US Army Corps of Engineers®
Engineer Research and Development Center

Regional Sediment Management Program

New Orleans District

Description

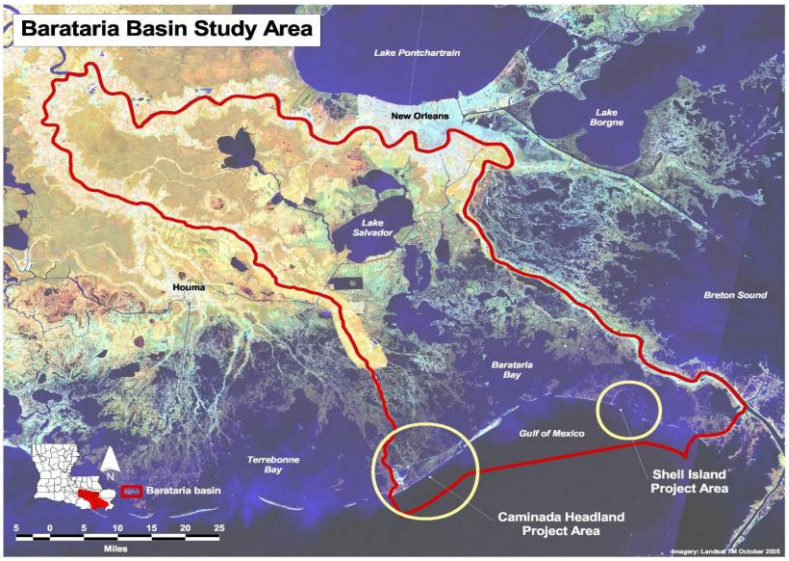
At the New Orleans District (MVN), we are developing and employing a vision for regional sediment management (RSM) that integrates projects and studies related by the sediment system and sediment resource needs. MVN has a critical need for RSM as we pioneer in protecting and restoring coastal and estuarine habitat, and as we uphold the Corps' mission of dredging waterways for navigation and protecting our state from flooding and storm damage. To address Louisiana's coastal protection and restoration needs; MVN has several ongoing programs and projects as part of the Louisiana Coastal Protection and Restoration Feasibility Study.

Issue

Louisiana is in critical need of mass quantities of sediment to increase elevations in estuaries to keep up with relative sea level rise rates into the future. Entire cities and communities have been lost and will continue to go away along with Louisiana's culture and history. Why is Louisiana's coastline important to the nation? Louisiana provides 25% of the continental U.S. commercial fisheries. The catch is comparable to the entire Atlantic seaboard, and triples that of the remaining Gulf States. Texas, Louisiana, Mississippi, and Alabama, produce 28.2% of United States Energy (Oil, gas, and coal) and have 47.1% of the nation's oil refining capacity. The Louisiana, Mississippi River Port Complex ranks #3 in worldwide total tonnage. The importance is clear, and the challenges are many. What does a sustainable Louisiana landscape look like? What are the sediment transport patterns along the coast? What can we do to keep sediments in the system? Which barrier islands do we restore? Understanding these issues is vital for coastal Louisiana and can be supported and addressed through Regional Sediment Management approaches.

Coastal sediment dynamics along Louisiana shorelines are complex and, to some extent, poorly understood. This is primarily due to the fact that sediment movement is not dominated by wave induced transport in the littoral zone but by processes associated with the abandonment phase of the delta cycle, storm impacts, and anthropogenic alterations to delta plain hydrology (Georgiou, I., H.D. Weathers, M.A. Kulp, M. Miner and D.J. Reed 2010, Interpretation of Regional Sediment Transport Pathways using Subsurface Geologic Data). Inconsistencies in transport rates reported in the literature underscore how much we still have to learn about long-shore and cross-shore transport patterns and rates.

The Louisiana Coastal Area (LCA) Barataria Basin Barrier Shoreline Restoration project was contingently authorized by Title VII of the Water Resources Act of 2007. The study will restore the geomorphic (physical) function of two barrier island chains. Restoration of the shoreline and coastal marshes of Caminada Headland and Shell Island would restore critical habitat, form and function, and long-term sustainability of the barrier shoreline.



