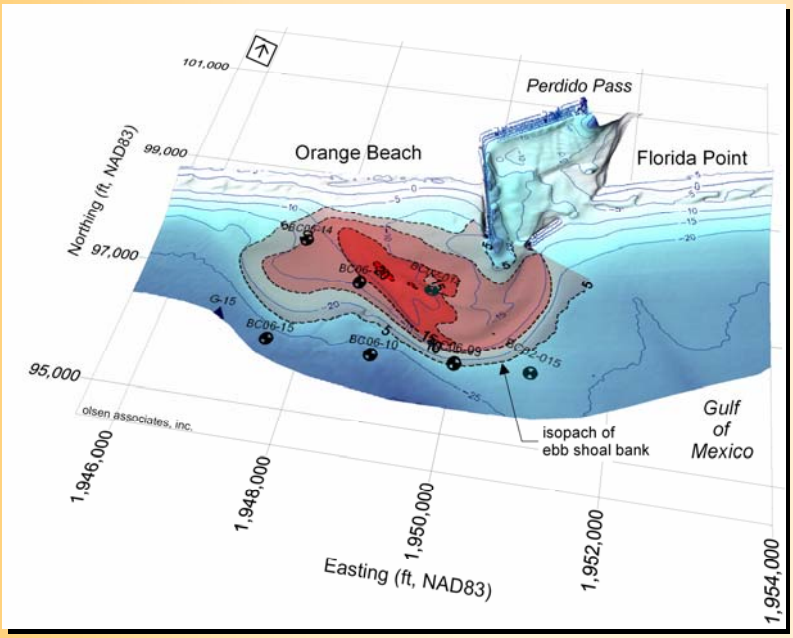
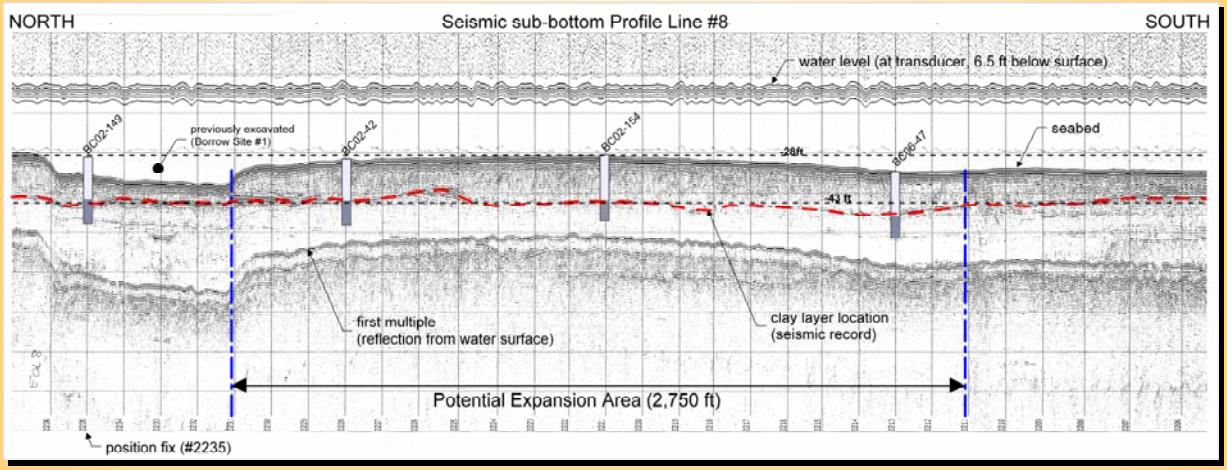
ORANGE BEACH / GULF STATE PARK / GULF SHORES

2006 Phase I Deep–Water Sand Search

Baldwin County, AL





Submitted By:
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4438 Herschel St
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November 2006

Submitted To:
City of Orange Beach, AL
Alabama Department of Conservation and Natural Resources
City of Gulf Shores, AL

olsen
associates, inc.
coastal engineering

Orange Beach / Gulf State Park / Gulf Shores
2006 Phase I Deep Water Sand Search
Baldwin County, AL

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EXECUTIVE SUMMARY

A reconnaissance-level geotechnical sand search was conducted in April/May 2006 in both State and Federal waters offshore of Baldwin County, AL, to identify additional potential sources of beach-compatible material for use in future beach nourishment operations along the eastern Baldwin County Gulf of Mexico shoreline. The study was performed for the City of Orange Beach, AL, the Alabama Department of Conservation and Natural Resources, and the City of Gulf Shores, AL. Sixty 20-ft sediment Vibracores were collected as part of the field work, along with limited seismic sub-bottom data along several bathymetric features in the study area. Alpine Ocean Seismic Survey, Inc., of Norwood, NJ, collected the sediment Vibracores and seismic sub-bottom data. Scientific Environmental Applications, Inc., of Melbourne, FL, logged the Vibracores and provided the geotechnical analyses of all sediment samples. Olsen Associates, Inc., was contracted by the three-party Owner group to design and manage the investigation and formulate the report of findings.

Taken as a whole, it is apparent from inspection of all the data that there is only a finite volume of truly "beach-compatible" sand that exists within reasonable retrieval distances offshore of Baldwin County, AL. This is particularly true for the shoreline at Gulf Shores, AL. This situation highlights the need to conserve sand at every opportunity.

Based upon this fact and the available data described herein, the following recommendations are offered.

- **Proceed with permitting tasks for the expansion of Borrow Sites #1, #2, and #3 for future use -** It is opined that sufficient geotechnical data exist to accomplish this task. It is expected that these sites will be the principal option, if not the only option, for renourishment in the short-term (such as after a major storm event). Complete excavation of the existing sites and the identified expansion areas may yield over 3.0 million cubic yards of sand, primarily from the expansion of Borrow Site #1. Tasks would include the creation of composite sediment distributions for each area and corresponding overfill ratios and the investigation of each area for potential cultural resources or obstructions. Advance preparation of these data along with a renourishment plan would expedite the fast-track permitting of a post-storm recovery plan.

- **Develop a sediment management plan for Perdido Pass** - The lack of significant long-term sand sources highlights the critical importance of proper sediment budget practices at Perdido Pass. This tidal entrance, along with Lagoon Pass, represents a substantial sink of sediment from the littoral system. While some sand has recently been more effectively bypassed around Perdido Pass, sand is still placed in areas where it is effectively lost from the littoral system -- in the upland, in areas immediately east and west of the entrance where its return to the channel is accelerated, and in nearshore areas that are too far seaward to promote the rapid infusion of the disposal sand back into the littoral system. Additionally, some areas that require attention in the interior of the inlet system lie outside the limits of the Federal project. The sediment management plan would address the proper disposal of all dredged material from all portions of the system, would investigate any possible structural changes in the inlet, and would provide a vehicle for the City of Orange Beach to participate with the U.S. Army Corps of Engineers and the State of Alabama (the Owners of the water bottoms in the inlet) in improving the inlet and the bypassing of sand to the adjacent beaches.

- **Complete Acquisition of Beach Construction Easements West of Perdido Pass –** In conjunction with the development of a sediment management plan at Perdido Pass, any remaining outstanding beach construction easements near

Perdido Pass should be acquired by the City of Orange Beach. Work is well underway in this regard.

- **Plan a Phase II Vibracore Collection** – A second phase of data collection would have the specific objectives of A) developing two smaller sites at the AL/FL State Line and southeast of previously developed and excavated Borrow Site #2, B) developing the outer, western flank of Perdido Pass as a potential borrow site (pending additional research), C) investigating in greater detail the offshore portion of Baldwin Shoal to determine if a viable site exists in that region, and D) collecting additional data along the boundary of the navigation entrance to Mobile Bay for purposes of developing a channel-widener/borrow site. This task is considered secondary to the first three recommendations, and may be most prudent when a Vibracore research vessel is available in the area.

- **Investigate the Western Terminus of North Perdido Shoals** – It is opined that North Perdido Shoals represents a potentially massive volume of beach-compatible sands. The site lies in Federal Waters near the AL/FL State Line, offshore of the extended boundaries of Florida. It is suggested that additional discussions be held with personnel at the State of Florida Department of Environmental Protection and Escambia County, FL, to address the potential multiple uses of the shoal area, which is presently permitted for artificial reefs. It is opined that the two uses can successfully coexist in the area, which covers thousands of acres of the seabed in Federal Waters. It is further opined that the two uses may actually be mutually beneficial in that post-excavation sites can be developed with artificial reef platforms, gaining the benefit of the artificially created change in relief associated with borrow areas.

Additional observations from the Phase I study include:

- Consistent with the 2002 sand search, as a general rule any sand found that appeared to be of beach-quality was found in the vicinity of some type of ridge or shoal feature in the nearshore. Vibracores collected in the broad valley areas between ridges and in the relatively featureless areas further offshore were found to be undesirable sandy materials containing high levels of silts and fines, occasional lenses of clay, and/or high levels of crushed shell mixed with fines and clay. These sediments also exhibit much darker color, and frequently contained

decaying organic material. This description was found to agree with the general findings of previous investigators. Atop *most* of the ridge and shoal features, beach-compatible sand was identified, combined with varying low levels of broken shell.

- The ebb shoal at Perdido Pass was investigated with additional Vibracores. While the total volume of the ebb shoal is roughly three million cubic yards or more, only approximately 1.0 million cubic yards is likely to be beach compatible material. Excavation of any portion of the ebb shoal would require additional Vibracoring and detailed coastal engineering analyses of the potential effects to the remaining shoal and the adjacent shorelines. As indicted in Table 5.1, additional sand will periodically become available from the maintenance of the recreational navigation channel at Perdido Pass (discussed below). It is possible that some of the excavated channel maintenance material could be pumped back into any excavated portion of the ebb shoal to eliminate any potential impacts caused by the void.

- Two smaller sites were identified as potential Borrow Sites. The first site lies along the AL/FL State Line, in Alabama State Waters. The site may contain 0.4 to 0.5 million cubic yards of sand. The second site lies to the south-southeast of Borrow Site #2, offshore of the Romar Beach area in Orange Beach. It too may contain 0.4 to 0.5 million cubic yards. These two sites would both require additional targeted Vibracoring and seismic sub-bottom profiling in order to successfully excavate the beach compatible material. These sites are much smaller than those excavated previously, and would represent a different approach to beach fill construction, utilizing more borrow sites and submerged pipeline assemblies than in previous contracts.

- Upon Baldwin Shoal, west of Gulf Shores, the previously developed and permitted Borrow Site #4 remains unexcavated. The sediments in this site, along with a greater volume of sand in the vicinity, are slightly finer and slightly darker than the native beach sand characteristics. These facts may be weighed against future sediment needs along the Baldwin County shoreline. Inspection of a limited number of Vibracore samples in Federal Waters along Baldwin Shoal indicate a possible zone of improved sediment characteristics roughly five to six

miles offshore along the shoal, approximately 10 miles from the western end of Gulf Shores.

- At the entrance to Mobile Bay, the ebb shoal east of the entrance channel, called Dixie Bar, was sampled. These Vibracores revealed beach compatible sands along the crest of the shoal, parallel to the channel. Away from the crest, to the east, sediment color and grain size degrade quickly. Further investigation would be required to develop a borrow site at this location. It is opined that the site would ultimately resemble a channel widener to the established navigation channel, seeking to excavate only the highest quality sediments. Given the lengthy nautical history of the entrance, detailed magnetometer and sidescan surveys would be required to address potential marine archaeological/cultural resource issues and potential obstructions.

- With limited exception, the conclusions reached by Hummell (1999) for sediments in Federal Waters just offshore of the 3-mile limit *could not be replicated during this study*. Based on a *very* limited number of Vibracores, Hummell (1999) suggests that there may be hundreds of millions of cubic yards of beach compatible sand available for nourishment purposes in the "Surficial Sand Sheet" in three identified resource areas in Federal Waters. Closer inspection of the older Vibracore logs used to reach that conclusion indicate that much of the material in the upper lenses of the Hummel and Parker Vibracores, while perhaps SP materials, would in fact *not* be suitable for direct beach placement, due to a combination of factors including color, silt content, shell content, presence of shallow clay layers, etc. This was re-verified by recent Vibracores. In some instances, very small pockets of beach-compatible material (following the general guidelines established herein) could possibly be identified with highly-targeted field investigation. With the possible exception of one region along Baldwin Shoal, it is opined that the reserve estimate of beach compatible sand from these three resource areas would be measured in the hundreds of thousands of cubic yards (as opposed to hundreds of millions).

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Baldwin County, AL

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Report Submitted to:
City of Orange Beach, AL
AL Department of Conservation and Natural Resources
City of Orange Beach, AL

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1.0 INTRODUCTION

This report describes the findings of a reconnaissance-level geotechnical sand search conducted in April/May 2006 in both State and Federal Waters offshore of Baldwin County, AL. The study was performed for the City of Orange Beach, AL, the Alabama Department of Conservation and Natural Resources, and the City of Gulf Shores, AL. Building on the work performed by Olsen Associates (2003), the purpose of the 2006 investigation was to identify additional potential sources of beach-compatible material for use in future beach nourishment operations along the eastern Baldwin County Gulf of Mexico shoreline. Sixty 20-ft sediment Vibracores were collected as part of the field work, along with limited seismic sub-bottom data along several bathymetric features in the study area. Vibracores were collected along the entire length of the Baldwin County shoreline from the ebb shoal platform at the entrance to Mobile Bay eastward to the Alabama/Florida State Line and offshore to points roughly 17 to 20 miles from the shoreline (Figure 1.1). Several Vibracores were collected in the vicinity of previously established sand borrow sites for purposes of expanding theses sites for future excavation. Alpine Ocean Seismic Survey, Inc., of Norwood, NJ, collected the sediment Vibracores and seismic sub-bottom data. Scientific Environmental Applications, Inc., of Melbourne, FL, logged the Vibracores and provided the geotechnical analyses of all sediment samples. Olsen Associates, Inc., was contracted by the three-party Owner group to design and manage the investigation and formulate the report of findings.

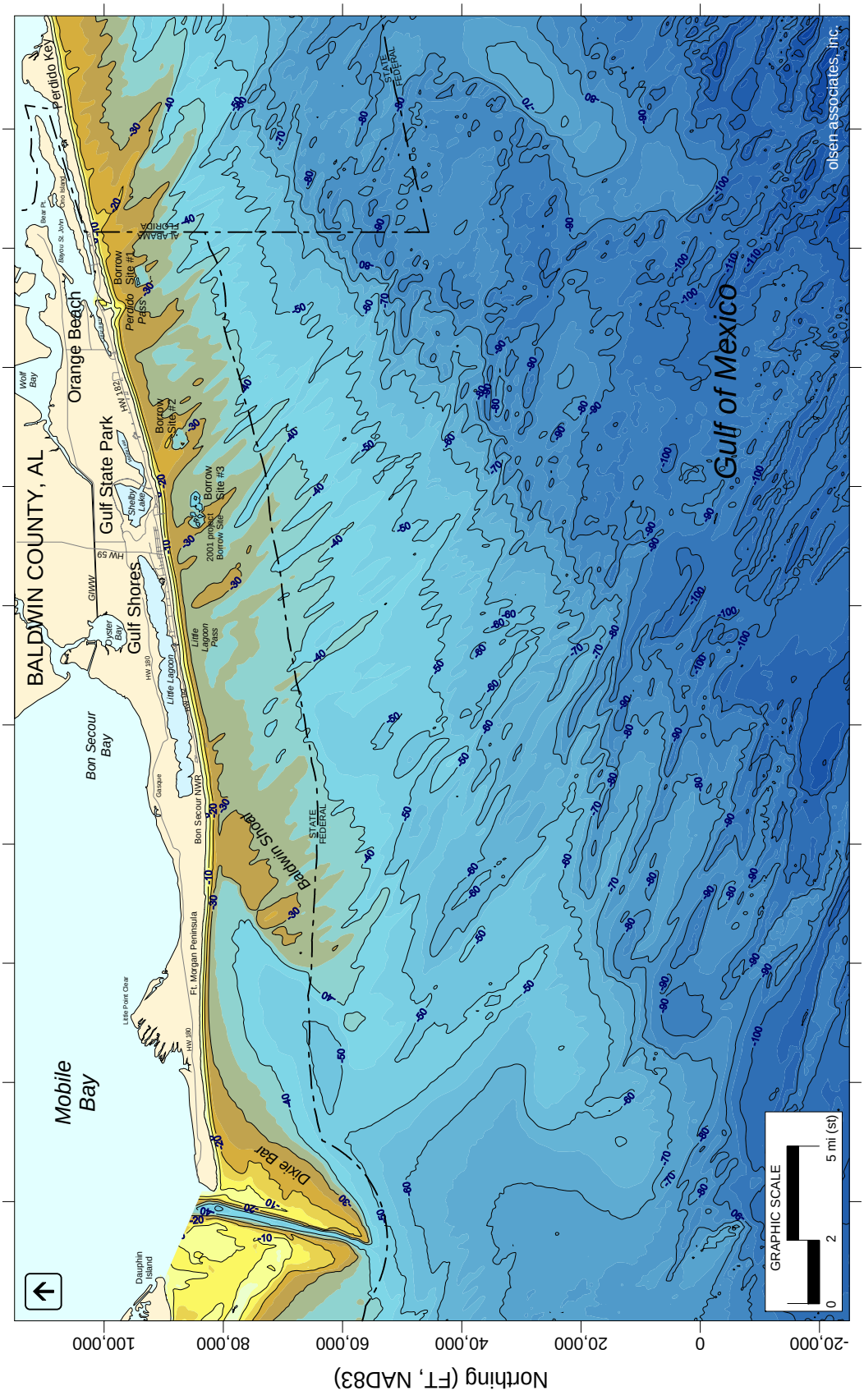

Figure 1.1 Bathymetric map depicting the general study area in Gulf of Mexico waters offshore of Baldwin County, AL. Depths are in feet, relative to NAVD88. Data source – NOAA NOS (dates vary) and local surveys (Olsen Associates, 2006).

1.1 Study Location

As depicted in Figure 1.1, the study area encompasses an area roughly 31 miles alongshore by as much as 20 miles cross-shore. Alabama State Waters extend offshore three nautical miles to the boundary with Federal Waters. Florida State Waters extend offshore nine nautical miles to the Federal Boundary. The investigation was limited to Alabama State Waters and Federal Waters seaward of the extended limits of Baldwin County, AL.

Referring to Figure 1.1, several distinct bathymetric features exist within the study area. The most prominent feature is the ebb shoal platform at the entrance to Mobile Bay, the crest of which extends offshore over five miles from the Ft. Morgan shoreline. The eastern portion of the ebb shoal is locally referred to as Dixie Bar. Along the next 12 miles of the Baldwin County shoreline, a deep embayment encroaches directly upon the peninsula shoreline and water depths exceeding 40 ft can be found within one mile of the shoreline. The embayment is bounded to the east by a broad shoreface-attached ridge extending over seven miles to the southwest. This ridge, labeled Baldwin Shoal, is unique for this area in that it trends offshore to the southwest, whereas other shoreface-attached ridges to the east trend offshore to the southeast. Limited data exist to explain this phenomenon, although some studies suggest that this may be a relict shoal feature of Mobile Bay.

East of Baldwin Shoal, the City of Gulf Shores extends for eight miles along the shoreline. The nearshore region off the western half of Gulf Shores, from the western tip of Little Lagoon eastward to Little Lagoon Pass, is characterized by a broad shallow shelf with few other bathymetric features. The -40-ft NAVD88[1] contour lies more than 3.5 miles offshore, and the -60-ft contour lies over eleven miles offshore[2].

East of Little Lagoon Pass, several large oblique shoreface-attached nearshore ridges extend offshore to the southeast into water depths of roughly 40 ft. These ridges occur

[1] In this report, the vertical datum used is the fixed North American Vertical Datum of 1988 (NAVD88). Mean High Water in this region lies roughly 0.85 ft above NAVD88. The horizontal datum used is the North American Datum of 1983, and the horizontal coordinate system in that datum is the State Plane Coordinate System, Alabama West Zone (units in feet).

[2] From Perdido Pass, the continental shelf at DeSoto Canyon lies roughly 30 miles to the south-southeast and begins below 120 feet to 140 feet depth. From the entrance to Mobile Bay, the shelf lies approximately 45 miles to the south-southeast.

frequently throughout the eastern portion of the study area and extend further eastward into the Florida Panhandle. The ridges typically have crest elevations above -30 ft NAVD88, approaching -20ft NAVD88 in some instances. These features are of primary interest for their potential to contain beach compatible sand, and several have been utilized recently for that purpose (discussed elsewhere in this report). Other bathymetric features of interest include the ebb shoal complex at Perdido Pass in Orange Beach. This feature was investigated previously, and additional Vibracores were collected along the shoal to determine the quality of material in the shoal.

The larger-scale trend in the continental shelf bathymetry is the narrowing of the width of the nearshore region from west to east. This trend is related to the orientation of the continental shelf along DeSoto Canyon (not shown). The narrowing trend continues to the east into Florida toward Destin, FL. In the nearshore, the bottom slope is very mild out to the 50- to 60-ft contours, which lie between 6 to 8 nmi offshore (~1:800 slope). Beyond the 60-ft contour, a bathymetric low exists with maximum depths reaching 95 ft. Along the eastern margins of the study area and into Federal Waters offshore of Florida, a large shore-parallel shoal exists roughly 15 miles from shore. This shoal is a portion of North Perdido Shoals, identified by McBride et al. (2000), among others. The shoal feature is very prominent in the waters off Florida, where the crest of the feature rises from -90ft to nearly -65ft NAVD88. The feature abruptly terminates near the extended AL/FL State Line, however, and is nearly indistinguishable in the Federal Waters off Alabama. South of North Perdido Shoals lies South Perdido Shoals, situated along the edge of the continental shelf in this region (not shown in Figure 1.1). South Perdido Shoals exhibits crest elevations of between -115 to -120 ft NAVD88. As depicted in Figure 1.1, the seabed offshore of Baldwin County is relatively featureless between the -70 ft contour and the edge of the continental shelf at South Perdido Shoals.

As will be discussed in this report, the study area is bounded not only by geological limits, but also by political boundaries and economic constraints. Concerns expressed by parties in Florida limited the exploration to Alabama State Waters and the waters offshore thereof. Limits in dredging technology presently restrict the practical need to search for sediment sources in water depths deeper than -90 to -100ft NAVD88. Economically, offshore sand sources located more than 15 to 20 miles distant become impractical for cost-effective construction of beach nourishment projects due to the increases in sail times and fuel required by hopper dredges.

2005-2006 Orange Beach/Gulf State Park/Gulf Shores Beach Restoration Project - Olsen Associates (2006a) describes the recent construction of a 15.3-mile, 7.9-million cubic yard beach restoration project for Orange Beach, Gulf State Park and Gulf Shores. The project was constructed between February 2005 and April 2006, utilizing sand excavated from Borrow Sites #1, #2, and #3 shown in Figure 1.1.

1.2 Permits

Permits for the study were obtained from the Mineral Management Service (MMS) of the U.S. Department of the Interior. Permits *M06-01* (geological prospecting) and *M06-02* (geophysical prospecting) were obtained from the MMS – Gulf of Mexico Region, New Orleans, LA, office. Activities were conducted within designated MMS blocks:

- MO 825 to MO 830,
- MO 869 to MO 874,
- MO 913 to MO 918,
- MO 959 to MO 962,
- MO 105,
- PE 751 to PE 753,
- PE 793 to PE 797,
- PE 837 to PE 841,
- PE 881 to PE 886,
- PE 925 to PE 930,
- PE 971 to PE 974,
- DD 03 to DD 05

Although permitted to do so by MMS, no activities were conducted in Federal Waters offshore of the extended boundaries of Florida's State Waters (Figure 1.1). More discussion of the test plan for data collection is included elsewhere in the text.

2.0 NATIVE BEACH CHARACTERIZATION & PREVIOUS INVESTIGATIONS

2.1 Native Beach Characterization

To begin the investigation, it was necessary to characterize the native, pre-beach fill sediments in order to identify a target grain size distribution, color range, and shell content percentage. As part of the permitting and design process for the recently completed Orange Beach/Gulf State Park/Gulf Shores Beach Restoration Project (Olsen Associates, 2006a) the pre-project characteristics of the sediments along the native beach within the project area were assessed via analysis of 77 surface grab samples collected along 10 beach profile transects across the area. Samples were collected by Dr. Scott Douglass for Olsen Associates, Inc., in April 2003. These transects are listed in Table 2.1.

