USACE JACKSONVILLE DISTRICT

Appendix D
Geotechnical

ST. JOHNS COUNTY, FLORIDA

COASTAL STORM RISK MANAGEMENT PROJECT
DRAFT INTEGRATED FEASIBILITY STUDY AND ENVIRONMENTAL ASSESSMENT

December 2015

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1 BACKGROUND

This report includes a description of the regional and local geology of St. Johns County, a sediment characterization of the native beach, and a preliminary sand source design which includes an adaptive sediment management approach. Vibracore boring logs and laboratory results are attached in the **Sub-Appendix** of this document.

Sand source coordinates and quantities listed are based on a limited number of vibracores and on outdated bathymetric data. To develop sand source coordinates, dredge depths, and quantities for the Plans and Specifications, additional vibracores need to be taken and updated bathymetric surveys will be required.

1.1 REGIONAL GEOLOGY

The Florida Peninsula occupies a portion of a much larger geologic unit called the Florida Plateau. Deep water in the Gulf of Mexico is separated from deep water of the Atlantic Ocean by this partially submerged platform, nearly 500 miles long, that varies from 250 to 450 miles wide. In the last 200 million years, the plateau has been alternately dry land or covered by shallow seas. During that time up to 20,000 feet of carbonate and marine sediments were deposited. There has been a tilting of the Florida Plateau about its longitudinal axis. The west coast is partially submerged, as indicated by the wide estuaries and offshore channels, while the east coast is correspondingly elevated, showing the characteristics of an emergent coastline (Randazzo and Jones, 1997).

During the last million years, a series of four glacial periods, or ice ages, brought about significant changes in sea level, as shown in **Figure 1.** As a result of these sea level fluctuations, the Florida peninsula was again covered and uncovered by shallow seas. Following the first glacial period, sea level rose 270 feet above its present level. Dry land on the Florida peninsula was then restricted to a few small islands along the central Florida ridge and in northeast Florida.

About 100,000 years ago, the last glacial period began. Sea level fell to 300 feet below its present level and the Florida Plateau emerged as dry land. Approximately 15,000 years ago, sea level began its most recent rise towards present sea level (Shackleton, 1987). Sea level rose at an average rate of 30 feet per 1,000 years. About 7,000 years ago, the rate of sea level rise slowed when the sea level was about 30 feet below its present level (Smith et al., 2011). It was during this most recent slowing of sea level rise that the modern barrier islands of southeast peninsular Florida formed.

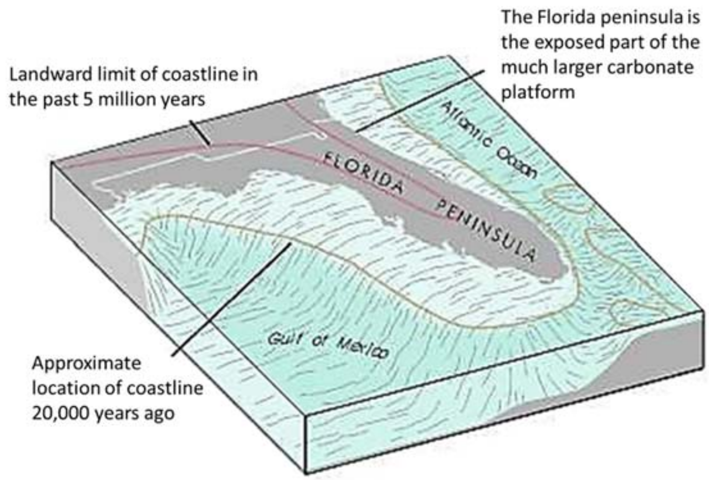

Figure 1. The Florida Peninsula, including the present coastline, previous sea level stands, and the extent of the carbonate platform.

Offshore of the beaches and modern barrier islands is the continental shelf. It is a broad, shallow, low relief shelf that extends from 80 miles offshore near Jacksonville, to only a few miles offshore near Miami. The shelf contains relic Pleistocene and Holocene terraces and submerged beach sand ridges. The wave climate and sediment transportation system creates a linear sandy coastline. The linear coastline is modified locally by inlets. An exception to the linear coastline is the cape structure located at Cape Canaveral which formed in response to a different wave and sand sediment transport system in the southern portion of the state.

The east coast of Florida, from the state line at the Georgia border to Miami Beach (350 miles), consists of a series of sandy barrier islands broken occasionally by inlets, as shown in **Figure 2**. The barrier islands are characterized by dunes and shore parallel beach ridges. Many of the islands display relic beach ridges formed during higher stands of sea level. The barrier islands often have a distinctive drumstick-shape with an accreting bulbous end and a slender eroding end. These barrier islands were formed from waves and longshore currents reworking marine and fluvial sediments. Lagoons and marshes are typically located between the barrier islands and the mainland.

The quartz component of the modern barrier island sand has deposited from sand migrating southward along the Atlantic coast, from the reworking of the Pamlico Sand that was previously deposited over the entire region. The remaining component of coastal sediments are typically carbonates, locally produced by calcite-producing plants and animals. Additional carbonate materials are from reworked materials from outcropping Pleistocene formations offshore (Duane and Meisburger, 1969).

Figure 2. Map of Florida, including points of interest on the Atlantic Coastal Plain.

1.2 LOCAL GEOLOGY

The local geology of St. Johns County for the Quaternary and upper Tertiary Systems range in age from Recent to Pleistocene to Miocene age sediments. The formations exposed at the surface are undifferentiated sediments and the Anastasia Formation of Pleistocene and Recent age (Scott, et al., 2001). These deposits consist of fine to medium quartz sand and lenses of shell and clay of varying thickness. Thick shell beds and erosion of the outcropping Anastasia formation near the coast have been firmly cemented to form coquina. This formation is underlain by Upper Miocene or Pliocene deposits of interbedded lenses of marine, fine to medium sand, shell and green, calcareous, silty clay. This is underlain by the Hawthorne Formation of early and middle Miocene age, the surface of which is approximately 130 feet below sea level. The Hawthorne Formation consists of gray to green, plastic, phosphatic, sandy clay and marl, interbedded with lenses of phosphatic sand, pebbles and sandy limestone. The Hawthorne Formation is underlain by limestone formations of Eocene age.

The project is located on the barrier beach on the Atlantic Ocean, in central St. Johns County, in the Atlantic Coastal Plain physiographic unit. The St. Johns County shore is a barrier beach with a low tidal marsh and lagoon behind it, as shown in **Figure 3**. For the northern 6 miles the beach ridge is about 3 miles wide, with dune elevations ranging from 15 to 25 feet, mean low water. For the next 12 miles the ocean is separated from the mainland by two ridges and two low marshes. The easterly ridge is about 500 to 1500 feet wide, with a nearly continuous dune line ranging in elevation from 15 to 44 feet. The eastern marsh, which contains the Guana River, is generally 2,000 feet wide. The land ridge west of the Guana River is generally 10 feet high and about 4,000 feet wide. The main marsh ranges in width from 3,000 feet to 9,000 feet wide and contains the Tolomato River at a point about 18 miles south of the Duval-St Johns County line.

The St. Johns County barrier islands have inlets at St. Augustine and at Fort Matanzas. There are low tidal marshes and lagoons between the barrier islands and the mainland. The barrier Islands are composed principally of sand and are underlain by silty, clayey marsh deposits that had formed at lower sea level stages. The sands are principally fine to medium-grained sand-sized quartz with variable amounts of shell and shell fragments.

Sediment transport in the area of St. Augustine Inlet has been altered in historic times by the construction of the navigation channel. Maintenance materials from the dredging of the entrance channel were disposed of offshore, but beach-quality materials have historically been placed on the beach.

Figure 3. Map of St. Johns County, Florida.

2 NATIVE BEACH

2.1 GENERAL

The original study area included the St. Johns County shoreline from South Ponte Vedra to Vilano Beach, north of St. Augustine Inlet, and Summer Haven, south of St. Augustine Inlet. South Ponte Vedra Beach and Summer Haven were excluded in the course of the feasibility study due to limited public access and parking plus other factors described in the main report. Therefore the Tentatively Selected Plan for the project includes only Vilano Beach from R-102.5 to R-117.5, as depicted on **Plate B - 1** and **Plate B - 9**.

2.2 NATIVE BEACH SAMPLING AND ANALYSIS

The project beach area has not been nourished before. Sediment samples of the existing beach were collected by USACE in 2010 throughout the beach length of approximately 3 miles. Sediment samples were collected along five representative cross-shore transects that were located approximately at the DEP survey monuments with an interval of 3000 feet. Along each transect, five (5) sediment samples were collected between the berm and 15 feet below mean sea level at the following locations: mid-berm, mid-tide, -5 feet, -10 feet and -15 feet, as shown in **Figure 4**. Each sample was collected from 6 to 12 inches below the ground surface. Due to coastal armoring and/or lacking presence of a dune feature, some of the beaches in St. Johns County do not show this typical profile, and therefore dune samples were not collected at these locations.

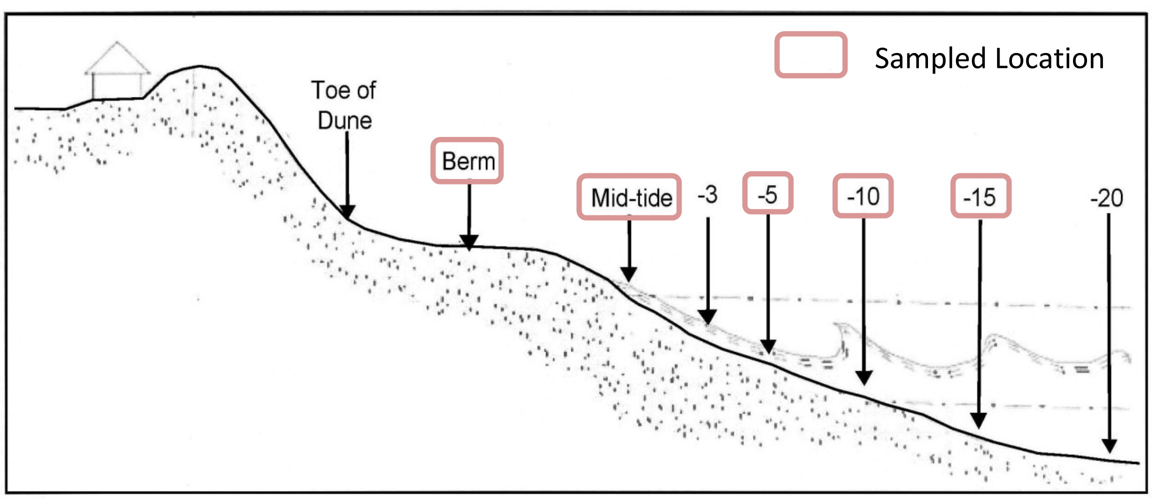

Figure 4. Beach Transect with Beach Sampling Locations

All of the beach samples and the composite samples of each cross-shore transect were analyzed in a laboratory with tests including sieve analysis, visual shell content, carbonate content, and Munsell color to characterize the sediments of the existing beach. The grain size statistics for the individual samples and composites of cross-shore transects and along-shore profiles were developed by using the moment method provided by the US Army Corps of Engineers, Coastal Engineering Manual, 1110-2-1100, dated 2003, version 2.01 Professional Edition (CEM). The results are summarized in **Table 1**, and the Grain Size Analysis Results for Vilano Beach are in the **Sub-Appendix** attached at the end of the report. The laboratory gradation curves for Vilano Beach will be provided upon request.

Table 1. Vilano Beach, Grain Size Statistics Summary

	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Percent Carbonate (%)	Visual Shell (%)	Munsell Color
St. Johns Beach Composite	**0.42**	**1.26**	**2.04**	**1.35**	**1.20**	**27.10**	**25.94**	**10YR 6/2**
St. Johns Beach Composite, Quartz Fraction	**0.24**	**2.09**	**0.00**	**0.02**	**0.59**	**0**	**0**	**10YR 7/1**

*Retained in the #4 Sieve, **Passing the #230 Sieve

The laboratory analyses characterize the existing sediments at Vilano Beach as shelly, poorly sorted, fine to medium-grained sand-sized quartz and carbonate material. In general, the materials at Vilano Beach have a high shell content, and are coarser than the potential sand source materials. Samples collected at the mid-berm and at mid-tide locations have especially high shell contents caused by the deposits from the Anastasia formation, which also causes the typical brownish grey color of the St. Johns County beaches. Carbonate analysis was completed on all samples collected from the existing beach in order to obtain a grain size distribution of the quartz fraction of the existing beach sands. Both the post-carbonate grain size statistics and pre-carbonate grain size statistics will be utilized to examine the similarity between the existing beach and the potential sand sources selected for this project.

3 SAND SOURCES

This report is based on the data collected during geotechnical investigations in 1996, 2006, 2009, 2010, 2012, and 2015, plus additional available data, and are described in the following sub-sections. Sediment samples were collected from each vibracore collected for laboratory testing, including sieve analysis, visual shell content, silt percent (passing the #230 sieve), carbonate content, and Munsell color, in order to characterize the sand source materials. The grain size statistics for the individual samples and composites of each vibracore were developed by using the moment method provided by the CEM. Geologic cross-sections have been developed to delineate the proposed sand source boundaries and preliminary dredging limits. The lithology shown on the cross-sections is based on the vibracore logs; however, if a soil classification in a vibracore log is different with that from the lab data, the classification from the lab tests are used for the cross-sections. The statistical analysis of data from the vibracores collected to date are provided in the **Sub-Appendix**; the vibracore logs and laboratory gradation curves will be provided upon request.

Several sand sources were identified during this Feasibility Study. The resulting potential sand sources for this project include the ebb and flood shoals of St. Augustine Inlet, the federal navigation channel, Porpoise/Vilano Point, off-shore sand sources, and upland sources. The upland sources were ruled out early in the process because of limited available volumes of beach quality material. The St. Augustine Inlet ebb and flood shoals, Porpoise/Vilano Point, and off-shore sand sources were investigated via vibracores. An overview of the study area and the recommended dredging boundaries of each proposed sand source are depicted on **Plate B - 1**. The proposed preliminary sand source locations and associated vibracores are depicted on **Plate B - 2**.

The proposed sand sources within the North Offshore Borrow Area (NOBA), South Offshore Borrow Area (SOBA), and the St. Augustine Inlet shoal complex (including the ebb and flood shoals, Porpoise/Vilano Point, and the federal navigation channel) have been divided into several sub-areas based on both the available volume and depth of beach quality sand at the location. A buffer zone of two (2) feet below the dredging limit has been allocated.

3.1 SAND SOURCE INVESTIGATIONS

Geotechnical investigations began offshore of St. Johns County in 1965, and have continued to present. Locations of all previous vibracores are depicted on **Plate B - 2**. Individual vibracore names and proposed sand sources are depicted on plates in subsequent sections.

3.1.1 Historic Investigations

In 1965, 10 vibracores (CB-1 through 10) were drilled adjacent to the Intracoastal Waterway (IWW) in St. Johns County. These vibracores are irregularly spaced over a distance of 27 miles. The vibracores show limited quantities of beach quality sand available along the IWW. In addition, the sand present was often interlayered with clayey or silty materials. This study was done in conjunction with the 1965 Beach Erosion Control Study, and the report was published March 15, 1965.

In July 1975, the Geomorphology, Shallow Structure, and Sediments of the Florida Inner Continental Shelf, Cape Canaveral to Georgia Study was published. The report is based on data collected in 1966 and 1967. The study covers the areas offshore from Cape Canaveral to Georgia, including St. Johns County. Over 1,000 miles of geophysical seismic lines were run and 197 3-inch diameter, 10 foot long vibracores were collected. The logs for these vibracores are no longer available. The report contains geologic sections based on the logged vibracores. A significant portion of this work was conducted offshore of St. Johns County, and the study identified potential sand sources offshore of St. Johns County.

In December 1977, the Feasibility Report for Beach Erosion Control was published, and later revised in January 1979. In 1976, 16 vibracores (CB-SJ-1 through CB-SJ-13) were collected to locate potential sand sources at and south of St. Augustine Inlet. Three of the vibracores were collected in the ebb shoal of the inlet. The remaining 10 vibracores were collected just offshore in the vicinity of the city of St. Augustine Beach.

In December 1991, the St. Augustine Inlet Section 933 Study was published. Seven (7) vibracores (CB-SJ-1 to 7) were collected at the St. Augustine Inlet ebb tidal shoal. The composite gradation for the ebb shoal indicates a mean grain size of 0.33 mm (1.64 phi) with a sorting of 1.46 phi. The percent shell ranged from 1 % to 47 % with an average shell content of 17 %. The report concluded that the ebb shoal was a suitable sand source for nourishing the beaches south of St. Augustine Inlet.

3.1.2 Recent Investigations

In 1996, the St. Johns County Beach Nourishment Exploration Program was initiated. This effort consisted of both geophysical and drilling efforts. The geophysical work utilized a new analytical method called Acoustical Impedance, which was used to identify sand sources offshore of St. Johns County. This method was designed to characterize and quantify sand resources.

The drilling effort collected twenty (20) vibracores (CB-SJ96-1 through CB-SJ96-20) offshore of St. Johns County in areas where the Acoustical Impedance work indicated potential sand sources. Based on these vibracores, (4) potential sand sources were identified: the NOBA, SOBA, the South Nearshore Borrow Area, and Ebb Shoal Borrow Area. Three of these features were further developed in more recent studies, and have been proposed as sand sources for the St. Johns County Coastal Storm Risk Management Project (**Plate B - 1**).

In 2006, forty five (45) vibracores were collected at all of the proposed sand sources identified in 1996, except the Ebb Shoal Borrow Area, to a depth of 6 feet to 20 feet below the sea-floor, in order to collect more information on the potential sand reserves. These data provided additional background information which guided future investigations.

In 2009, eighty seven (87) vibracores were collected within the limits of the ebb shoal, NOBA, and SOBA to a maximum depth of 20 feet below the sea floor. The materials from the potential sand sources are intended for beach nourishment, and a higher level of data density was required to delineate the study area into a potential sand source, as well as complete a compatibility analysis in preparation for permitting. These data within ebb shoal developed the potential sand source within the ebb shoal.

Additionally, USACE completed a geophysical study offshore of St. Johns County. A sub-bottom seismic survey was conducted over several shoal features in shallow waters in order to determine the potential volume of beach quality sand that may be present. The shoals were selected using the existing data sets described in earlier U.S. Army Corps of Engineers, Florida Geological Survey, and Florida Department of Environmental Protection reconnaissance reports. On this basis, approximately 125 miles of high seismic profile data were collected at frequencies between 500 Hz and 5 kHz (**Figure 5**). Based on the final analysis, the beach quality sand is likely to be contained within 5 to 10 feet below the topographic surface of the shoals. Consistent with the geologic model: the thickest deposits are below the crest and thin to near zero at the base of the shoals at depths of about 55 feet and greater. The total volume of sand present in five (5) shoals is calculated at approximately 157 million cubic yards. It is cautioned, however, that the actual volume of beach quality sand within the five (5) surveyed shoal features may be substantially lower pending further investigation based on additional geologic and acoustic data required to develop and permit offshore sand sources.

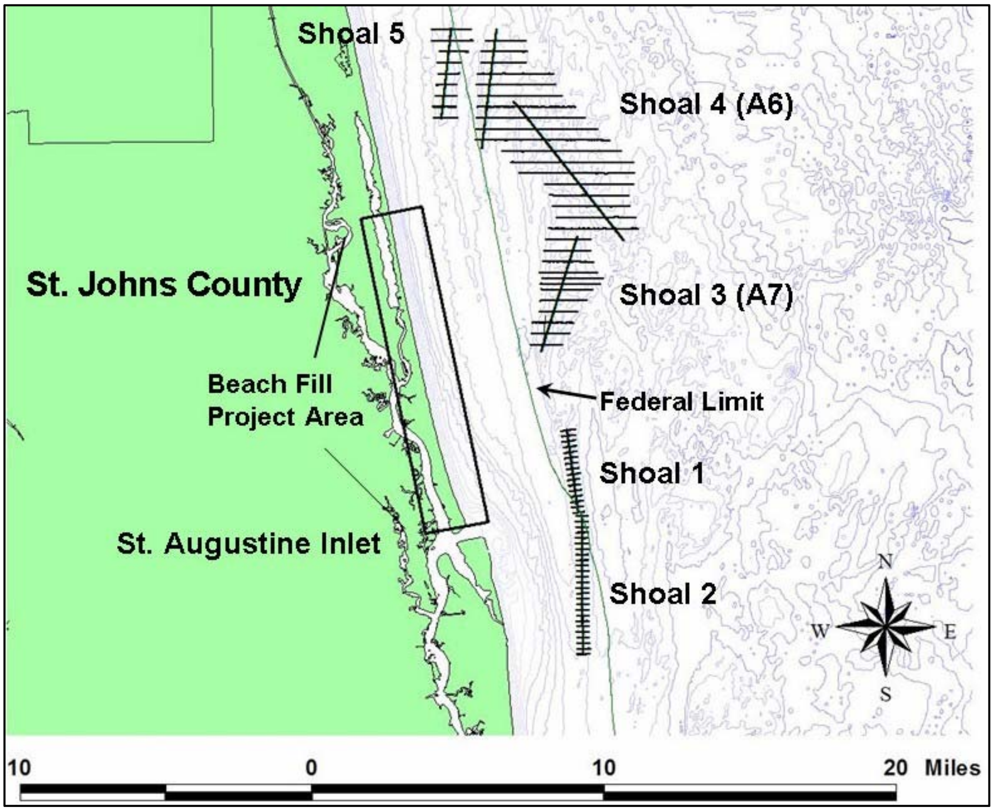

Figure 5. Pattern of survey lines used to collected acoustic sub-bottom profiles in each shoal area (USACE, 2009).

In 2010, three (3) vibracores were collected along Vilano Point (Porpoise Point). Accretion due to longshore transport had caused the spit to encroach on the navigation channel, causing a navigation hazard. The materials from the potential sand source are intended for beach nourishment, and data was required for compatibility analysis.

In 2012, one hundred twelve (112) vibracores were collected within the limits of SOBA and in the nearshore south of the ebb shoal to a maximum depth of 20 feet below the sea floor. The materials from these two potential sand sources are intended for beach nourishment. A higher level of data density was required to delineate the study area into a potential sand source, as well as complete a compatibility analysis in preparation for permitting. The data within SOBA developed the potential sand source S-1.

In 2015, one hundred one (101) vibracores were collected within the limits of the flood shoal, the nearshore south of the ebb shoal, and in N-2 and N-3, within NOBA, to a maximum depth of 20 feet below the sea floor. The materials from the potential sand sources are intended for beach nourishment. A higher level of data density was required to delineate the study area into a potential sand source, as well as complete a compatibility analysis in preparation for permitting. The data within NOBA developed the potential sand sources N-2 and N-3; the data within the flood shoal developed the potential sand sources within the flood shoal.

3.2 PROPOSED OFFSHORE SAND SOURCES

The proposed offshore sand sources N-1, N-2, N-3, and S-1 lay within the larger North Offshore Borrow Area (NOBA) and South Offshore Borrow Area (SOBA) study areas. The proposed preliminary sand source locations and associated vibracores are depicted on **Plate B - 2**.

Because the available vibracores are widely spaced offshore within NOBA and SOBA, geologic cross-sections were only developed for smaller sections of the study areas with higher levels of data density, which have been developed into a proposed sand source. The geologic cross sections presented within the subsequent sections of this Appendix are intended for a feasibility study, and are subject to change pending additional data.

In general, the material encountered within the proposed offshore sand sources consists of moderately well sorted quartz, fine to medium-grained sand with varying amounts of shell fragments, and grey or light grey in color.

3.2.1 North Offshore Borrow Area (NOBA)

The USACE began investigating the north borrow area (NOBA) in 2010. This area is a sand flat located approximately seven (7) miles northeast of the St. Augustine Inlet, extending approximately 17.5 miles to the north and nine (9) miles east in the Atlantic Ocean, and covers an area approximately of 79 square miles. NOBA has been subdivided into three (3) proposed sand sources: N-1, N-2, and N-3. Geologic cross-sections were previously developed for NOBA from the 2006 and 2009 data to guide future studies and delineate future sand source boundaries and dredging limits. The proposed sand source locations within NOBA, and associated vibracores, are depicted on **Plate B - 3**.

The materials in NOBA consist principally of quartz sand, having fine to medium-grained sand-sized particles, with varying amounts of shell fragments. The characteristics of the sand within this region were developed from laboratory gradations on samples of vibracores from 2006 located within the potential sand source boundary. The grain size statistics show the mean grain sizes of individual samples ranging from 0.19 to 0.71 mm with an overall average of 0.31 mm (1.72 phi). The silt content (passing #230 sieve) in individual samples is less than 10 percent, ranging from 0.4 % to 8.2 %, with an average of 2.6 %. The fine gravel content is also less than 5 %, varying from 0 % to 4 %, with an average of 1.1 %, and the amounts of visual shell range from 4 % to 63 %. The standard deviation values, which represent sorting values, range from 0.5 phi to 1.8 phi, representing moderately well sorted to poorly sorted sediments. The moist Munsell color of the material is predominately a value of 5 or lighter, occasionally there are some samples at deeper locations that are darker than 5.

The beach quality materials within NOBA are bounded by layers of silt or clay that control the dredging limits. The thickness of the beach-quality sand ranges from 2 to 15 feet. NOBA is estimated to contain approximately 400 million cubic yards of beach quality sand, based on the existing vibracores and bathymetry that are widely spaced over the sand source search area. The water depths of NOBA range from -40.5 to -57.5 feet (NAVD 88) and can accommodate a large-capacity hopper. This sand flat containing three (3) proposed sand sources is an excellent source of sand. The sand sources within NOBA are not currently permitted.

North Offshore Borrow Area Coordinates (NAD83):

Corner	X	Y
NW	555,434	2,119,186
NE	579,180	2,128,369
SE	612,948	2,042,010
SW	589,429	2,032,692

3.2.1.1 N-1

The investigation of N-1 included sub bottom surveys and the collection of approximately nine (9) vibracores and grain size analysis on selected samples. Most vibracores show a 10 to 15 foot thick beach-compatible top sand layer. Therefore, an estimated volume of 40 million cubic yards of sand exists within N-1; however, only a preliminary level of data is available and additional data is necessary for formal delineation. The proposed sand source N-1 and associated vibracores are depicted on **Plate B - 4**.

3.2.1.2 N-2

The investigation of N-2 included sub bottom surveys and approximately thirty (30) vibracores and grain size analysis on selected samples. A summary of the composite sediment statistics of the proposed sand source N-2 is available in **Table 2**. Most of the vibracores show a 10 to 15 foot thick beach-compatible top sand layer. Geological cross sections were developed from the 2015 vibracores along the north/south axis (A-A’) and the east/west axis (B-B’) of the proposed borrow area. The geological cross section from north (A) to south (A’) (**Figure 6**) is based on vibracores VB-SNJ15-65, VB-SNJ15-62, VB-SNJ15-60, VB-SNJ15-58, VB-SNJ15-54, VB-SNJ15-50, VB-SNJ15-46, VB-SNJ15-43, VB-SNJ15-40, and VB-SNJ15-37; the geological cross section from west (B) to east (B’) (**Figure 7**) is based on vibracores VB-SNJ15-56, VB-SNJ15-55, VB-SNJ15-54, and VB-SNJ15-53. Therefore, an estimated volume of 15 million cubic yards of sand exists within N-2; however, only a small segment of the sand source containing approximately 8 million cubic yards has been fully developed. The proposed preliminary sand source N-2 and associated vibracores are depicted on **Plate B - 5**. The statistical analysis of data from the vibracores collected to date are provided in the **Sub-Appendix**; the vibracore logs and laboratory gradation curves will be provided upon request.

