U.S. Army Corps of Engineers
Charleston District

APPENDIX A

CHARLESTON HARBOR POST 45
BENEFICIAL USE OF DREDGED MATERIAL
SUPPLEMENTAL ENVIRIONMENTAL ASSESSMENT
CHARLESTON, SOUTH CAROLINA

SCDNR Surficial Sediment Characterization: Crab Bank and Shutes Folly

30 September 2016

CHARLESTON HARBOR DREDGING PROJECT

ENVIRONMENTAL ASSESSMENT:

CRAB BANK AND SHUTES FOLLY
SURFICIAL SEDIMENT CHARACTERIZATION

Photos: 2012 SCDNR

FINAL REPORT

SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES
DNR

Submitted to:
U.S. Army Corps of Engineers
Charleston District

Prepared by:
Marine Resources Research Institute

CHARLESTON HARBOR DREDGING PROJECT ENVIRONMENTAL ASSESSMENT:

CRAB BANK AND SHUTES FOLLY

SURFICIAL SEDIMENT CHARACTERIZATION

FINAL REPORT

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A. Introduction and Objectives

Crab Bank is a South Carolina Department of Natural Resources (SCDNR) "Important Bird Area" for South Carolina. It is also known as the Crab Bank Seabird Sanctuary. The Crab Bank Seabird Sanctuary website states "Crab Bank supports colonies of nesting waterbirds because of its isolated nature and lack of mammalian predators. Although all species may not nest on the island each year, examples of species that have used the island include: brown pelican, least tern, royal tern, black skimmer, gull-billed tern, sandwich tern, common tern, laughing gull, Wilson's plover, American oystercatcher, willet, great egret, snowy egret, tricolored heron and ibis. Besides providing nesting habitat, the sanctuary provides winter loafing and feeding areas for numerous species" (https://www.dnr.sc.gov/mlands/managedland?p_id=215). While the island size is in a constant state of fluctuation, it has largely been migrating northeast over the last 15 years.

Shutes Folly provides nesting habitat for colonial seabirds due to its isolated nature, small size, and lack of predators. It is one of only nine active nesting sites in the entire state. Skimmers and oyster catchers like the shell hash that effaces the eastern side of Shutes Folly. The island has been identified by Charleston Harbor Wildlife as a site "often considered for restoration." Their website states that, "in 1997, wildlife biologists pressed for the island as a sight for dredge spoil to boost the small seabird colony there…" (http://charlestonharborwildlife.com/iwa/cp-sf/). However, this has not occurred to date. It should also be noted that Castle Pinckney, a historic site, sits atop the island. It is one of the oldest fortifications of its kind still extant and was built to provide defense of the coast. The site is experiencing erosion on the eastern end.

As part of an ongoing study to improve navigation efficiencies in Charleston Harbor, beneficial use of dredged material options are being explored by US Army Corps of Engineers (USACE) to enlarge Crab Bank and/or Shutes Folly. A better understanding of the existing sediment and macrobenthic community will provide baseline information in an evaluation of these islands. This information will aid in decision making for potential beneficial use of dredged material projects.

The objective of this report is to characterize surficial sediment across Crab Bank and Shutes Folly, both of which are located in Charleston Harbor, Charleston County, South Carolina. All work is being completed under USACE/SCDNR Cooperative Agreement # W912HP-12-1-0003.

B. Methods

Sampling areas

A total of 90 sampling locations across Crab Bank and Shutes Folly (45 each island) were identified within 1.5 hours of the low tide. Sampling occurred across five shore-perpendicular transects at each location (Figures 1 and 2). Each transect consisted of nine locations. The nine locations represented the high point of the island, and approximately mean high water, intertidal, mean low water, and sub-tidal on either side of the cross-section high point (Figure 3). The high point of the island was visually identified for each transect. For the mean high water, intertidal, and mean low water areas, the wrack line from the preceding tide was identified and the distance between it and the water line was determined. This distance was divided into three zones representing high water, mean water, and low water levels, and the center point of these zones was sampled. Multipliers of 0.83, 0.5, and 0.17, respectively, were applied to the distance measurement to identify these zones. During reconnaissance on October 22, 2014, the exact location of each sampling site was documented (Appendix A). These coordinates were used to obtain the samples on November 4, 2014. All sediment and macrobenthic samples were obtained by coring devices. At each transect location, a sediment core (2.6 cm wide and 9.0 cm deep) was collected. At transects A, C, and E, a macrobenthic core (7.8 cm wide and 9.0 cm deep) was collected at each location.

