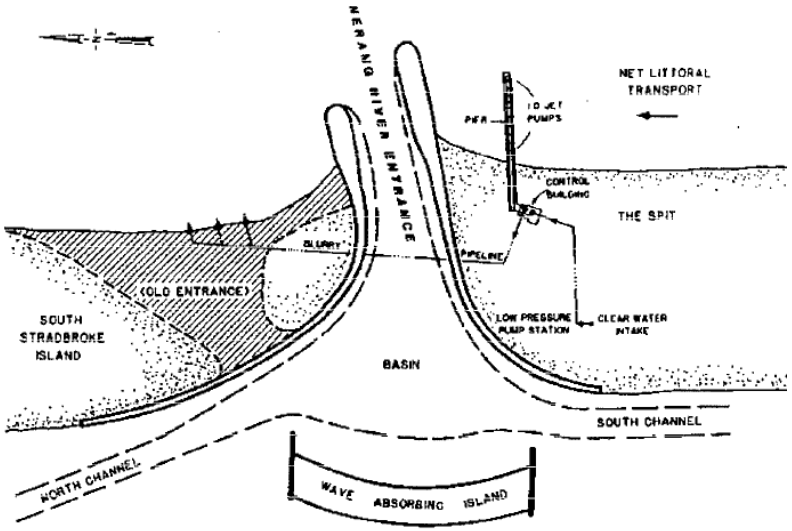
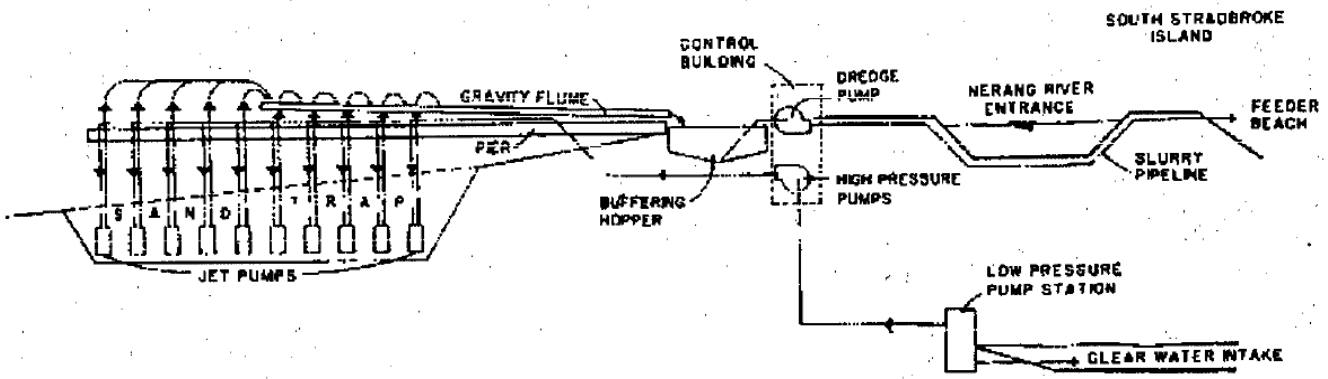


Figure 1. Nerang River Entrance Bypassing System



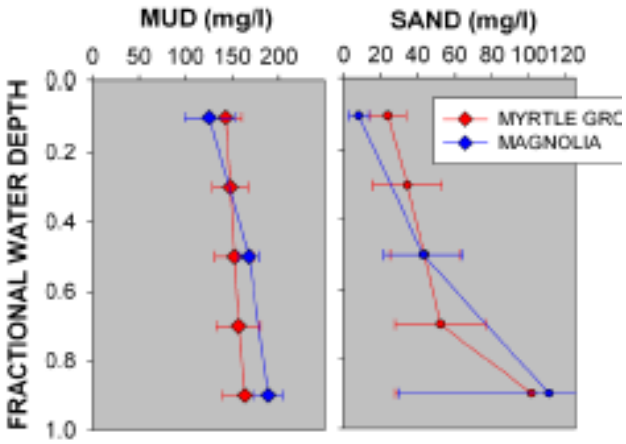
Science and Engineering Support

- Innovative techniques / operations: Bedload Capture

  - Streamside Systems manufactures bedload sediment removal systems for streams and small rivers.
  - Bedload is pumped to the surface as a slurry.
  - System can be linked to real-time gauges for optimal operation
  - A similar device could possibly be developed for application on larger rivers.

Science and Engineering Support

- Innovative techniques / operations: Siphon from depth
  - Similar to a traditional siphon, but one that pulls sediment from deeper in the water column where the greatest amounts of both sand and fines reside.



  - Could be combined with an outfall management plan that facilitates settling of fines

  - Could be combined with a sediment “concentrator” device such as a series of hydrocyclones and centrifuges

Science and Engineering Support

- Innovative techniques / operations: Hydrocyclone plant

  - Hydrocyclone plant to concentrate suspended sediments siphoned or pumped from the river at depth.
  - Concentrated sediment pumped to placement location.
  - “Clear” water returned to the river.
  - System could be constructed on barge to allow mobility along the river, maximizing sediment capture (in high sediment concentration zones) and minimizing pumping distances to disposal location