Table 2. Proposed Sand Source N-2 Sediment Analysis

	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color
N2 Sand Source Composite	**0.26**	**1.95**	**0.74**	**2.17**	**0.88**	**11.75**	**2.5Y 6/1**

*Retained in the #4 Sieve, **Passing the #230 Sieve

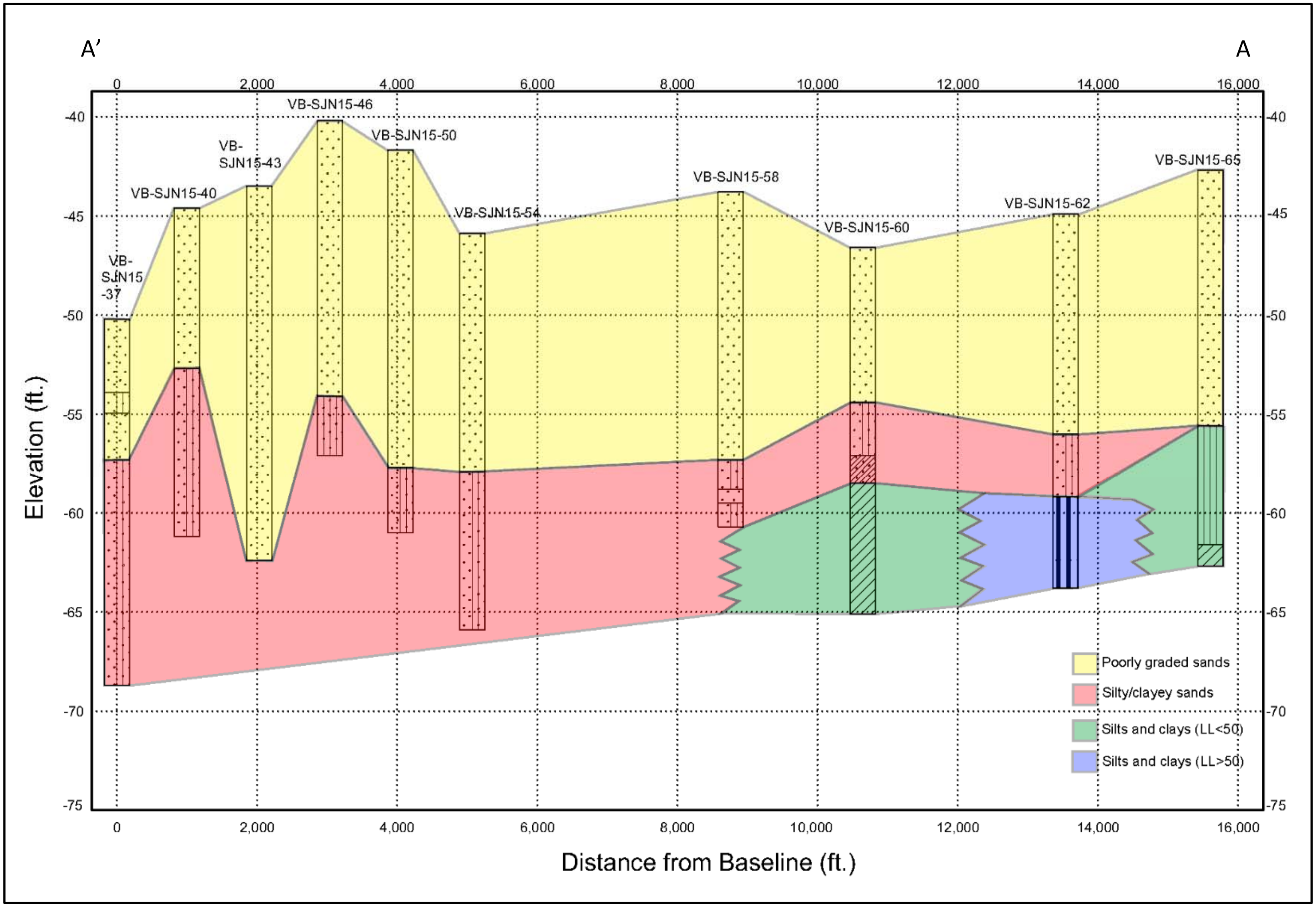

Figure 6. Geological cross section of the axis A-A' of proposed sand source N-2.

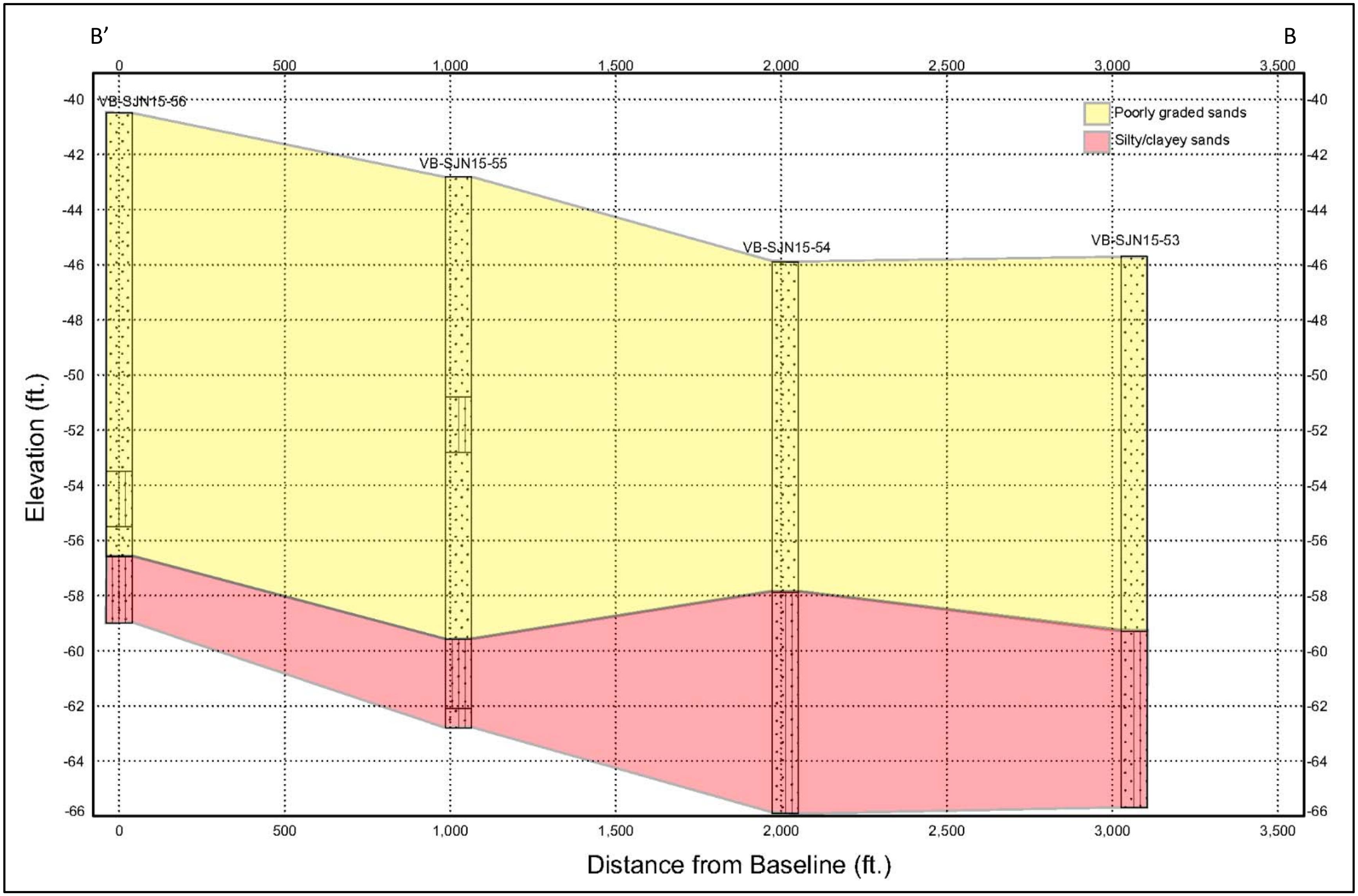

Figure 7. Geological cross section of the axis B-B' of proposed sand source N-2.

3.2.1.3 N-3

The investigation of N-3 included sub bottom surveys and approximately thirty five (35) vibracores and grain size analysis on selected samples. A summary of the composite sediment statistics of the proposed sand source N-3 is available in **Table 3**. Most of the vibracores show an 8 to 10 foot thick beach-compatible top sand layer. Geological cross sections were developed from the 2015 vibracores along the axis A-A' and the axis B-B' of the proposed borrow area. The geological cross section from north (A) to south (A') (**Figure 8**) is based on vibracores VB-SNJ15-32, VB-SNJ15-28, VB-SNJ15-25, VB-SNJ15-21, VB-SNJ15-17, VB-SNJ15-13, VB-SNJ15-10, VB-SNJ15-7, and VB-SNJ15-1; the geological cross section from west (B) to east (B') (**Figure 9**) is based on vibracores VB-SNJ15-23, VB-SNJ15-22, VB-SNJ15-21, and VB-SNJ15-20. Therefore, an estimated volume of 10 million cubic yards of sand exists within N-3; however, only a small segment of the sand source containing approximately 8 million cubic yards has been fully developed. The proposed preliminary sand source N-3 and associated vibracores are depicted on **Plate B - 6**. The statistical analysis of data from the vibracores collected to date are provided in the **Sub-Appendix**; the vibracore logs and laboratory gradation curves will be provided upon request.

Table 3. Proposed Sand Source N-3 Sediment Analysis.

	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
N3 Sand Source Composite	**0.26**	**1.95**	**2.33**	**2.33**	**0.92**	**2.33**	**2.5Y 6/1**

*Retained in the #4 Sieve, **Passing the #230 Sieve

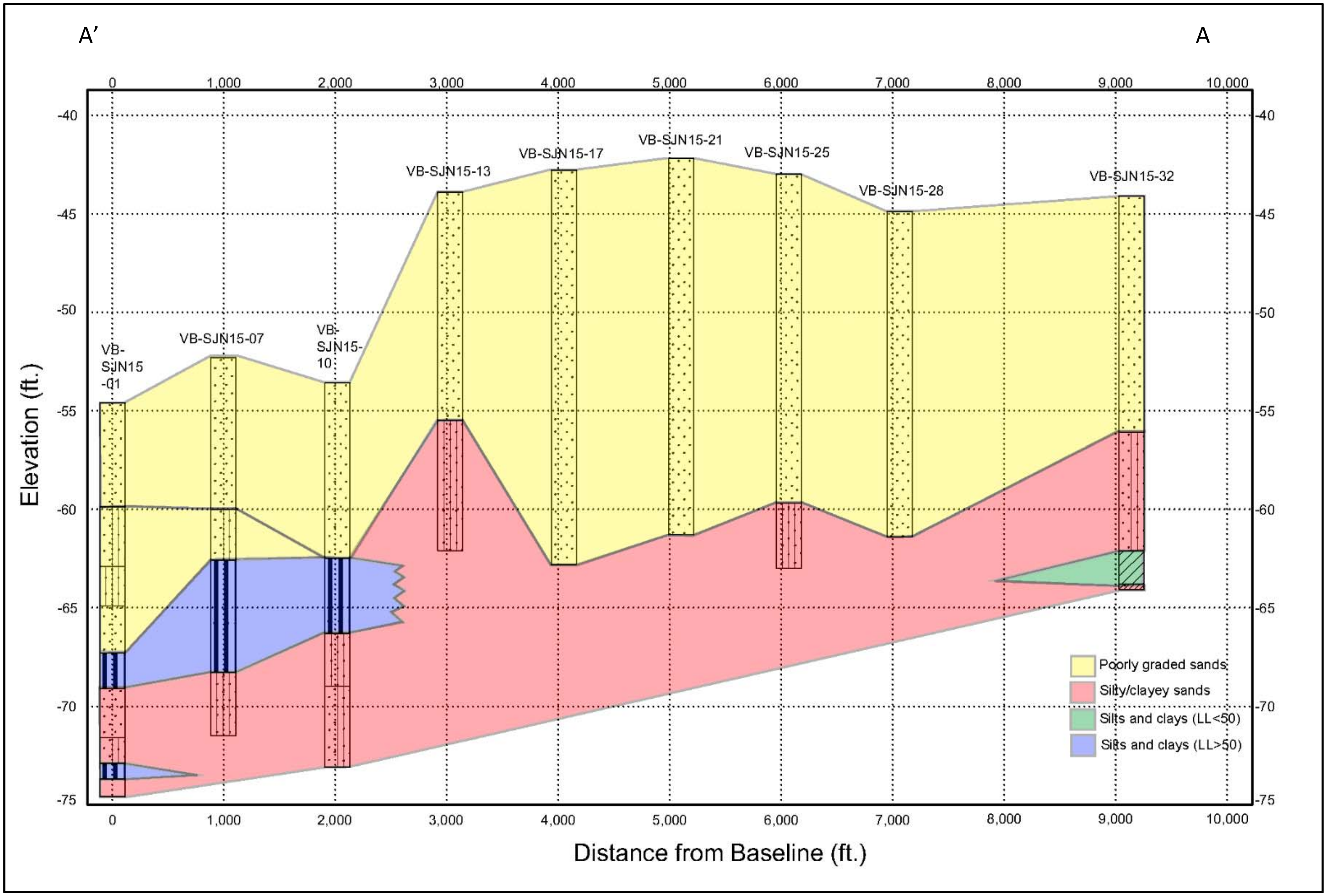

Figure 8. Geological cross section of the axis A-A' of proposed sand source N-3.

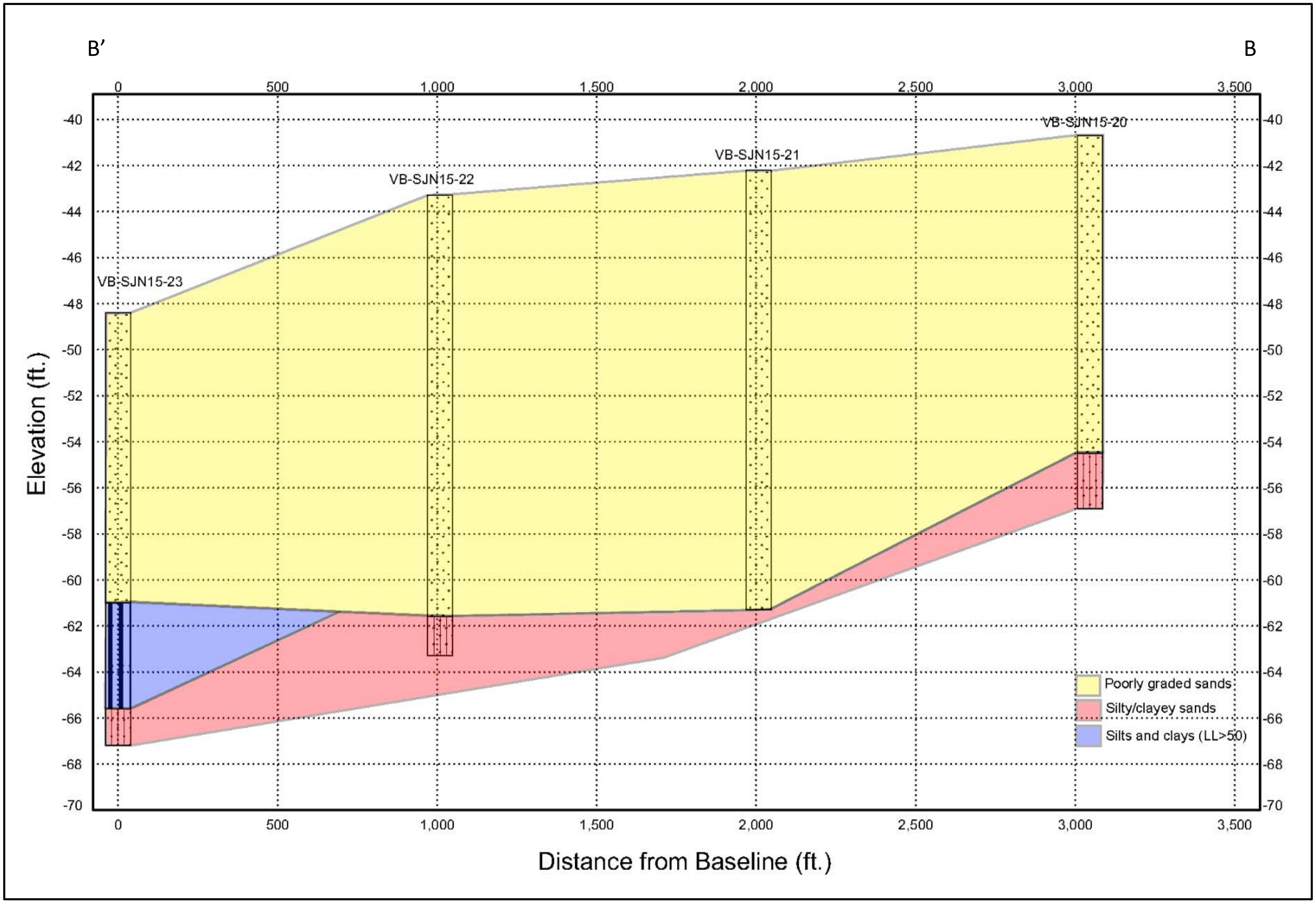

Figure 9. Geological cross section of the axis B-B' of proposed sand source N-3.

3.2.2 South Offshore Borrow Area (SOBA)

The South Offshore Borrow Area is located approximately eight (8) miles southeast of the city of St. Augustine Beach, and covers an area of approximately 30 square miles. SOBA has been subdivided into one (1) proposed sand source, S-1, and the remainder of SOBA will be investigated as additional sand sources are needed. Geologic cross-sections were previously developed for SOBA from the 2006 and 2009 data to guide future studies and delineate future sand source boundaries and dredging limits. The proposed sand source locations within SOBA, and associated vibracores, are depicted on **Plate B - 7**.

The materials in SOBA consist principally of quartz-rich, fine-grained sand with varying amounts of shell fragments. The characteristics of the sand for the sand source were developed from laboratory gradations on samples of vibracores from 2006 located within the potential borrow limits. The grain size statistics show the mean grain sizes of individual samples ranging from 0.18 mm to 0.40 mm with an overall average of 0.22 mm (2.30 phi). The silt content (passing #230 sieve) in individual samples ranges from 0.7 % to 10.2 %, having an average of 4.1%. The fine gravel content varies from 0 % to 7 %, having an average of 1.1 %, and the amount of visual shell ranges from 4 % to 28 %. The standard deviations range from 0.5 phi to 1.8 phi, representing moderately well sorted to poorly sorted sediments. The moist Munsell color of the materials is predominately a value of 5 or lighter; occasionally there are some samples at deeper locations appear darker than 5.

The beach quality materials within SOBA are bounded by layers of silt or clay that control the dredging limits. The thickness of the beach-quality sand ranges from 2 to 12 feet. SOBA contains approximately 130 million cubic yards of beach quality sand, based on the existing vibracores that are widely spaced over the sand source search area. The water depths of SOBA range from -52.5 to -60.5 feet (NAVD 88), which can accommodate a large-capacity hopper. This sand flat containing one (1) proposed sand source is an excellent source of sand. The sand sources within SOBA are not currently permitted.

South Offshore Borrow Area Coordinates (NAD83):

Corner	X	Y
NW	604,363	2,001,479
NE	620,513	2,003,143
SE	620,049	1,951,893
SW	602,832	1,952,913

3.2.2.1 S-1

The investigation of S-1 included sub bottom surveys and approximately one hundred sixteen (116) vibracores and grain size analysis on selected samples. A summary of the composite sediment statistics of the proposed sand source S-1 is available in **Table 4**. Most vibracores show a 5 to 10 foot thick beach-compatible top sand layer. Geological cross sections were developed from the 2012 vibracores along the axis A-A’ and the axis B-B’ of the proposed borrow area. The geological cross section from north (A) to south (A’) (**Figure 10**) is based on vibracores VB-SJSP12-16, VB-SJSP12-15, VB-SJSP12-10, VB-SJSP09-14, VB-SJSP09-16, VB-SJSP12-72, and VB-SJSP12-73; the geological cross section from west (B) to east (B’) (**Figure 11**) is based on vibracores VB-SJSP12-46, VB-SJSP12-29, VB-SJSP09-11, VB-SJSP09-14, VB-SJSP12-67, VB-SJSP12-93, and VB-SJSP12-109. Therefore, an estimated volume of 14 million cubic yards of sand exists within S-1; however, only a smaller segment of the sand source containing approximately 6.5 million cubic yards has been fully developed. The proposed preliminary sand source S-1 and associated vibracores are depicted on **Plate B - 8**. The statistical analysis of data from the vibracores collected to date are provided in the **Sub-Appendix**; the vibracore logs and laboratory gradation curves will be provided upon request.

Table 4. Proposed Sand Source S-1 Sediment Analysis.

	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
S1 Sand Source Composite	0.25	2.01	0.75	2.03	0.85	12.79	5Y 7/1

*Retained in the #4 Sieve, **Passing the #230 Sieve

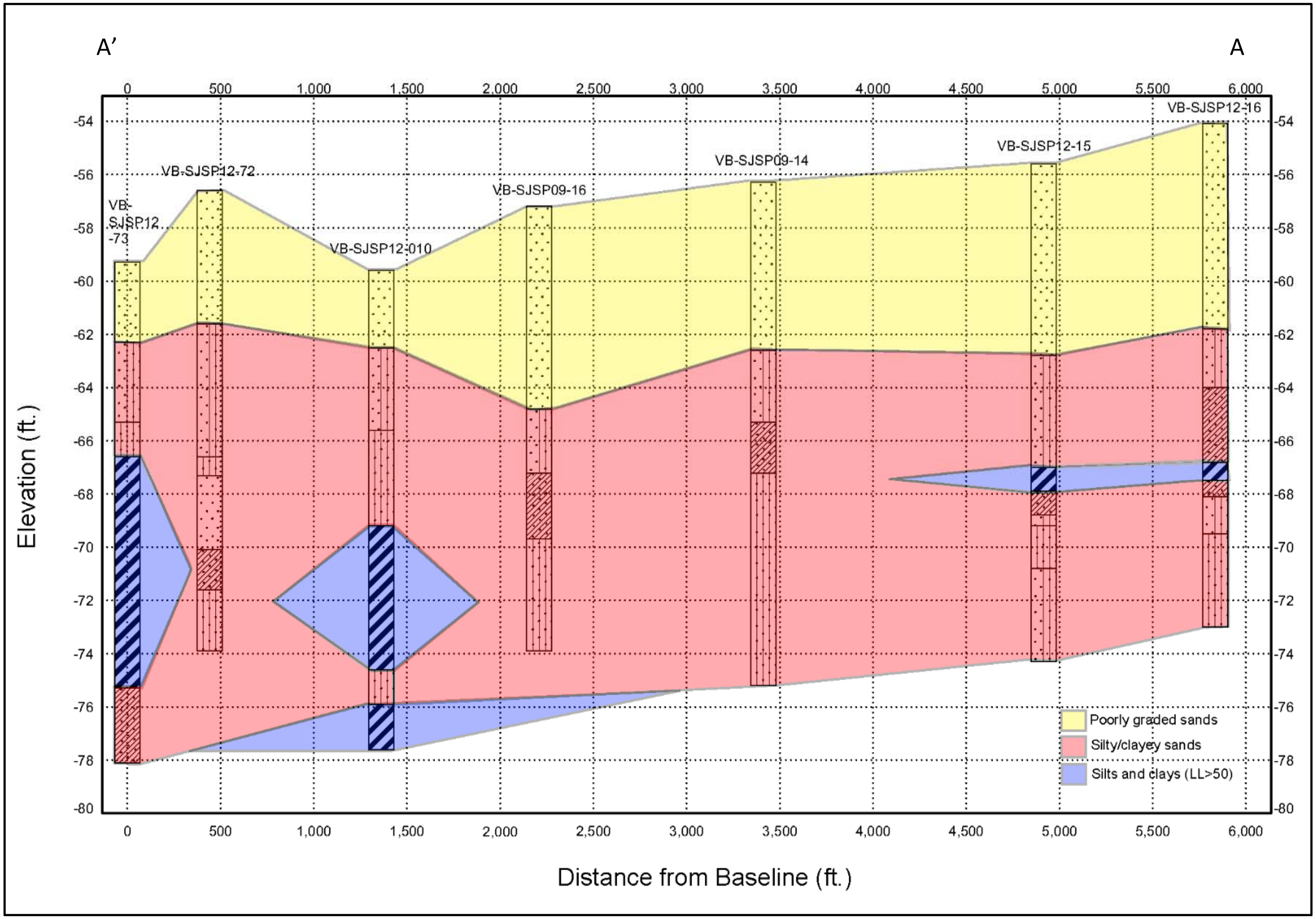

Figure 10. Geological cross section of the axis A-A' of proposed sand source S-1.

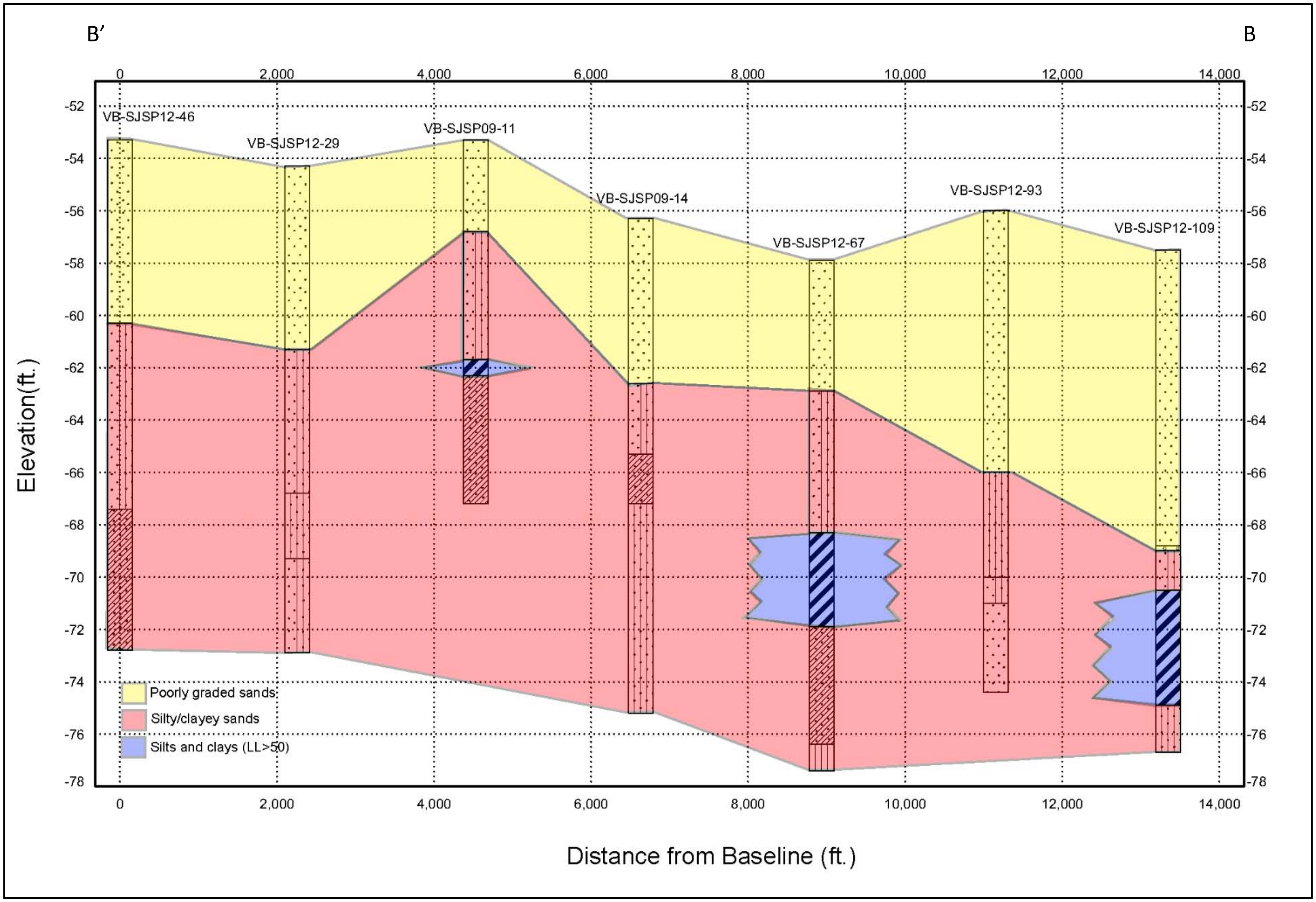

Figure 11. Geological cross section of the axis B-B' of proposed sand source S-1.

