Site Specific Exploration of Sand Resources, Offshore Delaware

Executive Summary and Proposal

Delaware Geological Survey

University of Delaware

August 27, 2019

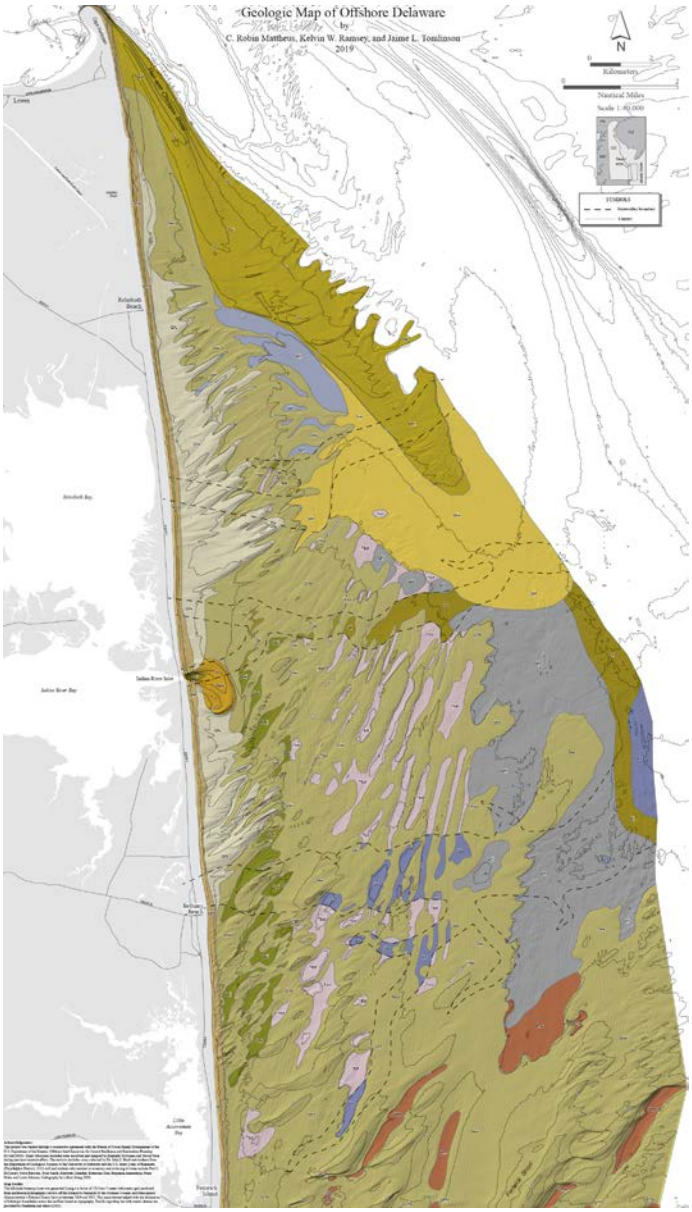

Figure 1. Geologic map offshore Delaware (Mattheus and Ramsey, 2019)

Summary of DGS Resource Assessment in Federal Waters

Since 2015, the Delaware Geological Survey (DGS) has participated in a cooperative effort with the U.S. Bureau of Ocean Energy Management (BOEM) to assess the area in Federal waters offshore Delaware for sand resources suitable for beach replenishment. Recently acquired vibracores and geophysical data have been integrated with archived core and geophysical data in order to better characterize sand-resources in Federal waters off the Delaware coast. The total dataset in this area comprises information from 69 sediment cores and 203 km of high-resolution 'chirper' seismic reflection data, which formed the basis for geologic mapping. Geologic mapping of the offshore (Ramsey and others, 2019) has allowed for extending the onshore geologic units that allow for understanding the distribution of offshore recent (Holocene) marine sediments that overlie the onshore units (Figure 1 on title page). From the mapping, a detailed understanding of the range of sediment textures within the map units provided the information that allowed DGS to determine which map units are most likely to contain sand resources. Geologic mapping of the Delaware shelf, based on lithologic constraints and regional mapping of major sediment layers, allowed for sand-volume assessments and grain-size data that provide textural constraints for resource assessment. This study used the CMECS classification system (Figure 2) and evaluated sand potentials on a geologic map-unit basis. The benefit of the CMECS classification is that is widely used for ecologic studies that will be a factor in permitting of potential sites for sand extraction.

