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National Regional Sediment Management Program New Orleans District (MVN):

Sediment Budget for the Calcasieu Ship Channel (CSC) Based on Numerical Modeling and Geochemical Fingerprinting

Description

In recent years research has been conducted through the RSM program to evaluate previous sediment budgets for the Calcasieu Shipping Channel (CSC) system and identify possible source(s) of shoaling through numerical modeling and geochemical fingerprinting techniques. In this final year, the goal is to compile the data from these studies, along with CSC surveys analyzed with the Corps Shoaling Analysis Tool (CSAT), to develop a new sediment budget that may better match observed shoaling and dredging volumes. This holistic approach demonstrates the utility of incorporating physical, geochemical, and numerical data together to identify sediment sources and develop sediment budgets. As a final step, newly acquired geochemical data will be evaluated in conjunction with shoaling rates obtained from the Corps Shoaling Analysis Tool (CSAT), and sediment transport rates and pathways obtained from the Adaptive Hydraulics (AdH) model for the Calcasieu Basin.

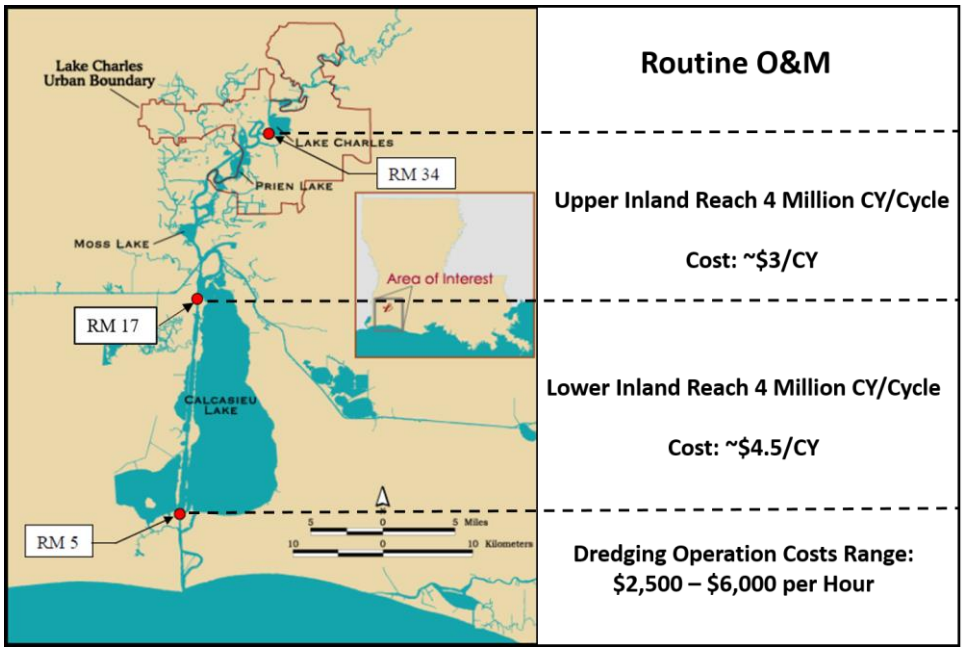

Figure 1. Map of the project area with annual O&M costs associated with each inland section of the CSC.

Issue/Challenge To Address

The Calcasieu Ship Channel (CSC) is a deep-draft federal channel located in Southwest Louisiana (Figure 1). It is the channelized lowermost segment of the Calcasieu River, connecting Lake Charles to the Gulf of Mexico. Maintenance dredging requirements for the inland reaches of the CSC are divided into two overlapping reaches. The lower "Mile 5 to 17" and upper "Mile 15 to 34" reaches are maintained on alternating Fiscal Year (FY) cycles, wherein approximately 4 million cubic yards is removed annually from the upper or lower reach in alternating years (Figure 1). The New Orleans District Office (MVN) have sponsored past sediment budget studies of the area, yet they were only able to account for approximately 20% of CSC dredging volumes (Fischenich, 2004). The RSM sponsored work described here, led by MVN and ERDC personnel, seeks to improve upon these sediment budgets by incorporating numerical modeling and geochemical data into the budget.