Table 2.1 Beach profile transect locations for native beach sand sampling (from Olsen Associates, 2003)

Transect # (per Douglass and Roland)	Location	Corresponding Survey Monument
1	West Beach – Laguna Key Subdivision	A04 (West Beach Sta 510+00)
2	2361 W. Beach Blvd	A13 (West Beach Sta 420+00)
3	1881 W. Beach Blvd	A22 (West Beach Sta 350+00)
4	1285 W. Beach Blvd	A29 (West Beach Sta 290+00)
5	Gulf State Park Convention Center	A50 (ADEM B-24)
6	Hilton Garden Inn – Orange Beach	A60 (Between B-31 & B-32)
7	Romar Beach Access	A68 (B-34)
8	Cotton Bayou Access	A76 (COE-284)
9	Windrift Condominium – Perdido Key	A90 (B-45)
10	Flor-Bama (AL/FL State Line)	A95 (B-48)

Samples collected – April 2003 (Douglass and Roland – see Olsen Associates, 2003).

At each profile, six to eight surface samples were collected (typically eight, but dependent on existing beach conditions). For dry beach samples, the upper two inches of sand was removed before the sample was collected. In addition to the 2003 samples, Douglass collected a similar suite of samples for the 2000-2001 East Beach Gulf Shores project (November 1999). All samples in the present analysis can be generally classified as quartz, medium- to fine-grained sand (Unified Soils Classification) or coarse- to fine-grained sand (Wentworth scale) with very low percentages of shell content (generally less than one percent, estimated).

Sediment grain sizes are typically described in either phi units, ϕ, or millimeters, *mm*. Phi units are commonly used to relate various properties of a sediment sample (e.g. sorting, skewness, etc.). The relationship between diameter, *d*, expressed in mm versus phi units is given in Equation 3.1.

$$d = 2^{-\phi} \tag{2.1}$$

The median diameter, D_{50}, of a sediment sample is that diameter for which 50% of the sample by weight is coarser (or finer). Median diameters for all the 2003 samples fall within a range of 0.21 mm to 0.46 mm (2.252ϕ to 1.120ϕ). All native samples contain a low percentage of fine material (material finer than the #230 sieve, 0.063 mm). The percentage of fines varies notably with the position along the profile. Samples collected on the dry beach berm had little to no fine material (0.5% or less) while samples collected seaward of the bar and in the trough exhibit fines fractions reaching 3.3%.

The sorting of a sediment sample describes the degree to which all sediments are similarly sized. This value is represented by the standard deviation/sorting coefficient of the sample, given by

$$\sigma_{\phi} = \frac{(\phi_{84} - \phi_{16})}{2} \tag{2.2}$$

The average sorting coefficient for all segments is 0.47 to 0.50ϕ, where West Beach in Gulf Shores exhibits slighter higher sorting values than its eastern neighbors. These values indicate sediments that are generally well-sorted ($\sigma_{\varphi} < 0.50\phi$), meaning most of the grain sizes in the sample are fairly similar. Sorting coefficients are also seen to vary

across the profile, with lower values on the dry beach (0.40ϕ), and higher values at depths offshore of the primary bar (0.5 to 0.6ϕ).

Figure 2.1 plots the grain size distributions of all 77 samples. The figure indicates the envelope of grain sizes that naturally exist (at the time of the data collection). Figure 2.2 illustrates the cross-shore variation of grain size across typical profiles in each of the three project segments.

Figure 2.2 demonstrates the offshore fining of sediments from the upper beach berm to beyond the primary bar. Each data point in the graph represents the average of the samples collected at the respective cross-shore stations for the transects in each segment (two or three values per station). Average median grain sizes along the dry beach typically exceed 0.30 mm, with some samples reaching a high of 0.46 mm. Seaward of the primary bar, sediments can be as fine as 0.21 mm with typical values of 0.22 to 0.23 mm.

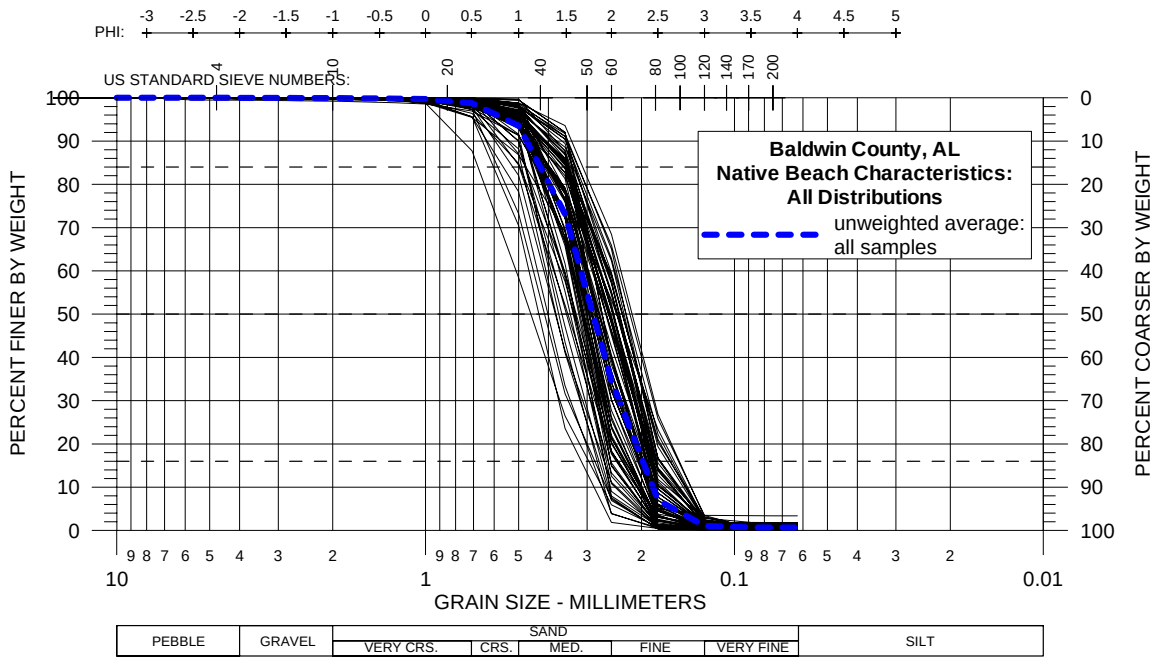

Figure 2.1 Grain size distributions for all native beach samples collected in April 2003 (Olsen Associates, 2003).

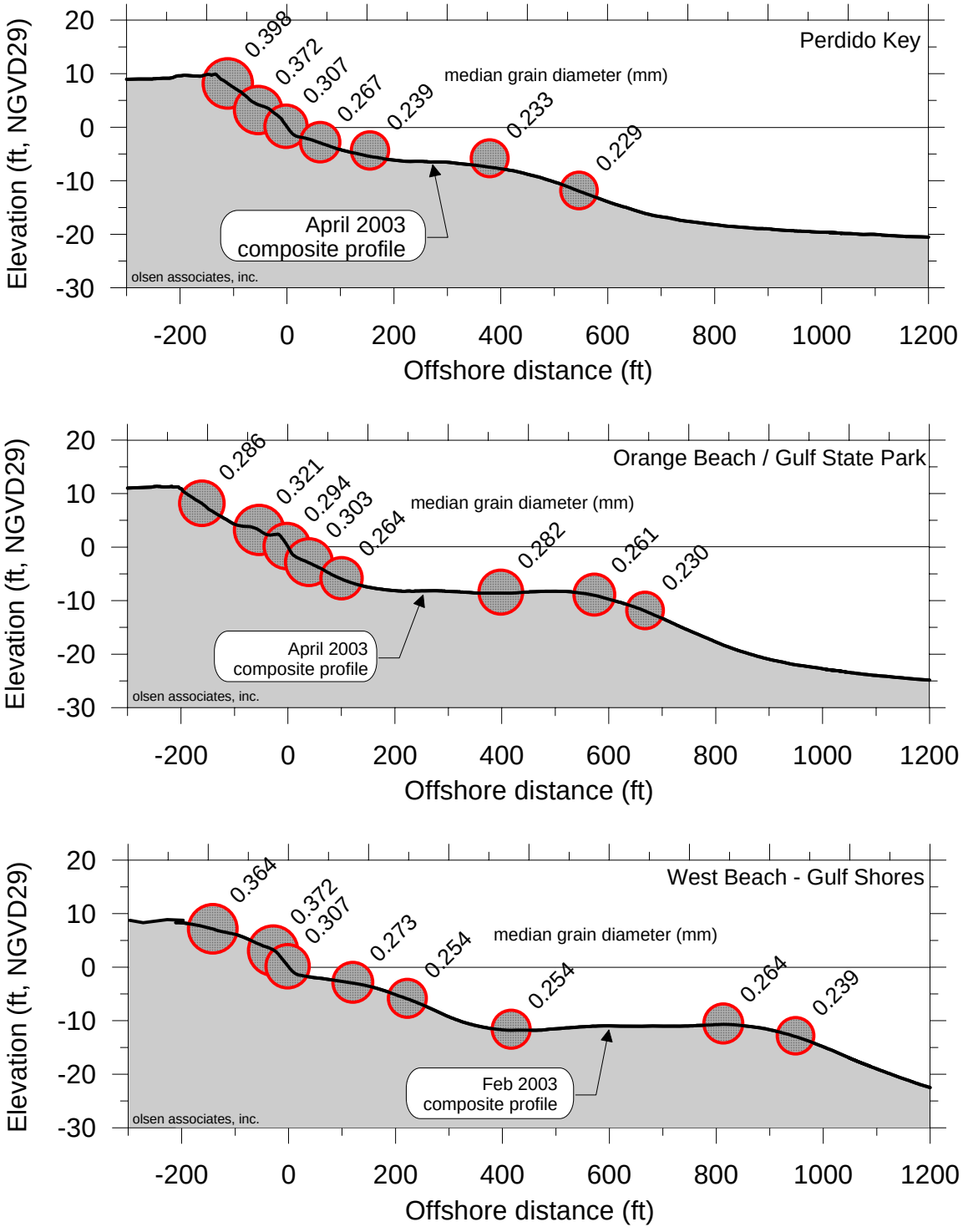

Figure 2.2 Cross-shore variation in median sand grain diameters for each of the three primary project segments. Each point represents the average of three corresponding discrete samples collected along different transects in each segment (from Olsen Associates, 2003).

For purposes of comparing the native beach characteristics to the sediments found in the various offshore Vibracores, a representative median diameter and sorting coefficient must be derived for each segment. These values must account for the variation in grain size along the profile. Dean (2000) discusses techniques for developing composite characteristics using spatially weighted averages. Both vertical and horizontal averages may be used, and there are arguments for and against each. Herein, the range of possible values is presented, principally to illustrate the uncertainty in developing a single value and ultimately determining an overfill factor (discussed elsewhere in this report).

Table 2.2 presents the range of composite median diameters and sorting coefficients determined from the various computational methods. In many regards the differences may seem slight, however, as will be shown in the borrow site analyses, small differences in both median size and sorting coefficient can produce larger differences in overfill factor.

Additional native beach grain size data is available from Olsen Associates (2001). These data were collected by Douglass in 1999 for the East Beach project. The 1999 samples were collected in November versus April for the present study. The November samples produced higher grain sizes along the submerged portions of the profile and produced a composite median diameter of 0.30mm. Given the variability in the data and the differences in seasonality and computational methods, it would seem appropriate to view the composite values as a small range rather than a single value.

Sediment Carbonate Content and Color Further characterizing the native beach is its shell/carbonate content and its color. The native beach contains very little shell. Previous experience suggests that the shell/carbonate content of the native beach is much less than 1% by weight, although there were shell fragments found along the upper beach. Shell content was low enough to be deemed unnecessary to test for carbonate content. Sediment color is described using the Munsell color scale. However, the color of the native beach is much whiter and brighter than the “high end” of the traditional Munsell Soils Color Chart (Browder, 2002). Using the 10YR hue page and the 10YR samples from the Nearly Whites fandeck, both Munsell products, the native sediment color is estimated to be 10YR 9.0/1.0 to 9.0/1.5 (all segments). This represents a nearly white sand that has a slight tan or orange cast to it (indicated by the 1.0 to 1.5 designation).

Table 2.2 Composite Native Beach Characteristics by Segment
(from Olsen Associates, 2003)

Segment	Direct Averaging		Horizontal Weighting		Vertical Weighting	
	Median (mm)	Sorting (Φ)	Median (mm)	Sorting (Φ)	Median (mm)	Sorting (Φ)
Perdido Key	0.29	0.47	0.27	0.49	0.29	0.49
Orange Beach / Gulf State Park	0.28	0.47	0.27	0.49	0.28	0.47
West Beach G.S.	0.29	0.50	0.27	0.53	0.29	0.49

Samples collected – April 2003 (Douglass and Roland).

Post-Construction Sediment Sampling – Olsen Associates (2006a) describes the beach sediment characteristics of the dry beach following the construction of the beach restoration project. Dry beach samples were collected along 11 transects (the ten listed in Table 2.1 plus an additional transect at Gulf Place at HW59 in East Beach Gulf Shores). In most areas, beach sediments collected after beach fill placement were found to be coarser than the pre-project native samples. Typical median grain sizes were found to be 0.37mm along the Perdido Key, AL, shoreline, 0.33mm along the Orange Beach/Gulf State Park shoreline, and 0.30mm along the Gulf Shores beaches. This trend is attributed to several factors. The excavation and hydraulic placement of the beach fill sediments tends to winnow out the finer fraction of borrow site sediments, coarsening the fill. Additionally, the fill itself contains a higher percentage of shell fragments, which are typically larger than the sand grains. This fact is documented by the corresponding increase in the sorting coefficient of the samples, which is higher in most cases (typically 0.55 top 0.60ϕ). Lastly, no significant cross-shore sorting of the sediments has yet occurred (at the time of sampling). Over time, the natural processes of winds, waves, and tides (including potential tropical events) will sort the beach sediments along the profile. It is expected that differences between the placed sediment characteristics and the native samples will diminish over time.

Summary – The Vibracore program discussed herein will be viewed in the context of the sediments' suitability for direct beach placement along the beaches of Orange Beach, Gulf State Park, and Gulf Shores. In that regard, beach compatible sediments are those that *generally* meet the following characteristics[3]:

- Median grain sizes of at least 0.27 to 0.30 mm,
- Sorting coefficients less than 0.7 to 0.8ϕ (generally to limit shell content),
- Fines content of less than 2% to 3%,
- In-situ color grades of at least 7.5 (Value) and no more than 1.5 (Chroma).

2.2 Previous Investigations

Building on the sand search conducted for the 2005-2006 beach restoration project (Olsen Associates, 2003, from which much of this discussion is excerpted), Figure 2.3 plots the position of numerous sets of Vibracores collected in the project area. In total, these datasets represent nearly 600 Vibracores collected between the Mobile Bay entrance and Pensacola Beach. That figure does not include Vibracores collected within the navigation channels at Main Pass at Mobile Bay and at Pensacola Pass. The 60 Vibracores collected as part of this study and discussed in subsequent chapters are plotted in the figure (denoted by the black circles labeled "*BC06-xx*"). All available Vibracore data can be viewed on the attached CD-ROM disc, which contains a searchable map to facilitate investigation of specific areas or Vibracores.

[3] While individual samples within a borrow site may not meet these goals, it is the intent that the composite of the site meet or exceed these values. Sediments which do not attain these levels may still be considered beach compatible, but will result in higher overfill ratios and/or varying levels of compromise in terms of sediment color and composition (shell content, etc.).

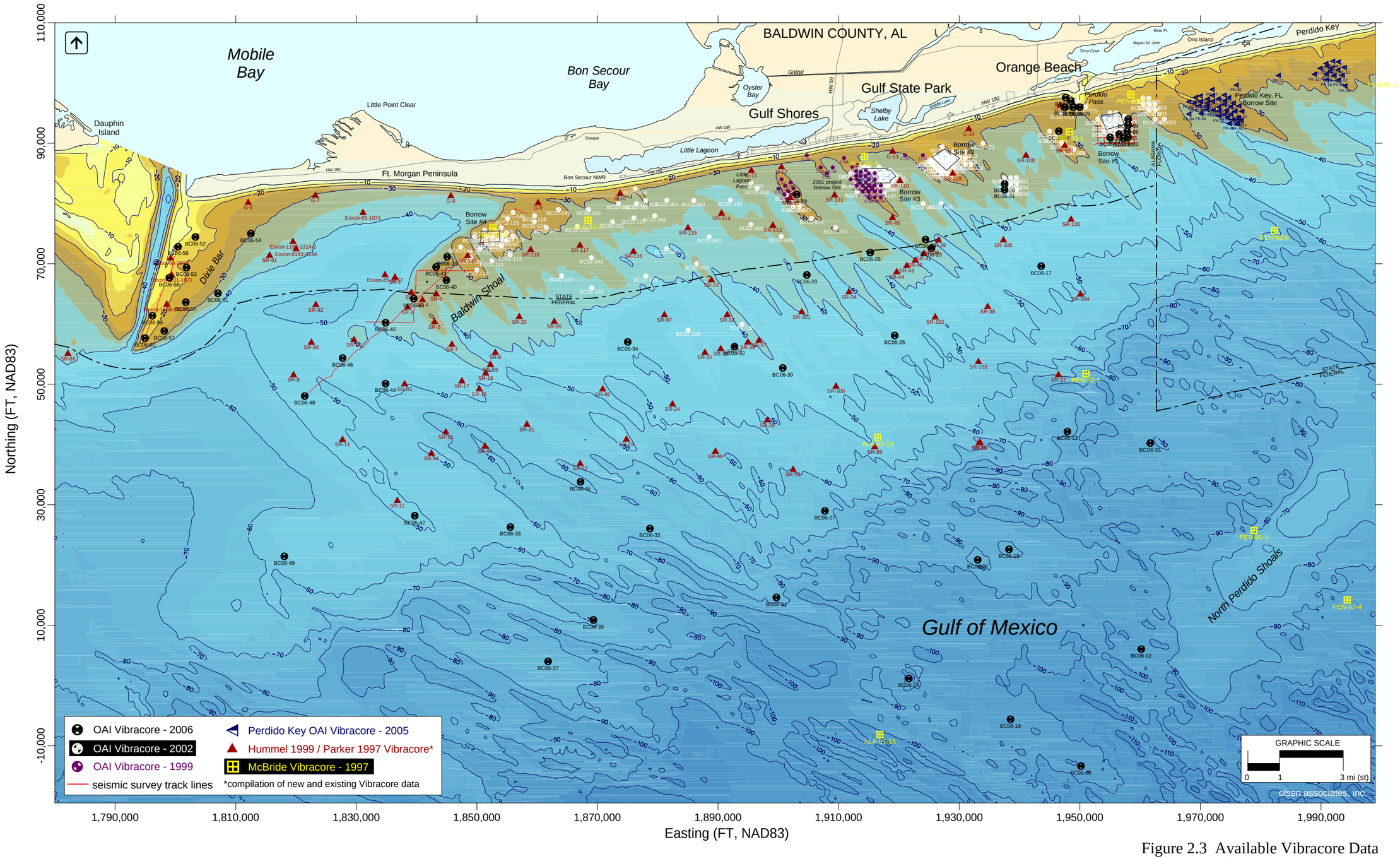

Figure 2.3 Available Vibracore Data in the Baldwin County, AL area.

McBride et al. (2000) conducted numerous studies in the Pensacola Pass, FL, to Mobile Bay, AL, area, collecting sediment samples and core borings out to the edge of the continental shelf at DeSoto Canyon. Many of the cores collected in this study were taken in the nearshore region offshore of Baldwin County. These cores are identified in Figure 2.3 by the yellow cross-hair boxes labeled "*ALA-9y-xx*" and similar. The cores reveal several differing sediment types, but generally revealed a thin lens of marine sands overlying relict estuarine silty clays and marine shell beds. The authors present information detailing the shift in the nature of shelf sediments between the Mobile subprovince and the Apalachicola subprovince to the east. The Mobile subprovince receives finer sediments from Mobile Bay and thus has a distinctly finer nature than the Apalachicola subprovince. The writers identify the boundary between the two provinces along the shoreline east of Gulf Shores in the West Orange Beach area[4].

Parker et al. (1997) present an investigation of nearshore leasable sand deposits for potential beach nourishment use. The authors characterize the area offshore of Shelby Lakes (Figure 2.3, generally south of the cores shown as Borrow Site 3 in Figure 2.3) at the eastern end of Gulf Shores as potentially containing 160 Mcy of clean sand. The sediments are characterized as having clean medium sand with a mean grain diameter of 1.99 ϕ (0.25 mm) and an average sorting coefficient of 0.86 ϕ. While these values are finer and more widely distributed than the majority of native Baldwin County sands (Table 2.2), in all likelihood, some fraction of that 160 Mcy deposit is compatible with the native beaches. While it is *unlikely* that the entire area and 160 Mcy are composed entirely of truly "beach compatible" materials, Parker et al. do identify the coarser sediments on the crests of transverse ridges in the area.

Incorporating the data of Parker et al. into an updated study, Hummell (1999) prepared an investigation of offshore sand resources in the Morgan Point Peninsula area. The study, sponsored by the Minerals Management Service of the U.S. Department of the Interior, focused on lands lying in Federal waters, more than three miles offshore, although cores lying inside State waters were also included. Hummell lists 96 Vibracores throughout the area, including 35 new cores collected for that study. Some of these cores are located within the limits of Figure 2.3, and are denoted by the dark red triangles labeled "*G-xx*" and "*SR-xxx*."

[4] As will be discussed in Chapter 4, recent Vibracore collection along the shoreline suggests that the sedimentological boundary between these two provinces may be further west along the Gulf Shores shoreline.

Hummell identifies the area as a Holocene-age transgressive fluvial-deltaic and marine fill sequence overlying older estuarine and fluvial deltaic deposits. The writer describes the genesis of the NW-SE oriented transverse ridges also described by Parker et al. (1997). The writer discusses the composition of the additional core borings taken during the study, and identifies potential beach nourishment borrow materials south of the Morgan Point Peninsula. Hummell generally describes the surficial sand sheet as an excellent source of borrow materials, but does recognize that project distances, lens thickness, and other issues may limit the usefulness of some areas. Similar to the Parker study, it is unlikely that the entire surficial sand sheet is "beach compatible," and in fact, analysis of the data in Hummel (1999) and subsequent investigation reveals that much of this sheet is not beach compatible sand. As part of the present study, a very limited number of Vibracores were collected to replicate portions of the Hummell dataset and to improve comparisons between datasets.

2000-2001 Gulf Shores, AL, Beach Restoration Project Sand Search - Olsen Associates (2001), describes the collection of 46 Vibracores collected in 1999 as part of the Sand Search Investigation for the East Beach Project. The locations of these cores are plotted in Figure 2.3 with purple circles labeled "*C-xx*." This study focused on the area immediate fronting East Beach in Gulf Shores, and identified a borrow area atop the eastern shoreface-attached ridge along the Gulf Shores / Gulf State Park Boundary. Approximately 1.8 million cubic yards of sand were excavated during the construction of the 2000-01 project (Olsen Associates, 2001).

2002-2003 Pensacola Beach, FL, Beach Restoration Project Sand Search – Browder and Olsen (2001) describe the data collection efforts for the Pensacola Beach project, which included the collection of 122 Vibracores from Pensacola Pass eastward toward Navarre Beach (roughly 15 miles east of the area plotted in Figure 2.3). Although located east of the present project area, the nearshore/shelf bathymetry and geologic features are similar. The borrow site developed for the project lies upon a portion of North Perdido Shoals.

2005 Perdido Key, FL, Beach Restoration Project Sand Search – Olsen Associates (2006b) present geotechnical data for the development of sand borrow sites offshore of the western six miles of Perdido Key, FL, immediately adjacent to the study area. That effort included the collection of 57 Vibracores and seismic sub-bottom data along the large shoreface-attached oblique ridges just east of the AL/FL State Line. A borrow site

for the project was developed upon that ridge, which is similar to the ridge features utilized for the 2005-2006 project in Baldwin County. The locations of these cores in State Waters off Florida are plotted in Figure 2.3 with blue triangles labeled "*PK-xx*."