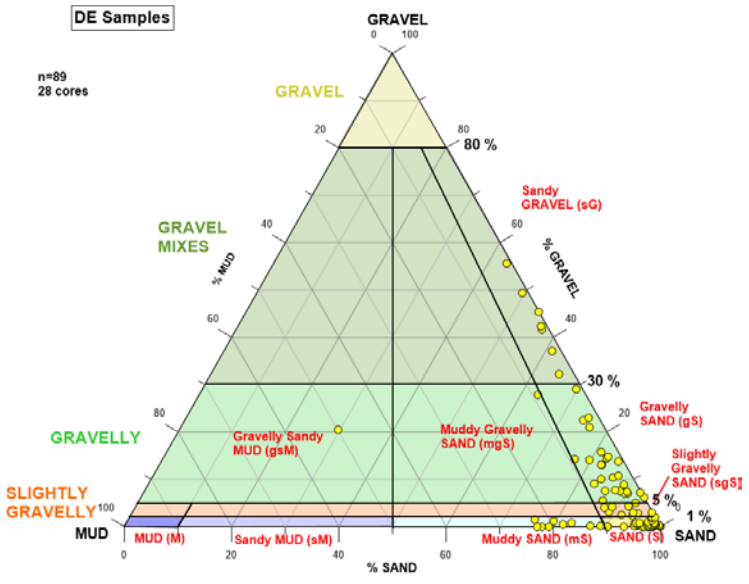

Figure 2. CMECS classification of sand textures in three pilot areas (Ramsey and others, 2019).

The seafloor geology across the study area is primarily sandy, but texturally heterogeneous. Beach quality sands for Delaware's shoreline are medium-grained with minimal amounts of gravel and shell. Similar sands have been identified and quantified across three distinct offshore areas (Figure 3) selected by BOEM as potential targets: 1) the distal portion of the Hen & Chickens Shoal, 2) a shoal situated around seven miles

seaward of Bethany Beach, and 3) the Fenwick Shoal offshore of Fenwick Island. Sand-volume estimates, assessed from seafloor position and the first high-amplitude subsurface seismic reflector are 108.5 million yd^3, 26.4 million yd^3, and 297.2 million yd^3, respectively. These sand bodies comprised of beach-quality sand, lie over older muddy valley fills, gravelly portions of the Beaverdam Formation, and/or gravelly transgressive lag deposits, which all unsuitable options for beach nourishment based on sediment texture.