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Successes Lessons Learned

- The FY18 sediment budget conducted by Brown identified offshore sediment and surrounding regional marsh edges as additional potential sediment sources to CSC shoaling (Brown, in preparation).
- Simulations on an existing AdH/SEDLIB model suggested that offshore sediments could be transported into the CSC up to the intersection with the Gulf Intracoastal Waterway (GIWW) (Brown, in preparation).
- FY19 geochemical fingerprinting data supported Brown's model results indicating that significant amounts of offshore sediments were shoaling within the lower CSC (Mile 5-17). However, the fingerprinting results indicated that Brown's most recent sediment budget was likely overestimating sediment shoaling from regional bankline and wetland sources (Perkey et al. 2020).
- A sediment budget study conducted by the Water Institute of the Gulf (WIG) published in 2019 also suggested minimal sediment contribution to the CSC from regional wetlands and the adjacent Lake Calcasieu. This study also reported large temporal variability in sediments sourced to the CSC based on meteorological factors such as floods and tropical storms/hurricanes.
- FY20 data further support a temporal variability in the source of organic carbon associated with sediments within the lower CSC.

Expected Products

- Further identification of local sources of sediment to high shoaling regions in the CSC
- Evaluation of variability of shoaling and shoaling sources in response to meteorological events
- Comparison of CSAT shoaling data to AdH/SEDLIB model results for further validation of model results
- Final report and presentation

Stakeholders/Users

Stakeholders include the Lake Charles Harbor and Terminal District, and the Calcasieu River Waterway Harbor Safety Committee.

Projected Benefits Value Added

Dredging costs can be reduced through sediment mitigation efforts when sediment sources and transport pathways are properly identified. With this information, future costs are saved by abstaining from expensive engineering projects that do not significantly reduced sediment inputs, such as shoreline armoring. For example, results have already indicated that armoring the shoreline of Lake Calcasieu would have little impact on channel shoaling. In addition, the lessons learned from this effort may be applicable to other Federal navigation channels – potentially resulting in even greater cost savings and navigation efficiencies.

Leveraging Opportunities

This study leverages several existing and ongoing studies, which builds off of the FY 2018-FY 2020 RSM studies, as well as previous sediment budget studies performed by Channell et al. (2004), Fischenich (2004), and The Water Institute of the Gulf (2019). Additionally, the methods employed in this work were informed by work performed on Calumet River sediment sources (Perkey et al., 2017) and an FY20 Dredging Operations Technical Support (DOTS) sponsored effort to compile CSAT data within the CSC over the last 20 years.

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Participating Partners

There are no participating partners

References

Brown, Gary (in preparation). Investigation of Sources of Sediment Associated with Deposition in the Calcasieu Ship Channel. FY18 RSM project report prepared for US Army Engineer District, New Orleans.

Channell, Mike, Susan Bailey, and Landris Lee (2004) “Calcasieu River and Pass Dredged Material Sediment Study” DRAFT report prepared for US Army Engineer District, New Orleans.

Fischenich, Craig, J. (2004) “Calcasieu River and Ship Channel, Erosion and Sediment Impact Assessment (Phase 1)” DRAFT report prepared for US Army Engineer District, New Orleans.

Perkey, D.W.; Chappell, M.A.; Seiter, J.M.; Wadman, H.M. 2017. Identification of sediment sources to Calumet River through geochemical fingerprinting. ERDC TR-17-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Perkey, D.W.; Priestas, A.M.; Boyd, B.M.; Corbino, J.M.; and Moores, L.C. In Review. Geochemical Fingerprinting of Sediment Sources Associated with Deposition in the Calcasieu Ship Channel. ERDC TN-RSM-20-5. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

The Water Institute of the Gulf. 2019. “Identifying Sediment Sources and Optimizing Placement of Dredge Material to Protect Critical Infrastructure – Port of Lake Charles.” The Water Institute of the Gulf. Prepared for and funded by the Port of Lake Charles. Baton Rouge, LA.