3.3 PROPOSED ST. AUGUSTINE INLET SAND SOURCES

The proposed sand sources within St. Augustine Inlet include the ebb and flood shoals, Vilano Point, and the federal navigation channel. The proposed St. Augustine Inlet sand source and associated vibracores are depicted on **Plate B - 9**.

The data used for developing the cross-sections for the sand sources within the St. Augustine Inlet sand source are limited to the ebb shoal, flood shoal, and Vilano Point. The geological cross sections presented within the subsequent sections of this Appendix are intended for a feasibility study, and are subject to change pending additional data. Additional vibracores may need to be collected as the ebb shoal was dredged in 2012, removing 2.1 million cubic yards, after the most recent vibracores were collected; the federal navigation channel is routinely dredged and maintained, most recently removing 150,000 cubic yards of material in 2015.

In general, the material encountered within the proposed St. Augustine Inlet sand sources consists of moderately well sorted quartz-rich, fine to medium-grained sand with varying amounts of shell fragments, and grey or light grey in color.

3.3.1 Ebb Shoal

The ebb shoal sand source is located just off St. Augustine Inlet. It covers an area of 1.2 square miles and contains approximately 30 million cubic yards of beach quality sand of which approximately 6 million cubic yards may be dredgeable. The ebb shoal feature can be divided into two lobes: a north lobe, and a south lobe. The investigation of the St. Augustine Inlet ebb shoal consisted of the collection of approximately thirty five (35) vibracores and grain size analysis on selected samples. A summary of the composite sediment statistics of the proposed ebb shoal sand source is available in **Table 5**.

The characteristics of the sand in the ebb shoal sand source were developed from laboratory analyses on samples from vibracores collected in 1996, 1998, and 2009. The sand deposit, as shown in the vibracores, is entirely beach quality sand. Geological cross sections were developed from the 2009 vibracores along the axis A-A’ and the axis B-B’ of the proposed borrow area. The geological cross section from north (A) to south (A’) (**Figure 12**) is based on vibracores CB-SJEB09-P2A, CB-SJEB09-P7, CB-SJEB09-P6, CB-SJEB09-P11, CB-SJEB09-P15, CB-SJEB09-P19, CB-SJEB09-P23 and CB-SJEB09-P26; the geological cross section from west (B) to east (B’) (**Figure 13**) is based on vibracores CB-SJEB09-P8, CB-SJEB09-P9, CB-SJEB09-P10, CB-SJEB09-P11, CB-SJEB09-P12, and CB-SJEB09-P13.

Therefore, an estimated volume of 4.5 million cubic yards of sand exists within the St. Augustine Inlet ebb shoal; however, only the southern portion of the sand source containing approximately 2 million cubic yards has been fully developed and permitted under FDEP JCP permit number 0295429-002-JC. This is an excellent source of sand; however, magnetic anomalies, which will be further investigated, may restrict its use. The proposed preliminary ebb shoal sand source and associated vibracores are depicted on **Plate B - 10**. The statistical analysis of data from the vibracores collected to date are provided in the **Sub-Appendix**; the vibracore logs and laboratory gradation curves will be provided upon request.

Table 5. Proposed St. Augustine Inlet Ebb Shoal Sand Source Sediment Analysis.

	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
Ebb Shoal Composite	**0.23**	**2.38**	**0.00**	**1.43**	**0.64**	**21.48**	**2.5Y 6/1**

*Retained in the #4 Sieve, **Passing the #230 Sieve

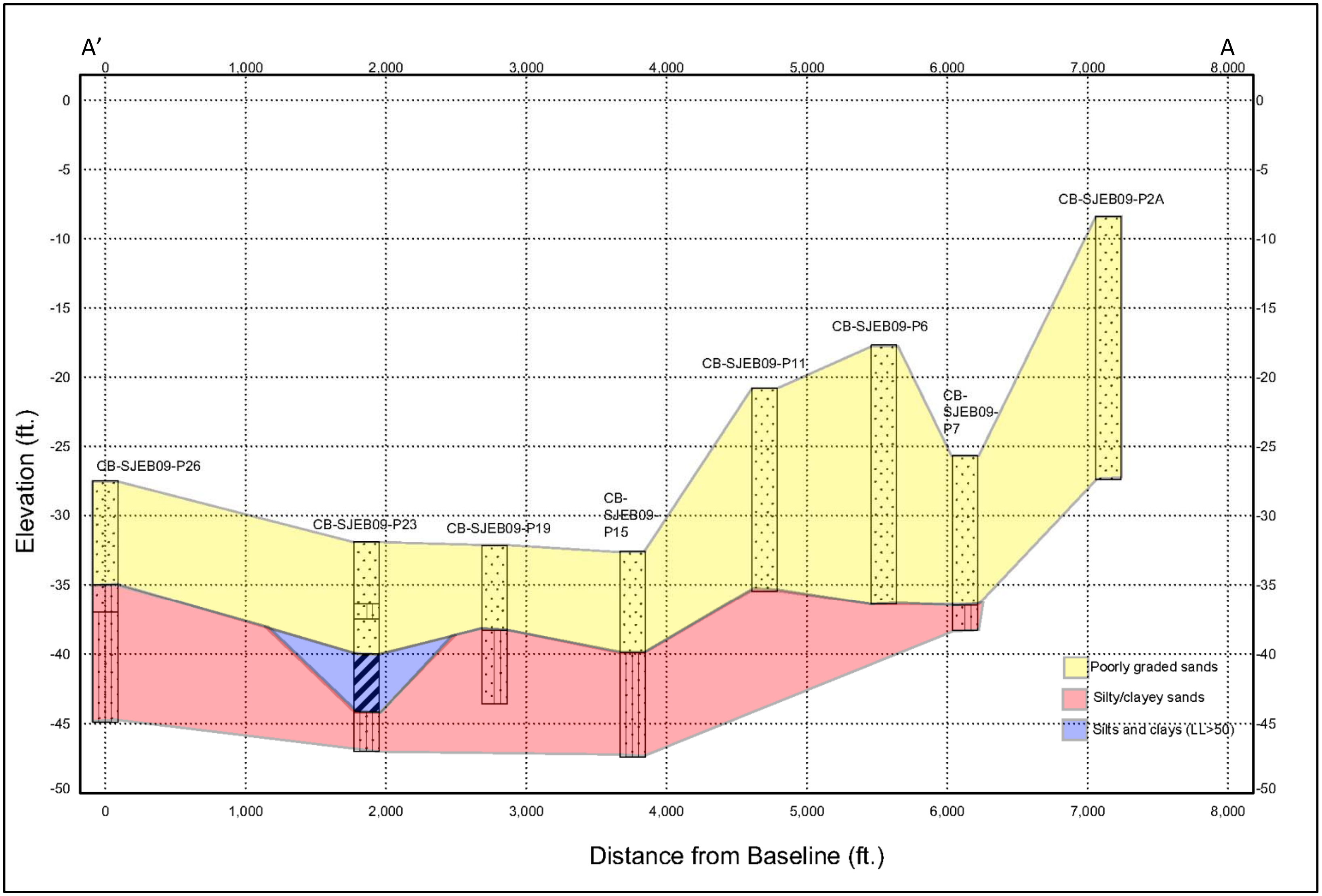

Figure 12. Geological cross section of the axis A-A' of proposed Ebb Shoal sand source.

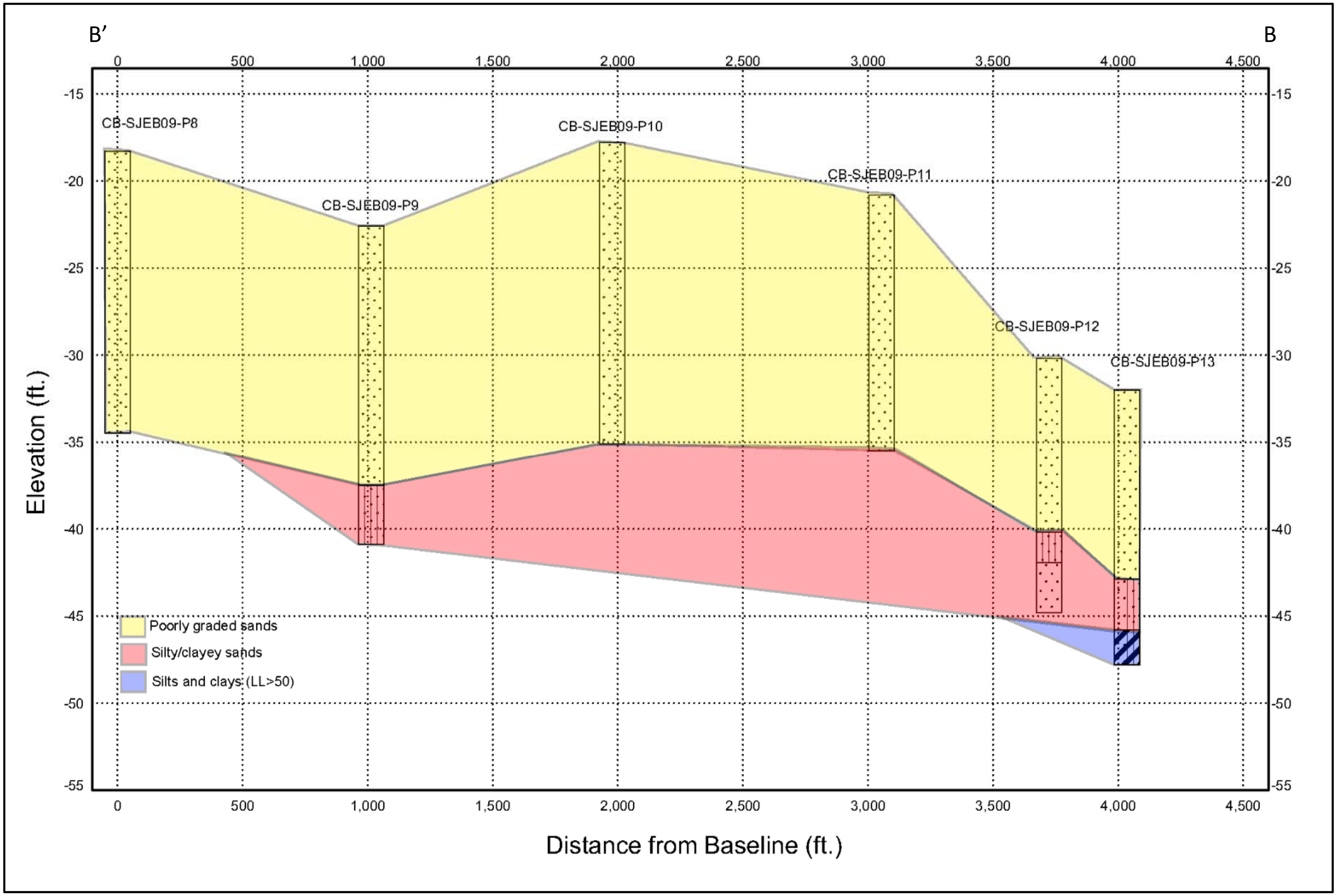

Figure 13. Geological cross section of the axis B-B' of proposed Ebb Shoal sand source.

3.3.2 Flood Shoal

The flood shoal sand source is located just inside St. Augustine Inlet. It covers an area of 1.2 square miles and contains approximately 2 million cubic yards of beach quality sand which may be dredgeable. The characteristics of the sand in the Flood Shoal Sand Source were developed from laboratory gradations on samples for vibracores collected in 2015; a bathymetric survey was not available at the time of this report and is scheduled to occur in early 2016. The flood shoal feature can be divided into two lobes: a north lobe, and a south lobe. The investigation of the St. Augustine Inlet flood shoal consisted of the collection of approximately thirty five (35) vibracores and grain size analysis on selected samples. A summary of the composite sediment statistics of the proposed flood shoal sand source is available in **Table 6**.

The characteristics of the sand in the flood shoal sand source were developed from laboratory analyses on samples from vibracores collected in 2015. The sand deposit, as shown in the vibracores, is entirely beach quality sand. Geological cross sections were developed from the 2015 vibracores along the axis A-A’ and the axis B-B’ of the proposed borrow area. The geological cross section of the north lobe of the flood shoal (**Figure 14**) is based on vibracores VB-SAFS15-1, VB-SAFS15-3, VB-SAFS15-2, VB-SAFS15-4, VB-SAFS15-5, and VB-SAFS15-6 from north (A) to south (A’); the geological cross section of the south lobe of the flood shoal (**Figure 15**) is based on vibracores VB-SAFS15-14, VB-SAFS15-13, VB-SAFS15-11, and VB-SAFS15-10 from west (B) to east (B’).

Therefore, an estimated volume of 2 million cubic yards of sand exists within the St. Augustine Inlet flood shoal; this sand source has not yet been permitted. This is an excellent source of sand; however, magnetic anomalies, which will be further investigated, may restrict its use. The proposed preliminary flood shoal sand source and associated vibracores are depicted on **Plate B - 11**. The statistical analysis of data from the vibracores collected to date are provided in the **Sub-Appendix**; the vibracore logs and laboratory gradation curves will be provided upon request.

Table 6. Proposed St. Augustine Inlet Flood Shoal Sand Source Sediment Analysis.

	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
Flood Shoal Sand Source Composite	**0.30**	**1.93**	**2.62**	**1.64**	**0.98**	**15.70**	**2.5Y 6/1**

*Retained in the #4 Sieve, **Passing the #230 Sieve

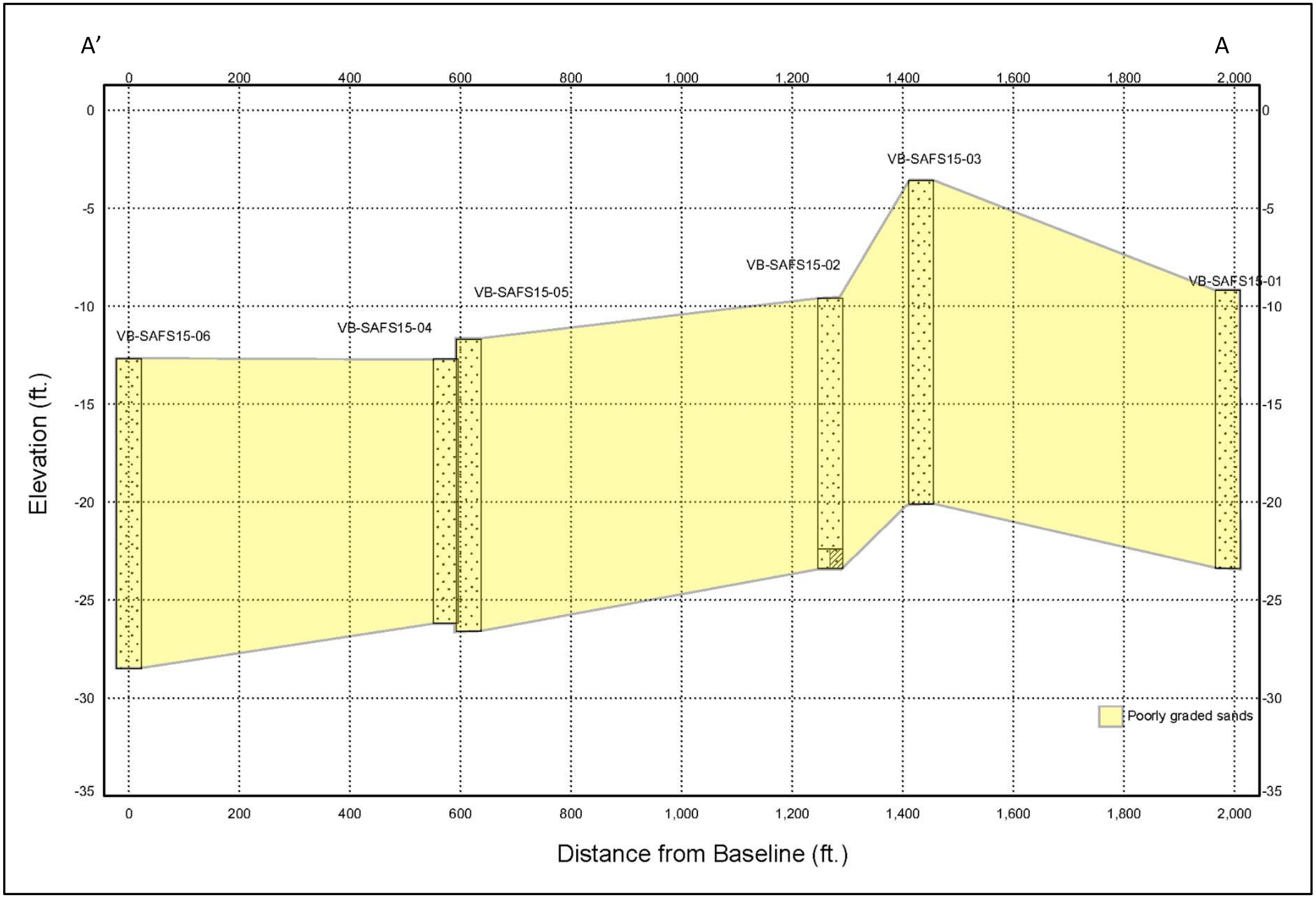

Figure 14. Geological cross section of the north lobe (A-A') of proposed Flood Shoal sand source.

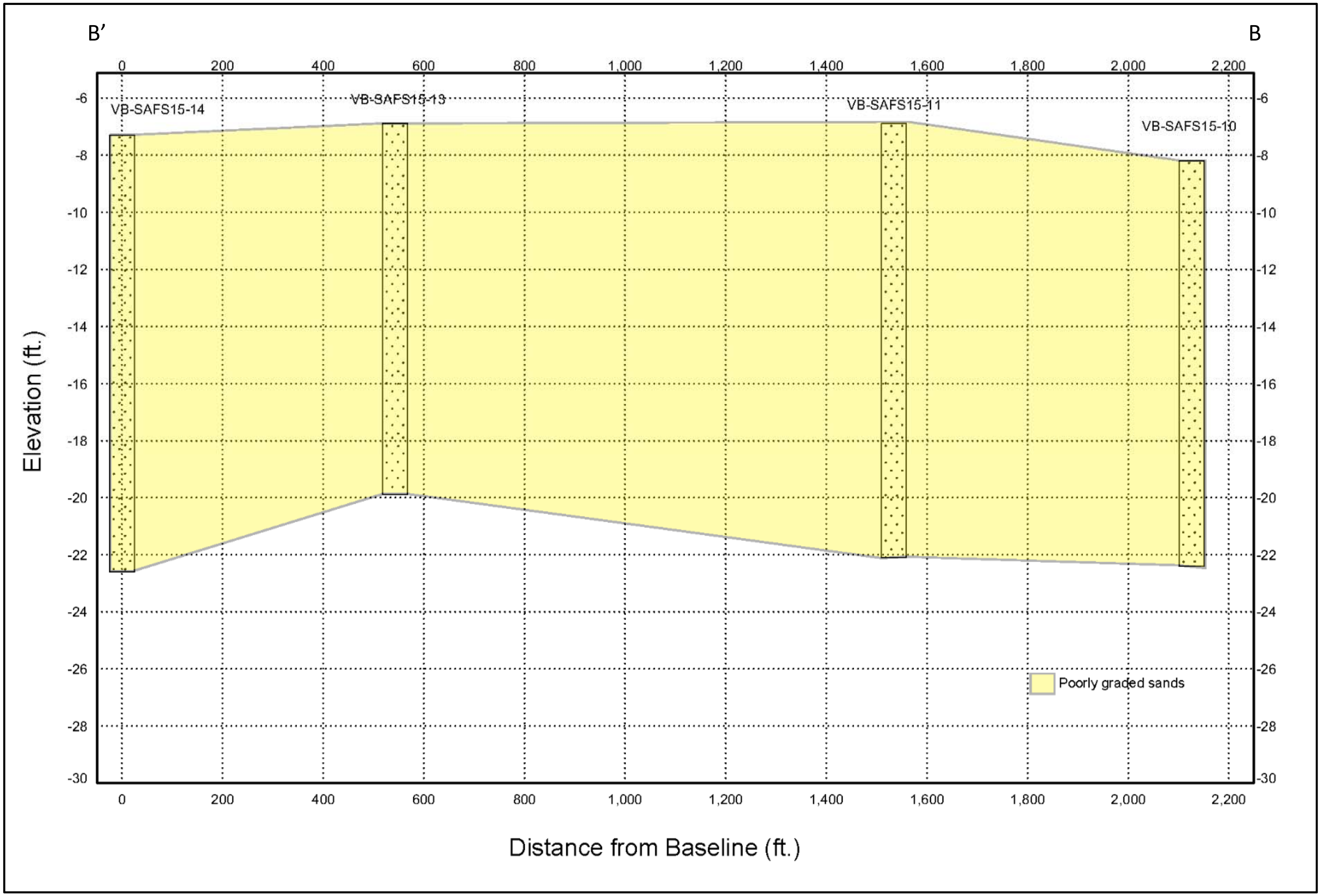

Figure 15. Geological cross section of the south lobe (B-B') of proposed Flood Shoal sand source.

3.3.3 Vilano Point

Four (4) vibracores were collected at Vilano Point in the St. Augustine Inlet channel. The material encountered consists of poorly-graded fine-grained sand-sized quartz and various shell layers. The shell layers consist of medium to coarse-grained sand-sized shell fragments with trace to some sand-sized quartz. Only in boring VB-SA08M-07, one 2-foot thick shell-layer exhibits approximately 20% fine-gravel-sized shell, retained in the #4 sieve. The proposed Vilano Point sand source and associated vibracores are depicted on **Plate B - 12**. This sand source is currently permitted under FDEP JCP permit number 0295429-002-JC, and has been utilized once.

3.3.4 Navigation Channel

Based on the earlier described 1991 933 study, maintenance dredging would be an excellent source of beach quality sand. The principal problem is that the quantity of sand available is limited to approximately 100,000 to 200,000 cubic yards at any given time. The proposed Navigation Channel sand source and associated vibracores are depicted on **Plate B - 9**. The federal navigation channel is permitted under FDEP JCP permit number 0294455-001-JC.

4 COMPATIBILITY OF THE SAND SOURCES WITH THE BEACHES

Florida Administrative Code (F.A.C.) 62B-41.007(2)(j) requires that beach fill meets the following requirements:

- Predominately carbonate or quartz with a particle size distribution ranging between 0.062 mm (4 phi) and 4.76mm (-2.25 phi);
- Contain less than 5% silt passing the #230 sieve;
- Contain less than 5% gravel sized shell retained on the #4 sieve;
- Not contain coarse gravel, cobbles, or material retained on the ¾" sieve in a percentage greater than the native beach
- Be free of construction debris, toxic material, or other foreign matter;
- Be similar in color and grain size distribution; and
- Not result in cementation of the beach.

All of the proposed sand sources meet the requirements of the sand rule criteria, as outline above, and in 62B-41/007(2)(j), F.A.C. Grain size distribution, Overfill Factor and Renourishment Factor are also used to determine compatibility between the proposed sand sources and the St. Johns County beaches, specifically Vilano Beach.

4.1 GRAIN SIZE DISTRIBUTION

Grain size analyses were performed on beach samples from St. Johns County's Beaches and on discrete samples of the proposed offshore and inlet sand sources. Samples were analyzed for grain-size, visual shell and carbonate content. An arithmetic composite sample was calculated from the granularmetric results. The composite sample results for the beach, ebb shoal, flood shoal, and offshore sand sources are summarized in **Table 7** and discussed below.

The native beach sediments of Vilano Beach consist of a moderately to poorly sorted, fine- to medium-grained quartz sand, with a fine gravel (shell) content higher than some of the adjacent beaches due to erosion of the outcropping Anastasia Formation. The material from the proposed offshore sand sources consists of moderately well sorted quartz-rich, fine- to medium-grained sand with varying amounts of shell fragments, and grey or light grey in color. The material from the proposed St. Augustine Inlet sand source also consists of moderately well sorted quartz-rich, fine- to medium-grained sand with varying amounts of shell fragments, and grey or light grey in color.

The testing results show that the material from both offshore (N-2, N-3, and S-1) and inlet sand sources (ebb shoal and flood shoal) are very similar and compatible with the existing beach and also meet the requirements of Florida state regulation, 62B-41.007(2)(j), F.A.C. The material from existing beach has a higher shell content than the proposed sand sources, which are composed of primarily quartz sands.

Table 7. Sediment Analysis Summary of Proposed Sand Sources.

Sand Source Composite	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color
NOBA	0.31	1.72	1.1	2.6	0.5-1.8	4-63	5 or lighter
N2	0.26	1.95	0.74	2.17	0.88	2-59	2.5Y 6/1
N3	0.26	1.95	2.33	2.33	0.92	0-36	2.5Y 6/1
SOBA	0.22	2.3	1.1	4.1	0.5-1.8	na	5 or lighter
S1	0.25	2.01	0.75	2.03	0.85	2-60	5Y 7/1
Ebb Shoal	0.23	2.38	0	1.43	0.64	0-95	2.5Y 6/1
Flood Shoal	0.30	1.93	2.62	1.64	0.98	0-66	2.5Y 6/1
Beach	0.42	1.26	2.04	1.35	1.2	3-84	10YR 6/2
Beach, Quartz Fraction	0.24	2.09	0.00	0.02	0.59	0	10YR 7/1

*Retained in the #4 Sieve, **Passing the #230 Sieve

4.2 OVERFILL AND RENOURISHMENT FACTOR

The Overfill and Renourishment Factors were calculated to estimate the predicted performance of borrow materials with respect to the native beach materials, both during initial beach stabilization and over the long term. Thus, they help in choosing the best available borrow material. The factors also are used to calculate fill construction volume and renourishment volumes.

Overfill and Renourishment Factors are calculated using the sediment mean grain size and standard deviation of the native beach and the sand source in phi units.

4.2.1 Overfill Factor

The Overfill Factor (RA) is primarily a volume factor which may be used to calculate an intentional overfill to compensate for volume loss during the initial construction. The RA is used to determine which of the proposed sand sources will provide the lowest placement volume, and thus is most compatible with the existing beach.

The overfill factor for Vilano Beach was calculated using the USACE CEM software program for each of the sand sources, and the results are in **Table 8**. However, due to the high shell content of the existing beach caused by the eroding Anastasia formation, the existing beach has a highly variable shell content that cannot be matched to the offshore, nearshore, or upland quartz-rich sand deposits found within the vicinity of St. Johns County. As a result of these unusual natural conditions, the overfill factor for the proposed sand sources and the existing beach is higher than typical values for beach nourishment.

