



# **BOEM Cooperative Agreement Number M22AC00001**

Delaware Geological Survey

# Assessing 21st Century Offshore Beach Sand Supply and Demand in Delaware and Maryland

## **Cooperative Agreement Summary Report**

Performance Period: December 01, 2021 – November 30, 2023

Lead Agency: Delaware Geological Survey

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## **Overview**

This project assesses the long-term demand and supply of beach sand for coastal communities along the Atlantic coastline of Delaware and Maryland. These beaches are major regional economic drivers, and beach nourishment has become the primary form of coastline stabilization and restoration in the region due to its relative costs and benefits. Most beach communities currently utilize sand resources within state waters (< 3 miles from shore), but sourcing sand from federal waters further offshore is becoming increasingly common. The Bureau of Ocean Energy Management (BOEM) is tasked with sustainably managing and balancing development activities in federal waters, such as sand resource extraction, wind energy installations, and carbon sequestration. These competing interests are rapidly accelerating in the 21<sup>st</sup> century, and BOEM is taking proactive actions to avoid potential use conflicts and resource sterilization issues. This cooperative agreement with the Delaware Geological Survey (DGS) was made to support BOEM's long-term vision for offshore management by investigating past and future sand supply and demand for the Delaware and Maryland Atlantic coast. The specific goals of this work were to:

- Forecast sand needs: We aimed to establish a baseline of past sand resource needs based on historical beach nourishment data and forecast sand resource needs into the future under different scenarios reflecting potential climate change-driven increases in high impact storm surges.
- Estimate sand supply: We aimed to estimate when current sand borrow areas may become exhausted, prompting a need for new sand sources.
- Identify potential additional sand resources: We aimed to identify possible future sand resource areas to prioritize for further sediment characterization and reserve from other potential competing interests on the OCS.

The primary deliverables of this project are a Technical Report covering the overall approach and interpretation of project findings and an ESRI Geodatabase containing forecasts of sand needs, modeled offshore sand resources, and other datasets used as inputs in our analysis. Deliverables will be made available through the BOEM Marine Minerals Information System and possibly other online data distribution platforms.

# Cooperative Agreement Outputs and Deliverables for DGS\_M22AC00001

#### **Technical Report:**

Warner DL, Ramsey KW, Wunsch DR (Delaware Geological Survey, Newark, DE). 2023. Assessing 21<sup>st</sup> century offshore beach sand supply and demand in Delaware and Maryland. Sterling VA: U.S. Department of the Interior, Bureau of Ocean Energy Management. Agreement No.: M22AC00001.

#### Abstract:

This technical report details the motivation and methods for assessing beach sand supply and demand along the Atlantic coastline of Delaware and Maryland. Results are discussed for the full study region and for each major beach nourishment area individually. This study estimated that new sand resource areas will be needed for most beach communities in the mid-21<sup>st</sup> century, with a wide range of predicted sand demand depending on forecasting parameters. Many potential sand resource units were identified using a geospatial machine learning model. However, physical core data is sparse, and potential hazards and competing interests are abundant in the offshore environment. This report provides recommendations for regional sand resource planning to support BOEM's ongoing mission of sustainable coastal management.



Example of sand needs forecasts for Ocean City, MD. The spread of points indicates the random variation across 1000 bootstrapped forecast simulations. Grey points correspond to "S0", or known nourishments prior to 2021, while blue, green, yellow, and magenta points correspond to forecasts from S1, S2, S3, and S4 scenarios.

#### ESRI Geodatabase:

Warner DL, Ramsey KW, Wunsch DR (Delaware Geological Survey, Newark, DE). 2023. Assessing 21<sup>st</sup> century offshore beach sand supply and demand in Delaware and Maryland: Geospatial and Tabular Datasets. Sterling VA: U.S. Department of the Interior, Bureau of Ocean Energy Management. Agreement No.: M22AC00001.

#### Abstract:

This geodatabase contains datasets refined from historical beach nourishment records, sediment core descriptions, forecasted sand needs simulations, and sand resource quality model outputs. Detailed methods used to produce the data products in the associated Technical Report. All data are in standard ESRI file formats and each layer has corresponding metadata describing its purpose, production steps, and spatial reference information. This database will be made publicly available to support future coastal research efforts.

#### Associated Data Products:

- Polygon: DGS\_M22AC00001 Cooperative Agreement Study Area Polygon
- Polygon: General beach nourishment placement areas
- Polygon: Current and Backup Borrow Areas and Sand Resources for the Delaware and Maryland Atlantic Coasts
- Polygon: Modeled Sand Resource Units off the Delaware and Maryland Atlantic Coasts
- Grid: Modeled Sand Resource Quality off the Delaware and Maryland Atlantic Coast
- Grid: Segmented and Classified Modeled Sand Resource Quality off the Delaware and Maryland Atlantic Coast
- Table: Moving average of cumulative sand needs forecasted for DE and MD through 2100
- Table: Total cumulative forecasted sand needs 2021-2100
- Table: Input Vibracore Data for Modeling Offshore Sand Resource in Delaware and Maryland



Comparison of known sand resource areas (A) to those predicted by DGS's bathymetry-based Random Forests model (B). Sand resources were categorized based on the presence of confirmatory data and knowledge of off-limits areas. The "KnownOver" field in the attribute for the modeled sand resource units notes major overlaps with known sand resource areas.