Laboratory methods

Sediment samples were analyzed for sediment composition including the percentages (by weight) of sand, silt, clay, and calcium carbonate ($CaCO_3$) using procedures described by Folk (1980) and Pequegnat *et al.* (1981). $CaCO_3$ was quantified as a subset of the sand component. Samples comprised of oyster shell were not quantitatively analyzed but were documented as 100% sand or greater size class and 100% $CaCO_3$. The sand fractions from the analysis were dry-sieved using a Ro-tap mechanical shaker and grain size was determined by using fourteen 0.5 phi-interval (ϕ) screens, where phi = $-\log_2$ (grain diameter in mm) according to the Udden-Wentworth Phi classification (Brown and McLachlan 1990). Only the sediment data is summarized in this report.

The macrobenthic samples were washed through a 0.5 mm mesh sieve. Organisms and sediment retained on the sieve were preserved in a buffered solution of 10% formalin/seawater with rose bengal stain. Macrobenthic organisms will be identified to the lowest possible taxonomic level and enumerated by experienced taxonomists. The macrobenthic data will be provided in a separate report (May 2015).

C. Results and Discussion

Sediment characteristics vary considerably across the study area, and the dominant grain size on both islands is fine sand (61% of samples). Raw data are presented in Appendix A and photographs of sediment from each island appear in Appendix B. An additional 22% of Crab Bank samples are characterized by medium sand, while the same percentage of Shutes Folly samples tend towards very fine sand. Surficial sediments on Crab Bank are dominated by sand (>50% by weight) at all but two sites (Figure 4, Table 1). These two sites lie along the middle of the island at its southwestern shoreline (transects C and D). As recent as the early 1990s, the island was located approximately 100 m to the south, and it is probable that these clays and silts are remnants from marsh that occupied the island during this time (Figure 5). The largest remaining marsh on Crab Bank is located along transect A, at the northeastern shoreline. These sediments also contain slightly higher than average clay and silt content (10.3% in the intertidal areas, and 27.1% for the adjacent subtidal area). Along the southeastern end of the island, one of the lowest elevation areas, sediments are characterized by sand and a larger proportion of $CaCO_3$ than is found elsewhere on the island. Sediment phi varies along Crab Bank, with mean phi for sands (i.e. excluding silt and clay) on Crab Bank is 2.3, which is classified as fine sand (Figure 6, Table 2). The largest sand classes generally fall along the higher elevation sites.

Shutes Folly is comprised of a wider variety of sediment types, ranging from abundant whole oyster shell along the eastern edge and north end to marsh sediments that are dominated by clays and silts (Figure 7). The sandiest portions sampled on Shutes Folly are the subtidal areas along the western edge (Figure 7, transects B through E), where a sand flat extends one to two hundred meters at water depths <50 cm. A similar, but narrower sand flat of comparable sediment composition extends from the eastern shoreline. This flat appears to transition to clays and silts towards Castle Pinckney, especially south of the point between transects D and E. Sediment phi is variable on Shutes Folly, with a mean sand phi of 2.7 (Figure 8).

Crab Bank is considerably sandier than Shutes Folly. On average, sediments collected from Crab Bank are comprised of 91% sand, as compared to 71% for Shutes Folly. Large portions of Shutes Folly are whole oyster shell, which is notably absent from Crab Bank. Between the two islands, the average composition is 81% sand (55% excluding $CaCO_3$), but there is a wide variety of sediment types present, especially on Shutes Folly.

D. References

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Pequegnat, W.E., L.H. Pequegnat, B.M. James, E.A. Kennedy, R.R. Fay, and A.D. Fredericks. 1981. Procedural guide for designation surveys of ocean dredged material disposal sites. Final Report prepared by TerEce Corp. for U.S. Army Engineer Waterways Experiment Station, Technical Report EL-81-1, 268 pp.

Plumb, R.H., Jr. 1981. Procedures for handling and chemical analysis of sediment and water samples. Tech. Rept. EPA ICE-81-1, prepared by Great Lakes Laboratory, State University College at Buffalo, NY, for the U.S. Environmental Protection Agency/Corps of Engineers Technical Committee on Criteria for Dredge and Fill Material. Published by the U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi

Figure 1. Transects and locations for Crab Bank, Charleston Harbor, Charleston, SC.

Figure 2. Transects and locations for Shutes Folly, Charleston Harbor, Charleston, SC.