Therefore, the overfill factor was calculated again for only the quartz fraction of the existing beach in order to obtain a more accurate RA value for the proposed sand sources. The proposed sand sources within NOBA (N-2, N-3), SOBA (S-1), and St. Augustine Inlet are suitable for placement on St. Johns County's beaches. It should be noted that the overfill factor for the proposed ebb shoal sand source is moderately high, due to the very well sorted material which was identified by previous vibracoring efforts. However, the material within the ebb shoal was dredged and placed on St. Johns County beaches in 2012, and has performed well. Additional vibracores and overfill factor calculations will be necessary prior to design and construction since the ebb shoal has been accreting with new material since 2012.

Table 8. Summary of Overfill Factors for Vilano Beach.

	Offshore					Shoal		Native Beach	Native Beach (Quartz only)
	NOBA	**N2**	**N3**	**SOBA**	**S1**	**Ebb**	**Flood**		
Mean (mm)	0.31	0.26	0.26	0.22	0.25	0.23	0.30	0.42	0.24
Mean (phi)	1.72	1.95	1.95	2.3	2.01	2.38	1.93	1.26	2.09
Sorting / St. Dev (phi)	0.5-1.8	0.88	0.92	0.5-1.8	0.85	0.64	0.98	1.2	0.59
Visual Shell (%)	4-63	11.75	2.33	n/a	12.79	21.48	15.70	25.94	0
Overfill Factor, RA (Native)	2.19	6.82	5.12	13.67	15.40	33.6	3.63	n/a	n/a
Overfill Factor, RA (Quartz)	1.097	1.12	1.14	1.42	1.13	1.73	1.16	n/a	n/a

4.2.2 Renourishment Factor

The Renourishment Factor (RJ) estimates long term relative erosion rates of borrow materials with respect to native materials. This is done by assuming all grains have a finite residence time in the local littoral system before being transported offshore or alongshore. Larger grains remain longer. The RJ is primarily a measure of relative long-term stability. RJ values greater than one predict the borrow material will erode at a higher rate than the native beach. Conversely, values of less than one predict the borrow material is more stable.

The renourishment factor for Vilano Beach was calculated using the USACE CEM software program for each of the borrow areas, and the results are shown in **Table 9**. However, due to the high shell content of the existing beach caused by the eroding Anastasia formation, the existing beach has a highly variable shell content that cannot be matched to the offshore, nearshore, or upland quartz-rich sand deposits found within the vicinity of St. Johns County. As a result of these unusual natural conditions, the renourishment factor for the proposed sand sources and the existing beach is higher than typical values for beach nourishment.

Therefore, the renourishment factor was calculated again for only the quartz fraction of the existing beach in order to obtain a more accurate RJ value for the proposed sand sources. The proposed sand sources within NOBA (N-2, N-3), SOBA (S-1), and St. Augustine Inlet are suitable for placement on St. Johns County's beaches. It should be noted that the renourishment factor for the proposed ebb shoal sand source is high, due to the very well sorted material within the ebb shoal which was identified by previous vibracoring efforts. However, the material within the ebb shoal was dredged and placed on St. Johns County beaches in 2012, and has performed well. Additional vibracores and renourishment factor calculations will be necessary prior to design and construction since the ebb shoal has been accreting with new material since 2012.

Table 9. Summary of Renourishment Factors for Vilano Beach.

	Offshore					Shoal		Native Beach	Native Beach (Quartz only)
	NOBA	N2	N3	SOBA	S1	Ebb	Flood		
Mean (mm)	0.31	0.26	0.26	0.22	0.25	0.23	0.30	0.24	0.42
Mean (phi)	1.72	1.95	1.95	2.3	2.01	2.38	1.93	2.09	1.26
Sorting / St. Dev (phi)	0.5-1.8	0.88	0.92	0.5-1.8	0.85	0.64	0.98	0.59	1.2
Visual Shell (%)	4-63	11.75	2.33	n/a	12.79	21.48	15.70	0	25.94
Renourishment Factor, RJ (Native)	1.71	2.24	2.18	2.77	2.40	2.96	2.06	n/a	n/a
Renourishment Factor, RJ (Quartz)	0.209	0.42	0.385	0.559	0.509	1.496	0.316	n/a	n/a

4.3 COMPATIBILITY SUMMARY

The offshore borrow areas of NOBA, SOBA, and shoal complex contain significant volumes of beach quality sand that can be excellent sources for beach nourishment, although the materials in both sand sources are finer than that at the project beach. In general, the borrow materials at NOBA are coarser than that at SOBA; while the water is deeper at the SOBA than that at NOBA.

Grain size distribution, overfill factor and renourishment factor computations were used to determine if the proposed offshore and St. Augustine Inlet sand sources NOBA (N-2, N-3), SOBA (S-1), ebb shoal, and flood shoal are compatible with the native beach in St. Johns County. The compatibility analysis results for St. Johns County's Vilano beach are summarized in **Table 7**, **Table 8**, and **Table 9**. The grain size analysis revealed that the sediments of the borrow areas are composed of fine-grained quartz sand with visual shell values between 2 % and 27 %. The native beach is composed of fine- to medium-grained quartz and carbonate sand with a mean visual shell value of 26 %.

The overfill and renourishment factors for Vilano beach were calculated for each of the sand sources using the USACE CEM software program. The proposed sand sources within NOBA (N-2, N-3), SOBA (S-1), and St. Augustine Inlet showed acceptable overfill factors and renourishment factors and are therefore suitable for St. Johns County's beaches.

4.4 ADAPTIVE MANAGEMENT OF SAND SOURCES

This project anticipates to utilize an adaptive management of sand sources in order to maximize both the lifetime of the project, and the resources within the sand sources. At the time of this study, the offshore sand sources, N-2 and N-3 (NOBA) and S-1 (SOBA), have not been permitted though the Florida Department of Environmental Protection (FDEP). Additionally, upland sand sources do not have the volume available to maintain the project. However, as a large portion of the St. Augustine Inlet sand source is already permitted through the FDEP (southern lobe of the ebb shoal, federal navigation channel, and Vilano Point) it is an efficient management of resources to first utilize the sand sources within St. Augustine Inlet before proceeding offshore. The St. Augustine Inlet sand source, consisting of the ebb shoal, flood shoal, Vilano Point, and federal navigation channel, currently contains approximately 6 million cubic yards of beach compatible sediment. However, due to cultural resources and dredging limitations, not all of this volume may be available for beach placement.

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PLATES

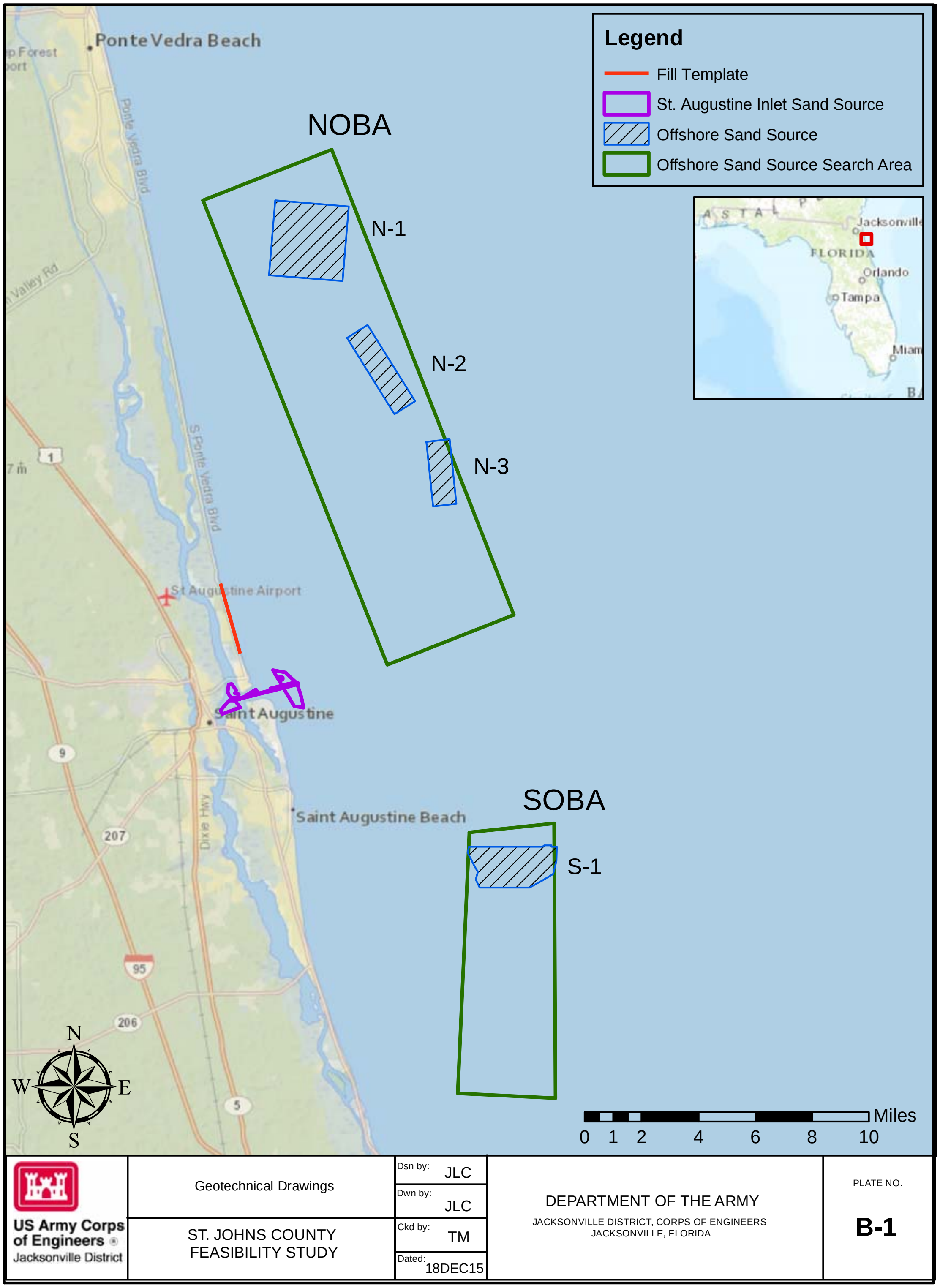


Plate B - 1. Overview of Vilano Beach and Proposed Sand Source Locations.

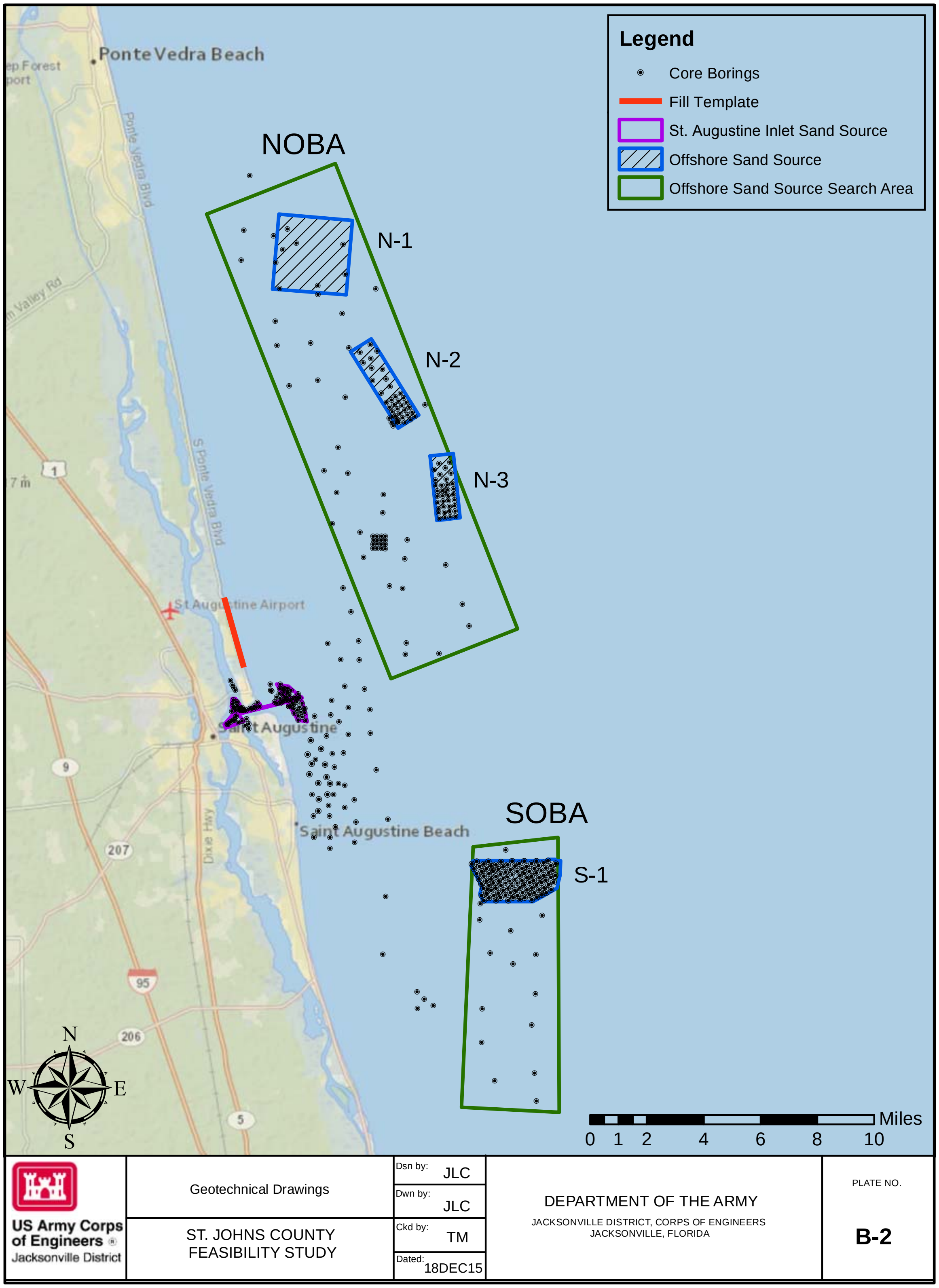


Plate B - 2. Overview of Vilano Beach and Proposed Sand Source Locations with Vibracore Boring Locations.

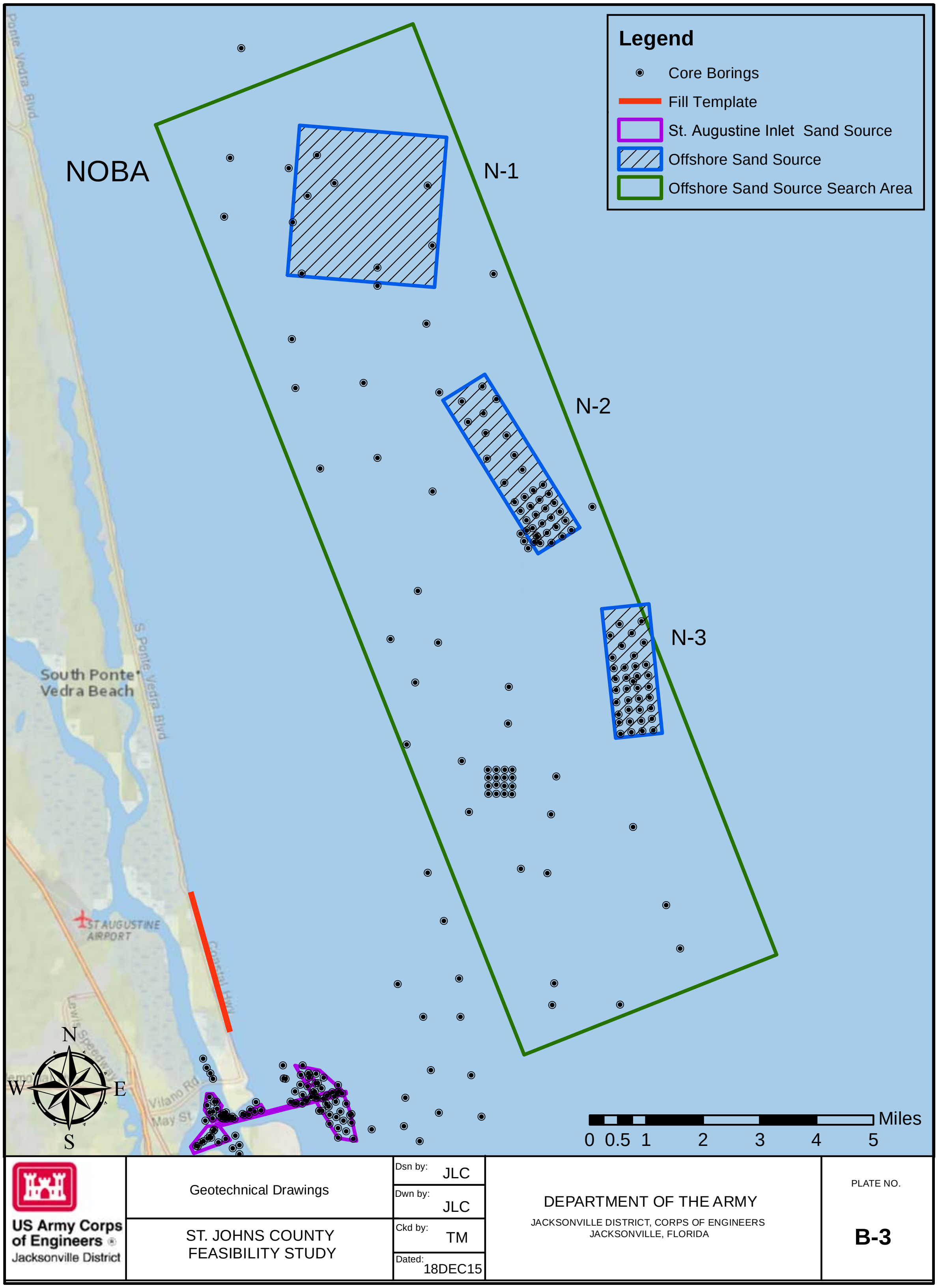


Plate B - 3. NOBA, Vibracore Boring Locations, and Proposed Sand Sources.

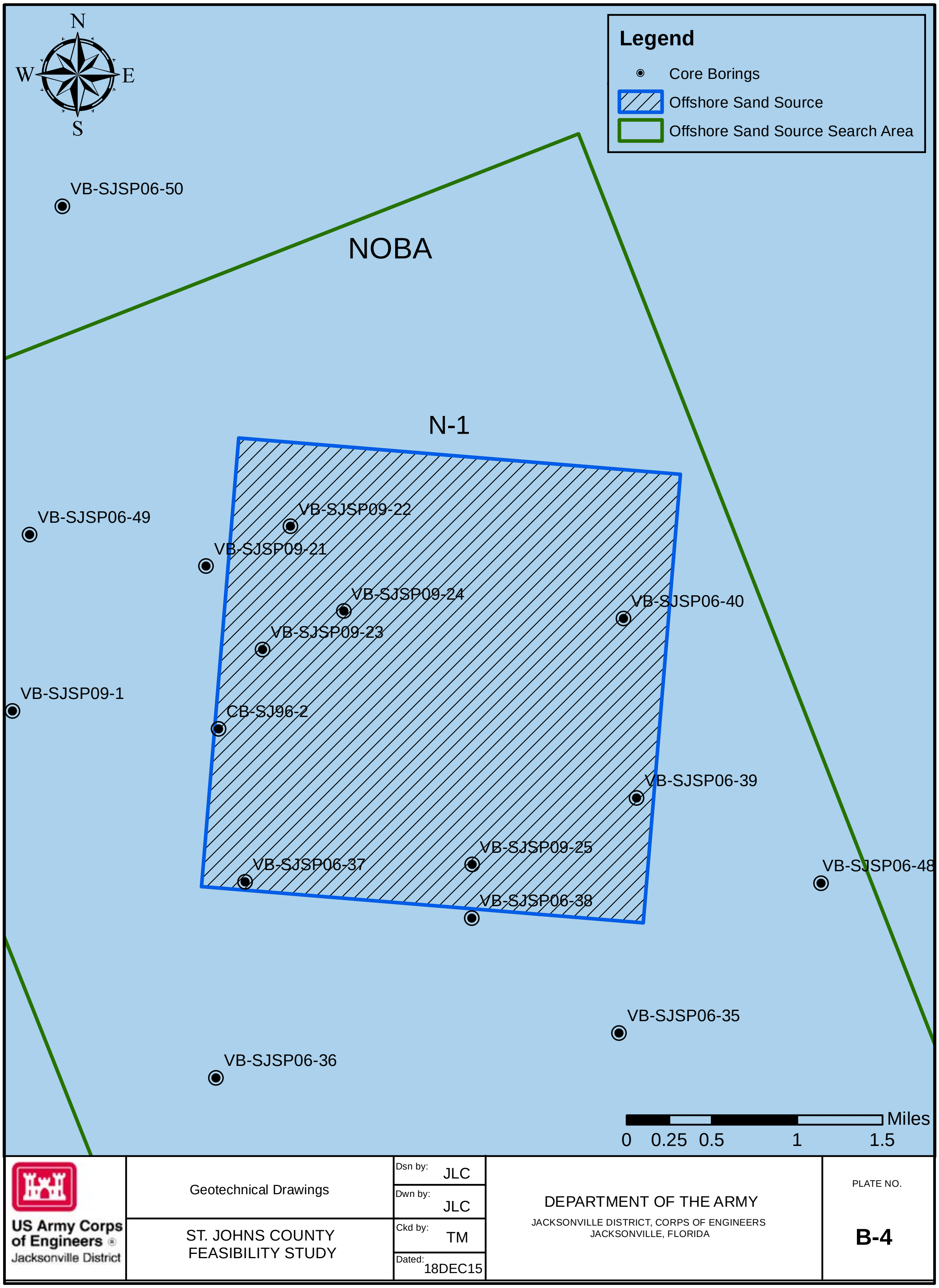
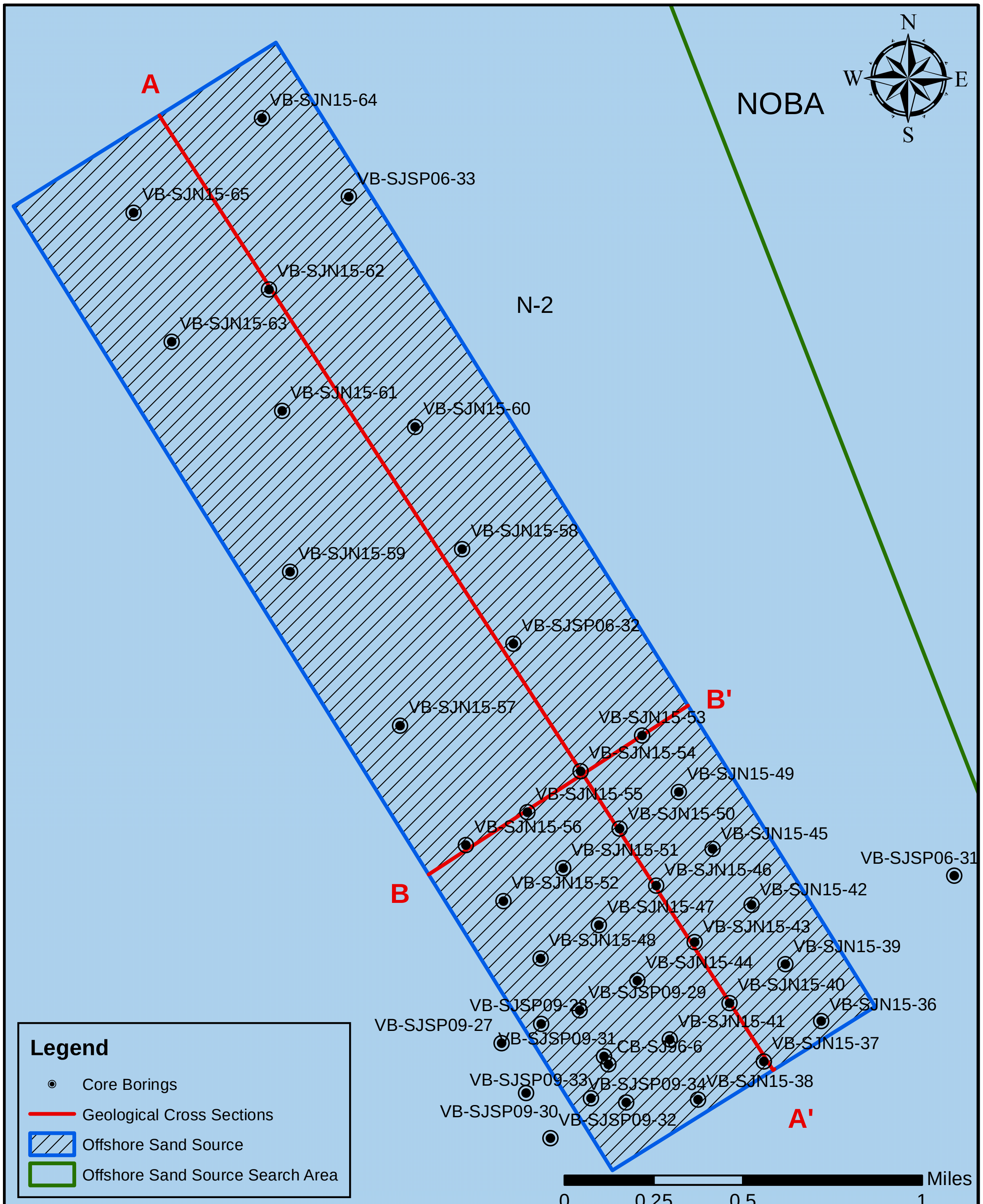


Plate B - 4. Proposed Sand Source N-1 and Vibracore Boring Locations.



US Army Corps of Engineers Jacksonville District	Geotechnical Drawings	Dsn by: JLC	DEPARTMENT OF THE ARMY JACKSONVILLE DISTRICT, CORPS OF ENGINEERS JACKSONVILLE, FLORIDA	PLATE NO.
		Dwn by: JLC		B-5
	ST. JOHNS COUNTY FEASIBILITY STUDY	Ckd by: TM		
		Dated: 18DEC15		

Plate B - 5. Proposed Sand Source N-2, Geological Cross Sections, and Vibracore Boring Locations.