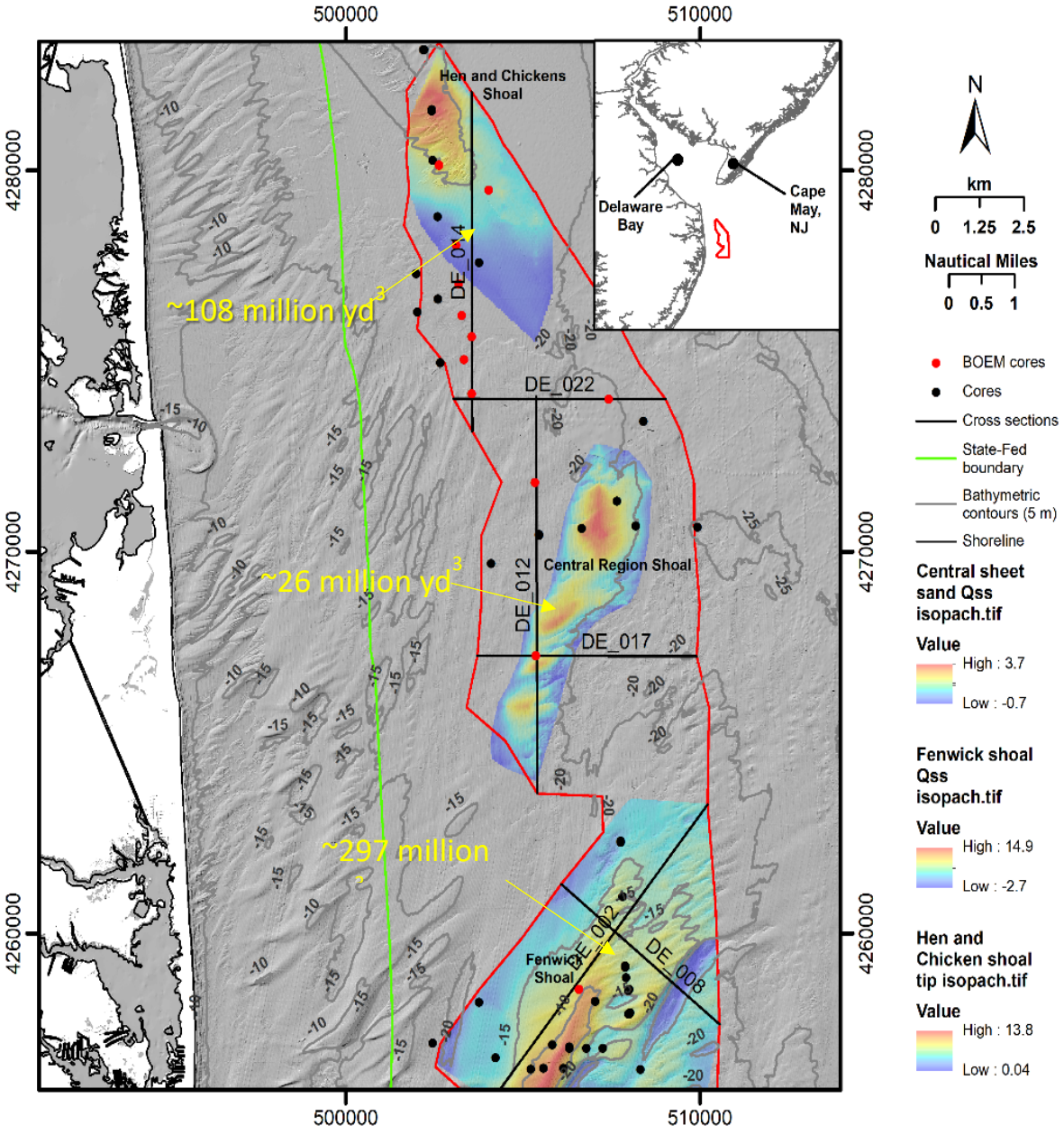

Figure 3. Estimated sand volumes for three areas offshore Delaware in Federal waters (Ramsey and others, 2019).

Statement of Need

Sand bodies used for Delaware beach replenishment to date have been in State waters (up to 3 miles offshore). Over the years, six borrow areas (Figure 4) have been designated for sand resources by U.S. Army Corps of Engineers (USACE), Philadelphia District. Three of the borrow areas have been determined to be excluded for use either for being over-exploited, possess ecologic concerns, or contain less than optimal material (e.g., too gravelly). Only borrow areas B, G, and Fenwick (South) are in use. A consensus by state and federal parties responsible for beach maintenance and oversight is that the present acceptable borrow areas can be used for another round or two of beach maintenance projects within the probable scheduling of the next five years. However, the occurrence of another major coastal storm, comparable to Hurricane Sandy, could speed up the consumption of this useable sand by requiring entire beach and dune rebuilds rather than the scheduled maintenance projects.

After this time window, the next viable potential resources for quality sand are in Federal waters, which are 3 miles and beyond from the shoreline. Their location is significant in that the cost of transporting useable sand adds significantly to the cost of beach restoration projects. Moreover, no sites in Federal waters have been designated as borrow areas with the accompanying State and Federal permits that will allow for rapid use of the sites as needed.

McKenna and Ramsey (2002) outlined several areas in Federal Waters (Figure 4) that had potential for beach replenishment sands. This work was based on limited data from cores and has been superseded by the recent BOEM cooperative study (Mattheus and Ramsey, 2019).

Borrow Area	Status
A	Inactive due to environmental concerns (Essential Fish Habitat (EFH));
B	Active, currently scheduled to be used for the Rehoboth/Dewey replenishment project (2019/2020). Looking in to possible expansion. The northern portion has been proposed for the project. The southern portion contains too much gravel and would require screening.
C	Inactive, too much gravel present
E	Inactive, no suitable material present
G	Active, used for last Bethany/South Bethany/Fenwick renourishment project (2017). Looking into possible expansion.
Fenwick (South)	Active, used for last Bethany/South Bethany/Fenwick renourishment project (2017). Looking into possible expansion.