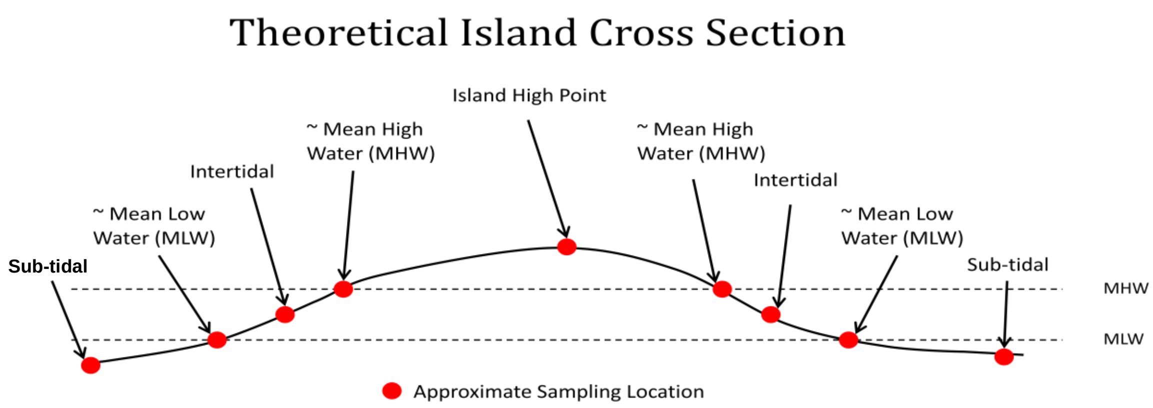

Figure 3. Sampling locations across a theoretical cross section.

Figure 4. Sediment composition across Crab Bank, Charleston Harbor, Charleston, SC.