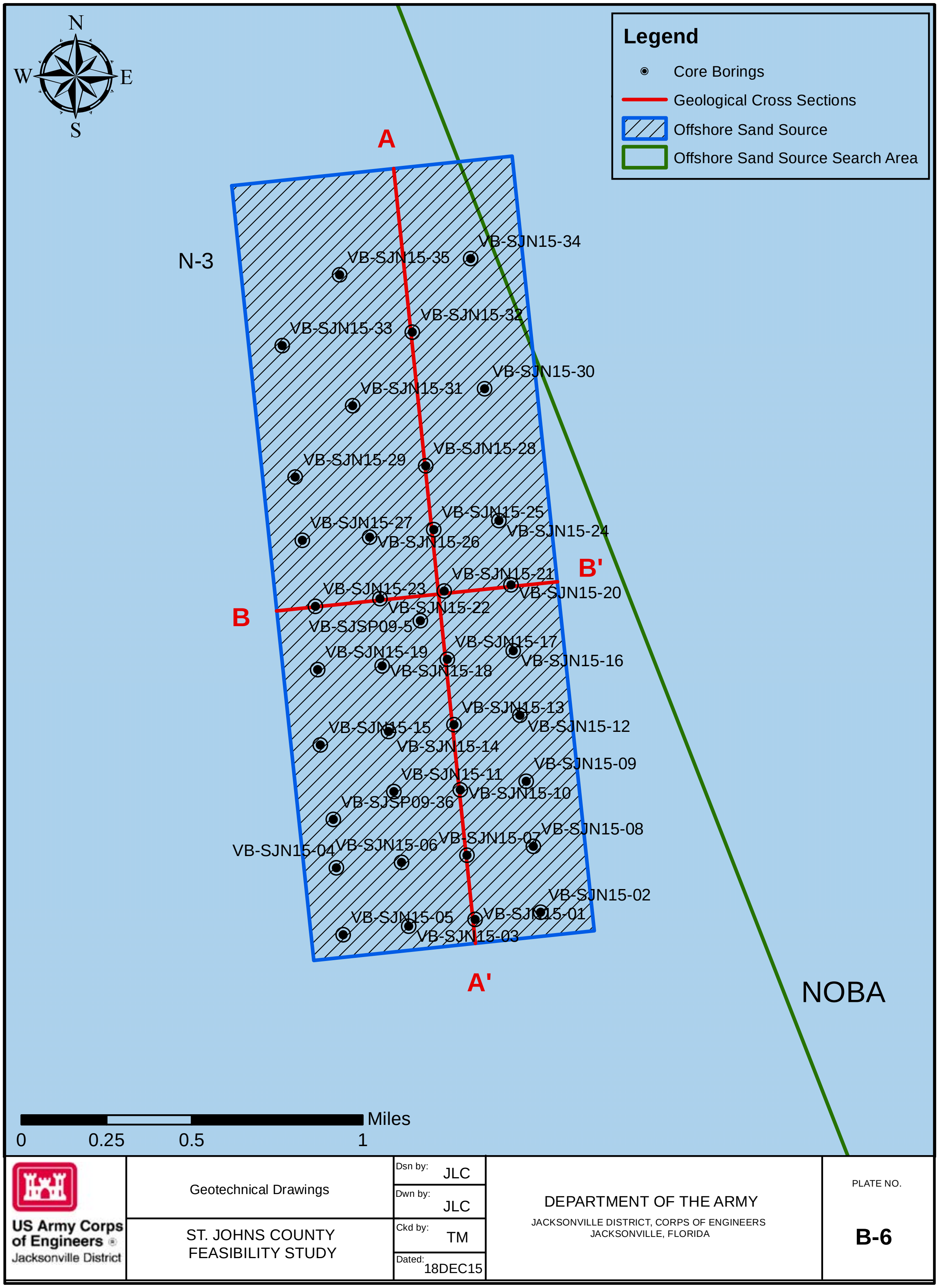


Plate B - 6. Proposed Sand Source N-3, Geological Cross Sections, and Vibracores.

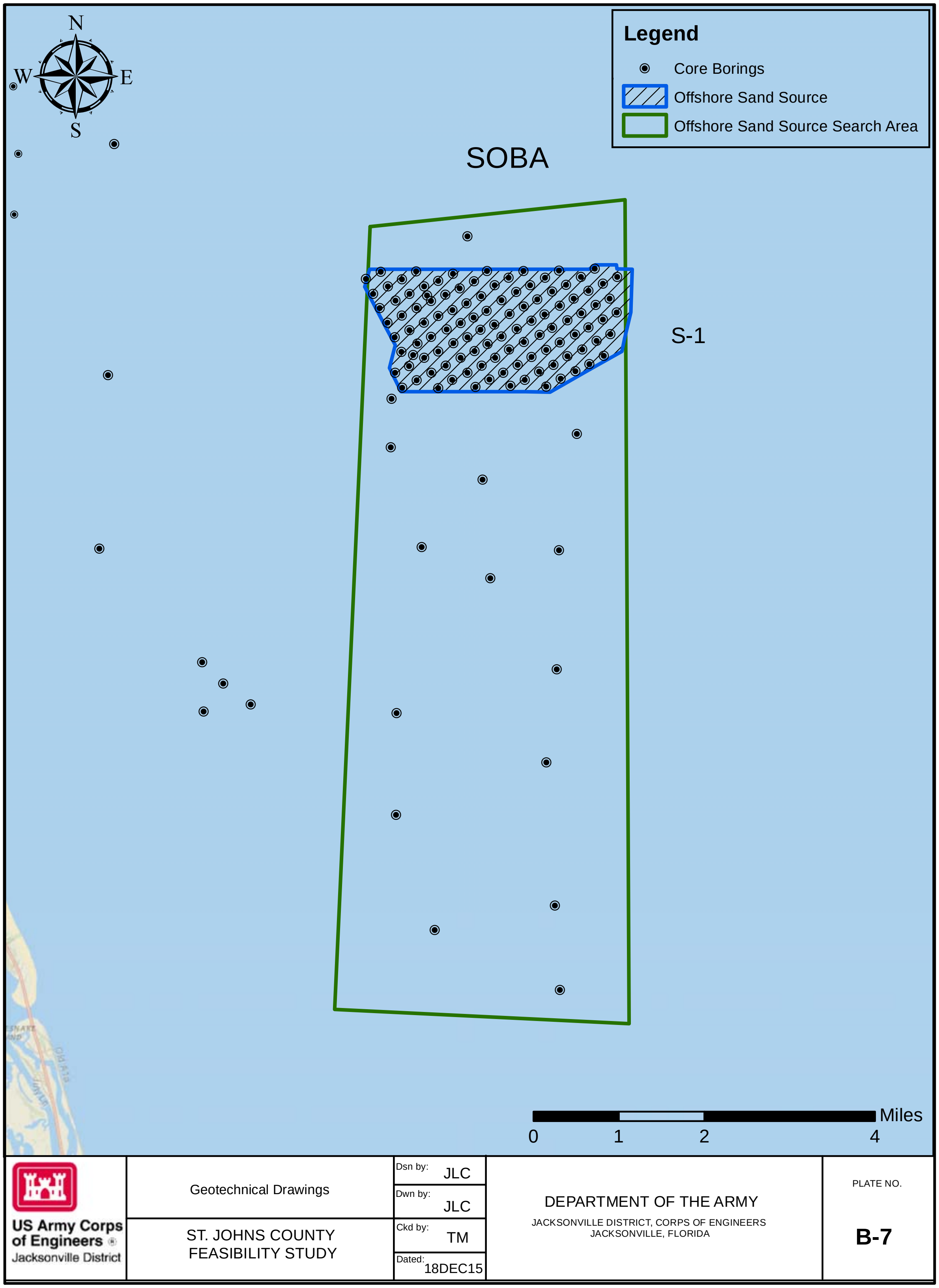


Plate B - 7. SOBA, Vibracores, and Proposed Sand Source S-1.

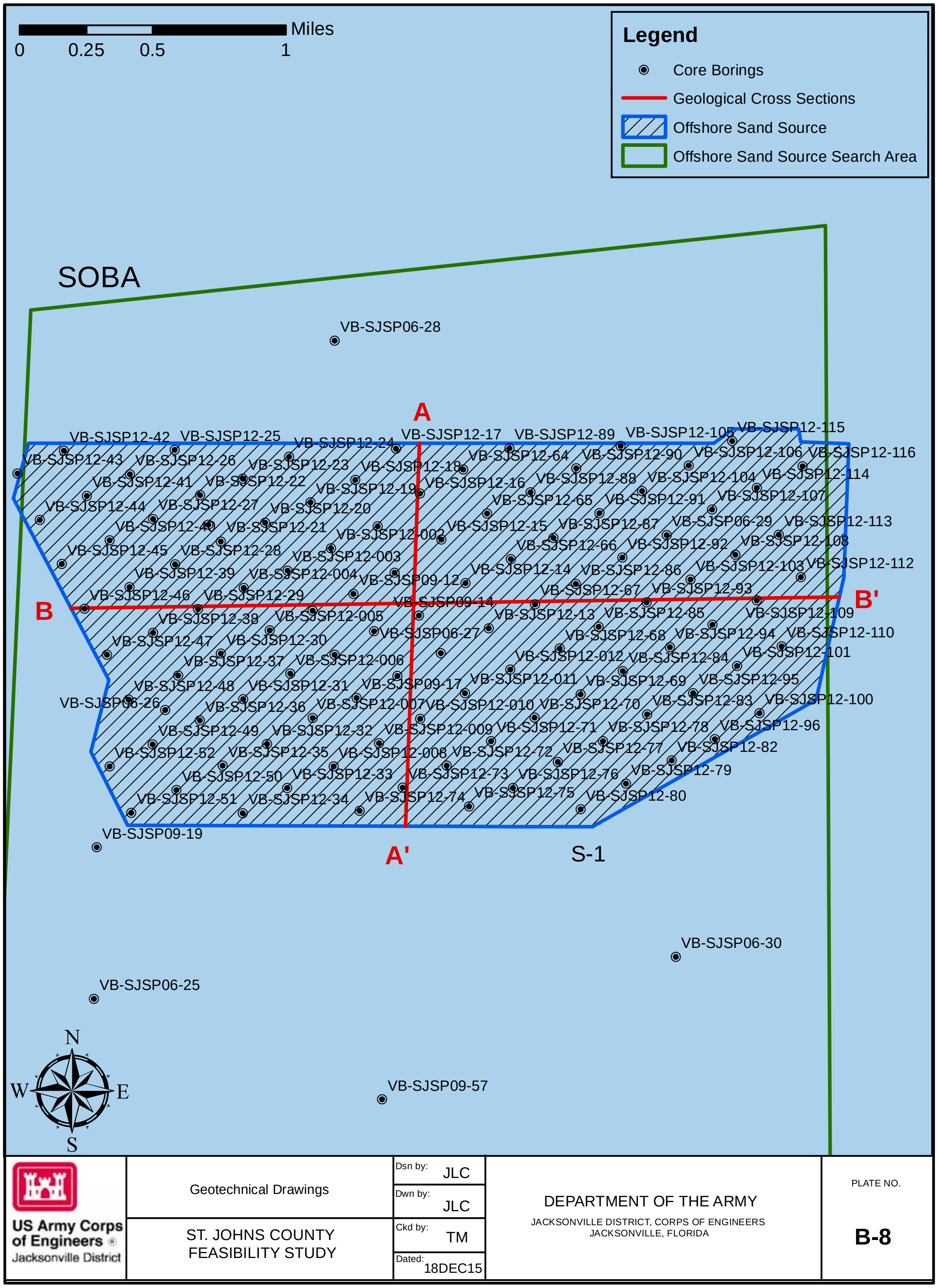
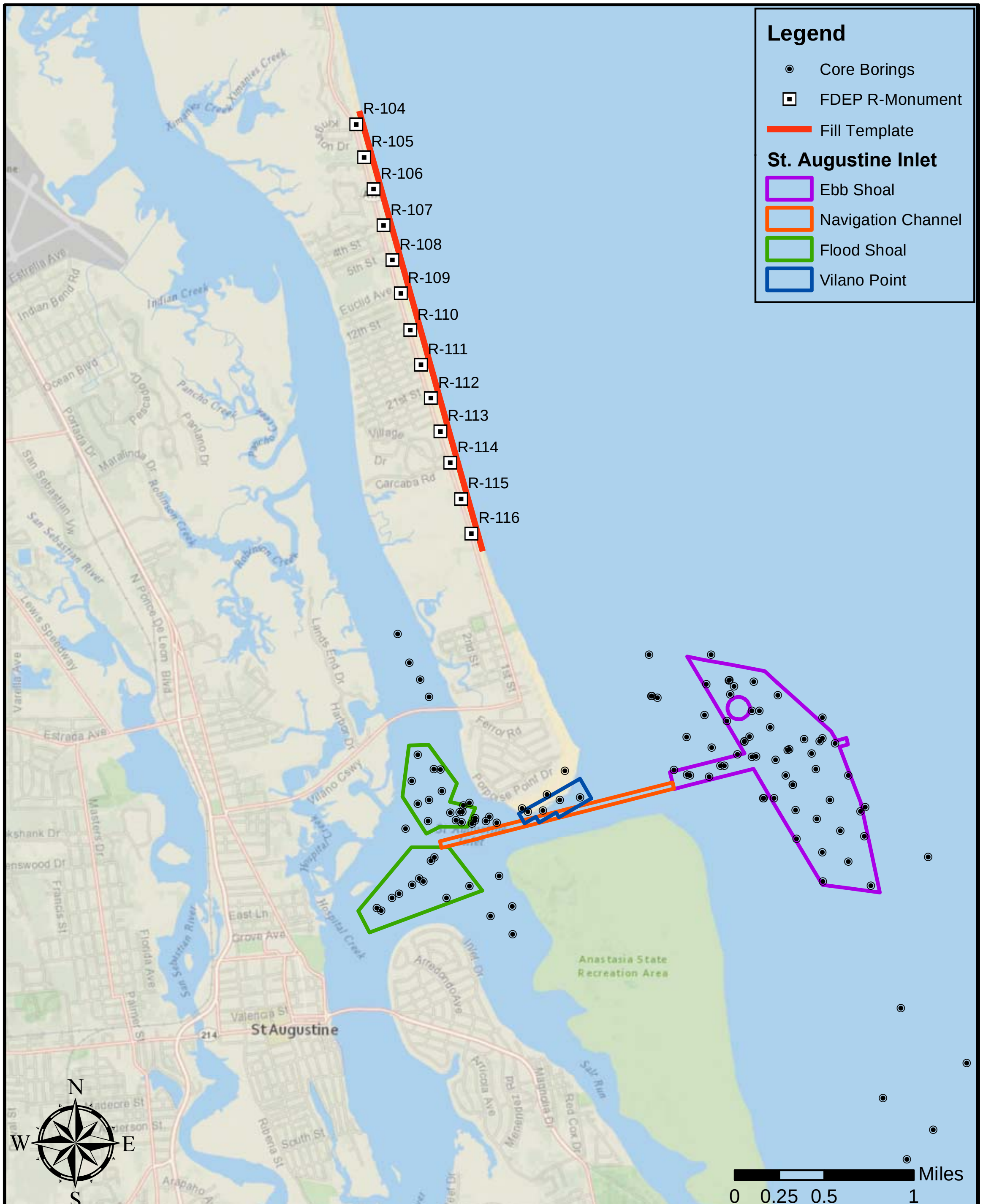


Plate B - 8. Proposed Sand Source S-1, Geological Cross Sections, and Vibracore Boring Locations.



US Army Corps of Engineers Jacksonville District	Geotechnical Drawings	Dsn by: JLC	DEPARTMENT OF THE ARMY JACKSONVILLE DISTRICT, CORPS OF ENGINEERS JACKSONVILLE, FLORIDA	PLATE NO.
		Dwn by: JLC		B-9
	ST. JOHNS COUNTY FEASIBILITY STUDY	Ckd by: TM		
		Dated: 18DEC15		

Plate B - 9. St. Augustine Inlet Proposed Sand Sources and Vibracore Boring Locations.

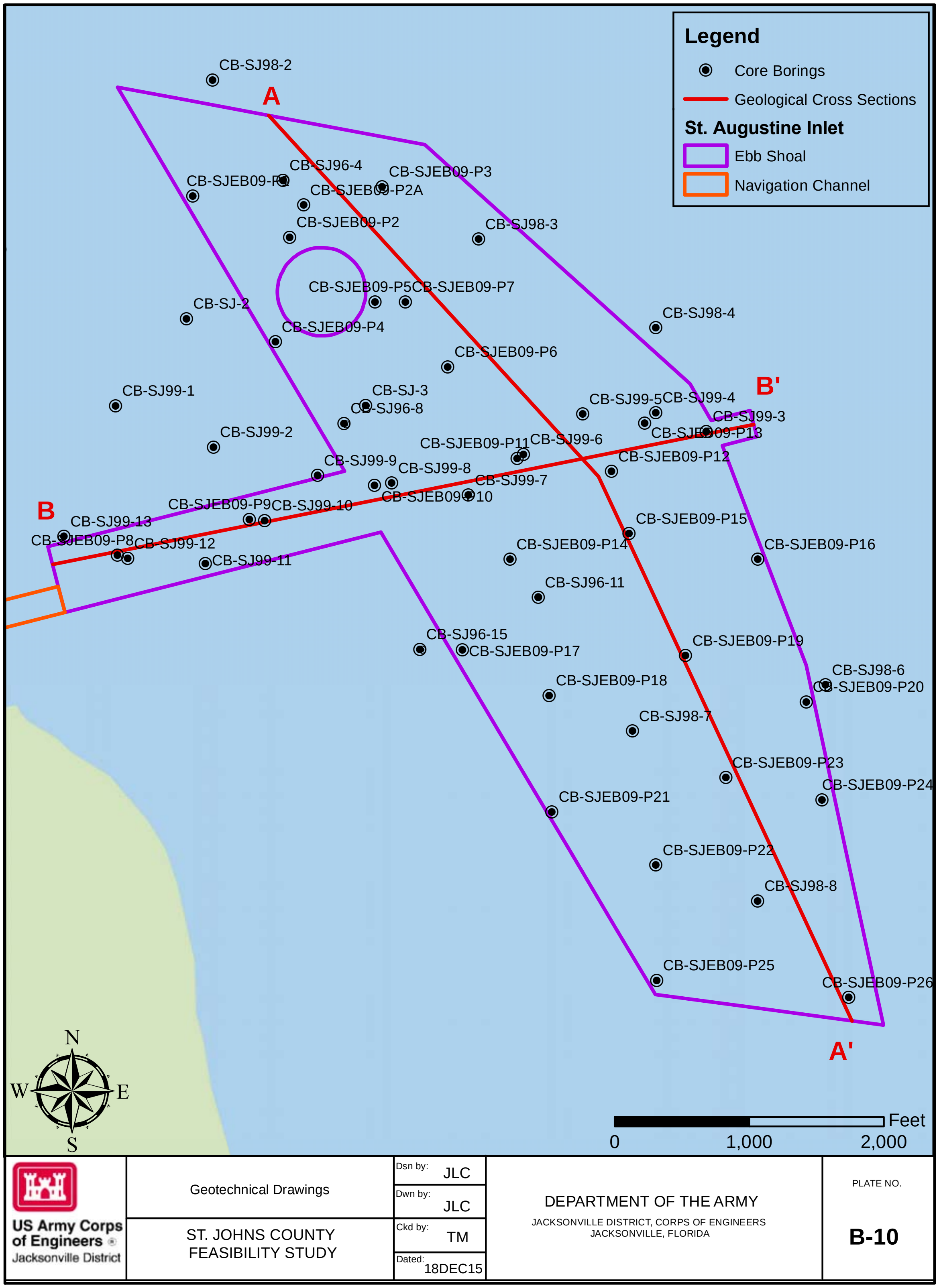


Plate B - 10. St. Augustine Inlet Ebb Shoal Proposed Sand Source, Geological Cross Sections, and Vibracore Boring Locations.

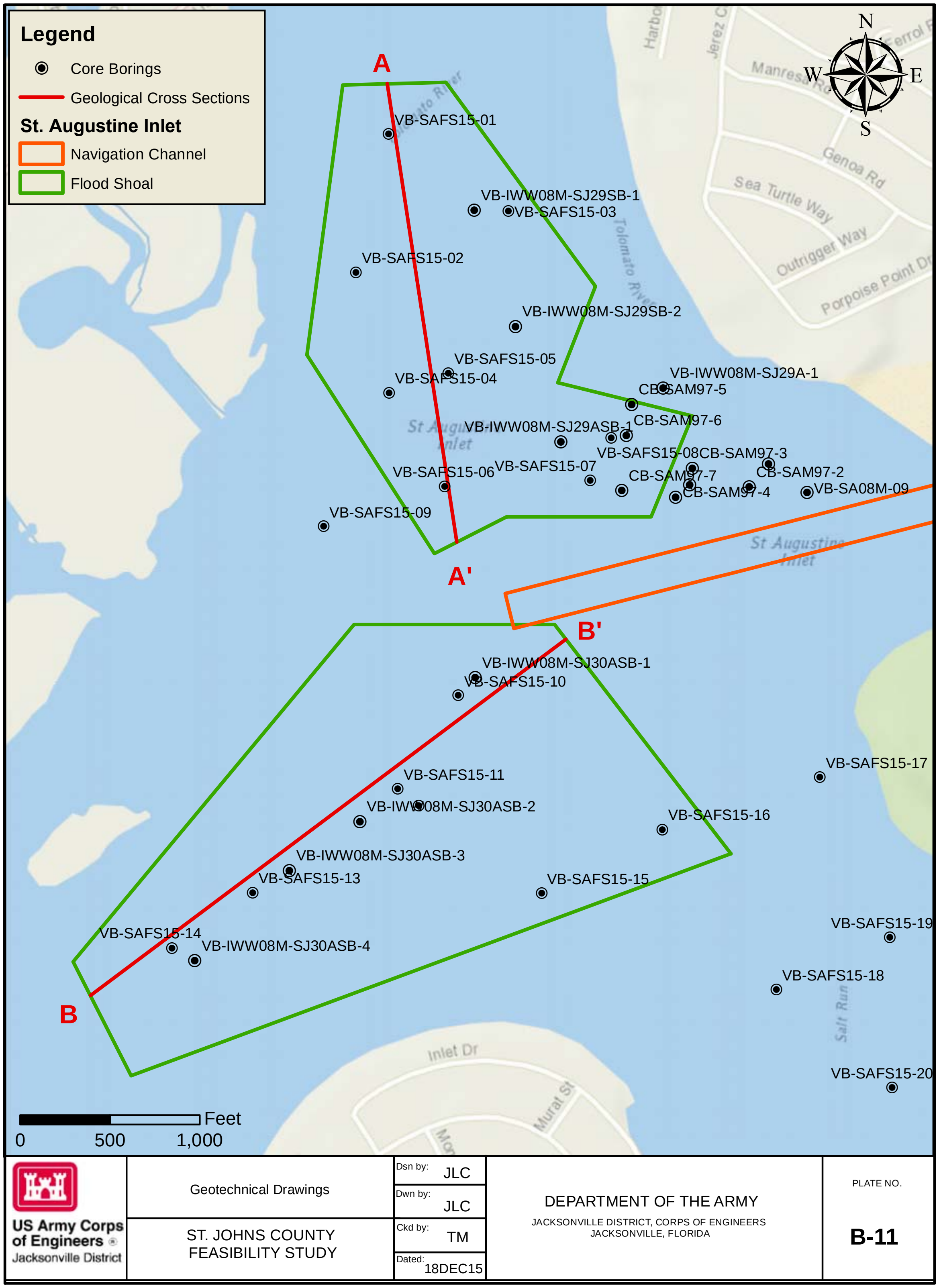


Plate B - 11. St. Augustine Inlet Flood Shoal Proposed Sand Source, Geological Cross Sections, and Vibracore Boring Locations.

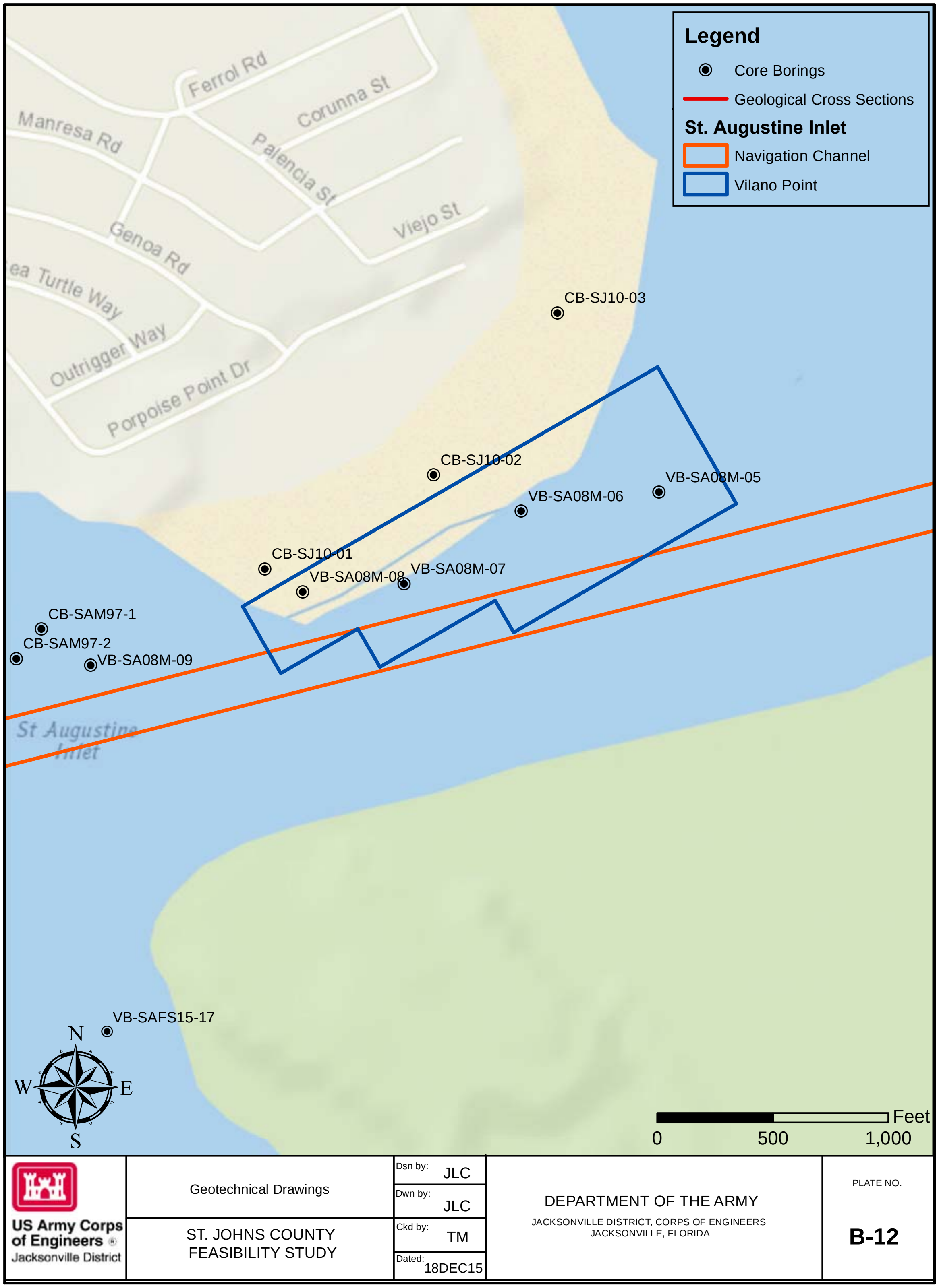


Plate B - 12. St. Augustine Inlet Vilano Point Proposed Sand Source and Vibracore Boring Locations.