Table 1. Status of USACE borrow areas in State waters (personal communication, Peter Gori, USACE, Philadelphia District, 2019).

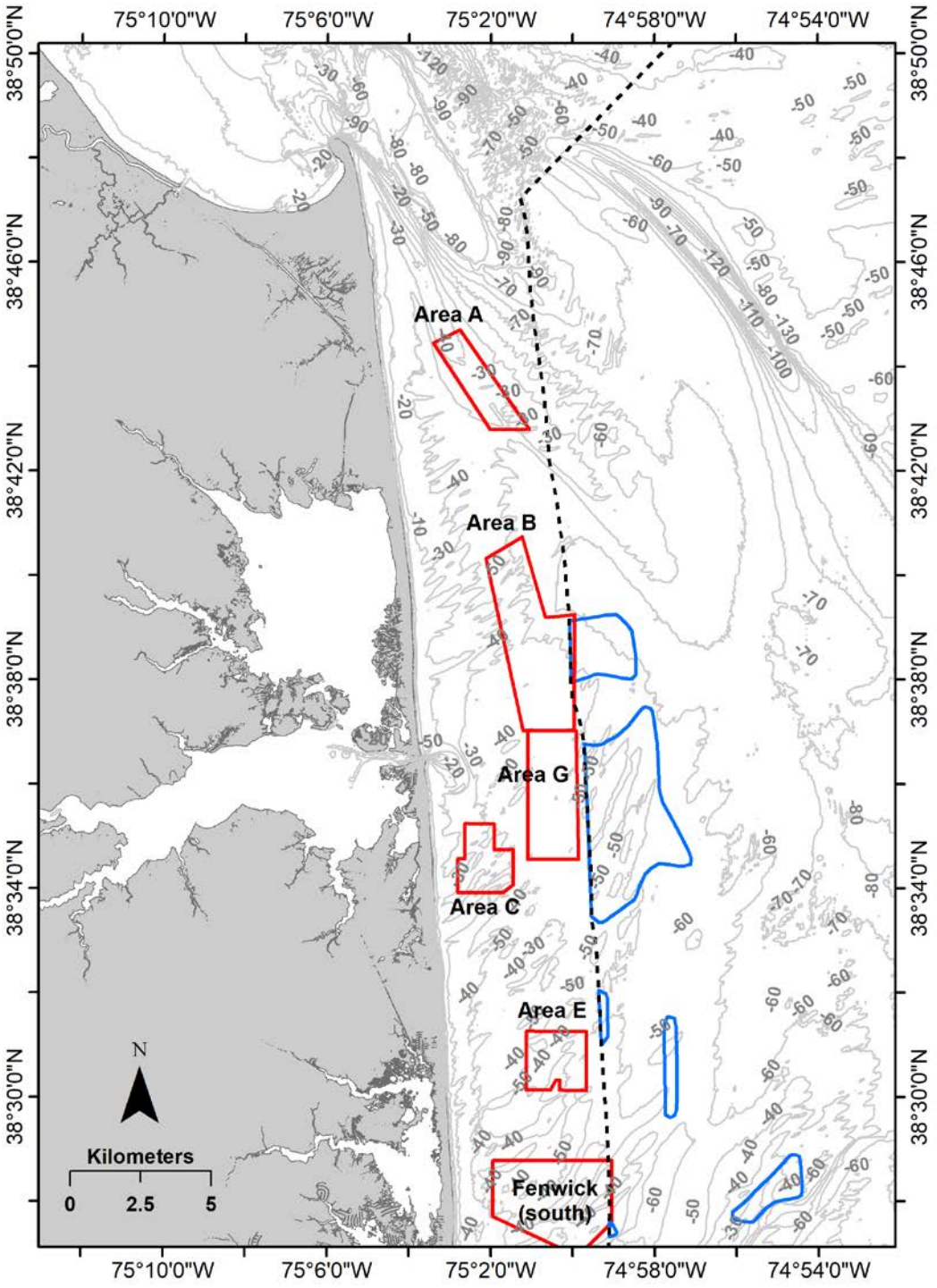

Figure 4. USACE designated borrow areas in State waters. Blue outlines were potential resource areas determined by McKenna and Ramsey (2002).