2005-2006 Orange Beach/Gulf State Park/Gulf Shores Beach Restoration Project Sand Search – The sand search for this project, conducted in December 2002, involved the collection of 160 Vibracores, almost all of which were located in AL State waters. Olsen Associates (2003). The locations of these cores are plotted in Figure 4.1 with white circles labeled "*BC02-xxx*." Three sand borrow sites were utilized during the construction of the project, which resulted in the placement of almost 8 million cubic yards of sand along 15.3 miles of the Gulf of Mexico shoreline from Perdido Key westward through Gulf Shores (Olsen Associates, 2006a).

Available Seismic Sub-Bottom Survey Data: Gulf Shores and Pensacola Beach - Olsen Associates (2001) and Browder (2002) describe the results of seismic sub-bottom surveys conducted in both areas during their respective sand searches. The seismic surveys, performed by Alpine Ocean Seismic Survey, Inc., of Norwood, NJ, consist of the measurement of pulses of sound directed into the seabed. The time of return of various frequencies of the reflected sound pulse provides information regarding changes in density of the material in the upper 30 ft (approximate) of the seabed. In this manner, areas characterized by multiple layers of sediment can be distinguished from areas containing little or no layering. In general, areas containing potential volumes of sandy-type sediments are essentially featureless in the upper 20 ft of the seabed. Areas with significant layering frequently have alternating layers of mud or silt with layers of dense sand or clay (obviously undesirable material for a beach).

In Gulf Shores, over 80 miles of offshore tracklines were surveyed near East Beach and the western portion of the main unit of Gulf State Park. This survey principally characterized the 2001 project borrow site ridge and the adjacent seabed. The Pensacola Beach survey covered over 300 trackline miles between Pensacola Pass and the eastern end of Pensacola Beach, over 15 miles alongshore. Similar to the Gulf Shores surveys, the seismic results indicated nearshore areas of irregular bedding, except on the crests of the shoreface-attached ridges. Further offshore, the irregularities diminish into featureless massive homogeneous units (i.e., no significant reflectors are seen in the upper 20 ft). Limited seismic data were collected as part of the present study around Borrow Site #1 near Perdido Pass, and along Baldwin Shoal and Dixie Bar (Chapter 4).

3.0 DATA COLLECTION

3.1 2006 Vibracore Collection

Based upon the existing data (Figure 2.3), a test plan was developed to expand the existing known sources of beach-compatible sand and to at least initially identify other sources of beach-quality sand for future beach nourishment along the eastern Baldwin County Gulf of Mexico shoreline. Specific areas of interest for the 2006 test plan include the eastern portion of the ebb shoal at Main Pass, the offshore portions of Baldwin Shoal, the ebb shoal at Perdido Pass and the area around nearby Borrow Site #1, and the offshore areas in the vicinity of a westerly extension of North Perdido Shoals. Vibracores were also collected in areas lacking data, and in limited cases in areas where previous data existed. The replication was performed to provide verification of the previous data and to better compare all datasets. Vibracore sampling was generally limited to a maximum depth of 100 ft, due to the limitations of much of the U.S. dredging fleet to excavate sediments below those depths. 60 Vibracores were collected in May 2006 by Alpine Ocean Seismic Survey, Inc., of Norwood, NJ, under direction by Olsen Associates, Inc. The sediment core-borings were collected using a vibrating pneumatic rig (Vibracore, Figure 3.1) set to collect a 20-ft core sample. Logs of the 2006 Vibracores are contained in Appendix A. A copy of the data collection report from AOSS is included herein as Appendix B.

After collection the cores were sent to a laboratory and split and logged to describe the sediment layers present within the core. Composite and discrete sediment samples of each core were analyzed for grain size distribution, color, and shell content. All logs, core photographs, and grain-size data are provided on the attached CD-ROM disc. The sediment classifications are based on the Unified Soils Classification System (USCS). Generally, beach quality sediments will have a USCS designation of SP. Several cores contained sediments rated as SM, ML, or CL sediments, indicating the presence of silts or clays. These sediments have noticeably higher percentages of fine particles or muds and, for that reason, are not analyzed for grain size distribution. These muddy sediments are also typically much darker in color than the sandy materials. Individual SP samples are taken from various elevations in each core and analyzed for grain size distribution, shell content, percentage of fine material, etc. The laboratory procedures were conducted by a professional geologist at Scientific Environmental Applications, Inc., of Melbourne, FL.

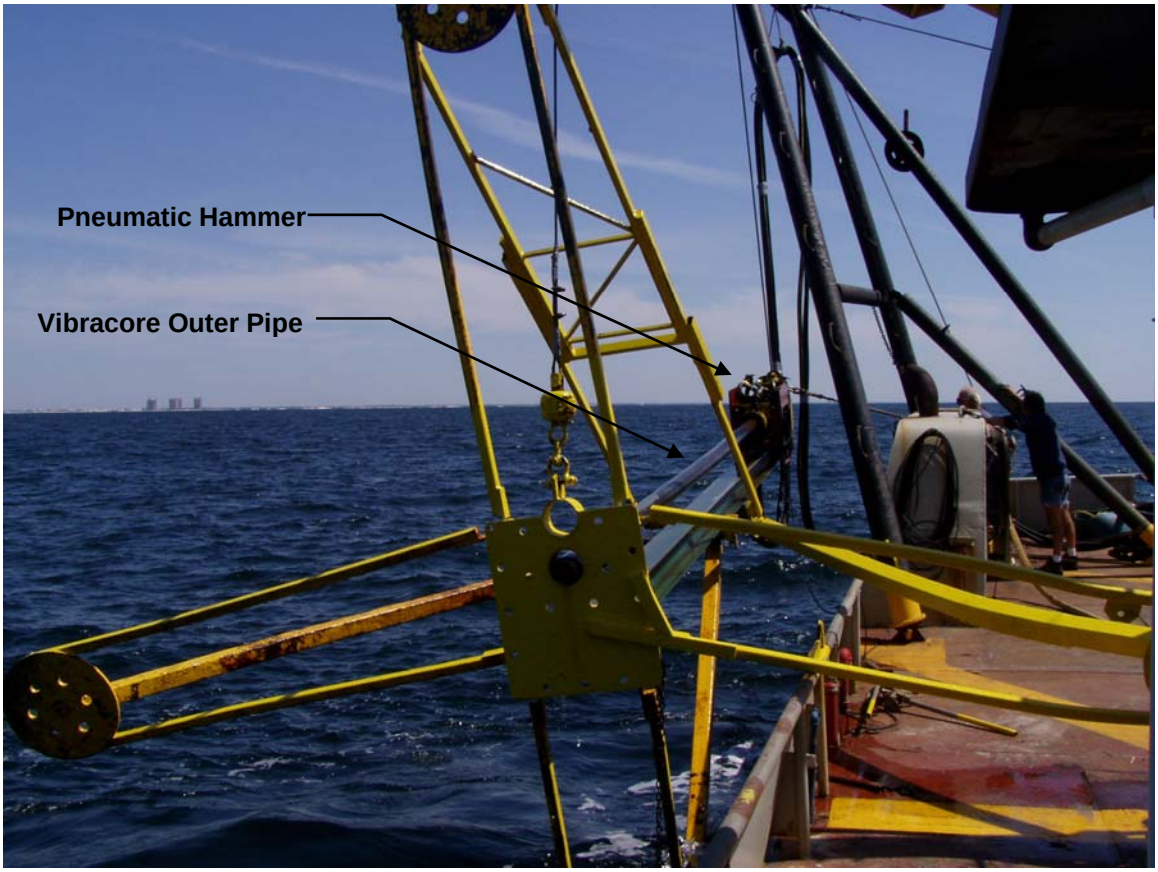

Figure 3.1 Vibracore rig being hoisted into vertical position from the R/V Atlantic Twin (the rig is stored horizontally alongside the vessel, as shown). A 20-ft clear sample core tube slides into the outer core pipe. The pipe assembly is then hammered into the seabed via the vibrating pneumatic head shown.

3.2 Seismic Data Collection

A limited amount of seismic sub-bottom profile data was collected in areas where potential sand deposits were identified by the Vibracores. These areas include the seabed in the immediate vicinity of Borrow Site #1, the Baldwin Shoal area, and the Dixie Bar area near the entrance to Mobile Bay. As described in Appendix B, over 30 line-miles of seismic data were collected in these three locations. The seismic data are compared to the Vibracores collected along the track-lines, enabling the calibration of both data sources. Once the data are correlated, information can be obtained about seabed sediments between Vibracores and beyond the limits of the Vibracores. A discussion of the seismic sub-bottom data collection procedures is found in Appendix B.

3.3 Sediment Sample Analyses

The previous chapter described the collection of 60 Vibracores throughout the nearshore waters off Baldwin County, AL. Each Vibracore has been analyzed in detail for the following characteristics:

- Grain size distribution and percentage of fine material (smaller than a #230 sieve, 0.0625 mm diameter),
- Sediment color,
- Shell/carbonate content,
- Heavy mineral content (visual estimate),

Several of these characteristics are generally discussed as follows:

Sediment Color – The nearly white color of the native beach makes the sediment color of nourishment sands a significant issue in this area. To properly grade the color of the sediment, it was necessary to apply color scales that exceed the standard scale used to grade soil color. The traditional scale of soil color is the Munsell Soil Color Charts (Munsell, 1998). This reference describes the variation of soil color for a wide distribution of Hues over Values in a range between 2 and 8 with Chroma numbers between 1 and 8. Browder (2002) describes the analysis of sediment color using the extended Munsell scales. Color designations discussed herein apply the following notation, given by example: ***10YR 8.0/1.0.***

In this example, 10 YR represents the **Hue**, 8.0 represents the **Value**, and 1.0 represents the **Chroma**. The Hue refers to the distinction between colors such as green, blue, red, yellow, or combinations thereof (such as YR for Yellow-Red). The Value of a sediment sample refers to the lightness of the color. The Value scale extends from 0 for pure black to 10 for pure white. A Value of 10 does not generally occur in nature. Value applies to all hues and the neutral colors (black, white and grays). The Chroma of a sediment sample describes its departure from the neutral color of the same Value and Hue. Neutral colors (i.e., on the grayscale between black and white), have a Chroma of zero. As a particular color becomes more vivid, the Chroma increases. In Orange Beach, for example, "*any material utilized on Gulf-fronting beaches must exhibit a Munsell color Chart value of 9/1 or higher*". This designation extends beyond the Munsell Soils Color Charts. The specific designation can be found on the Munsell Hue pages or the Nearly Whites Fandeck™. As discussed in Section 2, the native sediments sampled in Baldwin

County were found to generally agree with the Value designation of 9/1, but may have a slightly higher chroma, perhaps as much as 1.5, illustrating the slight tan/orange cast of the native sediments.

During the course of Vibracore collection, each core is inspected on-board for potential beach-compatible sediments. It must be recognized, however, that beach-compatible sand discovered in-situ offshore of the Baldwin County shoreline may *not*, in most instances, appear as light/white as the native beach. One reason for this discrepancy is that the native beach sediments, which have been in place on the beach for long periods of time, have been repeatedly reworked by wind, rain, and wave action and thus have virtually no fines content. Moreover, they have had the benefit of long-term exposure to sunlight (U.V.), which oxidizes any organic fraction within the material. As expected, beach compatible material derived from remote sources, particularly subaqueous sources such as an offshore shoal formation, has not had the benefit of prolonged sunlight exposure, nor has it been constantly reworked by waves, winds, and rain.

However, material dredged from an offshore borrow site can ultimately achieve a higher color rating that does meet or exceed a prescribed level. This is evidenced by the performance of the 2005-2006 beach restoration project. Sand pumped ashore from the three borrow sites was observed to lighten substantially over the first week to two weeks following subaerial exposure. None of the excavated borrow site sands contained any significant fraction of heavy mineral content, which would tend to permanently darken the sands and not fade or necessarily winnow out over time. The borrow site sands, and any future beach-compatible material, exhibit a low fraction of fine material, which is generally darker, organic, material. Regardless, the fine fraction of any initial fill volume will wash out during the hydraulic dredging process. The very small percentage of fines that does reside within the initial beach fill template, along with the remainder of the volume of material, benefits from sunlight exposure (UV). The latter will oxidize any remaining materials, thereby lightening the beach fill further over time.

Included on the enclosed CD-ROM disc are searchable maps of the entire study area, included Vibracore from areas excavated previously. The data files include a logging, photographs, and grain size data from each core within the two borrow sites. The logging includes a grading for sediment color, taken in the core itself. This grading may or may not represent an air dry condition, and likely indicates a darker color than that which would be expected following the combined effects of weather exposure and hydraulic fill

placement. Additional data sheets describing the fines content and carbonate content of the samples are included on the CD-ROM disc. The log sheets for each of the 60 Vibracores collected during this study are also plotted as Appendix A.

4.0 RESULTS & DISCUSSION

General Trends – Consistent with the 2002 sand search, as a general rule any sand found that appeared to be of beach-quality was found in the vicinity of some type of ridge or shoal feature in the nearshore. Vibracores collected in the broad valley areas between ridges and in the relatively featureless areas farther offshore were found to be undesirable sandy materials containing high levels of silts and fines, occasional lenses of clay, and/or high levels of crushed shell mixed with fines and clay. These sediments also exhibit much darker color, and frequently contained decaying organic material. This description was found to agree with the general findings of previous investigators (Chapter 2). Atop *most* of the ridge and shoal features, beach-compatible sand was identified, combined with varying low levels of broken shell. Farther Gulfward, near the 3-mile limit and out to the shelf, the ridge and valley features diminish and the sediment characteristics change subtly to a more consistent combination of gray fine sand with crushed shell. Occasional outcrops of marine clays approaching the seabed elevation are found in limited areas. The following discussion describes the findings from the 2006 Sand Search with the intent of identifying areas for the potential development of beach nourishment borrow sites. Reference is made to Figure 2.3, which plots the locations of all available Vibracore data. The attached CD-ROM disc contains a searchable map and all data available for each Vibracore, including logs, grain size data, and photographs.

4.1 Borrow Site #1 Expansion

Olsen Associates (2006) describes the post-construction condition of the seabed in the vicinity of Borrow Site #1, located approximately 1.3 miles to the southeast of Perdido Pass in Orange Beach. The existing permitted borrow site occupies an area of 163 acres, and an estimated 1.85 million cubic yards of sand were excavated during the 2005-2006 beach restoration project (Olsen Associates, 2006a). Sand excavated from the site was pumped to the shoreline along Perdido Key and along the Orange Beach shoreline west of Perdido Pass. As depicted in Figure 4.1, additional volume remains within the existing permitted limits of the site. Olsen Associates (2006a) estimated that approximately 405,000 cy of sand exist in sufficient sand lens thickness to allow excavation by hydraulic/cutterhead dredge. Also shown in Figure 4.1 are the locations of the 2002 Vibracores used to develop the original site and the seven Vibracores collected in 2006 to potentially expand the site.

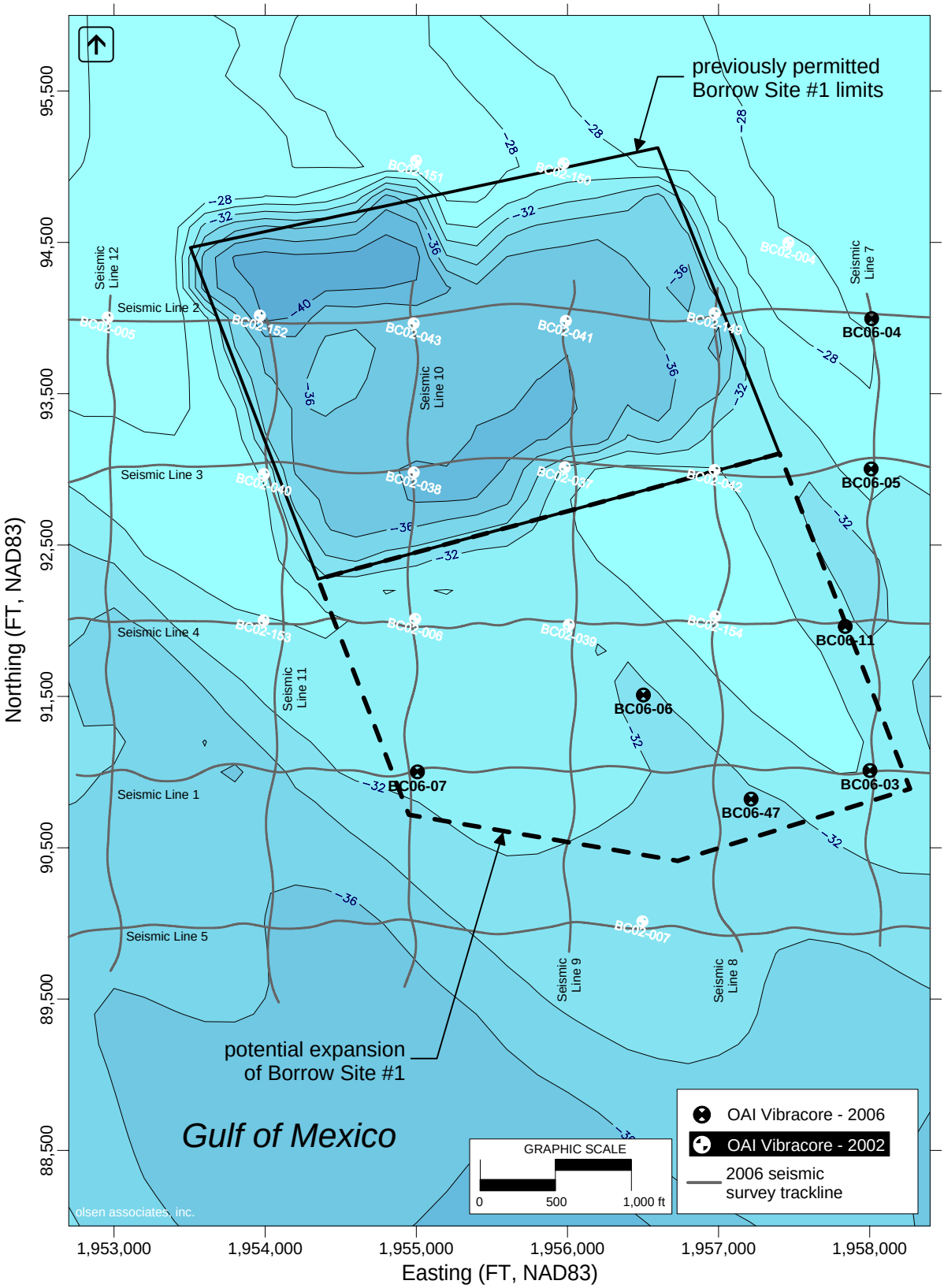

Figure 4.1 Potential expansion of Borrow Site #1, southeast of Perdido Pass in Orange Beach, AL.

As depicted in Figure 4.1, a potential expansion of Borrow Site #1 might encompass an area of approximately 160 acres, roughly the same size as the original borrow site. The height of bank available for excavation, however, will be reduced due to two factors. First the expansion area lies in deeper water than the original site by three to four feet. Second, seismic sub-bottom data indicate that the clay "bottom" layer may extend upward above elevations of -40ft NAVD88 in places. While it is recognized that some discrepancies exist between the bottom elevations indicated by Vibracores and by the reflectors shown in the seismic sub-bottom data, the potential outcropping of the clay layer must be accounted for. During excavation of Borrow Site #1 some outcrops were encountered and the elevation of excavation had to be raised. Ultimately, this may limit the height of bank to approximately seven or eight feet over the expansion area, ultimately lowering the reserve estimates of sand. Including the small portion in the SE corner of the existing permitted site, the volume of sand easily accessible and available via the expansion is approximately 2.0 million cubic yards. Additional analyses would be required to permit and ultimately excavate the site, included a more detailed analysis of the distribution of sediments across the site, a refinement of the elevation of the clay layer across the site, and an assessment of potential cultural resources in the areas not covered by the initial marine archaeological assessment conducted in 2003.

The sediments within the expansion area plotted in Figure 4.1 are well suited for beach placement. Median grain sizes typically range from 0.27 to over 0.35 mm. Figure 4.2 shows the sediments found in portions of Vibracore BC02-39 and BC06-07, in the SW corner of the expansion area. The reader is referred to the attached CD-ROM disc for electronic copies of all logs, maps, photographs, and data. Table 4.1 lists the basic sediment characteristics of the seven Vibracores collected in this area in 2006. The typical median grain diameter from the composite samples of these Vibracores was found to be 0.31mm and the sorting coefficient is 0.67ϕ (partially indicative of the presence of shell fragments). The samples exhibit a very low percentage of fines, less than 1.0%, and 1.0% to 3.0% carbonate material. The average color Value of the composite samples is 8.4.

Table 4.1 Primary sediment characteristics of 2006 Vibracore samples collected near Borrow Site #1, Southeast of Perdido Pass, AL.

Vibracore #	Easting (ft, NAD83)	Northing (ft, NAD83)	Seabed Elevation (ft, NAVD88)	Sample Depth (ft)	Sample Elevation (ft, NAVD88)	HUE*	VALUE	CHROMA	% Fines	Median Grain Size (mm)	Sorting Coefficient (phi)	% CARB.
BC06-03	1,958,002	91,010	-30.9	1	-31.9	10YR	8	1	0.17	0.31	1.16	-
				5	-35.9	10YR	8.5	1	0.02	0.34	0.69	-
				10	-40.9	10YR	8.5	1	0.21	0.36	0.59	-
				15	-45.9	10YR	8	1	0.23	0.35	0.54	-
				18	-48.9	10YR	8	1	0.59	0.37	0.76	-
				com(0-18')	-	10YR	8.5	1	0.16	0.36	0.77	2.03
BC06-04	1,958,013	93,996	-28.6	1	-29.6	10YR	8	1	0.18	0.36	0.78	-
				6	-34.6	10YR	8.5	1	0.35	0.38	0.44	-
				12	-40.6	10YR	8.5	1	0.04	0.30	0.48	-
				18	-46.6	10YR	8	1	1.72	0.31	0.42	-
				comp (0-18')	-	10YR	8.5	1	0.07	0.35	0.71	1.73
BC06-05	1,958,009	93,003	-29.8	1	-30.8	10YR	8.5	1	0.59	0.30	0.63	-
				4	-33.8	10YR	7.5	2	0.34	0.29	0.54	-
				6	-35.8	10YR	7.5	1	0.51	0.23	0.51	-
				8	-37.8	10YR	8	1	0.62	0.24	0.37	-
				12	-41.8	10YR	8	1	0.3	0.24	0.47	-
				15	-44.8	10YR	8	1	0.75	0.25	0.66	-
				comp (0-5')	-	10YR	8	1	0.16	0.31	0.73	-
				comp (0-18')	-	10YR	8	1	0.01	0.26	0.57	1.44
BC06-06	1,956,503	91,509	-33.2	1	-34.2	10YR	8.5	1	0.29	0.30	0.63	-
				4	-37.2	10YR	8.5	1	0.05	0.29	0.6	-
				8	-41.2	10YR	8	1	0.04	0.24	0.61	-
				12	-45.2	10YR	7.5	2	0.19	0.23	0.64	-
				16	-49.2	10YR	7.5	2	0.02	0.22	0.74	-
				comp (0-10')	-	10YR	7.5	1	0.53	0.28	0.62	-
				comp (0-16')	-	10YR	8	1	0.08	0.27	0.68	1.28
BC06-07	1,955,008	91,001	-32.1	1	-33.1	10YR	8	1	0.04	0.23	0.93	-
				5	-37.1	10YR	8.5	1	0.27	0.38	0.48	-
				9	-41.1	10YR	8.5	1	0.5	0.34	0.86	-
				14	-46.1	10YR	8.5	1	0.12	0.27	0.67	-
				18	-50.1	10YR	8.5	1	0.01	0.29	0.7	-
				comp (0-18')	-	10YR	8	1	0.78	0.32	0.8	1.84
BC06-11	1,957,838	91,962	-33.3	1	-34.3	10YR	9	1	0.5	0.35	0.55	1.29
				4	-37.3	10YR	9	1	0.69	0.31	0.45	0.22
				8	-41.3	10YR	9	1	2.22	0.24	0.37	0.78
				12	-45.3	10YR	9	1	7.89	0.21	0.4	1.49
				comp (0-12')	-49.3	10YR	9	1	1.68	0.27	0.57	2.16
BC06-47	1,957,215	90,822	-32.6	1	-33.6	10YR	8	1	0.67	0.37	0.7	2.97
				4	-36.6	10YR	8	1	-	0.36	0.52	1.1
				8	-40.6	10YR	8	1	0.63	0.37	0.58	1.13
				12	-44.6	10YR	8	1	0.6	0.33	0.68	1.56
				comp (0-12')	-50.6	10YR	8.5	1	0.47	0.34	0.57	1.33

*all samples analyzed for grain size distribution were classified as SP sediments (the composite samples may include small portions of non-SP material)

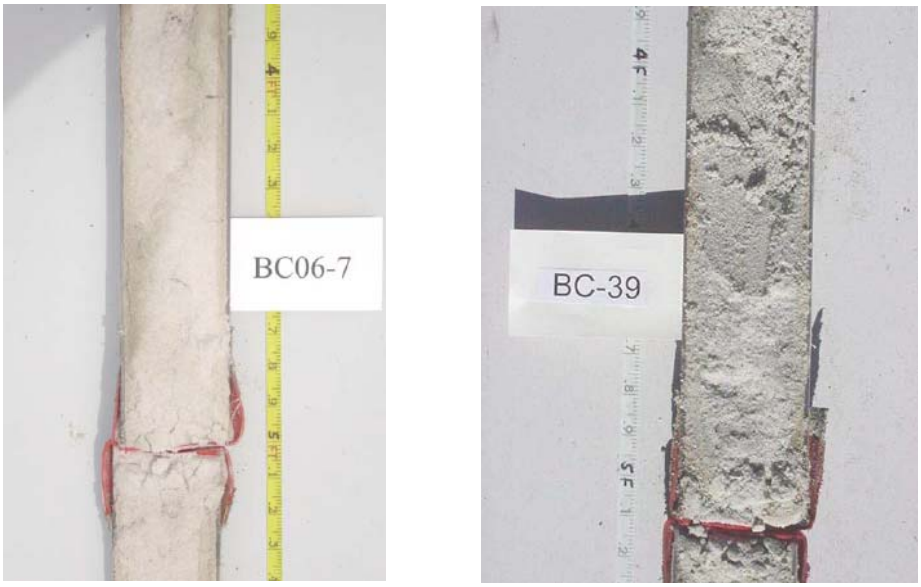

Figure 4.2 Example segments from Vibracores lying in the proposed expansion area for Borrow Site #1 (BC-39 is BC02-39 in Figure 4.1, from Olsen Associates, 2003). Note the difference in lighting between the two photos. Both samples were assigned color Values of 8.5.