SUB-APPENDIX

GRAIN SIZE ANALYSIS RESULTS FOR VILANO BEACH

Table D - 1. Vilano Beach, Grain Size Statistics

FDEP R-Monument	Sample Location	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Percent Carbonate (%)	Visual Shell (%)	Munsell Color
R-101	Mid-Berm	0.79	0.35	0	0.39	1.01	57.8	56	10YR 5/3
	Mid-Tide	0.67	0.58	0.9	0.41	1.04	47.1	45	10YR 5/3
	-3	0.57	0.82	4.12	0.71	1.84	51.8	43.2	10YR 5/3
	-5	0.18	2.44	0.12	1.32	0.92	10.4	8.7	10YR 6/1
	-10	0.20	2.34	1.78	1.82	0.92	5.3	5.3	10YR 6/1
	-15	0.17	2.58	0.97	2.32	1.18	10	8.6	10YR 6/1
R-105	Mid-Berm	0.69	0.53	2.07	0.04	1.21	43.8	50	10YR 5/3
	Mid-Tide	0.35	1.51	0	1.03	0.6	15.5	16.4	10YR 5/3
	-3	0.50	0.99	1.51	0.73	1.55	43.5	42.8	10YR 5/3
	-5	0.17	2.53	1.33	1.4	1.03	7.8	6.5	10YR 6/1
	-10	0.15	2.73	1.27	1.35	0.95	5.6	5	10YR 6/1
	-15	0.26	1.94	4.89	3.65	2.02	26.4	23.9	10YR 5/1
R-109	Mid-Berm	1.32	-0.40	3.08	0.21	1.04	78.5	83.7	10YR 6/4
	Mid-Tide	0.81	0.30	0.75	0.51	1.1	53.3	56.5	10YR 6/3
	-3	0.29	1.81	0.83	0.82	1.46	23	21.1	10YR 7/1
	-5	0.18	2.46	1.6	1.33	1.18	10.1	8.9	10YR 6/1
	-10	0.13	2.98	0.39	2.06	0.77	5.6	3.8	5Y 5/1
	-15	0.18	2.48	1.94	2.39	1.5	14.7	13	5Y 5/1
R-113	Mid-Berm	0.70	0.52	0.54	0.27	1.19	49.8	48.1	10YR 7/3
	Mid-Tide	1.42	-0.51	17.95	0.62	1.67	70.4	67	10YR 6/4
	-3	0.20	2.29	0.04	1.02	0.88	10.2	10.3	10YR 7/1
	-5	0.18	2.44	0.92	1.09	1.03	8.4	7.6	10YR 6/1
	-10	0.15	2.78	1.31	1.44	1.06	7.8	5.9	5Y 5/1
	-15	0.19	2.41	2	2.42	1.52	16.1	14.1	5Y 5/1
R-117	Mid-Berm	0.87	0.21	2.08	0.07	1.5	61.3	61.3	2.5Y 7/3
	Mid-Tide	0.55	0.87	3.01	0.44	1.47	43.3	38.3	2.5Y 7/4
	-3	0.16	2.63	0	1.53	0.57	4.2	2.9	2.5Y 7/1
	-5	0.16	2.67	2.58	1.48	1.17	7.2	6.1	2.5Y 6/1
	-10	0.15	2.74	1.49	3.2	1.25	10.1	7.9	2.5Y 5/1
	-15	0.16	2.64	1.61	4.38	1.43	14.1	10.4	2.5Y 5/1
St. Johns Beach Composite		**0.42**	**1.26**	**2.04**	**1.35**	**1.20**	**27.10**	**25.94**	**10YR 6/2**

*Retained in the #4 Sieve, **Passing the #230 Sieve

Table D - 2. Vilano Beach, Quartz Fraction, Grain Size Statistics

FDEP R-Monument	Sample Location	Quartz Mean (mm)	Quartz Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Quartz Munsell Color
R-101	Mid-Berm	0.44	1.17	0.00	0.03	0.81	10YR 7/1
	Mid-Tide	0.43	1.21	0.00	0.02	0.68	10YR 7/1
	-3	0.38	1.38	0.00	0.02	0.66	10YR 7/1
	-5	0.13	2.97	0.00	0.01	0.39	10YR 7/1
	-10	0.16	2.61	0.00	0.01	0.56	10YR 7/1
	-15	0.14	2.88	0.00	0.01	0.47	10YR 7/1
R-105	Mid-Berm	0.21	2.23	0.00	0.02	0.7	10YR 7/1
	Mid-Tide	0.33	1.59	0.00	0.01	0.53	10YR 7/1
	-3	0.23	2.10	0.00	0.02	0.74	10YR 7/1
	-5	0.13	2.90	0.00	0.01	0.41	10YR 7/1
	-10	0.15	2.74	0.00	0.01	0.41	10YR 7/1
	-15	0.13	3.00	0.00	0.02	0.5	10YR 7/1
R-109	Mid-Berm	0.60	0.74	0.00	0.03	0.9	10YR 7/1
	Mid-Tide	0.49	1.03	0.00	0.02	0.79	10YR 7/1
	-3	0.19	2.41	0.00	0.01	0.8	10YR 7/1
	-5	0.15	2.74	0.00	0.01	0.51	10YR 7/1
	-10	0.12	3.07	0.00	0.01	0.4	10YR 7/1
	-15	0.13	2.94	0.00	0.01	0.49	10YR 7/1
R-113	Mid-Berm	0.41	1.30	0.00	0.02	0.92	10YR 7/1
	Mid-Tide	0.39	1.36	0.00	0.03	0.98	10YR 7/1
	-3	0.18	2.47	0.00	0.01	0.57	10YR 7/1
	-5	0.16	2.67	0.00	0.01	0.4	10YR 7/1
	-10	0.13	2.99	0.00	0.01	0.41	10YR 7/1
	-15	0.13	2.96	0.00	0.01	0.46	10YR 7/1
R-117	Mid-Berm	0.31	1.69	0.00	0.02	0.69	10YR 7/1
	Mid-Tide	0.29	1.80	0.00	0.02	0.77	10YR 7/1
	-3	0.16	2.66	0.00	0.01	0.49	10YR 7/1
	-5	0.13	2.93	0.00	0.01	0.4	10YR 7/1
	-10	0.12	3.04	0.00	0.01	0.46	10YR 7/1
	-15	0.12	3.02	0.00	0.01	0.51	10YR 7/1
St. Johns Beach Composite		**0.24**	**2.09**	**0.00**	**0.02**	**0.59**	**10 YR 7/1**

*Retained in the #4 Sieve, **Passing the #230 Sieve

GRAIN SIZE ANALYSIS RESULTS FOR PROPOSED SAND SOURCES

Table D - 3. Sediment Analysis Results from Vibracores in Proposed Sand Source N-2.

Sample Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
VB-SJN15-36	3	0.29	1.78	1.85	0.75	1.08	12.4	2.5Y 6/1
	6	0.28	1.85	0.12	0.82	0.8	13.2	2.5Y 6/1
	9.5	0.20	2.29	0.02	0.97	0.75	14.6	2.5Y 5/1
	11.5	0.15	2.75	0.10	4.75	0.78	6.4	2.5Y 5/1
VB-SJN15-37	2	0.29	1.81	0.00	0.3	0.95	21.1	2.5Y 7/1
	4	0.22	2.16	0.48	6.3	0.87	7.7	2.5Y 5/1
	6	0.25	2.03	0.03	0.83	0.7	7	2.5Y 7/1
	8	0.20	2.36	2.70	6.53	1.23	6.8	2.5Y 7/1
VB-SJN15-38	2.5	0.34	1.56	0.49	0.36	1.11	16.3	2.5Y 5/1
	5	0.26	1.92	0.13	0.34	0.84	10	2.5Y 6/1
	7.5	0.21	2.24	0.27	2.92	0.78	9.3	2.5Y 5/1
	9.5	0.23	2.12	0.62	2.58	0.89	8.4	2.5Y 5/1
	11	0.15	2.71	0.14	5.21	0.69	3.7	2.5Y 5/1
VB-SJN15-39	3	0.25	1.98	0.38	1.48	0.88	13.7	2.5Y 7/2
	6	0.23	2.11	0.20	2.52	0.82	7.6	2.5Y 5/1
	7	0.18	2.46	0.20	4.46	0.78	5.6	2.5Y 5/1
VB-SJN15-40	2	0.27	1.90	0.63	1.42	0.95	14.5	2.5Y 6/1
	4	0.22	2.19	0.28	2.04	0.72	7.5	2.5Y 6/1
	6.5	0.23	2.11	0.00	1.83	0.72	8.5	2.5Y 5/1
	9	0.17	2.56	0.73	4.38	0.82	3.4	2.5Y 5/1
VB-SJN15-41	2	0.33	1.60	0.26	1.02	1.03	23.9	2.5Y 6/1
	4	0.24	2.05	0.20	0.61	0.78	9.5	2.5Y 6/1
	6	0.25	2.02	0.09	1.35	0.75	10.8	2.5Y 6/1
	8	0.26	1.95	1.63	1.76	1.11	12.1	2.5Y 6/1
	10	0.26	1.95	1.63	1.76	1.11	10.7	2.5Y 5/1
	11	0.20	2.29	0.02	1.44	0.62	6.7	2.5Y 5/1
VB-SJN15-42	2.5	0.27	1.88	0.15	1.2	0.94	21	2.5Y 6/2
	5	0.27	1.89	0.03	2.28	0.87	15	2.5Y 6/2
	7	0.24	2.06	0.08	0.96	0.74	13.6	2.5Y 5/2
	9	0.25	2.01	0.15	2.66	0.78	14.4	2.5Y 5/2
	11.5	0.17	2.58	0.07	3.93	0.67	13.6	10Y 5/1
VB-SJN15-43	3	0.35	1.50	0.06	0.19	1.05	25.9	2.5Y 7/1
	5.5	0.38	1.38	0.56	0.63	1.15	38.4	2.5Y 7/1

Sample Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	8.5	0.43	1.23	3.52	1.67	1.36	27.4	2.5Y 6/1
	10	0.19	2.37	0.00	4.12	0.65	7.3	2.5Y 6/1
	12	0.16	2.61	0.30	3.49	0.7	5.3	2.5Y 5/1
VB-SJN15-44	3	0.33	1.59	0.10	0.99	0.98	25.8	2.5Y 6/2
	6	0.36	1.47	0.18	0.69	1.04	34.9	2.5Y 6/2
	9	0.25	2.01	0.03	1.2	0.82	12.3	2.5Y 6/1
	10	0.27	1.90	0.31	1.81	0.94	15.9	2.5Y 6/1
	12	0.28	1.86	2.46	1.01	1.17	10	2.5Y 6/1
	14	0.21	2.25	0.02	2.16	0.63	8.3	2.5Y 6/1
VB-SJN15-45	2	0.28	1.85	0.03	1.26	0.95	24.9	N 4/
	3.5	0.22	2.21	0.08	1.53	0.76	10.4	2.5Y 6/2
	6	0.38	1.41	1.24	1.5	1.22	23.3	2.5Y 6/2
	7.5	0.22	2.21	0.13	0.27	0.69	5.3	2.5Y 6/2
	9	0.19	2.39	0.00	2.44	0.7	11.4	10Y 5/1
VB-SJN15-46	3	0.39	1.35	0.10	0.75	1.03	29.1	2.5Y 6/1
	6	0.27	1.91	0.24	2	0.94	17.6	2.5Y 6/2
	8	0.24	2.08	0.07	1.65	0.75	6.5	2.5Y 6/2
	10	0.24	2.06	0.14	1.79	0.84	8.3	2.5Y 6/2
	12	0.20	2.31	0.02	2.46	0.57	2.1	2.5Y 6/1
	13.5	0.19	2.38	0.00	1.83	0.57	5.7	2.5Y 6/1
VB-SJN15-47	3.5	0.31	1.68	2.35	0.61	1.27	17.8	2.5Y 6/1
	7	0.24	2.08	0.42	1.85	0.85	7.4	2.5Y 6/1
	10.5	0.22	2.20	0.08	2.29	0.77	5.8	2.5Y 6/1
	13	0.24	2.09	2.61	3.94	1.39	14.4	2.5Y 5/1
	15	0.20	2.33	1.94	7.94	1.42	15.2	2.5Y 5/1
VB-SJN15-48	3.5	0.53	0.91	0.64	0.27	1.16	28.8	2.5Y 6/2
	7	0.28	1.83	0.01	0.78	0.88	13.6	2.5Y 6/2
	8.5	0.27	1.90	0.09	1.32	0.84	6.5	2.5Y 6/2
	11	0.22	2.20	0.01	0.49	0.6	3.3	2.5Y 7/1
	13.5	0.20	2.32	0.32	1.59	0.67	2.9	2.5Y 5/1
VB-SJN15-49	3	0.31	1.68	0.27	1.24	1.06	16.5	2.5Y 6/1
	6	0.29	1.80	0.43	1.51	1.01	16.7	2.5Y 6/1
	8	0.29	1.77	0.91	1.07	1.13	19.8	2.5Y 6/1
	10	0.42	1.26	5.52	1.83	1.56	24.7	2.5Y 6/1
	12	0.25	1.99	1.06	0.85	0.93	8.9	2.5Y 6/1
	14	0.21	2.24	0.17	1.96	0.85	3.7	2.5Y 6/1

Sample Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	16	0.16	2.65	0.14	4.35	0.72	3.7	2.5Y 6/1
VB-SJN15-50	3	0.33	1.60	0.17	1.03	1.1	24.2	2.5Y 5/1
	6	0.35	1.52	1.14	1.17	1.18	26	2.5Y 6/1
	9	0.25	2.03	1.22	1.44	0.93	7.7	2.5Y 7/1
	12.5	0.21	2.25	0.00	1.94	0.6	3.6	2.5Y 7/1
	14.5	0.22	2.21	0.15	1.87	0.71	6.8	2.5Y 7/1
	16.5	0.17	2.60	0.24	5.42	0.8	6	2.5Y 5/1
VB-SJN15-51	3	0.37	1.44	0.00	0.46	0.95	19.9	2.5Y 7/2
	6	0.45	1.15	0.46	1.51	1.23	23.2	2.5Y 7/2
	9	0.27	1.89	0.55	1.35	1	18	2.5Y 7/2
	12	0.25	1.98	1.90	1.05	1.11	6	2.5Y 7/2
	15	0.28	1.82	2.43	2.34	1.2	8.9	2.5Y 7/2
	17	0.21	2.28	0.36	3.37	0.85	5.5	N 7/
	19	0.29	1.77	2.23	3.01	1.41	22.4	2.5Y 5/1
VB-SJN15-52	2	0.25	2.01	0.10	0.77	0.72	10.5	2.5Y 6/2
	4	0.25	2.01	0.06	0.99	0.78	9.7	2.5Y 6/2
	6	0.27	1.87	0.18	0.87	0.91	7.7	2.5Y 6/2
	8	0.26	1.96	0.00	1.07	0.92	14.7	2.5Y 6/2
	10	0.22	2.22	0.18	2.57	0.73	5.8	2.5Y 6/2
	12	0.22	2.20	0.00	3.37	0.7	4.5	2.5Y 6/2
	14	0.20	2.31	0.09	3.63	0.65	3.5	2.5Y 5/1
VB-SJN15-53	3.5	0.29	1.77	0.42	0.56	1.06	20.9	2.5Y 6/1
	7	0.24	2.06	0.19	3.73	0.87	10.8	2.5Y 6/1
	10	0.22	2.22	0.00	1.43	0.68	3.9	2.5Y 6/1
	12	0.21	2.27	1.34	1.89	1	9.2	2.5Y 5/1
	14	0.17	2.52	0.92	4.93	1.01	6.6	2.5Y 5/1
VB-SJN15-54	2	0.35	1.53	0.97	2.51	1.18	26.6	2.5Y 6/2
	4	0.25	2.00	0.06	1.36	0.86	13	2.5Y 6/2
	6	0.20	2.31	0.00	1.59	0.61	5.4	2.5Y 6/1
	8	0.20	2.35	0.06	3.59	0.75	11.1	2.5Y 5/1
	10	0.26	1.95	2.83	2.13	1.21	10.7	2.5Y 6/1
	12	0.18	2.47	0.20	4.87	0.82	8.5	2.5Y 5/1
VB-SJN15-55	2	0.29	1.81	0.05	1.25	0.95	20.2	2.5Y 6/1
	4	0.30	1.73	0.15	0.97	0.98	20.3	2.5Y 6/1
	6	0.30	1.74	0.94	1.06	1	18.7	2.5Y 6/1
	8	0.21	2.23	0.92	9.77	0.98	12.9	2.5Y 5/1

Sample Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	10	0.22	2.21	0.39	2.94	0.66	4.2	2.5Y 5/1
	13	0.24	2.04	0.88	1.9	0.93	10.1	2.5Y 5/1
	16	0.23	2.10	1.15	3.07	0.96	6.3	2.5Y 5/1
VB-SJN15-56	3	0.25	1.98	0.07	1.03	0.72	6.7	2.5Y 7/2
	6	0.25	2.01	0.00	1.17	0.68	8.3	2.5Y 7/2
	9	0.21	2.28	0.01	2.34	0.57	6.9	2.5Y 7/2
	11	0.21	2.24	0.00	3.21	0.63	4.8	2.5Y 6/1
	13	0.25	2.03	0.67	7.98	0.94	5.7	2.5Y 6/1
	15	0.25	2.01	0.00	3.19	0.84	7.9	2.5Y 6/1
VB-SJN15-57	3	0.27	1.89	0.00	1.41	0.81	10.5	2.5Y 6/2
	6	0.27	1.88	0.07	2.15	0.78	6.9	2.5Y 6/2
	9	0.27	1.87	0.00	0.97	0.78	9.1	2.5Y 6/2
	12	0.32	1.66	1.66	1.1	1.12	13.8	2.5Y 6/2
	15	0.23	2.11	0.00	1.61	0.6	3.3	2.5Y 6/2
	17.5	0.21	2.24	0.14	3.12	0.77	8.1	2.5Y 5/1
VB-SJN15-58	3	0.27	1.91	0.42	1.39	0.94	15.9	2.5Y 7/1
	6	0.24	2.04	0.25	1.45	0.76	8.5	2.5Y 7/1
	9	0.22	2.21	0.00	2.61	0.66	6.4	2.5Y 6/1
	11	0.24	2.09	1.89	1.79	1.02	6.5	2.5Y 6/1
	13	0.20	2.35	0.23	4.64	0.7	5.3	2.5Y 6/1
	15	0.26	1.95	1.91	2.98	1.2	13	2.5Y 6/1
	16	1.37	-0.45	27.50	7.26	2.31	58.9	2.5Y 5/1
VB-SJN15-59	3	0.26	1.92	0.02	0.63	0.74	10.4	2.5Y 6/2
	6	0.28	1.84	0.74	0.59	0.91	8.1	2.5Y 6/2
	9	0.23	2.13	0.03	2.16	0.64	6.6	2.5Y 6/2
	10.5	0.25	2.03	0.20	1.39	0.75	8.9	2.5Y 6/2
	13.5	0.22	2.22	0.02	2.29	0.62	4.9	2.5Y 6/2
	15.5	0.19	2.38	0.00	3.16	0.64	3.4	5G 5/1
VB-SJN15-60	3	0.29	1.78	1.11	1.82	1.1	19.8	2.5Y 6/2
	6	0.32	1.63	3.80	1.81	1.3	21.9	2.5Y 6/2
	8.5	0.18	2.45	0.02	4.62	0.6	6.4	2.5Y 5/1
VB-SJN15-61	3	0.27	1.87	0.19	0.98	0.77	12.4	2.5Y 6/1
	6	0.32	1.63	0.49	0.96	0.96	18.2	2.5Y 6/1
	9	0.30	1.74	1.31	0.9	1.03	9.7	2.5Y 6/1
	11	0.23	2.12	0.29	1.54	0.72	6.4	2.5Y 5/1
	12	0.21	2.23	0.16	2.09	0.62	8.6	2.5Y 5/1

Sample Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	15	0.23	2.12	0.14	3.16	0.63	3.2	2.5Y 6/1
	16	0.22	2.19	0.06	2.35	0.63	7.6	2.5Y 6/1
VB-SJN15-62	3	0.23	2.14	0.09	2.38	0.66	7.2	2.5Y 6/1
	6	0.24	2.06	0.34	1.31	0.7	8.4	2.5Y 6/1
	9	0.32	1.65	1.00	3.43	1.11	13.9	2.5Y 6/1
	12	0.25	2.01	7.25	5.26	1.34	13.5	2.5Y 5/1
VB-SJN15-63	3	0.29	1.78	0.47	1.2	0.93	9.9	2.5Y 6/2
	6	0.22	2.17	0.05	2.18	0.68	3.9	2.5Y 6/2
	9	0.22	2.20	0.20	1.33	0.66	8.4	2.5Y 6/2
VB-SJN15-64	2	0.27	1.90	0.50	2.29	0.85	8.7	2.5Y 6/2
	4	0.26	1.93	0.48	1.63	0.84	8.5	2.5Y 6/2
	6	0.19	2.40	0.15	1.66	0.63	3.4	2.5Y 6/2
	7	0.19	2.39	0.13	3.07	0.8	6.9	2.5Y 5/1
VB-SJN15-65	2	0.23	2.15	0.13	1.81	0.67	7.9	2.5Y 6/1
	4	0.23	2.15	0.11	2.31	0.7	7.8	2.5Y 6/1
	6	0.22	2.19	0.02	1.21	0.7	7.4	2.5Y 6/1
	8	0.24	2.09	0.00	2.42	0.84	11.7	2.5Y 6/1
	10	0.22	2.17	0.35	2.48	0.75	8.2	2.5Y 6/1
N2 Sand Source Composite		**0.26**	**1.95**	**0.74**	**2.17**	**0.88**	**11.75**	**2.5Y 6/1**

*Retained in the #4 Sieve, **Passing the #230 Sieve

Table D - 4. Sediment Analysis Results from Vibracores in Proposed Sand Source N-3.

Sample Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
VB-SJN15-01	2	0.25	1.99	2.36	2.16	1.14	7.9	2.5Y 8/1
	4	0.19	2.40	0.11	2.89	0.76	6.9	2.5Y 6/1
	6	0.17	2.59	0.39	8.44	0.82	3.6	10Y 5/1
VB-SJN15-02	1	0.21	2.25	0.00	1.51	0.6	8.3	2.5Y 6/1
	3	0.23	2.10	0.01	1.81	0.66	3.8	2.5Y 6/1
	5	0.18	2.49	0.03	2.92	0.62	4.5	2.5Y 5/1
	7	0.19	2.41	1.78	5.25	1.14	6.1	2.5Y 5/1
VB-SJN15-03	2	0.23	2.14	0.05	2.33	0.74	10.4	2.5Y 5/1
	4	0.20	2.31	0.00	8.44	0.69	6.9	2.5Y 5/1
	6	0.16	2.66	0.32	6.64	0.79	4	2.5Y 5/1
VB-SJN15-04	1.5	0.23	2.14	0.27	1.84	0.68	8.8	2.5Y 7/1
	3.5	0.22	2.20	0.08	5.11	0.69	11.4	2.5Y 6/1
	5	0.60	0.74	15.97	1.9	2.3	36	10Y 5/1
VB-SJN15-05	1	0.26	1.94	0.06	1.44	0.74	6.5	2.5Y 6/1
	2.5	0.20	2.35	0.04	2.07	0.72	7.5	2.5Y 5/1
VB-SJN15-06	2	0.24	2.04	0.44	3.62	0.88	10.2	2.5Y 6/2
	4.5	0.44	1.20	9.59	3.75	2.04	24.3	2.5Y 5/1
VB-SJN15-07	2	0.21	2.27	0.00	0.74	0.62	3.2	2.5Y 6/2
	4	0.26	1.92	2.48	1.83	1.19	9.3	2.5Y 6/2
	5.5	0.19	2.40	0.12	2.55	0.63	5.5	10Y 5/1
VB-SJN15-08	1	0.21	2.26	0.00	3.46	0.64	8	2.5Y 5/1
VB-SJN15-09	2	0.24	2.07	0.17	1.25	0.74	10.4	2.5Y 6/2
	4	0.24	2.08	0.49	1.25	0.79	11	2.5Y 6/1
	5	0.29	1.79	0.94	1.09	1.04	17.4	2.5Y 6/1
	6	0.36	1.46	8.07	1.19	1.54	21.3	2.5Y 7/1
	7.5	0.21	2.26	0.08	0.99	0.61	7	2.5Y 7/1
	8.5	0.19	2.43	0.10	2.38	0.71	2.83	2.5Y 5/1
VB-SJN15-10	1	0.27	1.91	0.47	0.45	0.89	15.3	2.5Y 7/1
	3	0.24	2.07	0.92	0.82	1.03	13.3	2.5Y 6/2
	4	0.20	2.34	0.00	2.33	0.66	6.4	2.5Y 6/2
VB-SJN15-11	2	0.27	1.91	0.11	0.56	0.72	11.5	2.5Y 7/1
	4	0.36	1.48	0.96	0.64	1.07	16.4	2.5Y 7/1
	6	0.29	1.78	0.60	0.93	1.01	16	2.5Y 6/2
	8	0.24	2.04	0.07	1.99	0.78	5.9	2.5Y 6/2
	10	0.24	2.06	0.11	1.77	0.78	5.7	2.5Y 6/2

Sample Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	12	0.25	1.99	0.41	0.84	0.88	7.1	2.5Y 6/2
	14	0.24	2.06	0.81	1.67	0.91	11.5	2.5Y 5/1
VB-SJN15-12	2	0.23	2.13	0.15	0.95	0.67	9.6	2.5Y 7/2
	4	0.33	1.62	0.67	1.23	1.13	23.1	2.5Y 7/2
	5	0.28	1.86	0.68	2.44	1	16.2	2.5Y 6/2
	7	0.24	2.06	0.62	1.69	0.86	10.7	2.5Y 6/2
	9	0.20	2.33	0.31	2.04	0.77	7.3	2.5Y 5/1
VB-SJN15-13	2	0.29	1.78	0.68	0.5	0.89	9.8	2.5Y 7/1
	4	0.25	1.98	0.27	1.19	0.71	5.7	2.5Y 7/1
	6	0.23	2.10	0.06	0.94	0.72	9	2.5Y 6/2
	8	0.31	1.67	2.22	0.81	1.18	17.5	2.5Y 6/2
	9	0.24	2.07	0.10	2.22	0.83	7.5	2.5Y 6/1
	10	0.18	2.44	0.00	64.88	0.68	0	2.5Y 6/1
VB-SJN15-14	2.5	0.27	1.89	0.15	0.46	0.78	9.1	2.5Y 7/1
	5	0.29	1.80	0.42	0.94	0.95	16.7	2.5Y 7/1
	7.5	0.25	2.00	0.08	1.53	0.8	8	2.5Y 7/1
	10	0.27	1.91	0.33	1.94	0.93	9.2	2.5Y 7/1
	12	0.25	1.98	0.81	0.89	0.91	6.9	2.5Y 7/1
	13	0.22	2.21	0.86	2.99	0.88	5.3	2.5Y 5/1
VB-SJN15-15	1	0.28	1.86	0.25	0.57	0.75	12	2.5Y 7/1
	3	0.22	2.21	0.10	1.08	0.65	6.9	2.5Y 7/1
	4.5	0.23	2.14	0.81	1.32	0.87	8.5	2.5Y 7/1
	6.5	0.24	2.08	0.03	2.15	0.8	9.8	2.5Y 7/1
	8	0.19	2.38	0.84	4.49	1.07	6.3	2.5Y 5/1
VB-SJN15-16	3	0.27	1.89	0.04	0.96	0.8	14.8	2.5Y 6/2
	6	0.26	1.92	0.11	2.46	0.88	8.9	2.5Y 6/2
	9	0.27	1.90	0.50	0.29	0.9	14.8	2.5Y 6/2
	12	0.20	2.29	0.35	1.79	0.69	1.9	2.5Y 5/2
	14	0.19	2.39	0.84	2.49	0.65	6	2.5Y 5/2
	16	0.17	2.54	0.61	9.19	0.9	4.3	10Y 5/1
VB-SJN15-17	3	0.28	1.82	0.91	0.29	0.89	14.3	2.5Y 7/1
	6	0.31	1.71	1.11	0.91	1.02	12.7	2.5Y 7/1
	9	0.31	1.70	0.60	1.13	0.98	18.4	2.5Y 7/2
	11	0.25	2.00	0.30	1.58	0.82	10.8	2.5Y 6/1
	13	0.25	2.01	0.90	1.31	0.92	12.4	2.5Y 6/1
	14	0.21	2.27	0.08	0.94	0.69	5.8	2.5Y 5/1