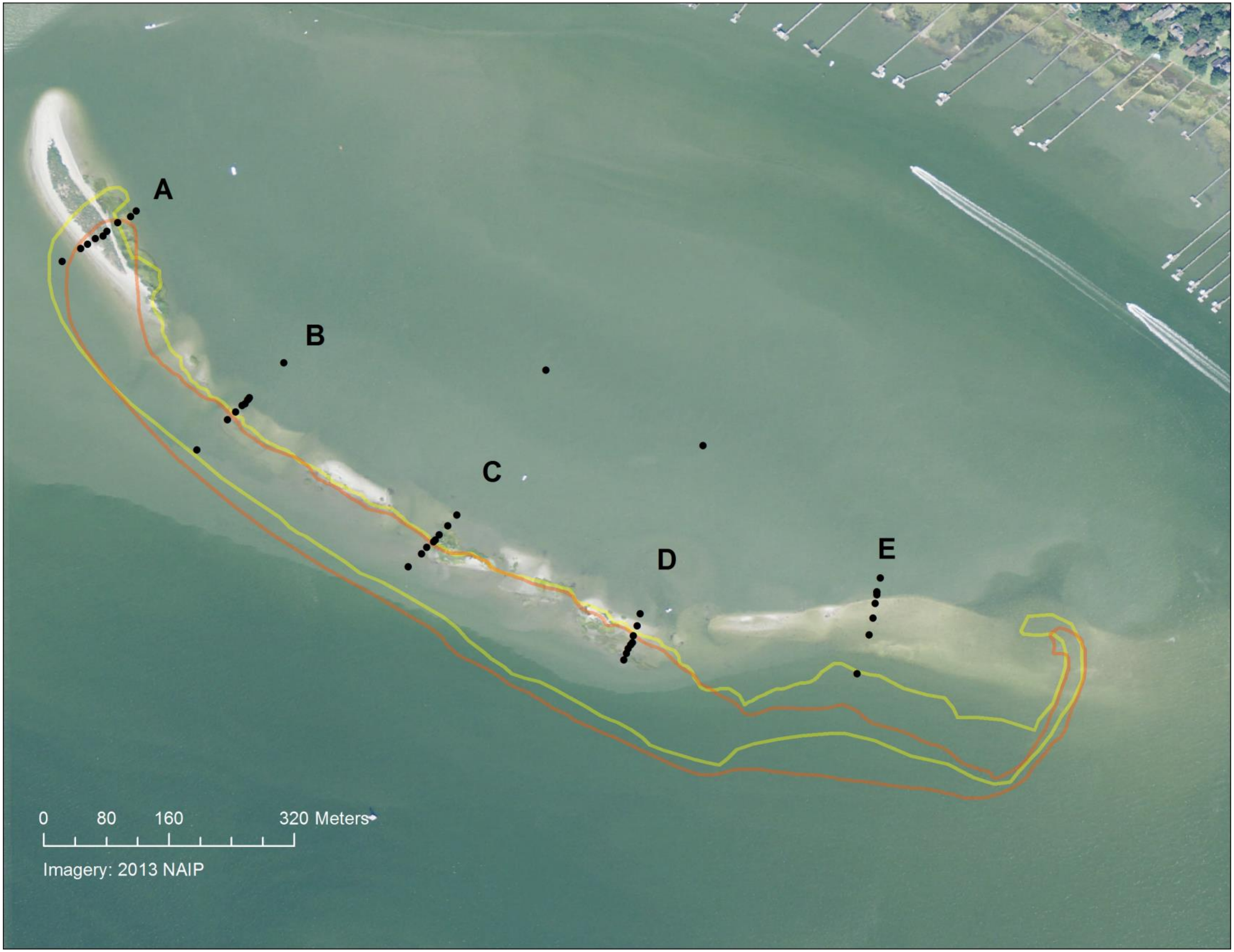

Figure 5. Approximate subaerial extent of Crab Bank in 1989 (orange) and 1994 (yellow). Some differences may arise from differences in tidal stage, especially near sand flats. Sites sampled in 2014 are shown in black.

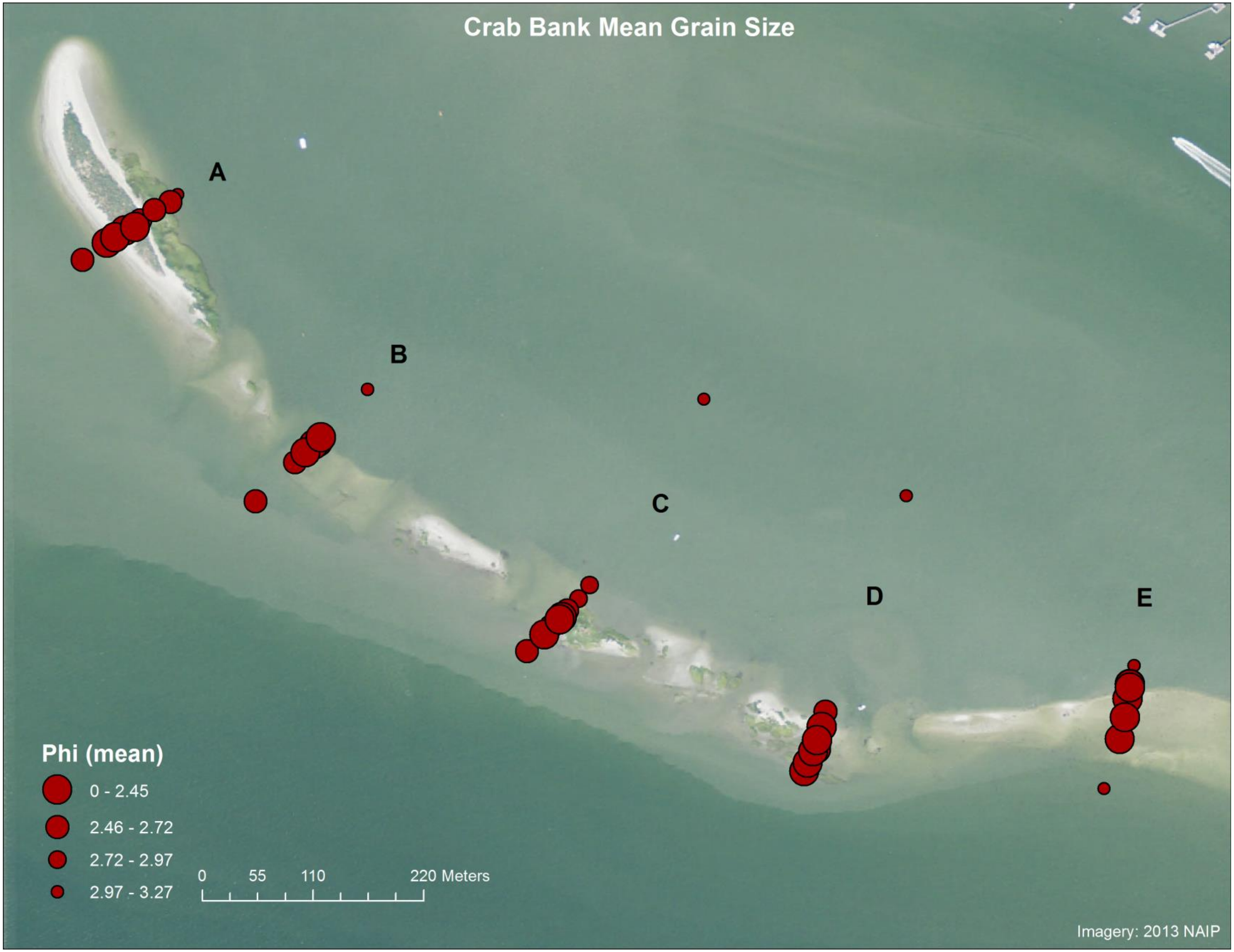

Figure 6. Mean phi across Crab Bank, Charleston Harbor, Charleston, SC. Smaller phi values correspond to larger grain size and are shown with a larger symbol size.

