Environmental Studies Program: Ongoing Studies

Study Area(s): National

Administered By: Marine Minerals Program

Title: Best Practices for Physical Process and Impact Assessment in Support of Beach Nourishment and Coastal Restoration Activities

BOEM Information Need(s) to be Addressed: Environmental analyses require an improved understanding of the nature, extent, and duration of potential physical impacts related to offshore dredging. Past analyses, focusing wave transformation and impacts along the adjacent shoreline, have generally predicted minor impacts related to dredging. As such, it is not clear if the current practice of site-specific physical process modeling is necessary for all projects that propose to use OCS sand resources. However, some of the key physical processes controlling impacts at the borrow area have not been considered and are still poorly understood.

Approx. Cost: $450 (in thousands) **Period of Performance:** FY 2010-2015

Description:

Background:

Since 1995 BOEM has funded over twenty physical process studies that have considered near-field and/or far-field impacts of dredging borrow areas on the U.S. Outer Continental Shelf (OCS). Past studies have concentrated on far-field shoreline impacts, focusing on wave transformation over the borrow area and induced gradients in longshore sediment transport potential, although a few recent efforts have studied longer-term morphological evolution at the borrow area. It is current practice for applicants to treat the potential wave transformation and sediment transport effects of proposed projects as part of the environmental review process in order to use OCS resources in beach nourishment or coastal restoration projects.

A recent literature review indicated that relatively few OCS projects are likely to cause discernible far-field impacts in context of natural variability, despite wide-ranging shelf slope and morphology, borrow area configurations, hydrodynamic setting, and meteorological forcing. Impacts are generally limited because of the relative depths and distances offshore of the proposed borrow areas. Predicted impacts to wave transformation and sediment transport potential are relatively infrequent and occur during severe storms that introduce significant and variable coastal change regardless of the assumed impacts of dredging. If more severe impacts are predicted, use of the borrow area is modified or precluded. The effects that seafloor modification due to dredging may have on near-field flow and sediment transport (i.e., within and adjacent to the borrow area) have not been typically analyzed.

The physical response at the borrow area is important to more fully understand dredge depression/pit migration and infilling, as well as margin, rim, and slope behavior, which in turn can influence far-field impacts. The degree of influence depends on dredge depression/pit location (*e.g.,* water depth, distance from shore), dredge depression/pit geometry (*e.g.,* length, width, depth), pit orientation (*e.g.,* the angle of critical axis and direction of flow), the magnitude and complexity of forcing, and adjacent bathymetry, sediment type, and bottom roughness elements.

Morphodynamic modeling can be a useful tool to help understand physical phenomena and evaluate potential near- and far-field impacts in such scenarios. It is recognized that the utility of such modeling approaches in site-specific application depends on calibration, validation, and/or sensitivity testing. Since modeling is time consuming and expensive owing largely to computational requirements, BOEM recognizes that modeling should be well-reasoned and useful. The application of these advanced tools may provide more much needed information about potential changes in nearshore and offshore waves and circulation, sediment transport, and morphologic evolution following dredging. From this improved understanding of physical processes, BOEM may begin to develop analysis criteria and general guidelines that would describe when and why site-specific modeling and higher-cost shoreline impact assessments would be required or could be precluded.

Objectives: Design and implement a morphological modeling approach in order to improve the present understanding of impacts to near-field and far-field physical processes (including morphologic response) related to the modification of offshore bathymetry due to dredging.

Methods: The contractor will identify a representative study area with adequate existing forcing and validation data to test a suite of models, including ROMS/Community Sediment Transport Model System, NearCOM, MIKE 21 Coastal Area Morphological Modeling Shell, and Coastal Modeling System against observed wave, current, sediment transport and morphologic response. The contractor will perform the necessary sensitivity testing for candidate models to assess the influence of model forcing, parameterizations, and process filtering. Each model will be skill assessed in terms of simulated wave, flows, and morphologic response. Best performing candidate models, including at least one community model, will be applied to a range of demonstrative geometries in schematized flat bed and sand ridge settings for typical and storm forcing.

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