Integrated Sediment Characterization Workflow for Offshore Wind Development

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Accurate characterization of seabed sediment distribution is critical for offshore wind development, particularly for sediment mobility assessments, cable routing, foundation design, and environmental evaluations. This study describes an integrated workflow developed through collaboration between Geosyntec Consultants, Inc., and Integral Consulting to delineate representative sediment boundaries across an approximately 240 km² offshore wind development area offshore New Jersey within the New York Bight. The workflow provides a more comprehensive, consistent, and efficient characterization of seabed sediment distribution.

Traditional sediment characterization approaches commonly rely on discrete grab samples and manually digitized sediment boundaries, which can introduce uncertainty when extrapolating conditions across large spatial extents and require labor-intensive interpretation. To provide for a more accurate characterization across an entire survey area, the workflow described in this study integrates direct sediment observations, acoustic datasets, and machine learning methods.

In this study, Geosyntec integrated sediment profile imagery plan view (SPI-PV) data, derived Coastal and Marine Ecological Classification Standard (CMECS) classifications, and high-resolution geophysical datasets to extend sediment interpretations across the survey area. The SPI-PV imagery and CMECS sediment classifications were correlated with observed side-scan sonar reflectivity responses and multibeam backscatter intensities to establish relationships between surficial sediment characteristics and acoustic response signatures. These relationships were incorporated into a machine-learning-assisted workflow designed to improve consistency in sediment boundary delineation and reduce interpretation bias. Resulting sediment polygons were then evaluated against regional geomorphic trends and then incorporated into sediment mobility analyses performed by Integral Consulting. This workflow improves sediment characterization across large offshore survey areas while supporting engineering and environmental assessments for offshore wind development.