Borrow Site #1 Seismic Sub-bottom Data As depicted in Figure 4.1, seismic sub-bottom profiles were collected across the entire potential expansion area (AOSS, 2006). The purpose of the data collection was to map any change in sediment characteristics that may occur within the upper 15 to 20 ft of the seabed (the potential excavation area). Inspection of the Vibracores revealed the presence of a clay layer approximately 12 ft (or shallower) beneath the seabed. Seismic sub-bottom data confirmed this observation and provided additional information on the elevation of the top of the clay layer between Vibracores.

Figure 4.3 plots the seismic record along seismic line #8. The record shows the reflection of various layers in the water column and seabed. The transducer travels roughly 6.5 ft below the water surface and detects the very hard reflector of the seabed itself, any areas where the sediments change in density, and multiple reflections of the water surface. Figure 4.3 illustrates the contours of the seabed, which range in elevation from approximately -28ft NAVD88 to below -32 ft NAVD88. Within the previously excavated area, seabed elevations reach -36 ft NAVD88 along this transect.

Also plotted in Figure 4.3 are the locations of Vibracores collected on or near the seismic track line. These Vibracores assist in calibrating the seismic data. The data indicate a noticeable reflector running roughly horizontally through the area, approximately 12 to 13 ft below the seabed. This reflector is revealed to be the top of a marine clay layer at least six feet thick in most places. Figure 4.3 suggests that while the clay layer is for the most part a horizontal feature, there may be some areas where the clay horizon lies closer to the seabed, approaching -40ft NAVD88 in areas. South of Vibracore BC02-42, the clay layer reflector appears to rise by two to three feet closer to the seabed. Due to the typical operation of a cutterhead dredge, which involves the disturbance of sediments below the prescribed depth of excavation (the depth at which the seabed must be maintained after excavation), and the need to maintain a reasonable buffer above the clay layer in the event of adverse weather, the depth of excavation in this case may ultimately be limited to seven or eight feet. As part of final borrow site development, this phenomenon will mapped along with the data from the other track lines and will be accounted for in the plans for the borrow site.

Scans of the seismic sub-bottom profile data near Borrow Site #1, similar to Figure 4.3, are contained on the attached CD-ROM disc. The seismic data collection report is likewise found in Appendix B and on the CD.

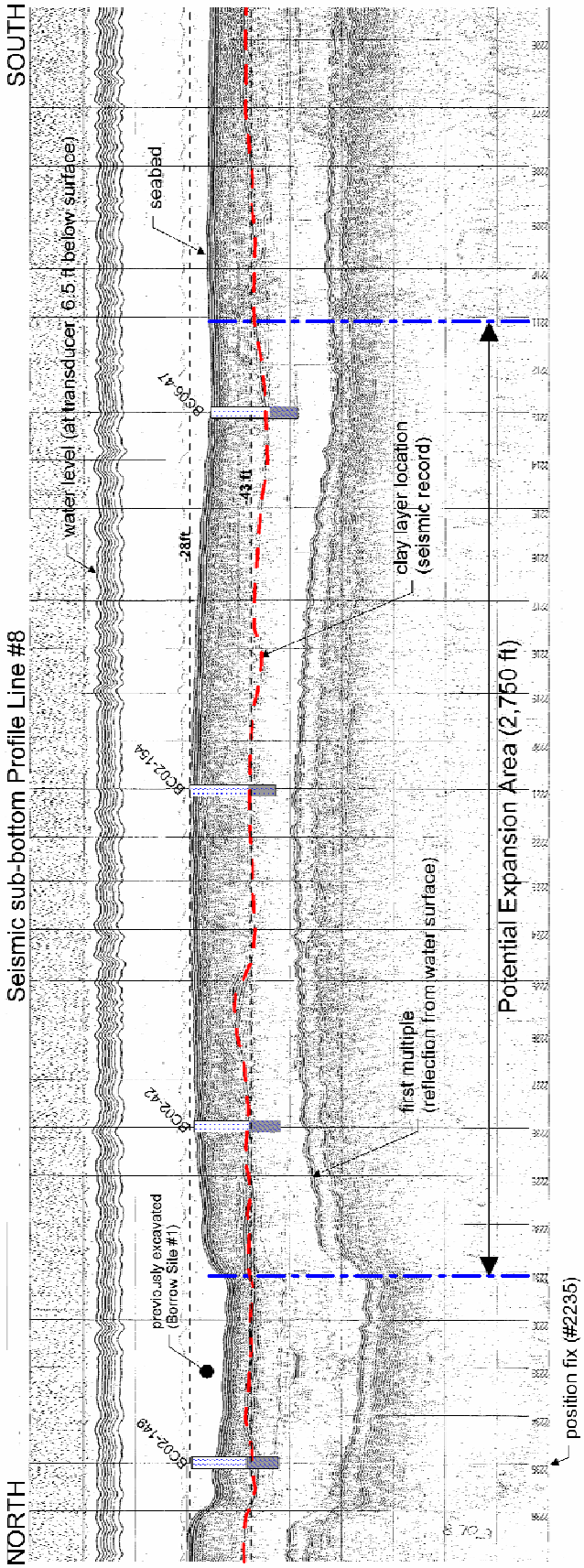

Figure 4.3 Seismic sub-bottom profile along track-line 8 (north-south, see Figure 4.1). The sub-bottom data, combined with the Vibracores, reveal the presence of an estimated 12-ft lens of sand above a clay or silty sand/clay lens. The sub-bottom data likewise reveal areas where the clay lens lies closer to the surface (e.g. south of BC02-42).

4.2 AL/FL State Line

During the 2002 Sand Search investigation, nine Vibracores were collected along a shoreface-attached ridge feature that originates in AL State Waters and extends to the SE into FL State Waters (Figure 4.4). The samples in these cores revealed significant lenses of beach-quality material. Due to the development of Borrow Site #1 just to the west, this site was not pursued further for the beach restoration project. However, inspection of these Vibracores (available on the attached CD-ROM disc) suggests that a small borrow site could be developed along the crest of the ridge, within 2,000 to 2,500 ft or less of the AL/FL State Line. The size of the ridge suggests that such a site, roughly 25 to 30 acres in area, could yield on the order of 400,000 to 500,000 cubic yards of beach-compatible sand. The site lies in relatively shallow water with 18 to 25 ft depths, just under a mile offshore of the developed portion of the Perdido Key, AL, shoreline.

The Vibracores collected in 2002 do indicate the presence of a clay layer potentially lining the southwest edge of the ridge. Vibracore BC02-002 reveals only a four-ft lens of SP sediments overlaid upon 14 ft of dark gray clay. The orientation of the ridge is such that the sands may exist in a relict channel running parallel to the ridge crest.

Sites of this scale may be found in several different locations along the Baldwin County shoreline. While it would likely be challenging to cost-effectively excavate sand from only this site, the site could be excavated as part of a larger project using multiple smaller sites located along the length of the Orange Beach shoreline. Given the small dimensions of the potential site and the proximity of clay near the seabed surface, it is opined that additional seismic sub-bottom profiling and Vibracoring would be required to successfully excavate only the beach-compatible sands.

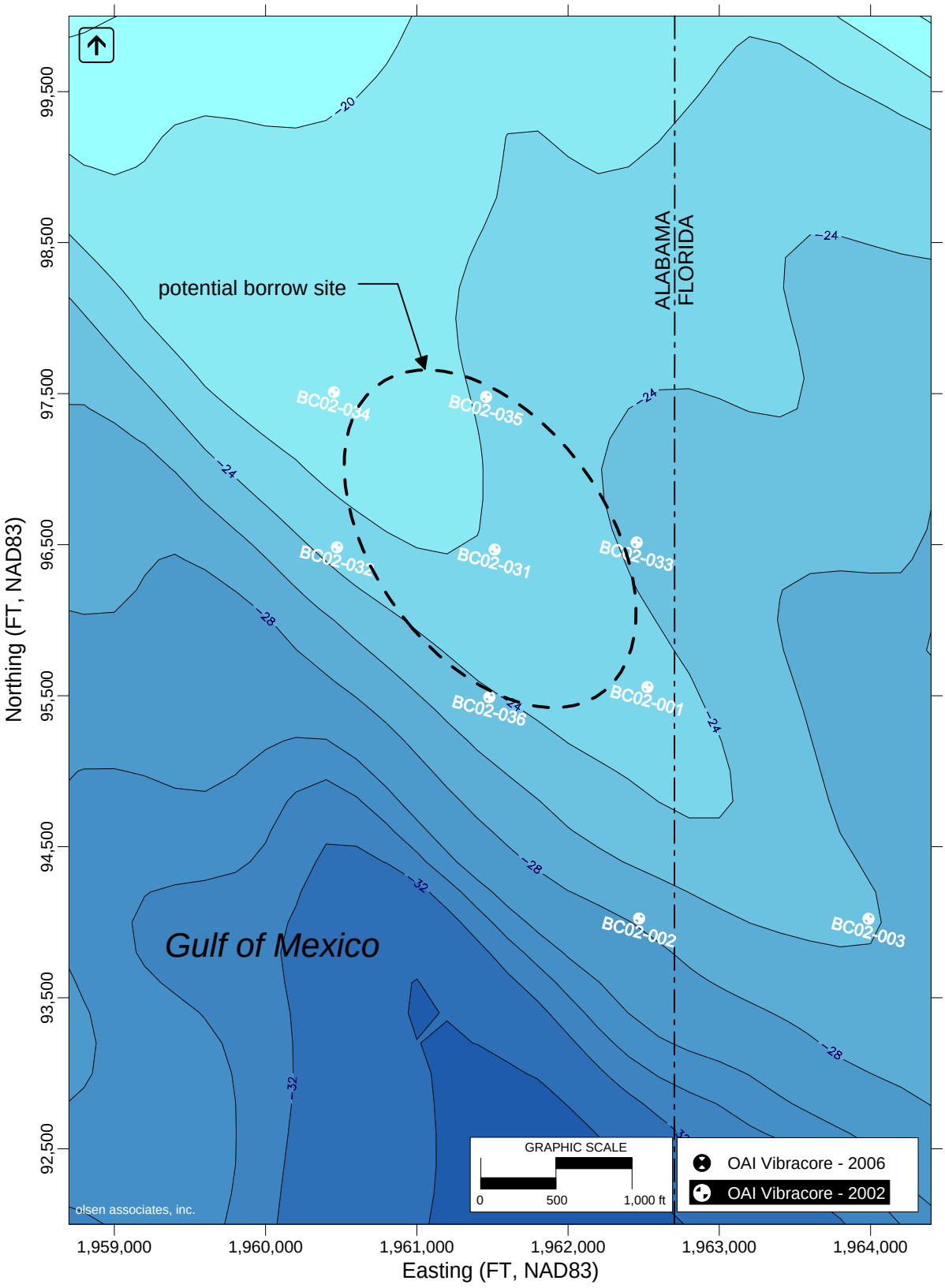

Figure 4.4 Vibracore locations near the AL/FL State Line (Olsen Associates, 2003).

4.3 Perdido Pass Ebb Shoal

Figure 4.5 depicts a perspective view of the ebb shoal at Perdido Pass in Orange Beach, AL. Sediment Vibracores were collected along the shoal in 2002 and 2006 to assess the suitability of its sediments for beach nourishment. Using the May 2004 bathymetric data provided by the U.S. Army Corps of Engineers SHOALS LIDAR program, an estimate was made of the total acreage and volume of sand present in the ebb shoal. To calculate this volume, the bathymetric data adjacent to and beyond the influence of the ebb shoal was smoothly interpolated across the inlet area to simulate shoreline and seabed elevations in the complete absence of the ebb shoal. The simulated no-inlet bathymetric surface was then compared to the actual measured surface, allowing the assessment of the ebb shoal itself. Isopachs of the ebb shoal thickness are overlaid on the bathymetric contours in Figure 4.6.

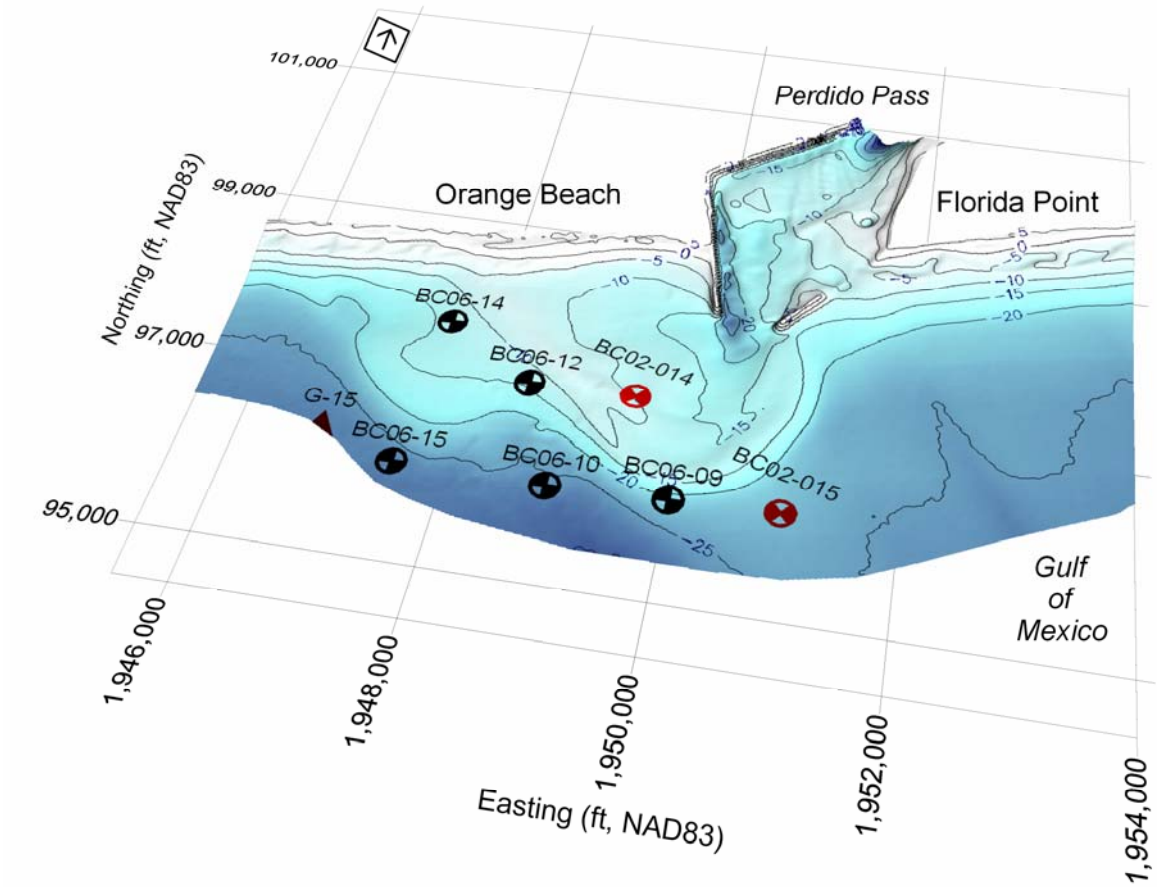

Figure 4.5 Perspective view of the Perdido Pass ebb shoal and the location of Vibracores collected along the shoal (survey data USACE SHOALS LIDAR program – May 2004). Elevations in feet relative to NAVD88 datum.

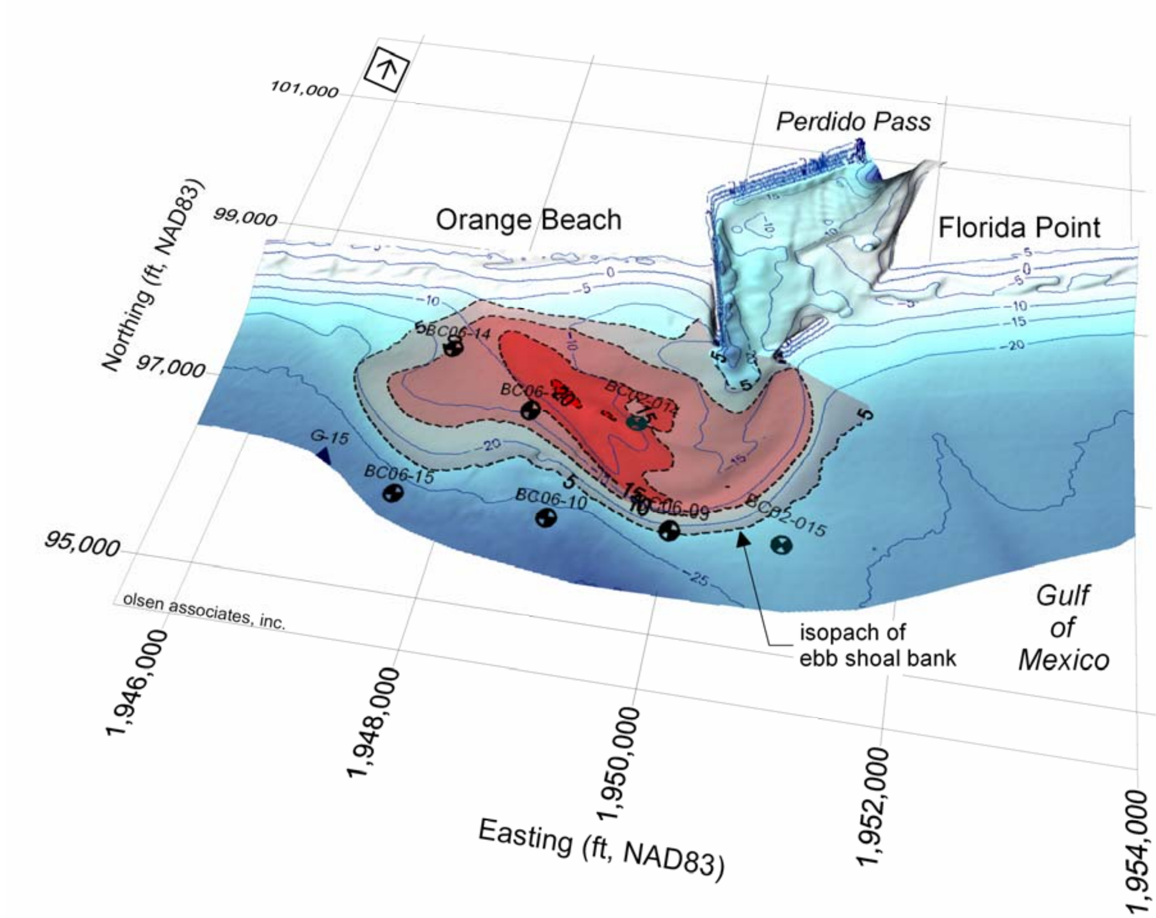

Figure 4.6 Isopachs of ebb shoal bank thickness (in feet) at Perdido Pass, AL. Note that only portions of the entire ebb shoal feature are considered to be potentially beach compatible sediments.

As depicted in Figure 4.6, the ebb shoal is estimated to cover approximately 240 acres of the seabed outside the jetties at Perdido Pass. The vast majority of the shoal feature lies above the -25ft NAVD88 contour and west of the entrance, due not only to the westward direction of net littoral transport but also to the direct disposal of channel maintenance material to the west of the channel. It is estimated that the perturbation to the seabed represented by the ebb shoal reaches over 20 ft in thickness along the crest of the shoal. The total volume of sand represented by the ebb shoal is approximately 3.0 to 3.4 million cubic yards. Only portions of that volume, however, appear to be comprised of beach-compatible sediments. Table 4.2 summarizes the sediment characteristics of the Vibracores collected in this area in 2006.

Inspection of the Vibracores collected in 2002 and 2006 reveals a variety of sediment types ranging from clean, potentially beach-compatible sediments to undesirable samples consisting of a matrix of fine gray sand and shell fragments. Vibracores BC06-12 and BC06-14, collected closer to the center of the shoal and closer to the shoreline, exhibit very light gray to white SP sands in the upper 12 to 17 ft. The upper SP lens of Vibracores BC06-09 and BC06-10 further seaward along the edge of the shoal, however, contain either very fine or very shelly sediments. Figure 4.7 illustrates the differences in these Vibracores. Along the interior of the shoal, Vibracore BC02-14 exhibits clean but fine sediments within the upper 16 ft of the core. Composite samples from the Vibracores along the eastern flank of the shoal exhibit median grain sizes of 0.28 to 0.29 mm and modest levels of shell content, while the interior Vibracore composite sample revealed a median diameter of only 0.21 mm.

Based upon a very limited number of samples, it appears that the western flank of the ebb shoal could contain a sufficient quantity of beach-compatible sediments. Preliminary calculations of the reserve estimate of such sands are on the order of one million cubic yards. It must be stressed, however, that the removal of such a volume of sand from the ebb shoal may have direct impacts to the shorelines on either side of the Pass. The void in the ebb shoal created by the excavation may result in an increased sink effect for sand that naturally bypasses the inlet, although the void could be filled by maintenance dredge material from areas with Perdido Pass. Careful study of the potential impacts of dredging along the ebb shoal would be required, along with additional Vibracoring to delineate more precisely the limits of truly desirable material.

Table 4.2 Primary sediment characteristics of 2006 Vibracore samples collected in the vicinity of the Perdido Pass ebb shoal.