Sample Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
VB-SJN15-18	2.5	0.32	1.63	0.14	0.55	0.88	16.6	2.5Y 7/1
	6	0.25	2.00	0.17	0.76	0.83	10.9	2.5Y 6/2
	8	0.22	2.16	0.41	1.22	0.8	8.6	2.5Y 6/2
	10	0.22	2.21	0.07	2.3	0.72	13.3	2.5Y 6/2
	12	0.30	1.73	2.46	4.06	1.41	17.3	2.5Y 6/2
VB-SJN15-19	3	0.32	1.66	1.40	0.76	1.02	6.7	2.5Y 7/1
	6	0.25	2.03	0.18	1.79	0.8	8.8	2.5Y 7/1
	9	0.26	1.92	0.41	0.65	0.93	10.5	2.5Y 7/1
	11	0.26	1.95	1.46	1.72	1.05	9.6	2.5Y 7/2
	13	0.21	2.24	0.05	1.43	0.66	4.9	2.5Y 7/1
	14.5	0.21	2.25	0.24	1.82	0.77	8.4	2.5Y 5/1
VB-SJN15-20	3	0.28	1.82	0.11	0.8	0.77	10.7	2.5Y 7/1
	6	0.32	1.63	0.49	0.95	0.94	16.7	2.5Y 7/1
	8.5	0.31	1.71	0.37	1.17	0.94	12.4	2.5Y 7/2
	11	0.24	2.04	0.02	1.69	0.82	8.1	2.5Y 7/2
	12.5	0.23	2.13	0.28	2.3	0.83	11	2.5Y 5/1
VB-SJN15-21	3.5	0.31	1.71	0.53	1.3	0.98	19.4	2.5Y 5/1
	7	0.27	1.87	0.29	1.07	0.86	12.2	2.5Y 5/1
	10.5	0.29	1.80	0.37	0.82	0.95	15.9	2.5Y 5/1
	14	0.22	2.16	0.00	4.47	0.87	12.5	2.5Y 5/1
	17	0.33	1.61	0.65	1.9	1.16	14.1	2.5Y 5/1
	18	0.27	1.91	2.97	3.6	1.43	16	2.5Y 5/1
VB-SJN15-22	3	0.32	1.64	0.99	0.99	1.1	20.8	2.5Y 6/1
	6.5	0.24	2.07	0.13	2.24	0.85	9.9	2.5Y 6/1
	9.5	0.22	2.18	0.45	1.72	0.88	12.6	2.5Y 5/1
	11	0.33	1.62	0.71	1.44	0.89	8.8	2.5Y 6/1
	14	0.21	2.25	0.13	2.11	0.79	6.8	2.5Y 5/2
	16	0.20	2.36	0.18	2.21	0.66	2.3	2.5Y 5/2
	18	0.20	2.29	0.90	2.89	0.94	5	2.5Y 5/2
VB-SJN15-23	1.5	0.31	1.70	0.78	1.41	0.94	12	2.5Y 5/1
	4	0.26	1.97	0.38	1.22	0.83	13	2.5Y 7/1
	6.5	0.26	1.97	0.25	0.81	0.9	10.3	2.5Y 6/1
	8	0.19	2.42	0.03	2.61	0.7	3.7	2.5Y 5/1
VB-SJN15-24	3	0.31	1.67	0.38	0.39	0.91	17.5	2.5Y 7/1
	6	0.32	1.64	0.25	1.19	0.98	16.9	2.5Y 7/1
	9.5	0.26	1.92	0.23	1.67	0.87	10.7	2.5Y 6/2

Sample Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	12.5	0.25	2.00	0.77	1.29	0.9	13	2.5Y 6/2
	14	0.20	2.35	0.07	1.95	0.72	8	2.5Y 5/1
VB-SJN15-25	3.5	0.32	1.63	2.59	0.95	1.25	17.3	2.5Y 7/1
	7	0.26	1.97	0.19	1.14	0.89	9.4	2.5Y 6/2
	10.5	0.24	2.08	0.29	1.49	0.8	9.2	2.5Y 6/2
	13.5	0.26	1.95	0.37	2.74	0.94	14.9	2.5Y 5/1
	15	0.22	2.16	0.21	2.66	0.75	6.9	2.5Y 5/1
VB-SJN15-26	3	0.29	1.78	0.24	0.66	0.94	17.1	2.5Y 7/2
	6	0.40	1.32	0.43	1.5	1	17	2.5Y 7/2
	9	0.24	2.07	0.12	1.57	0.82	17.1	2.5Y 6/2
	10.5	0.24	2.08	0.51	6.25	0.97	15.7	10Y 5/1
VB-SJN15-27	2.5	0.35	1.53	2.24	0.8	1.15	25.4	2.5Y 6/1
	5	0.31	1.68	0.00	0.41	0.95	17.9	2.5Y 6/1
	7	0.20	2.31	0.09	1.39	0.68	6.1	2.5Y 5/1
	9	0.20	2.35	0.20	1.43	0.7	4.2	2.5Y 5/1
	11	0.20	2.31	0.00	1.79	0.8	6.5	2.5Y 5/1
	13	0.24	2.09	0.94	5.98	0.98	12.3	2.5Y 5/1
VB-SJN15-28	2	0.32	1.64	0.54	1.08	1.01	18	2.5Y 7/2
	5	0.27	1.88	0.26	1.34	0.89	14.2	2.5Y 7/2
	8	0.28	1.85	0.68	1.45	0.97	14.1	2.5Y 7/2
	11	0.23	2.11	0.51	0.93	0.83	6.9	2.5Y 5/1
	12.5	0.27	1.90	1.96	0.94	1.18	16.3	2.5Y 5/1
	14	0.33	1.61	6.03	1.64	1.66	19.4	2.5Y 5/1
VB-SJN15-29	3	0.30	1.74	0.67	1.42	0.92	18.5	2.5Y 7/2
	6	0.27	1.91	0.12	0.99	0.86	13.1	2.5Y 7/2
	8	0.21	2.26	0.00	2.72	0.79	11.8	2.5Y 5/2
	10	0.20	2.35	0.41	3.15	0.77	7	2.5Y 5/2
	12	0.42	1.24	4.10	0.68	1.48	23.7	2.5Y 7/1
	14	0.17	2.54	0.00	2.57	0.61	8	2.5Y 5/1
VB-SJN15-30	3	0.32	1.66	0.51	0.67	0.96	17	2.5Y 7/1
	6	0.27	1.88	0.60	1	0.89	12.6	2.5Y 7/1
	9	0.27	1.91	0.15	1.25	0.89	20.8	2.5Y 7/1
	12	0.28	1.86	0.27	1.87	0.94	17.7	2.5Y 7/1
	13.5	0.21	2.24	0.00	2.14	0.74	8.5	2.5Y 6/1
	15	0.22	2.17	0.12	5.01	0.89	9.2	2.5Y 6/1
VB-SJN15-31	3	0.30	1.74	1.06	1.14	1.02	16	2.5Y 7/1

Sample Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	6	0.38	1.38	3.21	0.87	1.3	21.4	2.5Y 7/1
	9	0.30	1.76	0.32	1.16	1.08	16.8	2.5Y 6/1
	12	0.29	1.81	0.50	0.84	0.93	14	2.5Y 6/1
	13.5	0.25	2.00	0.47	1.72	0.94	12.3	2.5Y 6/1
VB-SJN15-32	3	0.31	1.67	1.20	0.71	1.13	23.2	2.5Y 6/2
	6	0.30	1.75	0.86	0.71	0.92	12.8	2.5Y 6/2
	9	0.24	2.05	0.15	1.36	0.82	10.7	2.5Y 6/2
	10	0.31	1.69	2.06	0.34	1.23	18	2.5Y 5/1
	12	0.19	2.41	0.00	2.22	0.7	5.7	2.5Y 5/1
	14	0.22	2.22	0.31	6.39	0.96	8.8	2.5Y 5/1
VB-SJN15-33	2	0.26	1.96	0.27	1.3	0.91	11.4	2.5Y 6/1
	5	0.22	2.19	0.03	2.5	0.75	9.6	2.5Y 5/1
	8	0.30	1.73	1.20	1.18	1.2	22.7	2.5Y 5/1
	9.5	0.21	2.25	2.82	8.15	1.44	11.5	2.5Y 5/1
VB-SJN15-34	3.5	0.26	1.93	0.00	0.53	0.72	11.4	2.5Y 7/1
	7	0.26	1.92	0.41	0.73	0.83	12.5	2.5Y 7/1
	10.5	0.25	1.98	0.28	1.22	0.81	15.5	2.5Y 7/1
	14	0.33	1.59	1.84	1.79	1.23	16.6	2.5Y 6/2
	16	0.54	0.89	10.58	1.09	1.87	26.7	2.5Y 6/2
VB-SJN15-35	3	0.26	1.94	0.57	0.51	0.81	8.2	2.5Y 6/1
	6	0.21	2.25	0.15	1.84	0.8	5.4	2.5Y 6/2
	8.5	0.25	2.01	2.41	5.5	1.43	15.4	10Y 5/1
	10	0.17	2.56	0.17	7.2	0.88	5.4	10Y 5/1
N3 Sand Source Composite		**0.26**	**1.95**	**2.33**	**2.33**	**0.92**	**2.33**	**2.5Y 6/1**

*Retained in the #4 Sieve, **Passing the #230 Sieve

Table D - 5. Sediment Analysis Results from Vibracores in Proposed Sand Source S-1.

Boring Number	Sample Depth (feet)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
VB-SJSP12-001	1	0.31	1.71	0.78	1.06	1.01	15	2.5Y 6/1
	5	0.30	1.75	1.63	1.28	1.04	16	10Y 6/1
	9	0.21	2.27	0.15	1.69	0.63	8	2.5Y 6/1
	12	0.16	2.65	0.02	4.57	0.59	21	10Y 4/1
VB-SJSP12-002	1	0.39	1.37	1.48	0.4	1.02	20	5Y 6/1
	6	0.21	2.28	0.00	1.08	0.51	7	5Y 6/1
	9	0.18	2.48	0.64	4.33	0.85	14	5GY 5/1
VB-SJSP12-003	1	0.31	1.71	0.76	0.41	0.92	14	2.5Y 6/1
	3	0.27	1.87	0.11	1.03	0.76	9	2.5Y 6/1
	6	0.26	1.92	0.36	0.64	0.74	14	2.5Y 6/1
	8	0.17	2.52	0.13	4.7	0.71	12	10Y 4/1
VB-SJSP12-004	1	0.30	1.75	0.46	0.65	0.81	12	5Y 6/2
	4	0.29	1.81	0.97	1.36	1.01	20	5Y 6/2
	6	0.20	2.30	0.04	1.68	0.68	13	5Y 6/2
VB-SJSP12-005	0.5	0.23	2.14	0.15	2.7	0.89	14	2.5Y 6/2
	2	0.20	2.32	0.14	3.61	0.71	6	2.5Y 6/1
VB-SJSP12-006	1	0.30	1.74	0.92	0.73	0.96	17	10Y 7/1
	4	0.23	2.14	0.08	1.26	0.61	9	10Y 7/1
	6.5	0.22	2.19	0.30	1.49	0.7	12	5Y 6/1
VB-SJSP12-007	2	0.27	1.87	0.08	0.73	0.78	12	10Y 7/1
	4	0.23	2.13	0.00	1.59	0.6	7	10Y 7/1
	6	0.23	2.10	0.51	1.42	0.8	14	10Y 7/1
VB-SJSP12-008	2	0.21	2.27	0.18	0.77	0.63	7	5Y 7/1
	4	0.21	2.25	3.88	4.62	1.41	10	5Y 4/2
VB-SJSP12-009	1	0.20	2.32	0.00	1.45	0.53	6	2.5Y 6/1
VB-SJSP12-010	1	0.26	1.92	0.02	1.57	0.94	14.1	5Y 6/1
VB-SJSP12-011	1	0.39	1.37	1.46	0.72	1.16	25.5	5Y 5/1
	4	0.26	1.92	0.11	1.06	0.82	12.9	5Y 5/1
	6	0.22	2.17	0.00	0.87	0.64	8.4	5Y 5/1
VB-SJSP12-012	1	0.30	1.76	0.21	0.92	0.82	15.8	5Y 8/1
	4	0.25	2.02	0.18	1.43	0.75	11	5Y 8/1
	6	0.17	2.52	0.07	3.91	0.63	10.9	5Y 8/1
VB-SJSP12-013	2	0.28	1.83	0.16	1.02	0.93	15.7	5Y 8/1
	4	0.26	1.95	0.10	1.58	0.8	11.7	5Y 7/1
VB-SJSP12-014	1	0.29	1.81	1.57	0.98	1.02	14.3	5Y 8/1
	4	0.20	2.33	0.00	1.4	0.51	5.5	5Y 8/1
VB-SJSP12-015	2	0.28	1.84	0.33	1.32	0.95	12	5Y 8/1
	4	0.26	1.95	0.53	1.26	0.79	9	5Y 8/1
	6	0.23	2.13	0.11	1.41	0.71	10	5Y 8/1

Boring Number	Sample Depth (feet)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
VB-SJSP12-016	1	0.30	1.76	0.92	0.74	1	14	5Y 8/1
	3	0.27	1.90	0.59	1.07	0.93	11	5Y 8/1
	7	0.31	1.71	3.05	1.01	1.29	15	5Y 8/1
	9	0.24	2.04	4.65	4.71	1.6	18	5Y 6/2
VB-SJSP12-017	2	0.30	1.75	0.94	0.87	0.97	8	5Y 8/1
	6	0.21	2.24	0.06	1.3	0.68	7	5Y 8/1
	9	0.18	2.50	0.46	4.49	0.81	6	5Y 8/1
VB-SJSP12-018	2	0.23	2.14	0.00	1.4	0.66	5	5Y 8/1
	6	0.24	2.07	0.20	1.06	0.73	7	5Y 8/1
	8	0.17	2.56	0.13	3.76	0.66	6	5Y 6/1
VB-SJSP12-019	2	0.28	1.84	0.12	1.13	0.83	10	5Y 8/1
	6	0.20	2.32	0.45	2.58	0.82	6	5Y 6/2
	9	0.17	2.55	0.24	4.07	0.71	5	5Y 6/2
	11	0.24	2.05	6.72	4.36	1.76	15	5Y 6/2
VB-SJSP12-020	2	0.31	1.67	0.56	0.92	0.92	15	5Y 8/1
	6	0.23	2.12	0.29	1.94	0.85	7	5Y 8/1
VB-SJSP12-021	2	0.32	1.63	0.04	1.04	0.8	12	5Y 8/1
	6	0.31	1.68	1.28	0.88	0.98	15	5Y 8/1
	9	0.21	2.27	0.03	1.43	0.5	4	5Y 8/1
VB-SJSP12-022	2	0.36	1.48	0.92	0.71	1.06	14	5Y 8/1
	6	0.31	1.70	0.68	2.92	1.07	20	5Y 8/1
	9	0.17	2.52	0.23	3.36	0.91	8	5Y 6/1
	11	0.33	1.59	7.34	2.55	1.88	25	5Y 6/1
VB-SJSP12-023	1	0.49	1.03	4.22	0.69	1.41	28	5Y 8/1
	4	0.27	1.87	0.65	2.01	0.92	9	5Y 8/1
	7	0.26	1.97	0.38	1.86	0.88	8	5Y 8/1
	9	0.17	2.59	0.00	3.33	0.74	4	5Y 6/2
VB-SJSP12-024	1	0.31	1.69	1.34	0.8	1.02	13	5Y 8/1
	4	0.25	1.98	0.30	1.62	0.77	8	5Y 8/1
	6	0.26	1.93	0.69	0.8	0.84	9	5Y 8/1
	8	0.17	2.55	0.47	3.49	0.8	5	5Y 6/2
VB-SJSP12-025	1	0.28	1.84	0.66	0.91	0.88	11	5Y 8/1
	4	0.22	2.16	0.02	1.16	0.52	4	5Y 8/1
	6	0.17	2.52	0.14	3.34	0.8	6	5Y 6/2
VB-SJSP12-026	1	0.30	1.75	0.60	1.32	0.83	8	5Y 8/1
	4	0.26	1.95	0.14	0.84	0.75	8	5Y 8/1
	6	0.18	2.48	0.10	3.51	0.74	8	5Y 6/2
VB-SJSP12-027	1	0.30	1.73	1.09	1.25	1	12	5Y 8/1
	4	0.25	2.03	0.32	1.93	0.91	9	5Y 8/1
	6	0.26	1.95	2.17	2.7	1.35	15	5Y 6/2

Boring Number	Sample Depth (feet)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
VB-SJSP12-028	1	0.30	1.72	0.71	0.98	0.87	9	5Y 8/1
	5	0.24	2.04	0.16	1.7	0.59	4	5Y 8/1
	9	0.25	1.99	0.45	1.19	0.8	7	5Y 8/1
	12	0.19	2.37	0.62	4.86	1.03	8	5Y 6/2
VB-SJSP12-029	2	0.25	1.99	0.04	0.79	0.63	5	5Y 8/1
	4	0.25	2.00	0.06	0.75	0.63	5	5Y 8/1
	6	0.21	2.24	0.82	1.61	0.79	6	5Y 8/1
VB-SJSP12-030	2	0.26	1.95	0.94	0.94	0.83	7	5Y 8/1
	4	0.22	2.17	0.00	1.6	0.52	3	5Y 8/1
	6	0.29	1.79	0.37	1.13	0.87	13	5Y 8/1
VB-SJSP12-031	0	0.28	1.82	1.09	1.25	1.02	12	5Y 8/1
VB-SJSP12-032	1	0.26	1.94	0.30	0.8	0.77	8.5	5Y 8/1
	3	0.21	2.24	0.00	1.47	0.56	3	5Y 8/1
	5	0.23	2.14	0.55	1.23	0.76	10.4	5Y 8/1
VB-SJSP12-033	2	0.20	2.31	0.03	1.7	0.54	5.1	5Y 6/2
VB-SJSP12-034	1	0.19	2.41	0.05	1.57	0.63	6.8	5Y 7/1
VB-SJSP12-035	2	0.19	2.39	0.02	0.88	0.49	3.7	5Y 8/1
	5	0.25	1.99	0.59	0.83	0.92	11.5	5Y 8/1
	9	0.23	2.11	0.51	1.25	0.89	9.3	5Y 8/1
VB-SJSP12-036	1	0.20	2.36	0.00	2.18	0.56	6.9	5Y 8/1
VB-SJSP12-037	2	0.19	2.40	0.00	1.08	0.41	2.2	5Y 8/1
	4	0.20	2.32	0.00	1.12	0.43	2.2	5Y 8/1
	6	0.19	2.37	0.00	1.6	0.42	3.3	5Y 8/1
VB-SJSP12-038	2	0.23	2.13	0.14	0.74	0.67	10.3	5Y 8/1
	5	0.23	2.12	0.04	0.97	0.64	9	5Y 8/1
VB-SJSP12-039	0	0.26	1.94	0.27	0.84	0.75	8.6	5Y 8/1
	2	0.19	2.43	1.06	3.62	0.89	8.2	5Y 6/2
VB-SJSP12-040	1	0.25	2.01	0.10	1.65	0.68	7.2	5Y 8/1
	3	0.25	1.98	0.00	0.9	0.63	9.2	5Y 8/1
	5	0.21	2.27	0.51	3.66	0.96	10	5Y 6/1
VB-SJSP12-041	3	0.28	1.83	1.27	1.3	0.94	17.2	5Y 8/1
	7	0.24	2.05	0.08	1.73	0.79	13.6	5Y 8/1
VB-SJSP12-042	2	0.30	1.74	3.47	2.9	1.44	24	5Y 6/1
VB-SJSP12-044	2	0.24	2.09	1.27	2.84	1.15	14.5	5Y 8/1
	4	0.21	2.26	0.77	3.36	0.9	12.4	5Y 8/1
VB-SJSP12-045	2	0.20	2.34	0.02	1.41	0.58	7.2	5Y 7/1
	4	0.20	2.35	0.28	1.85	0.75	12.3	5Y 7/1
	6	0.20	2.31	0.07	2.58	0.78	8.9	5Y 7/1
VB-SJSP12-046	2	0.27	1.88	0.17	0.92	0.75	10	5Y 6/1
	4	0.22	2.20	0.34	1.24	0.76	7.4	5Y 6/1

Boring Number	Sample Depth (feet)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	6	0.20	2.33	0.48	1.32	0.67	6.9	5Y 6/1
	8	0.19	2.38	0.34	4.58	0.85	8.9	5GY 5/1
VB-SJSP12-047	3	0.24	2.09	0.00	1	0.71	10	5Y 6/1
	6	0.20	2.36	0.00	0.73	0.43	5	5Y 6/1
	8	0.17	2.59	0.04	4.2	0.57	8	5Y 4/1
	9	0.18	2.45	1.20	4.76	1	12	5Y 4/1
VB-SJSP12-048	3	0.19	2.37	0.00	0.98	0.4	3	5Y 8/1
	6	0.20	2.34	0.11	1.11	0.53	4	5Y 8/1
VB-SJSP12-049	2	0.19	2.42	0.00	1.7	0.54	7	5Y 8/1
	4	0.17	2.58	0.30	4.38	0.73	7	5Y 6/2
VB-SJSP12-050	2	0.20	2.34	0.27	4.26	0.92	12	5Y 6/2
VB-SJSP12-051	3	0.20	2.33	0.09	1.02	0.74	8	5Y 8/1
	5	0.18	2.45	0.00	1.86	0.41	3	5Y 8/1
	7	0.18	2.46	0.00	1.92	0.5	4	5Y 8/1
VB-SJSP12-052	3	0.21	2.23	0.33	1.02	0.66	8	5Y 8/1
	6	0.20	2.30	0.00	0.77	0.41	2	5Y 8/1
	9	0.31	1.68	3.13	2.06	1.43	22	5Y 8/1
	12	0.17	2.52	0.11	4.07	0.69	7	5Y 8/1
VB-SJSP12-064	2	0.29	1.79	1.55	1.24	1.13	16	5Y 8/1
VB-SJSP12-065	2	0.34	1.57	1.68	1.5	1.18	22	5Y 8/1
	4	0.20	2.36	0.01	1.84	0.55	6	5Y 8/1
VB-SJSP12-066	2	0.30	1.75	0.69	0.99	1	13.3	5Y 8/1
	5	0.25	2.02	0.34	1.41	0.77	7.9	5Y 8/1
	8	0.24	2.05	0.85	1.84	0.87	8.7	5Y 8/1
VB-SJSP12-067	2	0.28	1.84	1.53	1.59	1.08	9.8	5Y 8/1
	4	0.22	2.19	0.35	1.3	0.67	5.3	5Y 8/1
VB-SJSP12-068	2	0.31	1.67	1.02	0.9	1.03	12.3	5Y 8/1
	4	0.25	1.98	0.39	1.04	0.77	10.9	5Y 8/1
	6	0.22	2.20	0.68	1.4	0.79	9.6	5Y 5/1
	8	0.17	2.52	0.25	4.17	0.64	5.7	5Y 5/1
VB-SJSP12-069	1	0.19	2.38	0.00	1.09	0.49	4	5Y 8/1
	3	0.18	2.47	0.00	3.17	0.56	6	5Y 5/1
	5	0.17	2.57	0.68	4.54	0.88	10	5Y 5/1
VB-SJSP12-070	1	0.23	2.14	0.00	0.81	0.62	5.8	5Y 8/1
	3	0.19	2.37	0.10	3.92	0.66	5	5Y 5/1
VB-SJSP12-071	1	0.25	2.00	0.19	0.66	0.71	5.6	5Y 8/1
	3	0.19	2.41	0.03	2.89	0.57	4	5Y 5/1
	5	0.17	2.58	0.43	4.65	0.69	6.8	5Y 5/1
VB-SJSP12-072	2	0.22	2.20	0.10	0.82	0.55	3.6	5Y 8/1
	4	0.20	2.35	0.01	2.34	0.52	4.4	5Y 8/1

Boring Number	Sample Depth (feet)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
VB-SJSP12-073	1	0.19	2.41	0.16	1.37	0.57	6	5Y 8/1
	3	0.17	2.53	0.36	4.42	0.7	9	5Y 8/1
VB-SJSP12-074	2	0.18	2.45	0.00	2.48	0.56	7	5Y 8/1
	4	0.18	2.48	0.15	4.12	0.73	10	5Y 6/2
	8	0.22	2.17	1.27	4.64	1.27	16	5Y 6/2
VB-SJSP12-075	2	0.17	2.55	0.11	4.69	0.63	10	5Y 6/2
VB-SJSP12-076	1	0.23	2.15	0.39	2.54	0.68	10	5Y 7/1
	3	0.18	2.45	0.32	4.24	0.78	10	5Y 5/2
VB-SJSP12-077	2	0.26	1.93	0.35	0.8	0.83	9.1	5Y 8/1
	4.5	0.21	2.28	0.11	2.47	0.6	5	5Y 5/1
	6	0.17	2.53	0.18	3.95	0.66	7.6	5Y 5/1
VB-SJSP12-078	1	0.27	1.89	0.20	1.05	0.73	8	5Y 8/1
	3	0.25	2.03	0.35	1.55	0.72	6.8	5Y 5/1
	5	0.23	2.10	0.05	1.37	0.62	5.6	5Y 5/1
	7	0.18	2.46	0.10	4.14	0.58	6.9	5Y 5/1
VB-SJSP12-079	2	0.27	1.88	0.56	1.01	0.86	8.9	5Y 8/1
	4	0.23	2.11	0.02	1.26	0.59	5.1	5Y 8/1
	6	0.20	2.33	0.02	3.44	0.52	6.6	5Y 6/1
	8	0.20	2.29	0.79	3.91	0.97	13.7	5Y 6/1
VB-SJSP12-080	1	0.23	2.10	0.00	1.09	0.56	5.1	5Y 8/1
	3	0.21	2.24	0.11	2.36	0.59	8.2	5Y 5/1
	5	0.17	2.53	0.38	4.43	0.73	8	5Y 5/1
VB-SJSP12-082	2	0.25	2.00	0.14	1.72	0.75	8.4	5Y 8/1
	5	0.28	1.86	0.34	1.11	0.84	10.2	5Y 8/1
	7	0.25	2.03	0.15	1.57	0.71	7.6	5Y 8/1
	9	0.23	2.15	0.03	2.82	0.66	4.7	5Y 6/1
VB-SJSP12-083	2	0.25	2.01	0.00	2.28	0.73	8	5Y 8/1
	5	0.25	1.99	0.34	1.66	0.82	8.7	5Y 8/1
	8	0.25	2.02	1.57	1.61	0.95	9.1	5Y 8/1
	10	0.19	2.43	0.09	3.69	0.6	8.9	5Y 5/1
VB-SJSP12-084	2	0.25	2.02	0.06	1.08	0.68	8	5Y 8/1
	4	0.21	2.26	0.25	1.22	0.95	9	5Y 8/1
	6	0.13	2.92	0.00	3.07	0.54	10	5Y 5/1
	8	0.20	2.29	0.86	2.96	0.97	11	5Y 5/1
VB-SJSP12-085	2	0.25	1.99	1.21	0.9	0.91	7	5Y 8/1
	4	0.29	1.79	0.28	1.71	0.9	19	5Y 8/1
	6	0.23	2.11	0.58	1.78	0.9	18	5Y 8/1
	8	0.18	2.46	0.92	3.59	0.91	12	5Y 5/1
VB-SJSP12-086	1	0.23	2.14	0.46	1.32	0.95	13	5Y 8/1
	3	0.27	1.89	0.43	1.61	0.86	8	5Y 8/1