Data gaps

Figure 5 shows the data collection sites used for the recent BOEM project for mapping offshore sand bodies. The BOEM project concentrated on obtaining geophysical and core data from the three areas mentioned previously-- all of which are between 5 and 8 miles offshore. As a result, the area between 3 and 5 miles offshore has limited geophysical (sub-bottom seismic) and core data to allow for selecting site-specific targets for borrow areas. Obtaining a denser grid of data in this area adjacent to state waters (outlined in red) is important for two reasons. First, borrow areas (B and South could possibly be extended into Federal waters if the resource can be proven to continue farther offshore. Second, other potential resources may be identified and quantified with a denser data grid.

The three BOEM-designated areas in which volumes of sand were determined do not have a data grid dense enough for site-specific work. Additional geophysical and core data collection will allow for identifying specific potential borrow areas. One of the areas, Fenwick Shoals, is a complex of shoal sands that with even limited geophysical and core data is highly likely a prime prospect. Additional data collection in Fenwick Shoals can be at a site-specific level to designate a borrow area. The area between Fenwick Shoals and the area in State waters (sometimes called Fenwick Shoal, but in not part of the Fenwick Shoal complex), does need additional data collection in case there is a resource closer to shore than the Fenwick Shoal complex.

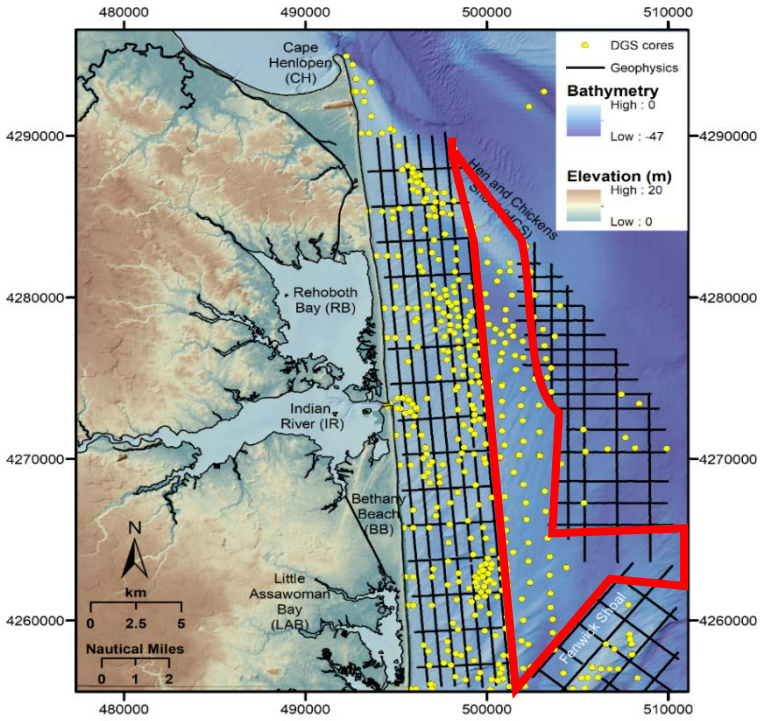

Figure 5. Data gap for geophysical data outlined in red. Western boundary is at the boundary between State and Federal waters. Note paucity of sediment core data in northern and eastern sections of the area of interest.

DGS Capabilities and Program Status

The Delaware Geological Survey has been involved in characterizing offshore sand resources intermittently for the last 30 years. Previous funding from the Minerals Management Service (MMS), the forerunner of BOEM, ended in approximately 2010. Funding from BOEM resumed in 2015 after Hurricane Sandy affected the region. DGS has partnered through the years with both DNREC and USACE in being a permanent repository for vibracores, sand texture data, and other data obtained from sand borrow areas.

The current BOEM project funds are scheduled to end on December 31st, 2019. All project deliverables, such as data collection, input of data into databases, and mapping are presently up-to-date and operative. BOEM project funds have allowed DGS to develop significant sand-resource characterization expertise. Currently DGS has on staff a full-time geologist with 32 years of expertise and experience in offshore geology and project management, and a project geologist with experience in seismic data collection and processing, core description, textural analysis, and offshore geologic mapping. With the current funding stream scheduled to expire at the end of 2019, DGS will be unable to continue to support our project geologist. Thus, state and federal agencies that depend on DGS will experience a pronounced reduction in our ability to provide data, expertise, and institutional knowledge of offshore sand resources. Moreover, a reduction in our programmatic capacity will cause DGS and its partners to lose momentum regarding characterizing sand resources for beach replenishment and maintenance—or potentially more urgently, rebuilding after a significant coastal storm. Continuation of funds for the DGS offshore mapping program at approximately current levels would allow DGS to maintain continuity for this vital program.