Vibracore #	Easting (ft, NAD83)	Northing (ft, NAD83)	Seabed Elevation (ft, NAVD88)	Sample Depth (ft)	Sample Elevation (ft, NAVD88)	HUE*	VALUE	CHROMA	% Fines	Median Grain Size (mm)	Sorting Coefficient (phi)	% CARB.
BC06-09	1,949,999	95,988	-21.3	1	-22.3	10YR	8.5	2	0.48	0.21	0.47	-
				3	-24.3	10YR	8.5	1	0.06	0.17	0.54	-
				6	-27.3	10YR	6.5	2	0.07	0.22	1.02	-
				comp (0-4')	-	10YR	8.5	1	0.1	0.18	0.51	-
				comp (0-7')	-	10YR	6.5	2	0.57	0.19	0.72	2.63
BC06-10	1,948,906	95,965	-27.9	1	-28.9	10YR	8	2	0.4	0.35	0.91	-
				3	-30.9	10YR	7.5	1	0.05	0.37	0.93	-
				6	-33.9	10YR	9	1	0.06	0.21	0.64	-
				comp (0-6')	-	10YR	7.5	1	0.41	0.31	0.86	3.61
BC06-12	1,948,518	96,995	-11.1	1	-12.1	10YR	9	1	0.01	0.29	0.54	1.26
				4	-15.1	10YR	9	1	0.06	0.23	0.61	3.36
				8	-19.1	10YR	8.5	1	0.02	0.28	0.58	1.45
				12	-23.1	10YR	8	1	0	0.26	0.55	1.39
				comp (0-12')	-	10YR	8.5	1	0.02	0.28	0.59	1.86
BC06-14	1,947,633	97,573	-10.3	1	-11.3	10YR	8.5	1	0.27	0.30	0.67	-
				6	-16.3	10YR	8.5	1	0.13	0.29	0.55	-
				12	-22.3	10YR	8.5	1	0.02	0.30	0.81	-
				17	-27.3	10YR	6.5	2	0.07	0.35	0.73	-
				comp (0-12')	-	10YR	8.5	1	0.02	0.30	0.57	-
				comp (0-17')	-	10YR	8.5	1	0.03	0.29	0.71	2.17
BC06-15	1,947,502	95,986	-27.2	0.5	-27.7	10YR	8.5	2	1.05	0.38	0.7	1.98

*all samples analyzed for grain size distribution were classified as SP sediments (the composite samples may include small portions of non-SP material)

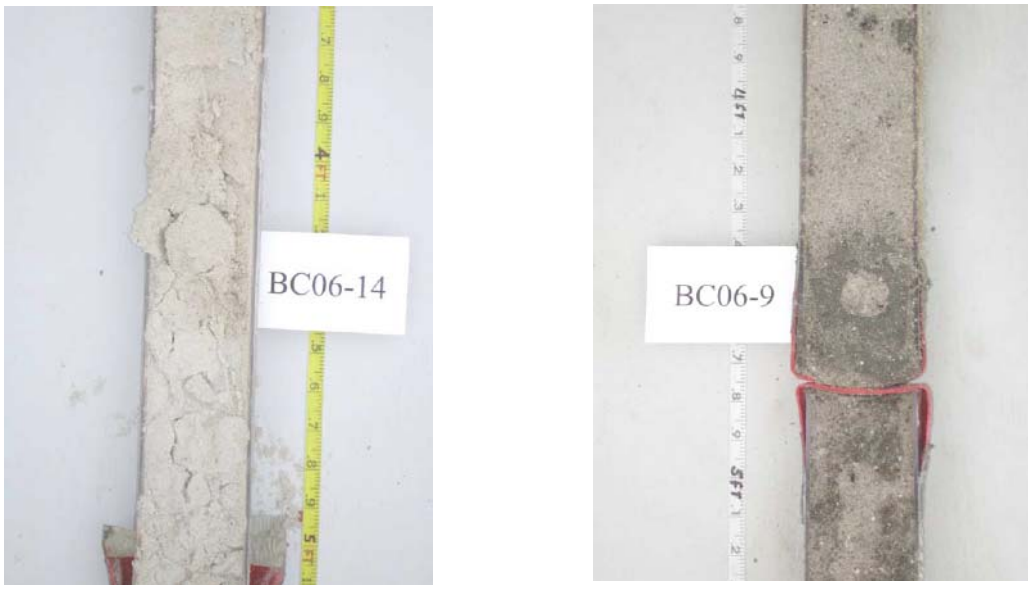

Figure 4.7 Comparison of Vibracore segments collected along the edge of the Perdido Pass ebb shoal.

4.4 Borrow Sites #2 and #3

The seabed in the vicinity of Borrow Sites #2 and #3 off the western end of Orange Beach and Gulf State Park has been studied extensively, and only a limited number of Vibracores were collected in this area in 2006. Figure 4.8 plots the available data in this area. The presently permitted limits for Borrow Site #2 occupy 189 acres of the seabed, and approximately 2.5 million cubic yards of sand were excavated from the site during construction of the 2005-2006 beach restoration project. Sand from Borrow Site #2 was pumped to the shoreline along the western end of Orange Beach, the Gulf State Park shoreline, and a portion of East Beach in Gulf Shores (Olsen Associates, 2006a). Borrow Site #3, including the area utilized for the first beach restoration project along East Beach in 2001, occupies a total area of 313 acres (combined permitted limits). Over the course of two projects an estimated 4.5 million cubic yards of sand have been excavated from this site. Sand from Borrow Area #3 has been placed along the entire 7.9-mile length of Gulf Shores, delivered by both hydraulic cutterhead dredge and by hopper dredge.

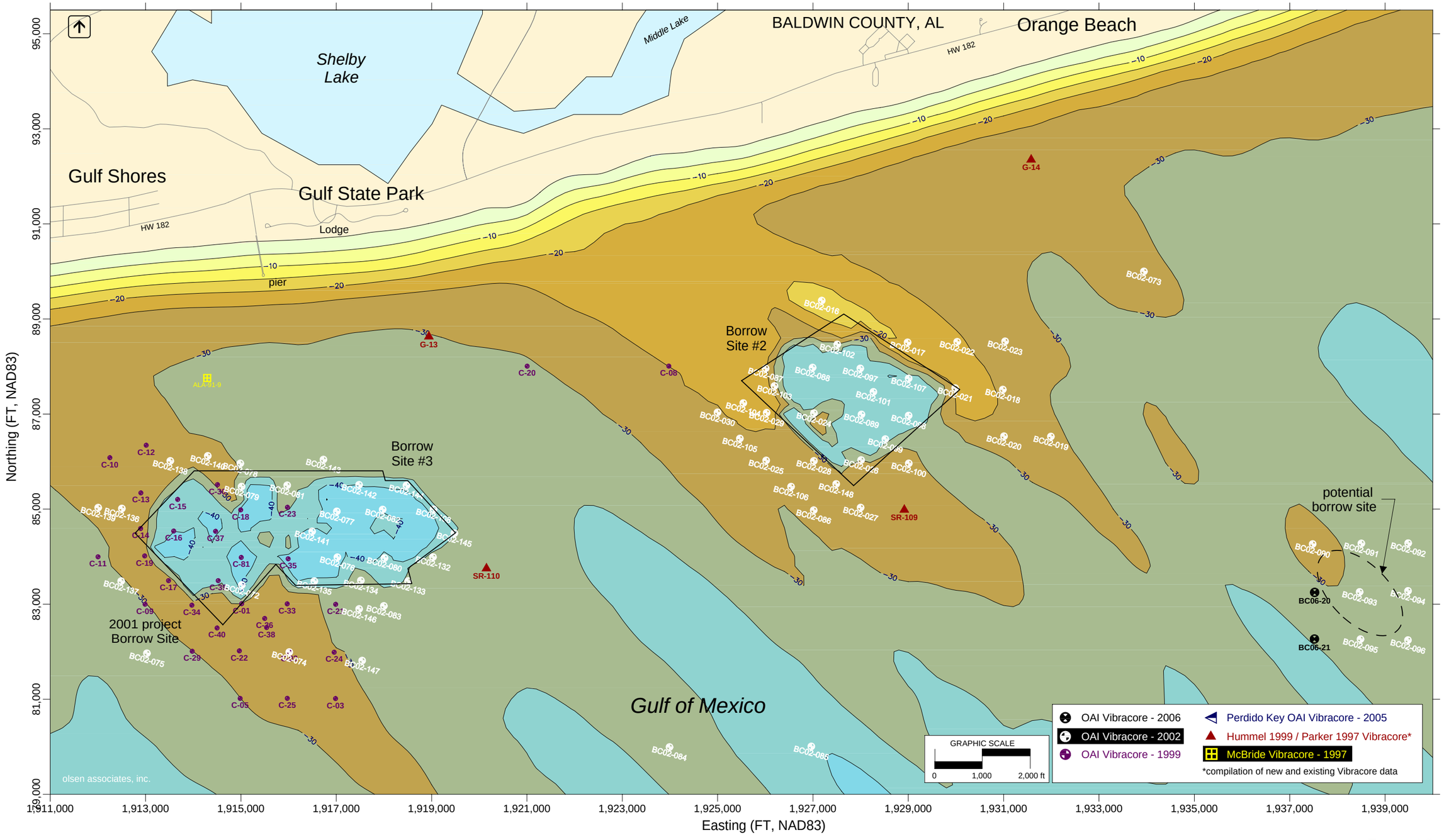

Figure 4.8 Locations of available Vibracore data in the vicinity of Borrow Sites #2 and #3 off Orange Beach and Gulf State Park, AL.

There remains some quantity of beach-compatible sand in each borrow site, although the ability of access the sand in a cost effective fashion has been diminished. Olsen Associates (2006a) estimates that 0.3 to 1.3 million cubic yards of sand remains within the presently permitted limits of Borrow Site #2. The wide range of available sand is a function of the dredge equipment expected to be used for excavation. Requirements for sufficient bank height for the cost-effective use of a hydraulic cutterhead/pipeline dredge limit the available sand to the lower end of the range, while a hopper dredge may be able to operate in the site and "clean up" the seabed, removing more sand in a thin lens. As discussed in Olsen Associates (2003), the southwestern boundary of Borrow Site #2 contains beach compatible sand, although the sediments tend to fine in the southwest and south directions. Typical median grain sizes of composite samples in this area range from 0.23 to 0.26mm, finer than the native target distribution median diameter. An expansion of Borrow Site #2 to the SW by approximately 1,000 ft might yield no more than one million cubic yards of fine sand.

Based upon a 2006 post-construction survey, an estimated 0.9 to 2.4 million cubic yards of sand remain within the permitted limits of Borrow Site #3. The existing reserves, however, lie in an irregular, scattered lens throughout the site, and much of what remains are sediments from the lowest elevations of the permitted site, indicating that the remaining sediments may be finer that expected. As the site ages, fine sediments will accumulate in the dredge pit, exacerbating this condition. Only limited areas of significant bank height remain, principally in the SW and N corners of the site. At this time it is unclear what quantity of sand could be cost-effectively excavated from the site. Additionally, resampling of the post-construction seabed in the site may be warranted prior to any future excavation therein. Evaluation of outlying Vibracores near Borrow Site #3 and available sub-bottom seismic data indicates that very little beach-compatible sediment exists outside the presently permitted limits. While SP lenses of sand are found south of the original site, the sediments tend to fine in the offshore direction and the color of the sediments darkens as increasing amounts of silts are reported[5] (see all logs in the attached CD-ROM disc). Given that understanding, a minor expansion of BA #3 could be conducted immediately south of the 2001 site, in the vicinity of BC02-72 and BC02-74.

[5] As discussed in the introduction, minor levels of silty sand are not considered particularly problematic, due to their tendency to wash out during dredging and fill placement. However, as the level of fine material increases, the likelihood of undesirable material appearing and persisting on the beach increases. Likewise, as the occurrence of silt increases, the overall quality and compatibility of the placed sediment decreases and the predicted performance and longevity of the beach fill suffers.

To the southeast of Borrow Site #2, a small shoal feature was investigated in both 2002 and 2006 in an attempt to identify another borrow site. The feature lies approximately 2.3 miles offshore of the western end of Orange Beach (Romar Beach).The center Vibracore, BC02-93 (Figure 4.9), reveals an 11 to 15 ft lens of very light gray to white clean sand with a composite median grain size of 0.28 mm. Adjacent Vibracores, however, suggest that the beach-compatible sediments quickly transition to finer or undesirable sediments. Vibracore BC02-94, located 1,000 ft east of the center core, reveals a slightly finer SP lens of only 8 ft lying atop a 10-ft lens of gray clay. Other adjacent Vibracores do suggest that an acceptable lens of beach-compatible material, oriented in a NW-SE direction, could be developed and excavated from this area. Based on the limited data available, careful development of this small feature could yield as much as 400,000 to 500,000 cy of beach compatible sand. Such a site represents a much smaller feature than those previously developed, and may only prove to be economically feasible for excavation in conjunction with a larger project utilizing other sites. Nonetheless, the sediments at the center of the shoal do appear to be high quality sands. Excavation of the site would likely require additional Vibracores, collected at a denser spacing, and seismic sub-bottom profiling in order to accurately map the clay lens that appears along the northeastern/eastern edge of these Vibracores.

Elsewhere in this vicinity (Figure 4.8), Vibracores collected in the lower, valley features yielded only undesirable sediments, consisting principally of fine gray sands mixed with abundant shell fragments. Many of these Vibracores consist of two to four feet of fine gray shelly sands overlaid upon silty sand (SM) or sandy silts (ML) or clays (CL).

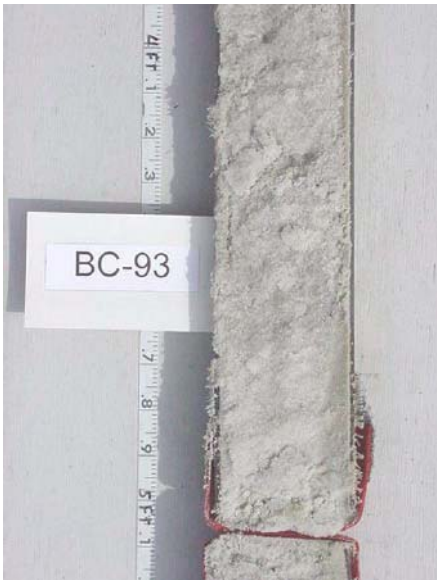

Figure 4.9 Photograph of a portion of Vibracore BC02-93, collected atop a small shoal feature roughly 2.3 miles offshore of Orange Beach, AL (Olsen Associates, 2003).

4.5 West Gulf Shores and Baldwin Shoal

West of Borrow Site #3, extensive Vibracoring has produced very little evidence of beach-compatible sediment in the nearshore region directly off Gulf Shores (Figure 4.10). A shoreface-attached oblique ridge just east of Little Lagoon Pass, similar to the ridge at Borrow Site #3, has been repeatedly investigated but has yielded a wide range of sediment quality, precluding the development of a borrow site upon that feature. The nearshore area in State Waters off West Beach Gulf Shores is relatively featureless, lacking any significant ridge or shoal features, and Vibracores collected in this area reveal only lenses of fine sand mixed with higher levels of broken shell (Olsen Associates, 2003).

West of the western limit of Gulf Shores, Baldwin Shoal extends from the shoreline to the southwest (opposite the direction of the shoreface-attached ridges to the east). The inshore, State Waters portion of Baldwin Shoal was sampled extensively in the 2002 Sand Search, and a borrow site was developed upon the shoal (Borrow Site #4). The permitted limits of Borrow Site #4 occupy 131 acres of the seabed on Baldwin Shoal, and the site contains as much as 1.1 million cubic yards. Additional reserves outside the permitted limits may increase the available volume to 2.0 million cubic yards (Olsen Associates, 2003). The sands in Borrow Site #4 are characterized as having a median grain size of 0.24 mm, typical overfill ratios of 1.2 to 1.7, and an average color grading of 10YR 7.5/0.5. Olsen Associates (2003) notes the following regarding Borrow Site #4:

> "While the material in Borrow Area #4 is not as high of quality as the other three borrow areas identified, the material is still of beach quality, particularly when viewed in light of the significant lack of suitable beach quality sand closer to West Beach Gulf Shores, and the overall limited supply of beach quality sand in the region. The quality of the sand and the higher values of overfill ratio must be acknowledged prior to bidding and construction and during the analysis of performance monitoring data following construction."

Because sufficient volume existed in Borrow Site #3, the City of Gulf Shores ultimately chose not to excavate sand from Borrow Site #4 for the construction of the 2005-2006 beach restoration project. However, during the course of construction, a test excavation of approximately 3,000 cubic yards of sand from Borrow Site #4 was performed in April 2006. The sand was pumped ashore via hopper dredge to the shoreline along West Beach Gulf Shores. Samples of the dredged and placed material were collected and analyzed as part of the present investigation. Samples collected during the test ranged in median grain size from 0.25 to 0.32mm.

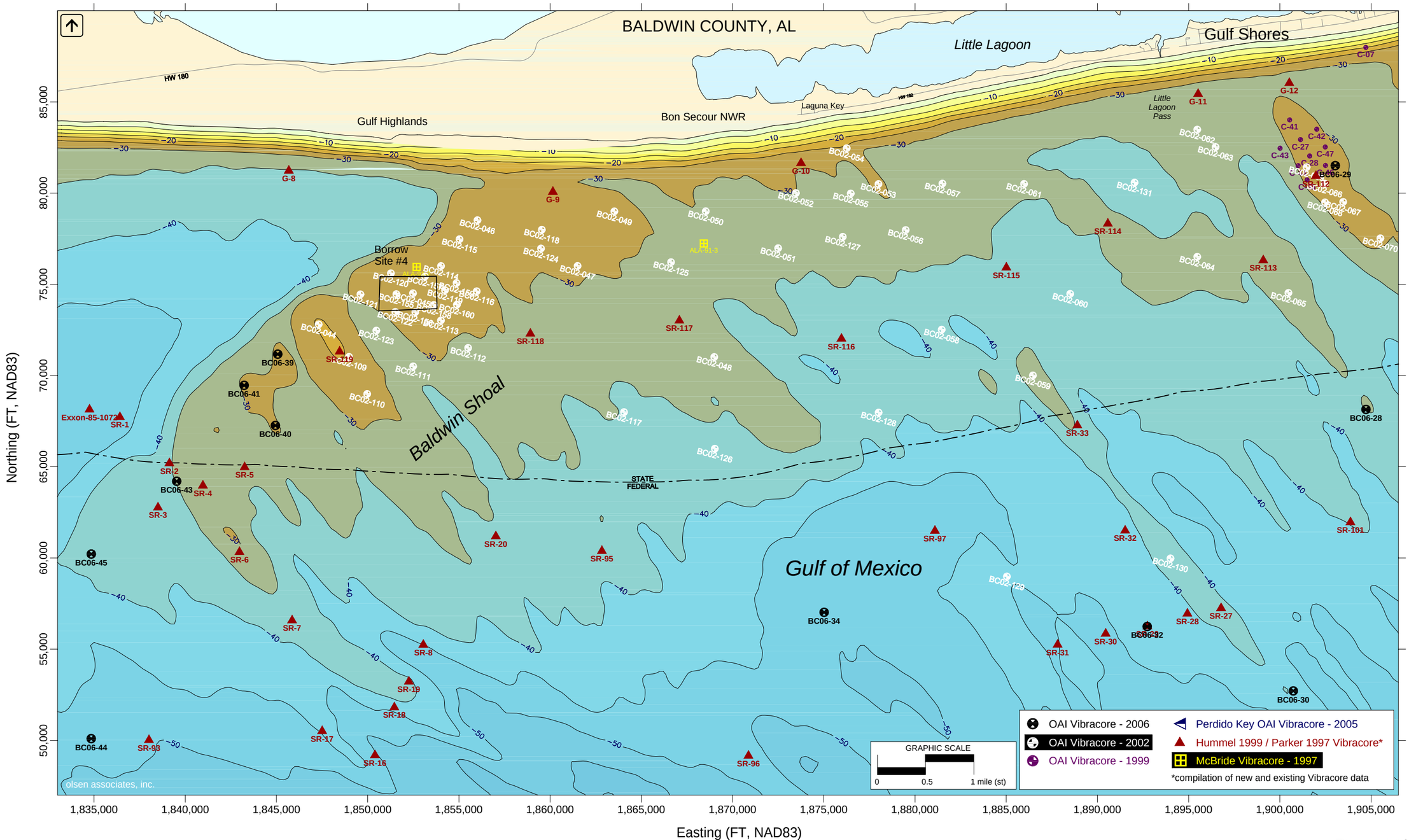

Figure 4.10 Locations of available Vibracore data in the vicinity of Baldwin Shoal and West Gulf Shores, AL.

Since the test excavation included only one or two passes across the site, only the upper surficial lens of the site was sampled. Thus, the sample likely contained an increased level of shell compared to the site as a whole. Carbonate-burn tests performed on the samples indicate carbonate percentages over 5%, compared to 2% to 3% for other borrow sites (site-wide composite averages). It is observed that much of the shell content in the Baldwin Shoal samples consists of small particles of broken black, possibly fossilized, shell. While the black shell fragments do contribute to the overall color grading of the sample of 10YR 7.5/05, the quartz sand component of the samples does exhibit a grayer cast than samples collected farther to the east (Figure 4.11)[6].

Additional Vibracores were collected further seaward along Baldwin Shoal to determine the extent of the SP sediment deposit. Similar sediments were found in Vibracores BC06-39 to BC06-41 and BC06-43 and BC06-45. Table 4.3 lists the primary sediment characteristics of samples collected from the Baldwin Shoals Vibracores. Median grain sizes of composite samples range from 0.24mm to 0.30mm, with an average sorting coefficient of 0.81ϕ. Carbonate percentages of the composite samples measured between two and three percent. The average color Value of the composite samples from the shoal was 7.4. Several samples, typically closer to the seabed, reported higher Chroma values of 2.0, indicating a tan or orange cast to the sediments.

A limited series of seismic tracklines were collected along Baldwin Shoal. Most of the seismic data in the area revealed very few significant reflectors in the upper 20 ft of the seabed. Inspection of the individual Vibracores does indicate the presence of silty materials or clays, typically beginning 15 to 17 ft below the seabed.

[6] Any differences in color depicted in photographs herein should be considered relative only to the photos in this report. Color differences caused by different printers, etc., can significantly alter the actual color presented, particularly in the limited range of light grey to white sands discussed herein.

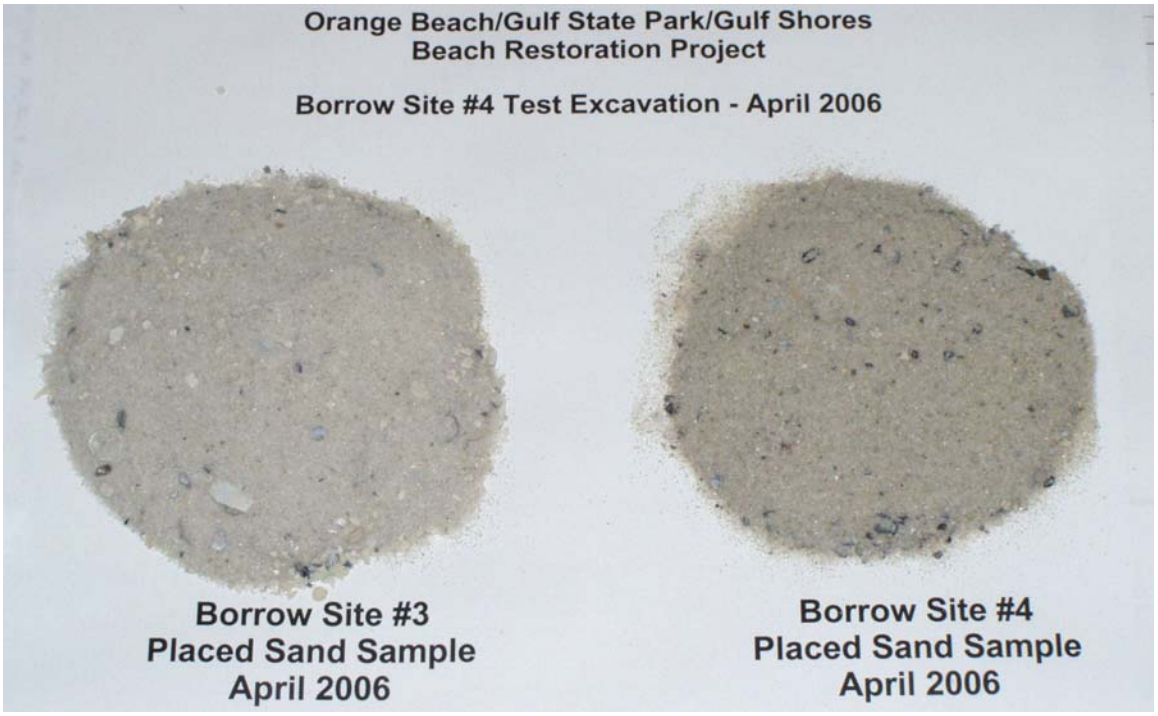

Figure 4.11 Comparison of sediments excavated from Borrow Site #3 off the eastern end of Gulf Shores and Borrow Site #4 located atop Baldwin Shoal, west of Gulf Shores. Color differences depicted in the photo should be considered relative only (for instance - the background for the photo is a nearly-white sheet of paper).