Boring Number	Sample Depth (feet)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	5	0.23	2.15	0.83	1.19	0.78	11	5Y 8/1
	7	0.20	2.32	1.43	4.71	1.11	15	5Y 6/1
VB-SJSP12-087	1	0.26	1.96	0.55	1.18	0.82	9	5Y 8/1
	3	0.22	2.18	0.38	2.05	0.76	9	5Y 8/1
	5	0.20	2.30	0.68	3.39	0.93	9	5Y 8/1
	7	0.19	2.42	0.34	4.47	0.83	8	5Y 5/1
VB-SJSP12-088	2	0.35	1.52	1.20	0.97	1.1	21	5Y 8/1
	4	0.24	2.07	0.22	3.53	0.77	11	5Y 8/1
	6	0.20	2.29	0.05	2.68	0.6	9	5Y 8/1
VB-SJSP12-089	2	0.26	1.92	0.49	1.81	0.9	18	5Y 8/1
	4	0.28	1.83	1.71	2.05	1.25	25	5Y 8/1
	6	0.17	2.54	0.25	2.83	0.83	8	5Y 5/1
VB-SJSP12-090	1	0.32	1.66	1.39	0.92	1.05	19	5Y 8/1
	3	0.26	1.95	0.22	1.71	0.78	15	5Y 8/1
	5	0.30	1.72	0.30	1.54	0.92	22	5Y 8/1
	7	0.17	2.57	0.03	4.18	0.61	8	5Y 5/1
VB-SJSP12-091	2	0.26	1.95	0.10	1.12	0.79	18	5Y 8/1
	4	0.26	1.96	2.01	1.65	1.18	16	5Y 8/1
	6	0.17	2.52	0.39	3.97	0.79	17	5Y 5/1
VB-SJSP12-092	2	0.26	1.93	0.05	0.97	0.74	14	5Y 8/1
	4	0.27	1.90	0.33	1.61	0.89	23	5Y 8/1
	6	0.26	1.97	0.52	0.96	0.93	18	5Y 8/1
	8	0.17	2.55	0.38	3.71	0.74	10	5Y 5/1
VB-SJSP12-093	2	0.24	2.05	0.12	1.02	0.66	15	5Y 8/1
	4	0.28	1.83	0.96	0.92	1.02	16	5Y 8/1
	6	0.21	2.24	0.25	1.19	0.64	10	5Y 8/1
	8	0.18	2.48	1.60	4.17	0.99	13	5Y 5/1
VB-SJSP12-094	3	0.29	1.78	0.63	1.17	1.03	16	5Y 8/1
	5	0.23	2.12	0.11	2.94	0.82	12	5Y 8/1
	7	0.21	2.27	0.04	1.7	0.64	6	5Y 8/1
	9	0.20	2.35	0.27	3.74	0.89	9	5Y 5/1
VB-SJSP12-095	3	0.43	1.21	0.36	1.23	1.11	23	5Y 8/1
	7	0.26	1.95	0.63	2.3	1.03	17	5Y 8/1
	11	0.18	2.45	0.04	2.03	0.55	6	5Y 8/1
VB-SJSP12-096	2	0.27	1.87	0.30	1.37	0.86	13	5Y 8/1
	5	0.26	1.92	0.36	1.96	0.89	15	5Y 8/1
	8	0.31	1.71	0.88	1.89	1.07	14	5Y 8/1
VB-SJSP12-100	3	0.27	1.88	0.56	1.11	0.89	13	5Y 8/1
	7	0.23	2.11	0.32	2.25	0.81	12	5Y 8/1
	11	0.18	2.46	0.26	2.83	0.75	9	5Y 5/1

Boring Number	Sample Depth (feet)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	13	0.17	2.59	0.22	3.87	0.78	11	5Y 5/1
VB-SJSP12-101	1	0.32	1.64	0.90	1.14	1.05	25	5Y 8/1
	4	0.34	1.57	1.26	0.72	1.09	22	5Y 8/1
	7	0.28	1.84	0.36	1.65	0.95	24	5Y 8/1
	9	0.20	2.32	0.22	3.13	0.79	10	5Y 5/1
VB-SJSP12-102	2	0.42	1.25	1.74	0.52	1.24	33	5Y 8/1
	5	0.28	1.85	0.38	1.43	0.84	18	5Y 8/1
	9	0.31	1.69	0.50	1.45	1.15	34	5Y 8/1
	12	0.18	2.51	0.00	4.63	0.63	9	5Y 5/1
VB-SJSP12-103	2	0.36	1.48	2.74	0.98	1.33	31	5Y 8/1
	4	0.42	1.25	2.05	1.33	1.22	36	5Y 8/1
	6	0.30	1.74	0.37	1.22	0.95	24	5Y 8/1
	8	0.20	2.34	0.04	2.63	0.67	10	5Y 5/1
VB-SJSP12-104	1	0.38	1.41	2.61	0.43	1.38	30	5Y 8/1
	3	0.21	2.27	1.55	2.75	1.07	13.2	5Y 5/1
	5	0.18	2.51	0.37	4.34	0.79	10.4	5Y 5/1
VB-SJSP12-105	1	0.69	0.54	11.79	1.15	1.88	52.4	5Y 8/1
	3	0.18	2.49	0.35	4.33	0.76	18.4	5Y 5/1
	5	0.18	2.44	0.20	3.34	0.87	23.5	5Y 5/1
VB-SJSP12-106	1	0.56	0.83	6.29	0.58	1.67	45.5	5Y 8/1
	3	0.21	2.27	2.14	2.85	1.14	18.3	5Y 5/1
	5	0.18	2.49	0.44	3.97	0.84	12.8	5Y 5/1
VB-SJSP12-107	0	0.90	0.15	10.69	0.46	1.69	60	5Y 8/1
	2	0.29	1.77	0.36	1.21	0.98	27	5Y 8/1
	4	0.27	1.89	0.36	2.8	1.11	27	5Y 5/1
	6	0.18	2.50	0.73	4.91	0.92	11	5Y 5/1
VB-SJSP12-108	1	0.77	0.37	6.30	1.03	1.56	56	5Y 6/1
	4	0.28	1.83	0.41	1.89	0.97	26	5Y 7/1
	6	0.25	1.98	0.77	3.57	1.03	26	5Y 7/1
	8	0.18	2.51	0.06	4.48	0.74	12	5Y 5/1
VB-SJSP12-109	1	0.64	0.65	5.79	0.45	1.55	55	5Y 6/2
	5	0.33	1.60	1.41	1.01	1.25	34	5Y 8/1
	9	0.20	2.30	0.20	2.04	0.78	16	5Y 8/1
VB-SJSP12-110	1	0.47	1.10	3.53	0.57	1.48	42	5Y 6/2
	3	0.21	2.24	0.06	1.46	0.73	17	5Y 8/1
	5	0.18	2.47	0.06	2.92	0.67	14	5Y 5/1
	8	0.17	2.53	0.86	4.29	0.89	11	5Y 5/1
VB-SJSP12-112	2	0.25	1.99	0.00	0.49	0.71	22	5Y 8/1
	6	0.24	2.04	0.58	0.79	0.79	11	5Y 8/1
	11	0.21	2.27	0.08	2.4	0.68	11	5Y 8/1

Boring Number	Sample Depth (feet)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	13	0.17	2.52	0.00	2.61	0.62	10	5Y 8/1
VB-SJSP12-113	1	0.35	1.53	3.25	1.21	1.33	25	5Y 8/1
	4	0.24	2.07	0.04	1.56	0.82	19	5Y 8/1
	7	0.19	2.43	0.04	2.85	0.59	9	5Y 8/1
	9	0.18	2.49	0.20	3.47	0.67	8	5Y 5/1
VB-SJSP12-114	2	0.35	1.50	1.06	1.83	1.19	28	5Y 8/1
	4	0.29	1.77	0.16	2.28	1.02	23	5Y 8/1
VB-SJSP12-115	2	0.53	0.91	6.17	0.91	1.71	43	5Y 8/1
	4	0.26	1.97	0.00	0	0.66	24	5Y 8/1
	6	0.20	2.31	2.38	3.74	0.87	13	5Y 5/1
	8	0.17	2.52	0.03	3.59	0.74	12	5Y 5/1
VB-SJSP12-116	2	0.27	1.87	1.68	0.99	1.07	17	5Y 8/1
	5	0.30	1.72	1.94	1.39	1.16	24	5Y 8/1
	8	0.28	1.82	1.81	1.85	1.28	25	5Y 8/1
	11	0.17	2.53	0.15	3.98	0.7	10	5Y 5/1
S1 Sand Source Composite		**0.25**	**2.01**	**0.75**	**2.03**	**0.85**	**12.79**	**5Y 7/1**

*Retained in the #4 Sieve, **Passing the #230 Sieve

Table D - 6. Sediment Analysis Results from Vibracores in the St. Augustine Inlet Ebb Shoal Proposed Sand Source.

Boring Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
SJEB09-1	2.0	0.18	2.49	0.00%	3.10	0.55	8	10YR 7/1
	7.0	0.16	2.67	0.00%	1.60	0.46	4	10YR 7/1
	12.0	0.16	2.67	0.00%	4.73	0.51	5	10YR 7/1
	17.0	0.15	2.74	0.00%	3.10	0.38	0	10YR 7/1
SJEB09-2A	2.0	0.17	2.57	0.00%	1.21	0.38	3	10YR 7/1
	7.0	0.17	2.52	0.00%	1.39	0.43	7	10YR 7/1
	12.0	0.17	2.58	0.00%	1.19	0.36	2	10YR 7/1
	17.0	0.16	2.64	0.00%	1.73	0.40	4	10YR 7/1
SJEB09-3	1.0	0.15	2.71	0.00%	1.32	0.43	25	5Y 6/1
	4.0	0.15	2.75	0.00%	2.06	0.36	22	5Y 6/1
	7.0	0.13	2.93	0.00%	3.14	0.36	17	5Y 5/1
SJEB09-4	1.0	0.22	2.16	0.00%	1.64	0.77	17	10YR 7/1
	2.5	0.30	1.72	1.30%	1.08	1.36	26	10YR 7/1
	6.0	0.25	2.00	0.70%	1.26	1.31	20	10YR 7/1
	11.0	0.16	2.61	0.00%	1.60	0.43	5	10YR 7/1
	16.0	0.14	2.87	0.00%	2.49	0.36	0	10YR 7/1
SJEB09-5	3.0	0.17	2.54	0.00%	1.40	0.46	3	10YR 7/1
	8.0	0.19	2.38	0.00%	0.82	0.52	4	10YR 7/1
	13.0	0.17	2.55	0.00%	1.29	0.44	3	10YR 7/1
SJEB09-6	4.0	0.16	2.67	0.00%	1.43	0.46	2	10YR 7/1
	9.0	0.17	2.55	0.00%	0.97	0.45	4	10YR 7/1
	14.0	0.16	2.62	0.00%	1.55	0.46	4	10YR 7/1
SJEB09-7	2.0	0.14	2.81	0.00%	3.99	0.42	19	2.5Y 6/1
	5.0	0.15	2.72	0.00%	1.62	0.37	21	2.5Y 6/1
	9.0	0.14	2.82	0.00%	2.70	0.43	19	2.5Y 6/1
SJEB09-8	3.0	0.66	0.60	3.98%	0.03	1.56	70	2.5Y 8/2
	7.0	0.27	1.88	0.62%	1.42	1.07	32	2.5Y 8/2
	10.0	1.44	-0.53	0.62%	0.49	1.42	92	2.5Y 6/3
	15.0	0.34	1.55	0.58%	0.28	0.92	34	2.5Y 8/1

Boring Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
SJEB09-9	3.0	1.60	-0.68	8.14%	0.25	1.16	95	2.5Y 6/3
	7.0	1.14	-0.19	4.45%	1.41	1.44	87	2.5Y 6/3
	12.0	0.31	1.70	2.55%	2.86	1.47	46	2.5Y 7/1
SJEB09-10	1.0	0.58	0.79	3.92%	0.40	1.36	71	2.5Y 6/3
	6.0	0.21	2.27	0.00%	0.83	0.57	33	2.5Y 7/1
	10.0	0.28	1.85	0.14%	1.35	0.78	39	2.5Y 7/1
	16.0	0.32	1.64	3.15%	3.10	1.61	42	2.5Y 6/3
SJEB09-11	2.0	0.17	2.52	0.00%	2.52	0.56	26	2.5Y 7/1
	7.0	0.17	2.57	0.00%	2.35	0.53	25	2.5Y 7/1
	10.5	0.16	2.64	0.00%	2.21	0.43	23	2.5Y 3/1
	13.0	0.24	2.04	0.31%	3.86	0.82	31	2.5Y 3/1
SJEB09-12	2.0	0.15	2.70	0.00%	1.56	0.38	21	2.5Y 5/1
	7.0	0.14	2.83	0.00%	2.48	0.37	19	2.5Y 5/1
SJEB09-13	1.0	0.14	2.78	0.00%	1.65	0.38	20	2.5Y 6/1
	6.0	0.14	2.83	0.00%	2.94	0.44	19	2.5Y 6/1
	8.0	0.14	2.83	0.00%	2.39	0.36	19	2.5Y 6/1
SJEB09-14	1.0	0.16	2.66	0.00%	1.94	0.49	25	2.5Y 6/1
	5.0	0.18	2.51	0.00%	1.35	0.65	27	2.5Y 6/1
	10.0	0.19	2.37	0.62%	1.67	0.99	30	2.5Y 6/1
SJEB09-15	2.0	0.16	2.68	0.00%	2.59	0.57	22	2.5Y 7/1
	6.0	0.17	2.59	0.00%	0.78	0.49	32	2.5Y 7/1
SJEB09-16	2.0	0.16	2.61	0.00%	1.22	0.46	23	5Y 6/1
SJEB09-17	2.0	0.17	2.54	0.00%	1.62	0.51	2	10YR 7/1
	7.0	0.24	2.08	0.00%	1.32	0.80	13	10YR 7/1
	12.5	0.17	2.54	0.00%	1.75	0.55	3	10YR 7/1
	14.0	0.16	2.60	0.00%	1.29	0.45	2	10YR 7/1
SJEB09-18	1.0	0.18	2.46	0.00%	1.49	0.65	27	10YR 7/2
	5.0	0.18	2.48	0.00%	2.91	0.70	26	2.5Y 6/1
	7.5	0.14	2.86	0.00%	3.78	0.46	18	2.5Y 6/1
SJEB09-19	1.0	0.14	2.81	0.00%	2.54	0.40	19	5Y 5/1
	4.0	0.14	2.82	0.00%	1.72	0.37	19	5Y 5/1

Boring Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
SJEB09-20	2	0.15	2.74	0.00%	2.71	0.40	20	2.5Y 7/1
	5	0.16	2.63	0.00%	1.03	0.44	23	2.5Y 7/1
SJEB09-21	2	0.22	2.17	0.19%	2.88	0.69	32	2.5Y 5/1
	3	0.14	2.82	0.12%	4.32	0.59	19	2.5Y 5/1
	4	0.18	2.46	0.00%	3.81	0.49	26	2.5Y 5/1
	8	0.14	2.82	0.00%	3.59	0.50	21	2.5Y 5/1
SJEB09-23	1	0.14	2.86	0.00%	2.49	0.42	19	2.5Y 7/1
	3.5	0.15	2.76	0.00%	4.30	0.43	20	2.5Y 3/1
SJEB09-24	1	0.17	2.60	0.00%	1.50	0.45	23	2.5Y 6/1
SJEB09-25	2	0.23	2.09	0.00%	2.48	0.63	39	2.5Y 6/1
	5	0.14	2.79	0.00%	2.71	0.43	19	2.5Y 6/1
SJEB09-26	0.5	0.15	2.77	0.00%	1.27	0.39	20	10YR 7/1
	4	0.13	2.92	0.00%	2.83	0.39	17	2.5Y 5/1
CB-SJ96-8	3.0	0.20	2.34	0.00%	0.80%	0.54	na	na
	6.0	0.52	0.94	1.70%	1.40%	1.35	na	na
	8.0	0.20	2.30	0.10%	3.40%	0.95	na	na
	12.5	0.17	2.52	0.50%	1.30%	0.77	na	na
	16.0	0.12	3.04	0.10%	4.70%	0.46	na	na
CB-SJ96-11	1.5	0.17	2.53	0.00%	1.10%	0.43	na	na
	6.5	0.15	2.77	0.00%	1.50%	0.48	na	na
	13.5	0.13	2.91	0.00%	1.20%	0.40	na	na
	19.0	0.11	3.21	0.00%	4.90%	0.45	na	na
CB-SJ98-2	3.5	0.13	2.95	0.00%	2.00%	0.43	na	na
	8.0	0.12	3.03	0.00%	3.00%	0.41	na	na
	9.5	0.16	2.67	0.00%	3.00%	1.17	na	na
	11.0	0.13	2.89	0.00%	3.00%	0.60	na	na
CB-SJ98-3	2.5	0.15	2.73	0.00%	1.00%	0.46	na	na
	4.5	0.14	2.81	0.00%	2.00%	0.43	na	na
	8.0	0.13	2.99	0.00%	2.00%	0.38	na	na
	14.0	0.12	3.05	0.00%	3.00%	0.43	na	na
CB-SJ98-7	1.0	0.15	2.70	0.00%	1.00%	0.41	na	na

Boring Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	9.0	0.14	2.89	0.00%	2.00%	0.49	na	na
	11.5	0.15	2.72	0.00%	2.00%	1.02	na	na
CB-SJ98-8	1.5	0.16	2.64	0.00%	1.00%	0.48	na	na
	9.0	0.16	2.65	0.00%	2.00%	0.41	na	na
	11.5	0.13	2.97	0.00%	3.00%	0.42	na	na
	14.5	0.13	2.97	0.00%	3.00%	0.59	na	na
	17.0	0.13	2.95	0.00%	2.00%	0.37	na	na
CB-SJ99-11	0.5	0.62	0.69	4.21%	0.94%	1.35	70%	na
	6.5	0.21	2.24	0.80%	2.02%	0.94	1%	na
	12.5	0.42	1.26	5.32%	2.18%	1.47	5%	na
CB-SJ99-13	0.6	0.59	0.76	3.15%	2.38%	1.26	45%	na
	6.6	0.78	0.36	2.12%	3.27%	1.14	30%	na
Ebb Shoal Composite		**0.23**	**2.38**	**0.00**	**1.43**	**0.64**	**21.48**	**2.5Y 6/1**

*Retained in the #4 Sieve, **Passing the #230 Sieve

Table D - 7. Sediment Analysis Results from Vibracores in the St. Augustine Inlet Flood Shoal Proposed Sand Source.

Boring Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
VB-SAFS15-01	1	0.221	2.18	0.67	0.89	0.71	7.7	2.5Y 7/2
	3	0.252	1.99	1.89	1.15	1.08	8.3	2.5Y 7/2
	6	0.179	2.48	0	2.77	0.34	3.1	2.5Y 7/2
	9	0.237	2.08	0.54	0.94	1	11.4	2.5Y 7/2
	11	0.215	2.22	0.54	1.04	0.8	8.6	2.5Y 7/2
	13	0.255	1.97	0.26	1.43	0.91	14.2	2.5Y 7/2
VB-SAFS15-02	1	0.213	2.23	0.38	0.9	0.72	7.6	2.5Y 7/2
	3	0.156	2.68	0	0.85	0.33	1.4	2.5Y 7/1
	6	0.176	2.51	0	0.93	0.32	0	2.5Y 7/1
	9	0.183	2.45	0	0.66	0.32	3.3	2.5Y 7/1
	12	0.248	2.01	0.66	3.47	1.04	9.2	2.5Y 7/1
	13	0.188	2.41	0	5.86	0.37	0.2	5GY 6/1
VB-SAFS15-03	1	0.192	2.38	0.09	0.44	0.55	5.5	2.5Y 7/2
	3.5	0.233	2.10	0.78	1.37	1.03	13.3	2.5Y 7/2
	7	0.219	2.19	0.35	1.28	0.68	8	2.5Y 7/2
	10.5	0.172	2.54	0	2.02	0.39	2.8	2.5Y 7/2
	14	0.189	2.40	0.17	0.56	0.63	5.4	2.5Y 7/2
	15.5	0.279	1.84	0.12	0.83	0.56	5.5	2.5Y 7/2
VB-SAFS15-04	1	0.314	1.67	2.77	2.74	1.48	23.1	2.5Y 7/2
	3	0.187	2.42	0	0.5	0.35	4	2.5Y 7/2
	6	0.289	1.79	1.1	0.23	1.22	20.8	2.5Y 7/2
	9	0.18	2.47	0	0.94	0.32	0.1	2.5Y 7/1
	12	0.193	2.37	0.3	0.59	0.59	2.2	2.5Y 7/1
	13.5	0.281	1.83	2.34	4.39	1.29	17.8	2.5Y 6/1
VB-SAFS15-05	3	0.266	1.91	2.82	0.89	1.38	16.5	2.5Y 7/1
	6	0.225	2.15	0.08	0.95	0.55	8.5	2.5Y 7/1
	9	0.215	2.22	0.47	1.54	0.79	6	2.5Y 7/1
	12	0.693	0.53	11.31	0.55	1.91	50.1	2.5Y 7/2
	14	0.186	2.43	0	1.28	0.52	2.5	2.5Y 6/1
VB-SAFS15-06	1	0.221	2.18	0.16	1.53	0.75	9.1	2.5Y 6/1
	3	0.382	1.39	4.75	1.79	1.72	26.6	2.5Y 6/1
	6	0.321	1.64	2.94	0.75	1.36	22	2.5Y 6/1
	8	0.59	0.76	8.13	0.94	1.83	41.6	2.5Y 6/1
	9	0.189	2.40	0	2.07	0.41	1.2	2.5Y 7/1
	11.5	0.24	2.06	0.43	0.52	0.88	11.9	2.5Y 7/1
	14	0.21	2.25	0.86	1.49	1.01	9.9	2.5Y 7/1
VB-SAFS15-07	1	0.264	1.92	0.83	1.35	1.07	16.5	2.5Y 7/2
	3	0.289	1.79	2.25	0.51	1.28	19.3	2.5Y 7/2
	6	0.154	2.70	0	2.69	0.42	1.9	2.5Y 6/1
	7.5	0.207	2.27	0.04	0.81	0.43	5.4	2.5Y 7/1
	10.5	0.193	2.37	0.14	1.21	0.56	5.1	2.5Y 7/1

Boring Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	14	0.354	1.50	4.56	1.53	1.78	27.9	2.5Y 7/1
VB-SAFS15-08	1	0.186	2.43	0	1.1	0.33	0.3	2.5Y 8/2
	3	0.184	2.44	0	0.54	0.33	3.6	2.5Y 8/2
	6	0.176	2.51	0	1.66	0.36	3	2.5Y 8/2
	9	0.209	2.26	0	0.77	0.49	11	2.5Y 7/2
	12	0.192	2.38	0	3.09	0.31	0.3	2.5Y 8/2
	15	0.5	1.00	9.2	0.75	1.94	37.5	2.5Y 8/2
VB-SAFS15-10	3	0.624	0.68	8.23	0.34	1.74	45.1	2.5Y 5/1
	6	0.18	2.47	0.27	1.56	0.59	4.4	2.5Y 7/1
	7.5	0.202	2.31	0.05	1.01	0.53	6	2.5Y 7/1
	9	0.747	0.42	13.98	0.88	1.59	45.9	2.5Y 7/1
	12	0.17	2.56	0	1.26	0.35	2.4	2.5Y 7/1
VB-SAFS15-11	1	0.252	1.99	5.34	2.66	1.64	15.4	2.5Y 6/2
	3	0.186	2.43	0.88	1.55	0.76	5.1	2.5Y 6/2
	6	0.529	0.92	9.53	0.95	1.9	39.9	2.5Y 7/1
	9	0.418	1.26	6.89	1.17	1.76	31.9	2.5Y 7/2
	12	0.559	0.84	2.59	1.24	1.46	48.8	2.5Y 7/2
	13.5	0.287	1.80	3.35	1.85	1.64	23.3	2.5Y 6/1
VB-SAFS15-12	1	0.551	0.86	8.05	1.23	1.79	43	2.5Y 6/2
	3	0.285	1.81	0.77	1.06	1.39	17.7	2.5Y 6/2
	6	1.37	-0.45	22.75	0.87	1.84	65.7	2.5Y 6/2
	9	0.993	0.01	11.75	1.08	1.72	66.3	2.5Y 6/2
	11	0.159	2.65	0.25	4.14	0.65	2.6	2.5Y 5/1
VB-SAFS15-13	1	0.369	1.44	4.71	2.86	1.81	30.7	2.5Y 6/1
	3	0.339	1.56	2.05	1.23	1.37	25.8	2.5Y 6/1
	5.5	0.865	0.21	18.69	1.26	2.09	48.1	2.5Y 7/2
	8.5	0.255	1.97	1.19	1.43	1.07	14.8	2.5Y 7/2
	10	0.218	2.20	0.23	2.34	0.79	9.2	2.5Y 6/1
	12	0.168	2.57	0.03	2.95	0.41	6.9	2.5Y 5/1
VB-SAFS15-14	1	0.54	0.89	9.47	1.66	1.97	40	2.5Y 6/2
	3	0.304	1.72	4.37	1.28	1.52	19.2	2.5Y 6/1
	6.5	0.646	0.63	12.49	1.01	1.98	44.5	2.5Y 7/2
	9	0.332	1.59	4.85	1.28	1.33	22	2.5Y 6/1
	10.5	0.171	2.55	0	2.3	0.44	2.9	2.5Y 6/1
	12	0.158	2.66	0	1.19	0.34	1.7	2.5Y 6/1
	14	0.243	2.04	2.54	1.68	1.32	14.3	2.5Y 6/1
VB-SAFS15-15	1	0.204	2.29	0.36	1.87	0.88	9.2	2.5Y 6/1
	3	0.159	2.65	0	2.15	0.52	2.37	2.5Y 6/1
	6	0.192	2.38	0.12	1.73	0.77	7	2.5Y 6/1
	9	0.255	1.97	0.89	1.7	0.89	12.4	2.5Y 7/2
	12	0.272	1.88	1.66	1.21	1.05	15.2	2.5Y 6/1
	15	0.203	2.30	0	2.32	0.45	6.2	2.5Y 7/2
VB-SAFS15-16	2	0.164	2.61	0	1.95	0.39	2.2	2.5Y 7/1

Boring Number	Sample Depth (ft)	Mean (mm)	Mean (phi)	Percent Fine Gravel* (%)	Percent Silt** (%)	Sorting / St. Dev (phi)	Visual Shell (%)	Munsell Color (moist)
	4	0.191	2.39	0.47	2.19	0.83	6.9	2.5Y 6/1
	7	0.646	0.63	9.96	1.22	1.93	46.8	2.5Y 6/2
	9.5	0.342	1.55	4.51	4.15	1.74	27.54	2.5Y 4/1
	12.5	0.463	1.11	5.97	1.05	1.69	37	2.5Y 7/1
VB-SAFS15-17	2	0.167	2.58	0	2.09	0.38	2.5	2.5Y 6/2
	4	0.207	2.27	0.09	6.07	0.42	1.1	2.5Y 5/1
	6	0.167	2.58	0	1.56	0.36	2.4	2.5Y 6/2
	8	0.147	2.77	0	6.78	0.5	0.9	2.5Y 6/2
Flood Shoal Sand Source Composite		**0.30**	**1.93**	**2.62**	**1.64**	**0.98**	**15.70**	**2.5Y 6/1**

*Retained in the #4 Sieve, **Passing the #230 Sieve