Figure 7. Sediment composition across Shutes Folly, Charleston Harbor, Charleston, SC.

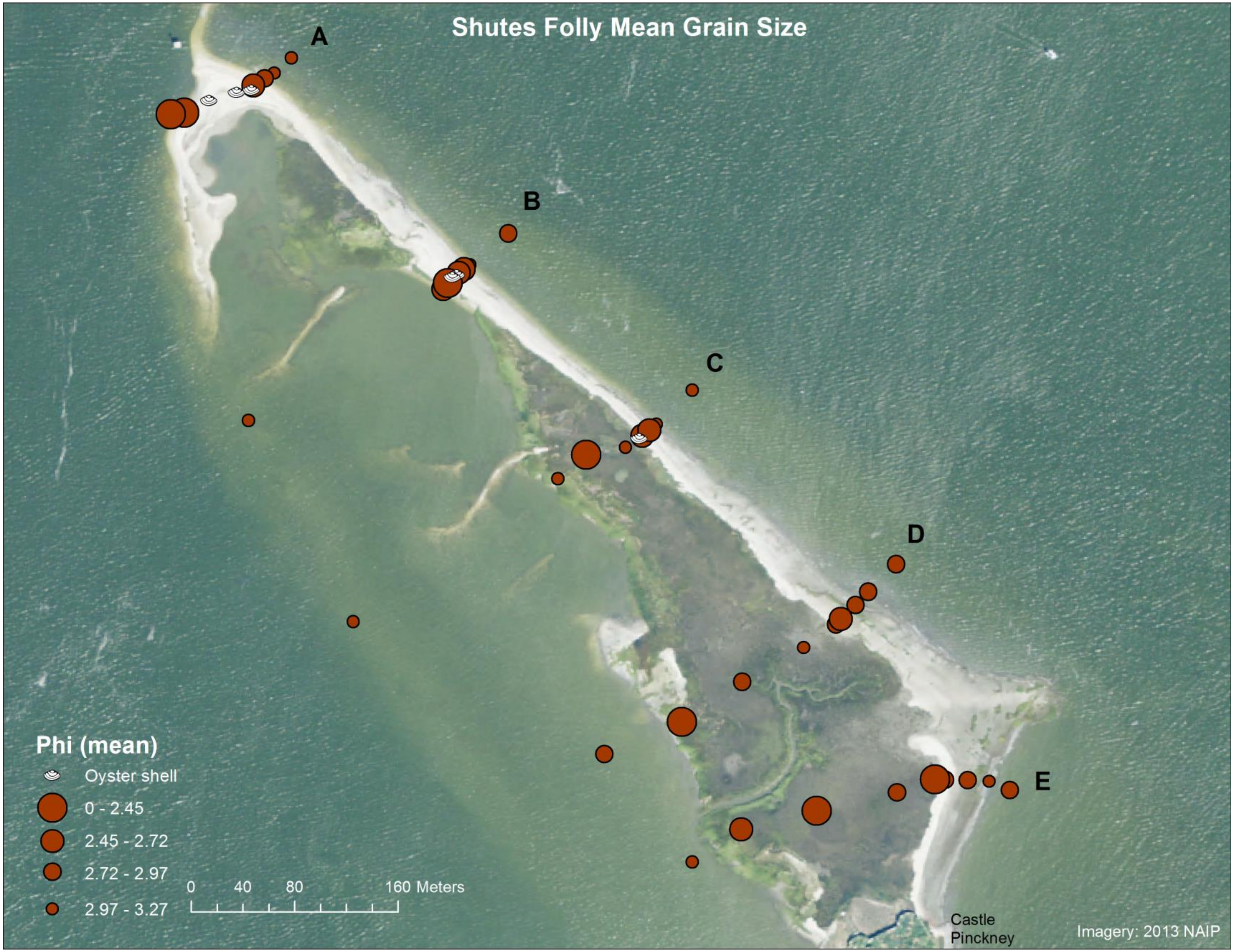

Figure 8. Mean phi across Shutes Folly, Charleston Harbor, Charleston, SC. Smaller phi values correspond to larger grain size and are shown with a larger symbol size.