Table 4.3 Primary sediment characteristics of 2006 Vibracore samples collected in the vicinity of Baldwin Shoal, west of Gulf Shores off the Ft. Morgan Peninsula.

Vibracore #	Easting (ft, NAD83)	Northing (ft, NAD83)	Seabed Elevation (ft, NAVD88)	Sample Depth (ft)	Sample Elevation (ft, NAVD88)	HUE*	VALUE	CHROMA	% Fines	Median Grain Size (mm)	Sorting Coefficient (phi)	% CARB.
BC06-39	1,845,069	71,169	-28.5	1	-29.5	10YR	8	2	0.3	0.33	0.81	-
				4	-32.5	10YR	7.5	1	0.04	0.31	1.01	-
				8	-36.5	10YR	7.5	1	0.29	0.21	0.73	-
				12	-40.5	10YR	7.5	1	0.53	0.27	0.8	-
				16	-44.5	10YR	8	1	0.34	0.21	0.67	-
				18	-46.5	10YR	8	1	0.71	0.21	0.55	-
				comp (0-18')	-	10YR	7.5	1	0.37	0.23	0.79	2.92
BC06-40	1,844,941	67,262	-30.4	1	-31.4	10YR	7.5	1	0.54	0.24	0.78	-
				5	-35.4	10YR	7	1	0.19	0.29	1.02	-
				10	-40.4	10YR	7	1	0.1	0.24	0.69	-
				15	-45.4	10YR	7	1	0.06	0.24	0.88	-
				comp (0-10')	-	10YR	7	1	0.11	0.31	0.88	-
				comp (0-15')	-	10YR	7	1	0.2	0.30	0.84	2.89
BC06-41	1,843,227	69,461	-28.2	1	-29.2	10YR	7.5	2	0.06	0.26	0.8	-
				3	-31.2	10YR	7.5	2	0.18	0.29	0.78	-
				6	-34.2	10YR	7.5	2	0.34	0.30	0.68	-
				10	-38.2	10YR	8	1	0.08	0.26	0.73	-
				13	-41.2	10YR	8	1	0.21	0.24	0.6	-
				16	-44.2	10YR	7	2	0.16	0.25	0.71	-
				comp (0-13')	-	10YR	8	1	0.1	0.30	0.67	-
				comp (0-17')	-	10YR	7.5	1	0.02	0.29	0.72	1.99
BC06-43	1,839,530	64,204	-35.0	1	-36.0	10YR	7.5	1	0.18	0.23	1.31	-
				4	-39.0	10YR	7.5	1	1.27	0.22	0.87	-
				8	-43.0	10YR	7.5	1	0.52	0.40	0.99	-
				12	-47.0	10YR	7.5	1	0.51	0.24	0.88	-
				16	-51.0	10YR	7.5	1	1.1	0.24	1.31	-
				comp (0-16')	-	10YR	7.5	1	0.29	0.30	1.15	3.15
BC06-45	1,834,850	60,213	-39.2	1	-40.2	10YR	7	1	0.3	0.22	1.03	-
				4	-43.2	10YR	7	1	0.48	0.23	0.86	-
				8	-47.2	10YR	7	1	0.13	0.26	0.63	-
				13	-52.2	10YR	6.5	1	1.27	0.27	1.36	-
				15	-54.2	10YR	7	1	0.33	0.23	0.8	-
				17	-56.2	10YR	7	1	0.55	0.24	1.04	2.4

*all samples analyzed for grain size distribution were classified as SP sediments (the composite samples may include small portions of non-SP material)

4.6 Mobile Bay Entrance and Ebb Shoal

The ebb shoal complex at Main Pass, the tidal entrance to Mobile Bay, contains a significant volume of sediment and thus represents a potential borrow source. The eastern portion of the ebb shoal, referred to locally as Dixie Bar, was sampled to preliminarily evaluate the sediments for potential beach-compatible sand. Figure 4.12 plots the bathymetry in the vicinity of Dixie Bar and the available Vibracore data, including the most recent study samples. The offshore limits of the ebb shoal are well defined by the -30 and -35 ft contours. Ten Vibracores were collected along the crest of the ebb shoal and the adjacent seabed to the east. The sediment characteristics of these Vibracores are summarized in Table 4.1.

As a whole, the Dixie Bar samples bear a strong resemblance to the sediments found along the crest of Baldwin Shoal, while samples from both features differ from the ridge and borrow site samples found farther eastward[7]. The highest quality sediments in this group are found directly atop the linear channel-parallel crest of the ebb shoal. While several samples exhibit median grain sizes in the desired range (approaching 0.29 to 0.30 mm or greater), the sediments as a whole are generally finer than the native target, with an average median grain size of 0.26 mm. Frequent thin layers of silt and dark gray clay are found in several of these cores. The shell content of the ebb shoal area, 1% to 2%, appears to be only slightly higher than the native, and is less than that of samples found upon Baldwin Shoal and on ridges east thereof. Correspondingly, the average sorting coefficient of these samples is relatively low at 0.60ϕ.

A seismic sub-bottom profile, collected along the crest of the shoal, revealed no significant reflectors in the upper 20ft of the seabed. Inspections of the Vibracores along the line do indicate the presence of some silty material near the bottoms of the logs, but these silty materials may not represent a significant change in sediment density, thus no reflector was recorded.

[7] It is likewise apparent from the bathymetry that these two shoal features were created by different processes, given their differences in scale and orientation. The ridges to the east are NW-SE oriented shoreface-attached features, likely created more recently. The ebb shoal complex and Baldwin Shoal, which may a be relict ebb shoal feature itself, are oriented in a NE-SW fashion. The combination of these observations leads the authors to conclude that the transition from the Mobile sub-province to the Apalachicola sub-province may actually occur closer to the western end of Gulf Shores, in the Little Lagoon region where the SE-oriented shoreface-attached ridges cease.

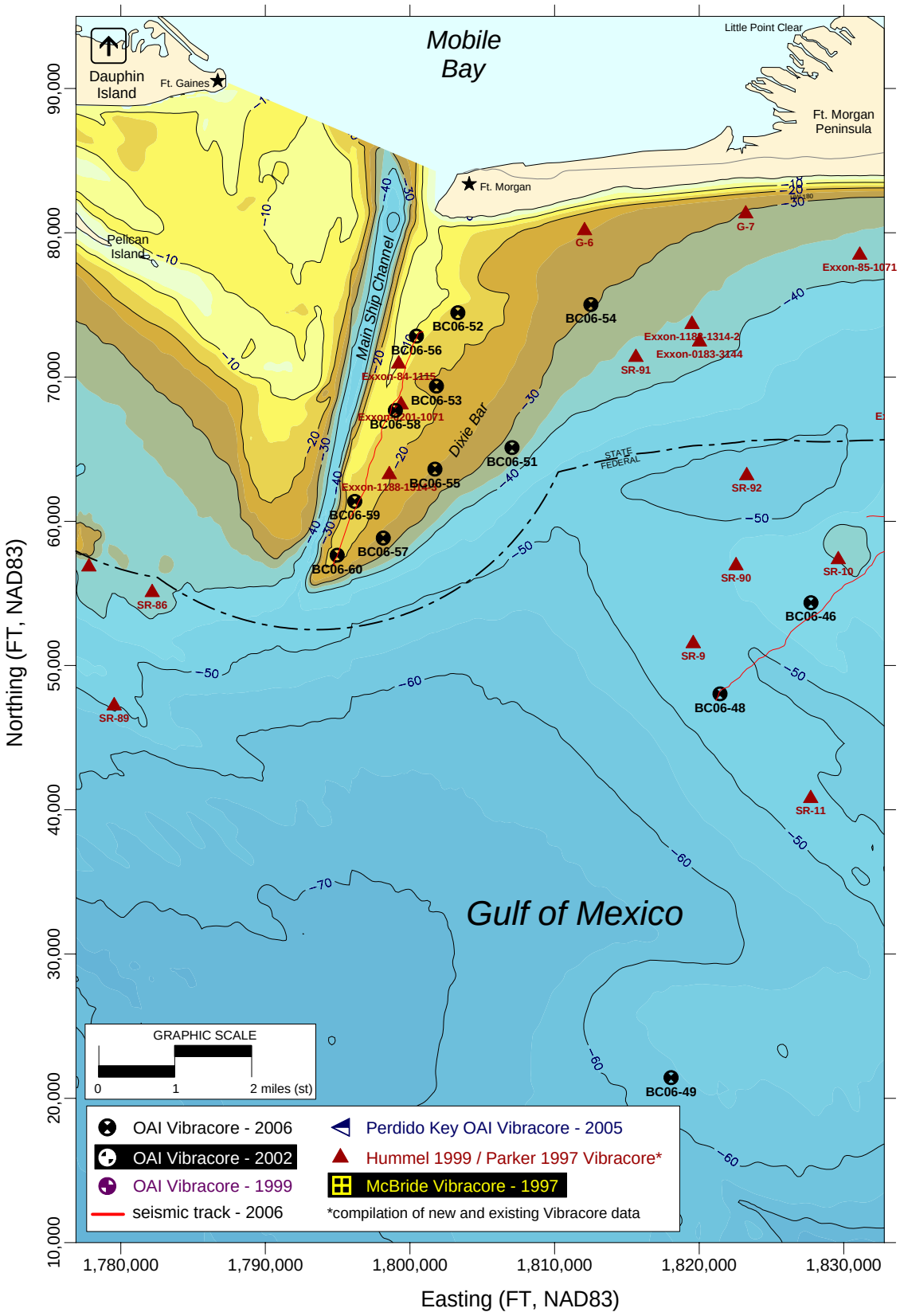

Figure 4.12 Bathymetry and Vibracore locations in the vicinity of the ebb shoal at the entrance to Mobile Bay, AL.

Table 4.4 Primary sediment characteristics of Vibracore samples collected at Dixie Bar, Entrance to Mobile Bay, AL.

Vibracore #	Easting (ft, NAD83)	Northing (ft, NAD83)	Seabed Elevation (ft, NAVD88)	Sample Depth (ft)	Sample Elevation (ft, NAVD88)	HUE	VALUE	CHROMA	% Fines	Median Grain Size (mm)	Sorting Coefficient (phi)	% CARB.
BC06-51	1,807,057	65,107	-33.4	1	-34.4	10YR	7.5	1	0.41	0.20	0.41	-
				3	-36.4	10YR	7.5	1	10.22	0.18	0.53	-
				6	-39.4	10YR	6	2	3.02	0.24	1.05	-
				9	-42.4	10YR	7.5	1	0.93	0.26	0.75	-
				13	-46.4	10YR	7.5	1	0.53	0.19	0.53	-
				16	-49.4	10YR	7.5	1	0.96	0.17	0.47	-
				comp (0-5')	-50.4	10YR	7.5	1	0.45	0.21	0.87	-
				comp (0-16')	-51.4	10YR	7	1	0.93	0.20	0.68	2.07
BC06-52	1,803,312	74,454	-18.4	1	-19.4	10YR	8.5	1	0.05	0.32	0.55	-
				4	-22.4	10YR	8.5	1	-	0.27	0.35	-
				8	-26.4	10YR	8.5	1	0.39	0.34	0.65	-
				12	-30.4	10YR	8.5	1	-	0.31	0.45	-
				16	-34.4	10YR	8.5	1	0.08	0.26	0.59	-
				comp (0-18')	-36.4	10YR	8.5	1	0.26	0.28	0.52	0.95
BC06-53	1,801,833	69,367	-21.5	1	-22.5	10YR	7.5	2	2.85	0.24	0.7	2.06
				4	-25.5	10YR	7.5	1	0.56	0.20	0.47	2.27
				8	-29.5	10YR	8	1	0.01	0.29	0.52	0.99
				12	-33.5	10YR	8	1	0	0.23	0.49	0.65
				17	-38.5	10YR	7.5	1	-	0.41	0.4	0.86
				comp (0-17')	-39.5	10YR	8	1	0.21	0.29	0.57	1.5
BC06-54	1,812,511	75,019	-30.8	1	-31.8	10YR	7.5	1	0.33	0.30	0.89	2.32
				4	-34.8	10YR	8	1	1.29	0.31	1.03	2.13
				8	-38.8	10YR	8	1	0.06	0.42	0.64	1.26
				12	-42.8	10YR	8	1	0.16	0.34	0.46	0.91
				15	-45.8	10YR	8	1	0.19	0.33	0.64	1.64
				comp 0-16'	-48.8	10YR	8	1	0.63	0.32	0.78	1.95
BC06-55	1,801,725	63,615	-26.4	1	-27.4	10YR	7.5	2	0.19	0.28	0.73	-
				4	-30.4	10YR	8.5	1	0.03	0.29	0.68	-
				8	-34.4	10YR	8.5	1	2.18	0.17	0.37	-
				12	-38.4	10YR	7.5	2	6.39	0.19	0.48	-
				15	-41.4	10YR	8	1	0.05	0.30	0.61	-
				comp (0-15')	-44.4	10YR	7.5	1	0.06	0.25	0.65	1.75
BC06-56	1,800,446	72,834	-15.3	1	-16.3	10YR	8.5	1	0.02	0.26	0.51	-
				4	-19.3	10YR	8.5	1	0.03	0.27	0.47	-
				8	-23.3	10YR	8.5	1	0.7	0.33	0.53	-
				12	-27.3	10YR	8.5	1	0.59	0.29	0.58	-
				16	-31.3	10YR	8.5	1	0.18	0.27	0.54	-
				comp (0-18')	-33.3	10YR	8.5	1	0.76	0.27	0.51	0.75
BC06-57	1,798,151	58,837	-29.1	1	-30.1	10YR	8	1	0.51	0.25	0.61	-
				4	-33.1	10YR	7.5	1	0.49	0.20	0.7	-
				8	-37.1	10YR	7.5	1	0.56	0.21	0.75	-
				12	-41.1	10YR	7.5	1	1.43	0.17	0.55	-
				comp (0-10')	-43.1	10YR	7.5	1	1.13	0.19	0.56	-
				comp (0-13')	-44.9	10YR	6.5	1	3	0.18	0.57	1.37
BC06-58	1,798,987	67,681	-16.4	1	-17.4	10YR	8	2	0.39	0.29	0.61	-
				5	-21.4	10YR	8	1	0.21	0.25	0.39	-
				10	-26.4	10YR	8	1	0	0.23	0.37	-
				15	-31.4	10YR	8	1	0.06	0.23	0.38	-
				18	-34.4	10YR	8	1	1.31	0.22	0.35	-
				comp (0-18')	-36.4	10YR	8	1	3.75	0.24	0.48	1.11
BC06-59	1,796,181	61,378	-18.0	1	-19.0	10YR	8.5	2	1.49	0.30	0.6	0.92
				4	-22.0	10YR	8.5	1	0.15	0.27	0.48	0.61
				8	-26.0	10YR	8.5	1	1.91	0.21	0.45	0.7
				12	-30.0	10YR	8.5	1	0.12	0.37	0.38	0.56
				16	-34.0	10YR	8.5	1	1.37	0.28	0.46	0.42
				comp (0-18')	-36.0	10YR	8.5	1	1.17	0.28	0.53	0.73
BC06-60	1,794,965	57,650	-26.1	1	-27.1	10YR	8.5	1	0.44	0.22	0.43	1.21
				4	-30.1	10YR	8.5	1	0.33	0.23	0.45	1.35
				8	-34.1	10YR	8.5	1	0.73	0.29	0.56	0.51
				12	-38.1	10YR	8.5	1	1.2	0.32	0.56	0.65
				16	-42.1	10YR	8.5	1	0.98	0.27	0.56	0.95
				comp (0-16')	-44.1	10YR	8.5	1	0.75	0.25	0.61	0.86

*all samples analyzed for grain size distribution were classified as SP sediments (the composite samples may include small portions of non-SP material)

In terms of sediment color, samples collected at Dixie Bar typically exhibit color Values of 7.5 to 8.0, with some samples reaching Values of 8.5. Inspection of the core photographs, found on the attached CD-ROM disc, reveals that in general the samples are slight darker than core samples farther east of Baldwin Shoal (see previous discussion). Chroma values average 1.0. The upper lenses of most of the Vibracores do indicate higher Chroma values with sands than exhibit tan or orange casts to them.

While the sediments along Dixie Bar do appear to be slightly finer and slightly darker than the native target sands, the site could be developed for potential beach nourishment needs. It is opined that with additional sampling, a borrow site could be developed that would resemble a channel widener to Main Pass. The best sediments appear to be directly along the margin of the channel and atop the crest of the ebb shoal. It is noted that the site is relatively distant from Gulf Shores, lying approximately 15 miles west of the western limit of the City of Gulf Shores. The separation distance would dictate the use of a hopper dredge for any potential beach fill construction, and the sail distance itself would influence the cost per cubic yard to obtain and deliver the sand.

4.7 Three-mile to Nine-mile Offshore Zone

The offshore areas between the -40-ft contour and the -80ft contour (approx.) have been studied by previous investigators to attempt to identify beach-compatible sands in Federal Waters. In particular, Parker (1997) and Hummell (1999) collected Vibracore data under the sponsorship of the Minerals Management to characterize the near-term geologic and economic potential of sand resources in this area. As plotted in Figure 2.3, over 90 Vibracores are described in their work (see attached CD-ROM disc for data). Hummel (1999) identifies three resource areas that could provide beach-compatible sediment. Referring to Figure 2.3, these areas include the region near the State/Federal Waters boundary and immediately south of Borrow Sites #2 and #3 (Resource Area #1 -- Vibracores SR-39 to SR-44), the region immediately south of Little Lagoon Pass (Resource Area #2 -- SR-27 to SR-31), and in the general vicinity of the southern portions of Baldwin Shoal (Resource Area #3 -- SR-16 to SR-19 among others).

Numerous Vibracores were collected in this region as part of the present study to fill in the knowledge base of the seabed in the area and to verify the sediments described in previous works. At Resource Area #1, two Vibracores were collected in the immediate vicinity of SR-39 to SR-44 (Figure 4.13). Referring to the data on the CD-ROM disc, Vibracore BC06-23, collected very close to SR-40, revealed a 12-ft lens of very light gray to white SP materials. The upper 2.5 to 3.0 feet of the Vibracore contains abundant whole shell and shell fragments. Median grain diameters vary significantly with depth, ranging from 0.22 to 0.31 mm. Below 12 ft, sediments turn to gray silt (ML) with some clay present (indicated in both BC06-23 and SR-40).

Vibracore BC06-50, collected approximately 1,500 ft to the NNW of BC06-23, indicates only a 1.2-ft lens of shelly SP material atop 15 ft of gray clay and silty materials (ML and CL). Inspection of the older *SR-xx* Vibracores adjacent to SR-40 and BC06-23 reveal rapidly decreasing sediment quality, consistent with the findings at BC06-50. The limited data describing these Vibracores indicate mean grain sizes typically approaching or exceeding 2.0ϕ ($\leq$0.25 mm). Color descriptions typically include labels such as 5Y 6/1 (light olive gray) at best, to 5Y 4/1 (olive gray) to 5Y 4/6 (olive). Closer inspection of the bathymetry in Figure 2.3 suggests that a small quantity of relatively clean sands was identified in Vibracores SR-40 and BC06-23 atop the extreme SE end of the Borrow Site #3 ridge. Adjacent Vibracores suggest, however, that the lens of potentially acceptable material, if viable at all, does not extend more than 500 to 1,000 ft from BC06-23.

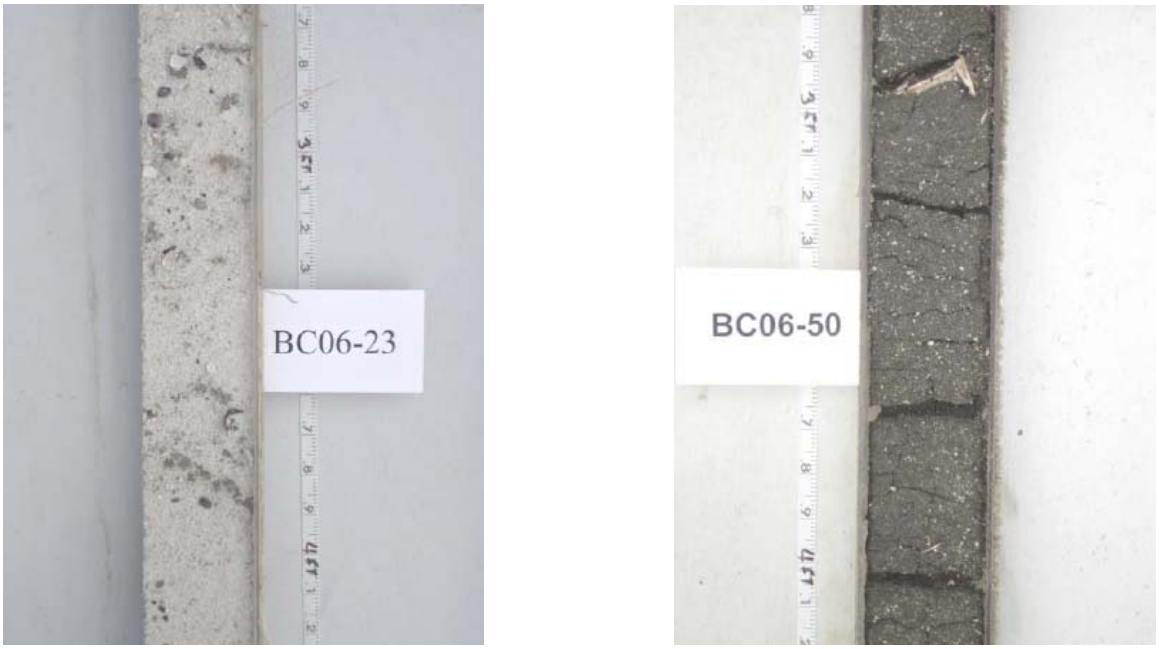

Figure 4.13 Comparison of Vibracore segments collected in the vicinity of Resource Area #1 (Hummell, 1999). These segments, three to four ft below the seabed, lie roughly 1,500 ft apart. Vibracore BC06-23 lies very near Vibracore SR-40 (Hummell, 1999). The segment on the left is classified as white fine quartz sand (10YR 8.5/1) with traces of shell fragments, while the segment on the right is classified as dark gray clay (10YR 4.5/1) with scattered shell fragments and whole shells.

Similarly, Vibracore BC06-32 was collected in the center of the string of older Vibracores collected in Resource Area #2 (SR-27 to SR-31, Hummell, 1999). Similar sediment characteristics were found in these samples, with typical sediment diameters of 0.25 mm or finer, and color gradings of 5Y 5/1 (SR-29). Vibracore BC06-32 revealed no SP lenses of material anywhere in the sample. The upper six inches were found to be shells and shell fragments in the gravel range or larger, with some fraction of fine gray sand. Below the surface shell lag, materials were classified as ML or CL (clayey silt or silty clay). No grain size information was collected from these undesirable sediments. Similar results were reported from SR-31 to SR-27. Adjacent Vibracores BC02-130 and BC06-30 collected more recently by Olsen Associates reveal the lack of any beach compatible sediments in the area. In limited places, thin sediment lenses of SP material are found, some of which reveal very light gray to white color. These lenses, however, typically are found with high levels of shell fragments while the sand fraction is generally finer than the target distribution. These occurrences of SP lenses typically do not extend horizontally for any useful distance.