Barrier shorelines in Louisiana separate the Gulf of Mexico from the interior estuaries and consist of three landforms: beaches, dunes, and marsh. Ship shoal, the nearest accessible sand source for much of the Barataria basin, is 40 miles from the Caminada headland. Thousands of oil and gas wells and pipelines prevent access to other shoals. An estimated 43 million cubic yards of material is required to construct and maintain these barrier shoreline projects over the 50 year period of analysis. Lack of accessible, suitable sediment as well as the high cost of transporting sediments makes shoreline restoration a major challenge. As part of the ongoing work to better understand the complexities in Louisiana's coastal environment, MVN is undertaking the development of an operational sediment budget in the Barataria Basin in partnership with the Engineering Research and Development Center (ERDC). Sediment budgets combined with numerical modeling can provide critical understanding of the estimated volume of sediment that will remain in a system over a period of analysis for different alternatives, under various sea level, wave and storm conditions and can determine when or if maintenance (renourishment) is required. This understanding is required to evaluate the sustainability of federal ecosystem benefits into the future.

Expected Products

Data Management: The files associated with the coastal change database developed for the Barataria Basin regions will be acquired and stored at MVN to provide a foundation and support to coastal process modeling efforts in ADCIRC and CMS. These data files include:

1) Polygons of geomorphic units (shore-face, tidal inlet channels, ebb/flood deltas, spits, back-barrier bays, sub-aerial barrier islands)
2) Raw and Adjusted Topo/Bathy Data sets with datum adjustments
3) Vibracore Data with datum adjustments

4) Spatial Interpolation polygons and resultant grids for various data
5) Volume Change results (separated by sands/fines if avail) for each geomorphic unit

Average Annual Hydrodynamic Conditions: This subtask will consist of evaluating WIS hind-cast conditions to determine historic average annual conditions in terms of wave and water level parameters. These will provide forcing components and boundary conditions for sediment transport rates reflective of long-term average conditions. In addition of representative conditions more recent short term wave gage observations (WAVCIS) will be analyzed as available.

Hydrodynamic and Sediment Coastal Modeling: This subtask will apply a multi-model approach with one way coupling using the large domain ADCIRC model, the Coastal Inlets Research Program's Coastal Modeling System (CMS) as well as the Adaptive Hydraulic (ADH) model to gain quantitative understanding of the hydrodynamics and sediment transport processes. The CMS and ADH model domains will be established within the Barataria Bay region. ADCIRC will provide tidal forcing and boundary conditions for the CMS, driven by tide and representative wave conditions. CMS will provide regional sediment transport flux values at various locations to assess the relative magnitudes and frequencies of over-wash and long-shore transport. CMS results will provide boundary forcing for a small domain ADH model. ADH simulations will be performed primarily to address fine grain sediment transport processes. Sediment characteristics including grain size curves will be established using all available data sets.

Regional Sediment Budget Development: The rate and direction of net and gross transport of sediment (separated into sand and finer fractions, as possible) throughout the Barataria coastal zone and within the riverine systems will be defined and used to develop a Base Condition Regional Sediment Budget within the Sediment Budget Analysis System for ArcView© (SBAS-A).

Alternative Analysis Framework: A Framework of several tools including CMS, ADH, and SBAS-A will provide the capability to quantitatively evaluate the impact of select engineering activities on the overall regional sediment system. A guidance document will provide suggested methods to evaluate engineering activities in a regional approach. Implementation of the framework will be performed for a finite number of alternative engineering activities developed by MVN.

Potential Users

Potential MVN Users of the Regional sediment budget include but are not limited to the Gulf Coast Ecosystem Restoration Task Force, the Gulf of Mexico Alliance Regional Sediment Management Master Plan, the CWPPRA program, LCA Barataria Basin Barrier Shoreline Restoration Study and other LCA studies, Operations Division, Engineering Division and our partnering agencies, including the Coastal Protection and Restoration Authority of Louisiana 2012 Coastal Master Plan, the Louisiana Department of Wildlife and Fisheries and numerous other federal and state agencies.

Projected Benefits

The regional sediment budget will provide critical understanding of sediment transport rates, pathways, sediment sinks and sources and hydrodynamic effects of planned sediment altering activities, some of which include, sediment mining, changes to inlets and jetties, and dedicated dredging barrier island restoration. Currently we have a very limited understanding of these sediment transport processes which hinders project planning and the ability to identify sustainability over the long term.

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Points of Contact

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Participating ERDC Laboratories/Partners

Regional Planning and Environmental Division South, New Orleans District, U.S. Army Corps of Engineers

Coastal and Hydraulics Laboratory, Engineering Research and Development Center, U.S. Army Corps of Engineers

Coastal Protection and Restoration Authority of Louisiana