References cited

Mattheus, C.R., and Ramsey, K.W., 2019, Geologic map offshore Delaware: Delaware Geological Survey Geologic Map Series No. , scale 1:40,000, in review.

McKenna, K.K., and Ramsey, K.W., 2002, An evaluation of sand resources, Atlantic offshore, Delaware: Delaware Geological Survey Report of Investigations No. 63, 37 p.

Ramsey, K.W., Mattheus, C.R., Wehmiller, J.F., Tomlinson, J.L., and Metz, T.L., 2019, Federal sand-resource assessment of the Delaware shelf: Technical Report for BOEM Cooperative Agreement M14AC00003, 63 p.

Proposal

The Delaware Geological Survey proposes to do the following work contingent upon funding. The work will adhere to a strict schedule lasting two years. The outcome of the work will be designation of specific areas in Federal waters that have a high potential for yielding beach replenishment sand in sufficient volumes and area that will sustain dredging projects. Geophysical data collection, vibracore collection, and sediment texture analyses will be contracted for by partner agencies.

Year 1

1. Schedule and carry out a geophysical survey of data gaps area. The project will use the Klein 3310 chirp sub bottom profiler owned by the USACE, Philadelphia district.
2. Process subbottom data using SonarWiz currently under license at the Delaware Geological Survey
3. Interpret subbottom data and integrate into existing geologic framework.
4. Incorporate all available sediment texture data from cores or bottom grab samples from Federal waters offshore Delaware into the DGS sediment texture database.
5. Using the geologic framework map, new subbottom data, and texture data, create map of areas that have the highest potential for sand resources.

Year 2

1. Based on the results of the year 1 work, prioritize targets for vibracore and if deemed necessary bottom grab samples.
2. Work with partners on site selection and number of vibracores.
3. Upon collection of vibracores, cutting, describing, and sampling of vibracores. Sediment samples will be sent to ASTM rated lab for size analyses contracted by partners.
4. Integrate vibracore data into the offshore geologic framework.
5. Analysis of textural data provided by sediment lab and incorporation in the DGS sediment texture database.
6. Based on results of the vibracore acquisition and textural analyses, specific sites will be identified for potential designation for borrow areas pending all State and Federal permitting.

Deliverables

1. All data generated as a result of the work including, but not limited to, geophysical data, GIS map derivatives of data, vibracore descriptions, and sediment texture data.
2. A report of work and results including specific areas for permitting for borrow use.
3. A digital dataset of all data including GIS polygons and associated data.

Preliminary budget

Year 1

Wages	
Project geologist salary and benefits	$72,927
Student summer intern	$4,500
Indirect costs (32%)	$24,777
Supplies and Expenses	
Software licenses (SonarWiz and ArcGIS)	$2000
Travel associated with geophysical data collection	
Tolls, parking	$200
Mileage (.58/mile x 400 miles)	$232
Indirect costs (32%)	$778
Total year 1	$105,414

Year 2

Wages	
Project geologist salary and benefits	$74,386
Student summer intern	$4,500
Indirect costs (32%)	$25,244
Supplies and expenses	
Software licenses (SonarWiz and ArcGIS)	$2000
Expendibles for vibracore analyses	
(sharpies, saw blades, sample bags, etc)	$500
Core boxes for permanent storage of vibracores	
300 cores boxes at $7/box	$3,500
Plastic tubing for permanent storage of vibracores	$400
Other analyses for integration into stratigraphic framework	
AAR analyses of shell material ($75 x 50 analyses)	$3,750
Radiocarbon dates of organic sediment or shell ($600 x 5 samples)	$3,000
Travel associated with vibracore collection	
Tolls, parking	$200
Mileage (.58/mile x 400 miles)	$232
Indirect costs (32%)	$4,346
Total year 2	$122,058
Total for 2-year Project	$227,472