Offshore of Baldwin Shoal, Vibracores collected in the vicinity of eastern Resource Area #3 (SR-8, SR-16 to SR-19, Hummell, 1999) reveal similar undesirable sediments. The western portions of Resource Area #3 lie along the offshore limits of Baldwin Shoal. As such, some Vibracore samples do indicate thick lenses of SP materials. These samples may be considered to be beach compatible, but only with the caveats discussed previously for Baldwin Shoal (Section 4.5). Vibracores BC06-43 and BC06-45 contain lenses of SP material between 12 and 17 ft thick, respectively. Median grain diameters in the SP lens typically range between 0.22 and 0.30 mm. Color gradings range between 10YR 7/1 and 10YR 7.5/1 (again, refer to Section 4.5 and Figure 4.10 for Baldwin Shoal).

In limited instances, however, Vibracores along Baldwin Shoal reveal improved quality. Vibracore BC06-44 reveals a 19-ft lens of light gray to white sand with median grain diameters of 0.26 to 0.32 mm, all beach-compatible characteristics. A nearby Vibracore, SR-93, suggests similar sediments. Vibracore BC06-46, closer to the shoal crest, also indicates improved sediment color. It is possible that a narrow zone of improved sediment quality exists along Baldwin Shoal, roughly 5 to 6 miles offshore and just over 10 miles from the western end of West Beach Gulf Shores. In the event reserve estimates drop to a sufficiently low level, this zone should be re-investigated. Vibracores collected at much denser spacing, along with additional seismic sub-bottom profiling, would be required to assess the viability of this area for use as a beach nourishment borrow site[8].

Between resource areas, Vibracores typically revealed little or no SP lenses. Generally, the resource areas identified by Hummell (1999) lie along the extremities of shoreface attached ridges. The majority of beach-compatible sediment associated with the ridges lies closer to shore in State Waters. Between these ridges, in lower-elevation areas 40- to 50-ft deep, most Vibracores contain darker clayey silts and silty clays or clays.

With limited exception, the conclusions reached by Hummell (1999) could not be replicated during this study. Hummell (1999) suggests that there may be hundreds of millions of cubic yards of beach compatible sand available in the "Surficial Sand Sheet" in the three identified resource areas. Closer inspection of the Vibracore logs used to reach that conclusion indicate that much of the material in the upper lenses of the

[8] Additionally, this area lies amongst known pipeline and platform areas. These features were identified prior to the field work portion of this study, and must be positively re-located for any additional investigation or excavation. Magnetometer surveys of the area would be recommended prior to any excavation work in the area.

Hummel and Parker Vibracores, while perhaps SP materials, would in fact *not* be suitable for direct beach placement, due to a combination of factors including color, silt content, shell content, presence of shallow clay layers, etc. It is apparent that the reserve estimates provided by Hummell were based on a very limited number of Vibracores. In some instances, very small pockets of beach-compatible material (following the general guidelines established herein) could be identified with very targeted field investigation. With the possible exception of the western portion of Resource Area #3, it is opinied that the reserve estimate of beach compatible sand from these three resource areas would be measured in the hundreds of thousands of cubic yards (as opposed to hundreds of millions).

Further offshore in the 3- to 9-mile region, the shoreface ridge features disappear, and sediment Vibracores collected in waters deeper than 50 ft reveal only intermittent lenses of fine sand, typically in combination with an increased level of shell fragments and/or silt. Frequently, Vibracores containing almost entirely ML or CL sediments were recovered (BC06-33, BC06-35 through BC06-38).

4.8 Offshore Zone and North Perdido Shoals

Along the bathymetric low between nine and fifteen miles offshore, water depths approach or exceed 100 ft. Sediment Vibracores collected in this region reveal no indication of beach-compatible sediments, although surface lenses of SP sands are found throughout the area. Fine gray to light gray SP sands are found in combination with abundant small shell fragments in numerous Vibracores. These SP sediments are noticeably different in nature than the sand used in recent projects, exhibiting higher concentrations of crushed shell fragments and a gray cast in color. Occasional lenses of SP material with color gradings of 10YR 7/1 to 7.5/1 do occur, but the sand is typically much finer than the native target distribution.

To the east-southeast of the study area lies a portion of North Perdido Shoals. As discussed in Chapter 2, this shoal feature lies in Federal Waters offshore of the extended boundaries of Florida. The shoal feature runs more-or-less parallel to the continental shelf break at DeSoto Canyon, and extends eastward toward Destin, FL. The shoal feature rises to elevations of roughly -65ft NAVD88 at its crest. As depicted in Figure 2.3, the shoal feature dissipates completely near the extended AL/FL State Line. Previous investigators have collected Vibracore data near the crest of this portion of

North Perdido Shoals. McBride et al. (2000) collected one Vibracore just north of the crest of the feature, in 80-ft water depth. That Vibracore (PEN 91-5) revealed an upper SP lens, 14.5-ft in thickness, containing medium "creamy tan" sand[9] with median grain diameters between 0.4 and 0.5 mm. A nearby Vibracore (PEN 92-4), located farther from the center of the shoal and to the south-southeast in deeper water, revealed an 8-ft lens of light-grayish tan medium grained sand with median grain size diameters of between 0.24 to 0.30 mm.

Because the shoal feature lies offshore of Florida waters, objections were raised by parties in Florida to the exploration and presumably the eventual excavation of some portion of the shoal. Much of the shoal feature lies in an artificial reef area permitted by the State of Florida and the U.S. Army Corps of Engineers. For these reasons, no additional data were collected in this area in 2006.

The hypothetical extension of the shoal westward into Federal Waters offshore of Alabama was investigated to determine if any beach-compatible sediments extended into that area. As evidenced by the bathymetry in Figure 2.3, water depths near the hypothetical intersection of the extended shoal centerline and the extended AL/FL State Line reach over 90 ft, compared to the 65-ft water depths at the crest of the shoal. Vibracore BC06-02, collected in 92-ft water depths along what appears to be the western extremity of North Perdido Shoals, does reveal an upper SP lens of nearly 12-ft thickness (Figure 4.14). The sediments in the SP lens are characterized with color gradings of 10YR 7/1 to 7/2, with median diameters of 0.26 to 0.40 mm. The median diameters do appear to be biased somewhat by abundant shell fragments (noted in the log). Carbonate percentages of samples collected along the length of the Vibracore range from 3.5 to 7.3%. Below 12-ft, sediments transition to silty material through the bottom of the Vibracore. Sediment from Vibracores collected further to the southwest (BC06-08 and BC06-18) becomes increasingly shelly and darker in average color. The upper SP lens was found to be between 4 and 11 ft thick. The sand fraction in each SP sample is comprised of fine sand, such that in samples lacking shell fragments, the median grain diameters decrease to 0.20 to 0.21 mm. Color gradings lie between 10YR 6/1 and 10YR 7.5/1.

[9] Differences in the description techniques and data collected for each Vibracore are acknowledged. The reader is encouraged to investigate the data CD included herein to compare the available data and study the Vibracores in relation to their local bathymetry.

Based upon inspection of the Vibracores collected around the edges of this portion of North Perdido Shoals, it is opined by the author that this shoal feature likely contains a large volume of potentially high-quality beach compatible sand. All three Vibracores collected near the feature clearly missed the physical crest of the shoal, which lies at least 15 ft above the elevations of these Vibracores. All three Vibracores do contain sediments that appear to be at least marginally beach compatible. The author's opinion is further supported by Vibracore data collected further eastward along North Perdido Shoals. Roughly 15 miles to the east, the shoal feature approaches within four to five miles of the shoreline off Pensacola Beach, FL. A portion of the shoal feature was developed into a multi-million cubic yard borrow site for the Pensacola Beach, FL, Beach Restoration Project (Browder, 2002) and the subsequent post-Hurricane Ivan renourishment project. A similar feature on North Perdido Shoals is believed to have been utilized for a recent nourishment project at Navarre Beach, FL, further east from Pensacola Beach.

The shoal feature occupies an area in excess of 2,300 acres above the 70-ft contour. In comparison, a 5-million cubic yard borrow site might occupy $1/10^{th}$ of that area. Thus, the feature may easily contain 60 to 70 million cubic yards of sand and possibly much more, depending on the ambient seabed depth permitted and the deepest feasible depth of excavation.

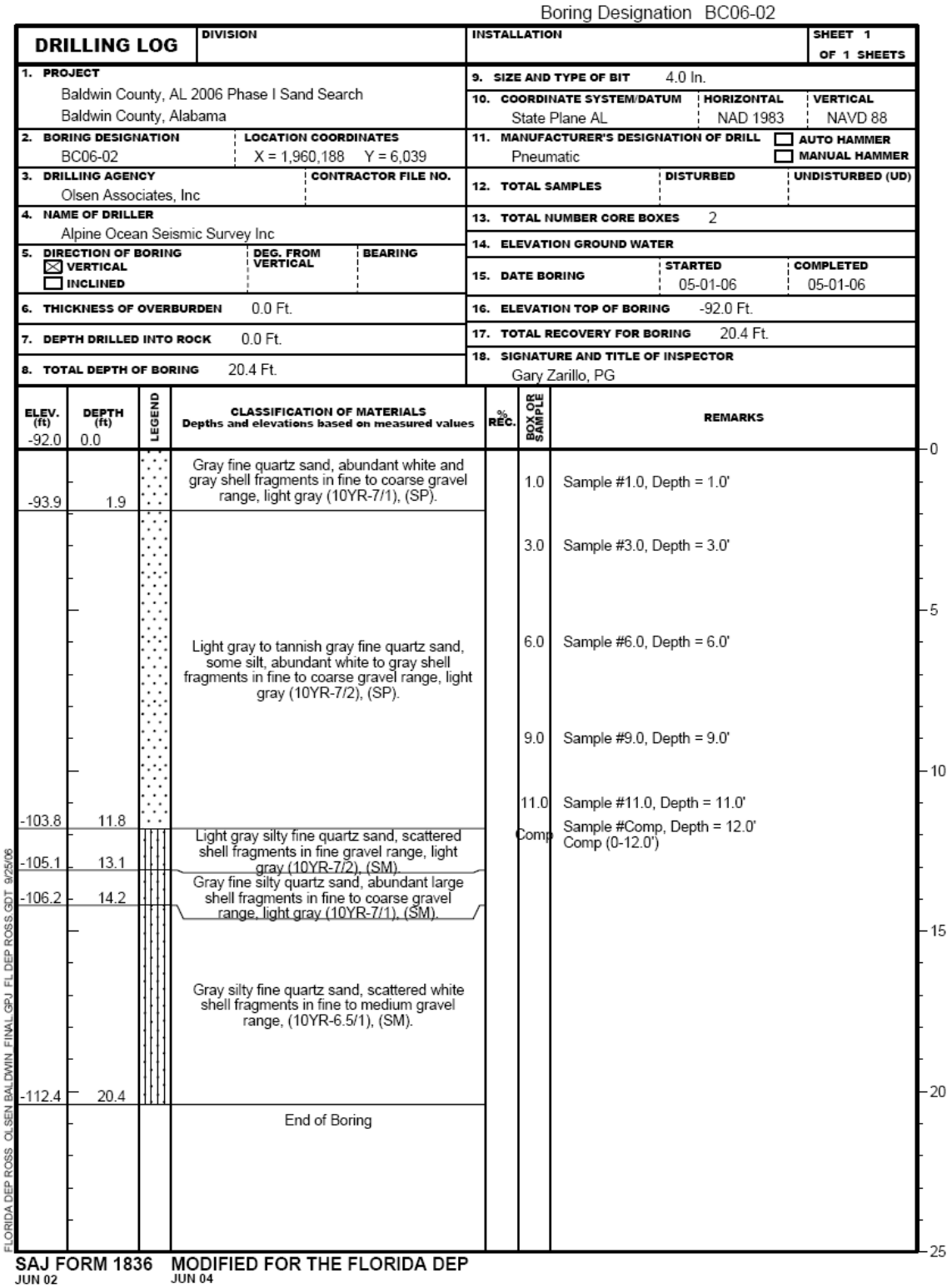

Figure 4.14 Vibracore log BC06-02, collected along the extended AL/FL State Line approximately 15 miles offshore of the Orange Beach, AL shoreline. This Vibracore is believed to lie along the western extremity of North Perdido Shoals, the bulk of which lies in Federal Waters offshore of waters of the State of Florida.

5.0 DISCUSSION & RECOMMENDATIONS

60 sediment Vibracores and over 30 line-miles of seismic sub-bottom profile data were collected in April/May 2006 to supplement existing geotechnical data in the area offshore of Baldwin County, AL. The objective of the study was to identify additional potential sources of beach-compatible material for use in future beach nourishment operations along the eastern Baldwin County Gulf of Mexico shoreline. The study was performed by Olsen Associates, Inc., for the City of Orange Beach, AL, the Alabama Department of Conservation and Natural Resources, and the City of Gulf Shores, AL.

5.1 Observations

Based upon the available data, the following observations are offered. A summary of the identified reserve estimates of beach-compatible sand is provided in Table 5.1

- Consistent with the 2002 sand search, as a general rule any sand found that appeared to be of beach-quality was found in the vicinity of some type of ridge or shoal feature in the nearshore. Vibracores collected in the broad valley areas between ridges and in the relatively featureless areas further offshore were found to be undesirable sandy materials containing high levels of silts and fines, occasional lenses of clay, and/or high levels of crushed shell mixed with fines and clay. These sediments also exhibit much darker color, and frequently contained decaying organic material. This description was found to agree with the general findings of previous investigators. Atop *most* of the ridge and shoal features, beach-compatible sand was identified, combined with varying low levels of broken shell.

- Inspection of available Vibracore data indicates that expansion of previously utilized borrow sites #1, #2, and #3 is possible, to varying degrees. Vibracores and seismic data were collected adjacent to Borrow Site #1, identifying roughly 2.0 million cubic yards of sand potentially available for excavation. Borrow Sites #2 and #3 may be further utilized or expanded, but to a much more limited extent (see Table 5.1)

Table 5.1 Estimates of Beach-Compatible Sand Reserves – Baldwin County, AL

Site Name	General Location		Estimated Volume of Beach Compatible Sand (cy)
	Easting (ft, NAD83)	Northing (ft, NAD83)	
AL/FL State Line Site	1,961,500	96,500	400,000 to 500,000
Borrow Site #1 Expansion	1,956,500	92,000	< 2,000,000
Perdido Pass Ebb Shoal	1,948,500	97,000	1,000,000
Borrow Site #2	1,926,500	86,500	300,000 to 1,000,000 (expansion)
BC02-93 Site	1,938,500	83,250	400,000 to 500,000
Borrow Site #3	1,915,000	84,500	900,000
Borrow Site #4	1,852,000	74,500	1,100,000 to 2,000,000 (expansion)
Baldwin Shoal (Federal Waters)	1,830,000	50,000	Further investigation required
Dixie Bar Entrance to Mobile Bay	1,797,000	65,000	Further investigation required
Perdido Pass Channel Maintenance			200,000 to 300,000 cy/yr (estimated average)

- The ebb shoal at Perdido Pass was investigated with additional Vibracores. While the total volume of the ebb shoal is roughly three million cubic yards or more, only approximately 1.0 million cubic yards is likely to be suitable for beach placement. Excavation of any portion of the ebb shoal would require additional Vibracoring and detailed coastal engineering analyses of the potential effects to the remaining shoal and the adjacent shorelines. As indicted in Table 5.1, additional sand will periodically become available from the maintenance of the recreational navigation channel at Perdido Pass (discussed below). It is possible that some of the excavated channel maintenance material could be pumped back into any excavated portion of the ebb shoal to eliminate any potential impacts caused by the void.

- Two smaller sites were identified as potential Borrow Sites. The first site lies along the AL/FL State Line, in Alabama State Waters. The site may contain 0.4 to 0.5 million cubic yards of sand. The second site lies to the south-southeast of Borrow Site #2, offshore of the Romar Beach area in Orange Beach. It too may contain 0.4 to 0.5 million cubic yards. These two sites would both require

additional targeted Vibracoring and seismic sub-bottom profiling in order to successfully excavate the beach compatible material. These sites are much smaller than those excavated previously, and would represent a different approach to beach fill construction, utilizing more borrow sites and submerged pipeline assemblies than in previous contracts.

- Upon Baldwin Shoal, west of Gulf Shores, the previously developed and permitted Borrow Site #4 remains unexcavated. The sediments in this site, along with a greater volume of sand in the vicinity, are slightly finer and slightly darker than the native beach sand characteristics. These facts may be weighed against future sediment needs along the Baldwin County shoreline. Inspection of a limited number of Vibracore samples in Federal Waters along Baldwin Shoal indicate a possible zone of improved sediment characteristics roughly five to six miles offshore along the shoal, approximately 10 miles from the western end of Gulf Shores.

- At the entrance to Mobile Bay, the ebb shoal east of the entrance channel, called Dixie Bar, was sampled. These Vibracores revealed beach compatible sands along the crest of the shoal, parallel to the channel. Away from the crest, to the east, sediment color and grain size degrade quickly. Further investigation would be required to develop a borrow site at this location. It is opined that the site would ultimately resemble a channel widener to the established navigation channel, seeking to excavate only the highest quality sediments. Given the lengthy nautical history of the entrance, detailed magnetometer and sidescan surveys would be required to address potential marine archaeological/cultural resource issues and potential obstructions.

- With limited exception, the conclusions reached by Hummell (1999) for sediments in Federal Waters just offshore of the 3-mile limit *could not be replicated during this study*. Based on a *very* limited number of Vibracores, Hummell (1999) suggests that there may be hundreds of millions of cubic yards of beach compatible sand available for nourishment purposes in the "Surficial Sand Sheet" in three identified resource areas in Federal Waters. Closer inspection of the older Vibracore logs used to reach that conclusion indicate that much of the material in the upper lenses of the Hummel and Parker Vibracores, while perhaps SP materials, would in fact *not* be suitable for direct beach

placement, due to a combination of factors including color, silt content, shell content, presence of shallow clay layers, etc. This was re-verified by recent Vibracores. In some instances, very small pockets of beach-compatible material (following the general guidelines established herein) could possibly be identified with highly-targeted field investigation. With the possible exception of the western portion of Resource Area #3, it is opined that the reserve estimate of beach compatible sand from these three resource areas would be measured in the hundreds of thousands of cubic yards (as opposed to hundreds of millions).

- Offshore of Florida State Waters (beyond the 9-mile limit) lies the western terminus of North Perdido Shoals. Based upon limited Vibracore data collected near this portion of the Shoals, a potentially large volume of beach-compatible sand is believed to exist (on the order of 60 to 70 million cubic yards or more). This shoal feature lies a minimum of 15 miles from Perdido Pass, and falls within the limits of an artificial reef site permitted by the State of Florida, the U.S. Army Corps of Engineers, and Escambia County, FL. The shoal feature effectively terminates at the extended AL/FL State Line, and Vibracores collected just west of the feature reveal only traces of it.

5.2 Recommendations

Taken as a whole, it is apparent from inspection of all the data that there is only a finite volume of truly "beach-compatible" sand that exists within reasonable retrieval distances offshore of Baldwin County, AL. This is particularly true for the shoreline at Gulf Shores, AL. This situation highlights the need to conserve sand at every opportunity. Based upon this fact and the available data described herein, the following recommendations are offered.

- **Proceed with permitting tasks for the expansion of Borrow Sites #1, #2, and #3 for future use -** It is opined that sufficient geotechnical data exist to accomplish this task. It is expected that these sites will be the principal option, if not the only option, for renourishment in the short-term (such as after a major storm event). Complete excavation of the existing sites and the identified expansion areas may yield over 3.0 million cubic yards of sand, primarily from the expansion of Borrow Site #1. Tasks would include the creation of composite sediment distributions for each area and corresponding overfill ratios and the

investigation of each area for potential cultural resources or obstructions. Advance preparation of these data along with a renourishment plan would expedite the fast-track permitting of a post-storm recovery plan.

- **Develop a sediment management plan for Perdido Pass** - The lack of significant long-term sand sources highlights the critical importance of proper sediment budget practices at Perdido Pass. This tidal entrance, along with Lagoon Pass, represents a substantial sink of sediment from the littoral system. Douglass (2001) discusses the fate of material dredged from Perdido Pass since its stabilization in 1968-69. Douglass estimates the total volume dredged to be on the order of six million cubic yards. Douglass further estimates that as much as eight million cubic yards of sand has been removed from the longshore littoral system by the creation of the stabilized tidal entrance. This value represents the sum effect of dredging disposal out of the littoral system, trapping of sand against both jetties at the inlet, and the formation of the ebb tidal shoal Gulfward of the jetties.

  While some sand has recently been more effectively bypassed around Perdido Pass, sand is still placed in areas where it is effectively lost from the littoral system -- in the upland, in areas immediately east and west of the entrance where its return to the channel is rapid, and in nearshore areas that are in fact too far seaward to promote the rapid infusion of the disposal sand back into the littoral system. Additionally, some areas that require attention in the interior of the inlet system lie outside the limits of the Federal project. The sediment management plan would address the proper disposal of all dredged material from all portions of the system, would investigate any possible structural changes in the inlet, and would provide a vehicle for the City of Orange Beach to participate with the U.S. Army Corps of Engineers and the State of Alabama (the Owners of the water bottoms in the inlet) in improving the inlet and the bypassing of sand to the adjacent beaches.

- **Complete Acquisition of Beach Construction Easements West of Perdido Pass –** In conjunction with the development of a sediment management plan at Perdido Pass, any remaining outstanding beach construction easements near Perdido Pass should be acquired by the City of Orange Beach. Work is well underway in this regard.

- **Plan a Phase II Vibracore Collection** – A second phase of data collection would have the specific objectives of A) developing the two smaller sites at the AL/FL State Line and the BC02-93 site southeast of Borrow Site #2, B) developing the outer, western flank of Perdido Pass as a borrow site (pending additional research), C) investigating in greater detail the portion of Baldwin Shoal near BC06-44 and BC06-46 to determine if a viable site exists in that region, and D) collecting additional data along the boundary of the navigation entrance to Mobile Bay for purposes of developing a channel-widener/borrow site. This task is considered secondary to the first three recommendations, and may be most prudent when a Vibracore research vessel is available in the area.

- **Investigate the Western Terminus of North Perdido Shoals** – As described herein, North Perdido Shoals represents a potentially massive volume of beach-compatible sands. This opinion has not been directly verified by field data, due to concerns expressed by parties in the State of Florida. It is suggested that additional discussions be held with personnel at the State of Florida Department of Environmental Protection and Escambia County, FL, to address the potential multiple uses of the shoal area, which is presently permitted for artificial reefs. It is opined that the two uses can successfully coexist in the area, which covers thousands of acres of the seabed in Federal Waters. It is further opined that the two uses may actually be mutually beneficial in that post-excavation sites can be developed with artificial reef platforms, gaining the benefit of the artificially created change in relief associated with borrow areas.

6.0 REFERENCES

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Data report provided on CD-ROM (attached).

APPENDIX A 2006 VIBRACORE LOGS

The following Vibracore logs were prepared by Scientific Environmental Applications, Inc., of Melbourne, FL. The sediment Vibracores were collected by Alpine Ocean Seismic Survey, Inc., of Norwood, NJ.

Boring Designation BC06-01

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-01 — LOCATION COORDINATES: X = 1,961,736 Y = 40,252
3. DRILLING AGENCY: Olsen Associates, Inc — CONTRACTOR FILE NO.:
4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG. FROM VERTICAL: — BEARING:
6. THICKNESS OF OVERBURDEN: 0.0 Ft.
7. DEPTH DRILLED INTO ROCK: 0.0 Ft.
8. TOTAL DEPTH OF BORING: 19.5 Ft.
9. SIZE AND TYPE OF BIT: 4.0 In.
10. COORDINATE SYSTEM/DATUM: State Plane AL — HORIZONTAL: NAD 1983 — VERTICAL: NAVD 88
11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic — ☐ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES — DISTURBED: — UNDISTURBED (UD):
13. TOTAL NUMBER CORE BOXES: 2
14. ELEVATION GROUND WATER:
15. DATE BORING — STARTED: 05-01-06 — COMPLETED: 05-01-06
16. ELEVATION TOP OF BORING: -81.7 Ft.
17. TOTAL RECOVERY FOR BORING: 19.5 Ft.
18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-81.7	0.0					
			Gray medium to fine sand composed of shell fragments, abundant whole shells and shell fragments in fine to coarse gravel range, some gray silt, light gray (10YR-7/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-84.4	2.7				Comp	Sample #Comp, Depth = 2.6' Comp (0-2.6')
			Gray to brownish gray silty sand, (10YR-6.5/2), (SM).			
-86.5	4.8					
			Gray silt, some gray clay, (10YR-6.5/1), (ML).			
-90.1	8.4					
			Gray clay, light gray (10YR-7/1), (CL).			
-99.8	18.1					
			Gray silt, some quartz sand, (10YR-6.5/1), (ML).			
-101.2	19.5					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-02

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-02 — LOCATION COORDINATES: X = 1,960,188 Y = 6,039
3. DRILLING AGENCY: Olsen Associates, Inc — CONTRACTOR FILE NO.:
4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG. FROM VERTICAL: — BEARING:
6. THICKNESS OF OVERBURDEN: 0.0 Ft.
7. DEPTH DRILLED INTO ROCK: 0.0 Ft.
8. TOTAL DEPTH OF BORING: 20.4 Ft.
9. SIZE AND TYPE OF BIT: 4.0 In.
10. COORDINATE SYSTEM/DATUM: State Plane AL — HORIZONTAL: NAD 1983 — VERTICAL: NAVD 88
11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic — ☐ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES — DISTURBED: — UNDISTURBED (UD):
13. TOTAL NUMBER CORE BOXES: 2
14. ELEVATION GROUND WATER:
15. DATE BORING — STARTED: 05-01-06 — COMPLETED: 05-01-06
16. ELEVATION TOP OF BORING: -92.0 Ft.
17. TOTAL RECOVERY FOR BORING: 20.4 Ft.
18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	CLASSIFICATION OF MATERIALS (Depths and elevations based on measured values)	% REC.	BOX OR SAMPLE	REMARKS
-92.0	0.0				
-93.9	1.9	Gray fine quartz sand, abundant white and gray shell fragments in fine to coarse gravel range, light gray (10YR-7/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
				3.0	Sample #3.0, Depth = 3.0'
		Light gray to tannish gray fine quartz sand, some silt, abundant white to gray shell fragments in fine to coarse gravel range, light gray (10YR-7/2), (SP).		6.0	Sample #6.0, Depth = 6.0'
				9.0	Sample #9.0, Depth = 9.0'
-103.8	11.8			11.0	Sample #11.0, Depth = 11.0'
-105.1	13.1	Light gray silty fine quartz sand, scattered shell fragments in fine gravel range, light gray (10YR-7/2), (SM).		Comp	Sample #Comp, Depth = 12.0' Comp (0-12.0')
-106.2	14.2	Gray fine silty quartz sand, abundant large shell fragments in fine to coarse gravel range, light gray (10YR-7/1), (SM).			
		Gray silty fine quartz sand, scattered white shell fragments in fine to medium gravel range, (10YR-6.5/1), (SM).			
-112.4	20.4				
		End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-03

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-03
3. LOCATION COORDINATES: X = 1,958,002 Y = 91,010
4. DRILLING AGENCY: Olsen Associates, Inc
5. CONTRACTOR FILE NO.:
6. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
7. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
8. DEG. FROM VERTICAL:
9. BEARING:
10. THICKNESS OF OVERBURDEN: 0.0 Ft.
11. DEPTH DRILLED INTO ROCK: 0.0 Ft.
12. TOTAL DEPTH OF BORING: 20.2 Ft.
13. SIZE AND TYPE OF BIT: 4.0 In.
14. COORDINATE SYSTEM/DATUM: State Plane AL; HORIZONTAL: NAD 1983; VERTICAL: NAVD 88
15. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic ☐ AUTO HAMMER ☐ MANUAL HAMMER
16. TOTAL SAMPLES: DISTURBED: UNDISTURBED (UD):
17. TOTAL NUMBER CORE BOXES: 2
18. ELEVATION GROUND WATER:
19. DATE BORING: STARTED 05-01-06 COMPLETED 05-01-06
20. ELEVATION TOP OF BORING: -30.9 Ft.
21. TOTAL RECOVERY FOR BORING: 20.2 Ft.
22. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-30.9	0.0					
			Light gray fine quartz sand, scattered white shell fragments in fine to medium gravel range, white (10YR-8/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-34.8	3.9					
			White fine quartz sand, scattered white to light tan shell fragments in fine to coarse gravel range, (10YR-8.5/1), (SP).		5.0	Sample #5.0, Depth = 5.0'
					10.0	Sample #10.0, Depth = 10.0'
-44.3	13.4					
			Light gray fine quartz sand, scattered white shell fragments in fine gravel range, white (10YR-8/1), (SP).		15.0	Sample #15.0, Depth = 15.0'
-49.4	18.5				18.0	Sample #18.0, Depth = 18.0'
			Tannish gray fine quartz sand, rock fragments in medium to coarse gravel range, scattered white shell fragments in fine gravel range, (10YR-7.5/2), (SP).		Comp	Sample #Comp, Depth = 20.0' Comp (0-18.0')
-51.1	20.2		End of Boring			

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-04

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-04
LOCATION COORDINATES: X = 1,958,013 Y = 93,996

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.3 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -28.6 Ft.

17. TOTAL RECOVERY FOR BORING: 20.3 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-28.6	0.0					
			Very light gray to white fine quartz sand, abundant shell fragments and whole shells in fine to coarse gravel range, white (10YR-8/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-32.4	3.8					
			White fine quartz sand, few scattered white shell fragments in fine gravel range, (10YR-8.5/1), (SP).		6.0	Sample #6.0, Depth = 6.0'
-40.6	12.0				12.0	Sample #12.0, Depth = 12.0'
-41.7	13.1		Brownish gray silty fine quartz sand, (10YR-5.5/3), (SM).			
-43.8	15.2		White fine quartz sand, trace of gray clay in collapsed burrows, (10YR-8.5/1), (SP).			
-45.1	16.5		Gray fine quartz sand, some gray silt and clay inclusions, (10YR-6.5/1), (SP).			
			White fine quartz sand, scattered inclusions of gray silt and clay in collapsed burrows, white (10YR-8/1), (SP).		18.0	Sample #18.0, Depth = 18.0'
-48.2	19.6					
-48.9	20.3		Gray clay, (10YR-6.5/1), (CL).		Comp	Sample #Comp, Depth = 20.0' Comp (0-18.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-05

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-05
LOCATION COORDINATES: X = 1,958,009 Y = 93,003

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.4 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -29.8 Ft.

17. TOTAL RECOVERY FOR BORING: 20.4 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-29.8	0.0					
-32.0	2.2		White very fine sand, abundant white to light gray shell fragments in fine to medium gravel range, (10YR-8.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-35.3	5.5		Light gray to light tannish gray fine quartz sand, some silt, scattered large shell fragments and whole shells in coarse gravel range, wood chips at 5.0-5.1 ft, (10YR-7.5/2), (SP).		4.0	Sample #4.0, Depth = 4.0'
-37.0	7.2		Light gray fine silty sand, (10YR-7.5/1), (SM).		6.0	Sample #6.0, Depth = 6.0'
-45.0	15.2		Light gray to white fine quartz sand, some silt, scattered white shell fragments in fine to medium gravel range, white (10YR-8/1), (SP).		8.0	Sample #8.0, Depth = 8.0'
					12.0	Sample #12.0, Depth = 12.0'
					15.0	Sample #15.0, Depth = 15.0'
-45.8	16.0		White fine quartz sand, (10YR-9/1), (SP).			
-50.2	20.4		Gray clay and silt, (10YR-6.5/1), (CL).		Comp 1	Sample #Comp 1, Depth = 18.0' Comp 1 (0-5.0')
					Comp 2	Sample #Comp 2, Depth = 20.0' Comp 2 (0-15.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-06

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-06
LOCATION COORDINATES: X = 1,956,503 Y = 91,509

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.3 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -33.2 Ft.

17. TOTAL RECOVERY FOR BORING: 20.3 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-33.2	0.0					
			White fine quartz sand, scattered white shell fragments and whole shells in medium to coarse gravel range, (10YR-8.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
					4.0	Sample #4.0, Depth = 4.0'
-39.4	6.2					
			Light tannish gray fine quartz sand, light gray (10YR-7/2), (SP).			
-40.9	7.7					
			Light gray fine quartz sand, white (10YR-8/1), (SP).		8.0	Sample #8.0, Depth = 8.0'
-43.3	10.1					
			Light tannish gray fine quartz sand, some silt, (10YR-7.5/2), (SP).		12.0	Sample #12.0, Depth = 12.0'
					16.0	Sample #16.0, Depth = 16.0'
-50.2	17.0					
			Gray clay and silt, gray (10YR-5/1), (CL).		Comp 1	Sample #Comp 1, Depth = 18.0' Comp 1 (0-10.0')
					Comp 2	Sample #Comp 2, Depth = 19.6' Comp 2 (0-16.0')
-53.5	20.3					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-07

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT Baldwin County, AL 2006 Phase I Sand Search Baldwin County, Alabama		9. SIZE AND TYPE OF BIT 4.0 In.	
		10. COORDINATE SYSTEM/DATUM State Plane AL	HORIZONTAL NAD 1983	VERTICAL NAVD 88
2. BORING DESIGNATION BC06-07	LOCATION COORDINATES X = 1,955,008 Y = 91,001	11. MANUFACTURER'S DESIGNATION OF DRILL Pneumatic	☐ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY Olsen Associates, Inc	CONTRACTOR FILE NO.	12. TOTAL SAMPLES	DISTURBED	UNDISTURBED (UD)
4. NAME OF DRILLER Alpine Ocean Seismic Survey Inc		13. TOTAL NUMBER CORE BOXES 2	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL BEARING	14. ELEVATION GROUND WATER	
		15. DATE BORING	STARTED 05-01-06	COMPLETED 05-01-06
6. THICKNESS OF OVERBURDEN 0.0 Ft.		16. ELEVATION TOP OF BORING -32.1 Ft.	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.		17. TOTAL RECOVERY FOR BORING 18.8 Ft.	
8. TOTAL DEPTH OF BORING 18.8 Ft.		18. SIGNATURE AND TITLE OF INSPECTOR Gary Zarillo, PG	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-32.1	0.0					
-33.2	1.1		White fine quartz sand, trace of white shell fragments, white (10YR-8/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-35.2	3.1		Light gray fine quartz sand, some white to tan shell fragments in fine to medium gravel range, trace of gray silt, (10YR-7.5/1), (SP).		5.0	Sample #5.0, Depth = 5.0'
					9.0	Sample #9.0, Depth = 9.0'
			White fine quartz sand, scattered white to light gray shell fragments in fine gravel range, scattered whole shells in coarse gravel range, scattered inclusions of gray silt in burrow linings, (10YR-8.5/1), (SP).		14.0	Sample #14.0, Depth = 14.0'
-50.9	18.8				18.0	Sample #18.0, Depth = 18.0'
			End of Boring		Comp	Sample #Comp, Depth = 18.8' Comp (0-18.0')

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 **MODIFIED FOR THE FLORIDA DEP**
JUN 02 JUN 04

Boring Designation BC06-08

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-08
LOCATION COORDINATES: X = 1,950,173 Y = -13,376

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 15.4 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -97.1 Ft.

17. TOTAL RECOVERY FOR BORING: 15.4 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-97.1	0.0					
			Gray medium sand, some coarse sand, abundant white, tan, and gray shell fragments and whole shells, (10YR-7.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-100.3	3.2				3.0	Sample #3.0, Depth = 3.0'
			Gray medium to fine quartz sand, few scattered white shell fragments in fine to medium gravel range, (10YR-7.5/1), (SP).			
-102.7	5.6					
			Gray medium sand, some coarse sand, abundant whole shells and shell fragments in fine to coarse gravel range, light gray (10YR-7/1), (SP).		6.0	Sample #6.0, Depth = 6.0'
-103.8	6.7					
			Gray medium to fine quartz sand, few scattered shell fragments in fine to medium gravel range, (10YR-7.5/1), (SP).		9.0	Sample #9.0, Depth = 9.0'
-108.2	11.1					
-108.8	11.7		Gray silty sand, some dark gray clay, gray (10YR-6/1), (SM).			
-109.7	12.6		Dark gray silt, some clay, (10YR-4.5/1), (ML).			
			Gray clay, gray (10YR-6/1), (CL).		Comp	Sample #Comp, Depth = 13.0' Comp (0-10.0')
-112.4	15.3					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-09

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-09
LOCATION COORDINATES: X = 1,949,999 Y = 95,988

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 15.3 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -21.3 Ft.

17. TOTAL RECOVERY FOR BORING: 15.3 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-21.3	0.0					
-23.1	1.8		Very light tan fine quartz sand, trace of white and gray shell fragments in fine gravel range, (10YR-8.5/2), (SP).		1.0	Sample #1.0, Depth = 1.0'
-25.7	4.4		Light gray fine quartz sand, scattered inclusions of gray silt and clay, trace of white and gray shell fragments in fine gravel range, (10YR-8.5/1), (SP).		3.0	Sample #3.0, Depth = 3.0'
-26.1	4.8		Gray silt and clay, gray (10YR-5/1), (ML).			
-26.7	5.4		Tannish gray silty fine quartz sand, light brownish gray (10YR-6/2), (SM).		6.0	Sample #6.0, Depth = 6.0'
-36.7	15.4		Tannish gray silty fine quartz sand, (10YR-6.5/2), (SM).		Comp 1	Sample #Comp 1, Depth = 10.0' Comp 1 (0-4.0')
					Comp 2	Sample #Comp 2, Depth = 14.0' Comp 2 (0-7.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-10

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-10
LOCATION COORDINATES: X = 1,948,906 Y = 95,965

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 15.9 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -27.9 Ft.

17. TOTAL RECOVERY FOR BORING: 15.9 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-27.9	0.0					
-29.2	1.3		Light grayish tan medium to fine quartz sand, some tan and white shell fragments in fine to medium gravel range, very pale brown (10YR-8/2), (SP).		1.0	Sample #1.0, Depth = 1.0'
-30.1	2.2		Gray medium to fine quartz sand, some gray silt, some white and gray shell fragments in fine to coarse gravel range, light gray (10YR-7/1), (SP).			
-31.8	3.9				3.0	Sample #3.0, Depth = 3.0'
-32.6	4.7		Gray medium to fine quartz sand, abundant white and tan shell fragments and whole shells in fine to coarse gravel range, (10YR-7.5/1), (SP).			
-34.5	6.6		Gray medium to fine quartz sand, scattered shell fragments in fine to medium gravel range, (10YR-7.5/1), (SP).		6.0	Sample #6.0, Depth = 6.0'
-35.4	7.5		Near white medium to fine quartz sand, trace of white shell fragments in fine gravel range, (10YR-9/1), (SP).			
			Light gray fine quartz sand, inclusions of gray silt and clay, (10YR-8.5/1), (SP).			
-38.9	11.0		Gray silty fine quartz sand, some clay, abundant white to tan shell fragments and whole shells in fine to coarse gravel range, gray (10YR-6/1), (SM).		Comp	Sample #Comp, Depth = 10.0' Comp (0-6.0')
-43.8	15.9		Dark gray clay and silt, scattered white shell fragments in fine to medium gravel range, dark gray (10YR-4/1), (CL).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-11

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-11
LOCATION COORDINATES: X = 1,957,838 Y = 91,962

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.4 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -33.3 Ft.

17. TOTAL RECOVERY FOR BORING: 20.4 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-33.3	0.0					
			White fine quartz sand, scattered tan shell fragments in fine to medium gravel range, (10YR-9/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-36.3	3.0					
					4.0	Sample #4.0, Depth = 4.0'
			White fine quartz sand, trace of tan silt, (10YR-9/1), (SP).		8.0	Sample #8.0, Depth = 8.0'
					12.0	Sample #12.0, Depth = 12.0'
-46.0	12.7					
			Tan to tannish gray silty sand, white shell fragments in fine to medium gravel range, light gray (10YR-7/2), (SM).			
-47.4	14.1					
			Gray silt, white shell fragments, light gray (10YR-7/1), (ML).			
-49.2	15.9				Comp	Sample #Comp, Depth = 16.0' Comp (0-12.0')
			Gray clay and silt, light gray (10YR-7/1), (CL).			
-51.6	18.3					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-12

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-12
LOCATION COORDINATES: X = 1,948,518 Y = 96,995

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 18.9 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -11.1 Ft.

17. TOTAL RECOVERY FOR BORING: 18.9 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-11.1	0.0					
			White fine quartz sand, scattered white to dark gray shell fragments in fine gravel range, (10YR-9/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
					4.0	Sample #4.0, Depth = 4.0'
-17.9	6.8					
-18.7	7.6		White fine quartz sand, tan to white shell fragments in fine to coarse gravel range, (10YR-8.5/1), (SP).			
			White fine quartz sand, some tan silt, (10YR-8.5/1), (SP).		8.0	Sample #8.0, Depth = 8.0'
-21.5	10.4					
			Very light tannish gray fine quartz sand, trace of tan silt and shell fragments in fine gravel range, white (10YR-8/1), (SP).		12.0	Sample #12.0, Depth = 12.0'
-24.2	13.1					
-24.4	13.3		Gray silt and clay, gray (10YR-6/1), (CL).			
-25.7	14.6		White fine quartz sand, black decayed organic matter, (10YR-8.5/1), (SP).			
			Gray silty fine sand, gray (10YR-6/1), (SM).		Comp	Sample #Comp, Depth = 16.0' Comp (0-12.0')
-30.0	18.9					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-13

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-13
LOCATION COORDINATES: X = 1,947,932 Y = 42,153

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 17.8 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -74.3 Ft.

17. TOTAL RECOVERY FOR BORING: 17.8 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-74.3	0.0					
			Light gray fine quartz sand, some gray to dark gray shell fragments and whole shells in fine to medium gravel range, (10YR-7.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-77.2	2.9				Comp	Sample #Comp, Depth = 3.0' Comp (0-2.5')
			Tannish gray clay and silt, light gray (10YR-7/2), (CL).			
-92.1	17.8					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-14

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-14 — LOCATION COORDINATES: X = 1,947,633 Y = 97,573
3. DRILLING AGENCY: Olsen Associates, Inc — CONTRACTOR FILE NO.:
4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG. FROM VERTICAL: — BEARING:
6. THICKNESS OF OVERBURDEN: 0.0 Ft.
7. DEPTH DRILLED INTO ROCK: 0.0 Ft.
8. TOTAL DEPTH OF BORING: 20.2 Ft.
9. SIZE AND TYPE OF BIT: 4.0 In.
10. COORDINATE SYSTEM/DATUM: State Plane AL — HORIZONTAL: NAD 1983 — VERTICAL: NAVD 88
11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic — ☐ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES — DISTURBED: — UNDISTURBED (UD):
13. TOTAL NUMBER CORE BOXES: 2
14. ELEVATION GROUND WATER:
15. DATE BORING — STARTED: 05-01-06 — COMPLETED: 05-01-06
16. ELEVATION TOP OF BORING: -10.3 Ft.
17. TOTAL RECOVERY FOR BORING: 20.2 Ft.
18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-10.3	0.0					
			White fine quartz sand, trace of white shell fragments in fine gravel range, few scattered inclusions of gray clay in collapsed burrows, (10YR-8.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
					6.0	Sample #6.0, Depth = 6.0'
					12.0	Sample #12.0, Depth = 12.0'
-23.6	13.3					
			Light gray fine quartz sand, scattered inclusions of gray clay in burrow linings and collapsed burrows, (10YR-7.5/1), (SP).		17.0	Sample #17.0, Depth = 17.0'
-28.4	18.1				Comp 1	Sample #Comp 1, Depth = 18.5' Comp 1 (0-12.0')
			Brownish gray silty quartz sand, (10YR-6.5/2), (SM).		Comp 2	Sample #Comp 2, Depth = 20.0' Comp 2 (0-17.0')
-30.6	20.3					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-15

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-15
LOCATION COORDINATES: X = 1,947,502 Y = 95,986

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 17.4 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -27.2 Ft.

17. TOTAL RECOVERY FOR BORING: 17.4 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-27.2	0.0					
-28.3	1.1		Light tan to white fine quartz sand, abundant whole shells and shell fragments in fine to coarse gravel range, (10YR-8.5/2), (SP).		0.5	Sample #0.5, Depth = 0.5'
-29.5	2.3		Gray silt, some fine quartz sand, light gray (10YR-7/1), (SM).			
-30.1	2.9		Large whole shells and shell fragments in fine to coarse gravel range, matrix of fine sand and silt, light gray (10YR-7/1), (GW).			
-31.0	3.8		Light tannish gray fine quartz sand, abundant echinoid fragments and mollusk fragments in fine to coarse gravel range, light gray (10YR-7/2), (SP).			
-35.3	8.1		Gray silt, some fine quartz sand, scattered white shell fragments in fine gravel range, (10YR-6.5/1), (ML).			
-40.5	13.3		Gray silt, abundant shell fragments and whole shells in fine to coarse gravel range, (10YR-6.5/1), (ML).			
-44.6	17.4		Gray clay and white shell fragments, (10YR-6.5/1), (CL).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-16

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-16
LOCATION COORDINATES: X = 1,946,501 Y = 92,010

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 17.9 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -29.2 Ft.

17. TOTAL RECOVERY FOR BORING: 17.9 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-29.2	0.0					
			White fine quartz sand, scattered gray and white shell fragments in fine to medium gravel range, polychaete worm tubes, (10YR-8.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-32.3	3.1				3.0	Sample #3.0, Depth = 3.0'
			Tan to tannish gray fine quartz sand, some silt, (10YR-7.5/2), (SP).			
-35.6	6.4				6.0	Sample #6.0, Depth = 6.0'
-36.5	7.3		Tan silty fine quartz sand, (10YR-6.5/2), (SM).			
			Tannish gray silt, some sand, abundant white and tan shell fragments in fine to coarse gravel range, light brownish gray (10YR-6/2), (ML).			
-39.5	10.3				Comp	Sample #Comp, Depth = 10.0' Comp (0-6.0')
			Gray clay, abundant white shell fragments in fine to medium gravel range, gray (10YR-5/1), (CL).			
-44.4	15.2					
			Gray silt, some fine quartz sand, abundant white and light gray shell fragments in fine to coarse gravel range, gray (10YR-5/1), (ML).			
-47.1	17.9					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-17

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-17
LOCATION COORDINATES: X = 1,943,586 Y = 69,600

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 18.4 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED
UNDISTURBED (UD)

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -48.0 Ft.

17. TOTAL RECOVERY FOR BORING: 18.4 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-48.0	0.0					
-48.5	0.5		Gray clay, gray (10YR-5/1), (CL).			
-52.8	4.8		Gray silt, some sand, (10YR-5.5/1), (ML).			
-55.1	7.1		Gray clay, (10YR-5.5/1), (CL).			
-57.8	9.8		Gray silt, some sand, (10YR-5.5/1), (ML).			
-64.6	16.6		Gray clay, some silt, (10YR-5.5/1), (CL).			
-66.4	18.4		Gray silt and clay, (10YR-5.5/1), (ML).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-18

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-18
3. DRILLING AGENCY: Olsen Associates, Inc
4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
6. THICKNESS OF OVERBURDEN: 0.0 Ft.
7. DEPTH DRILLED INTO ROCK: 0.0 Ft.
8. TOTAL DEPTH OF BORING: 20.3 Ft.

LOCATION COORDINATES: X = 1,938,493 Y = -5,609

CONTRACTOR FILE NO.:

DEG. FROM VERTICAL:

BEARING:

9. SIZE AND TYPE OF BIT: 4.0 In.
10. COORDINATE SYSTEM/DATUM: State Plane AL; HORIZONTAL: NAD 1983; VERTICAL: NAVD 88
11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic ☐ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES: DISTURBED: UNDISTURBED (UD):
13. TOTAL NUMBER CORE BOXES: 2
14. ELEVATION GROUND WATER:
15. DATE BORING: STARTED 05-01-06; COMPLETED 05-01-06
16. ELEVATION TOP OF BORING: -94.3 Ft.
17. TOTAL RECOVERY FOR BORING: 20.3 Ft.
18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-94.3	0.0					
			Gray fine sand, some silt, scattered shell fragments in fine to medium gravel range, gray (10YR-6/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
					3.0	Sample #3.0, Depth = 3.0'
-98.1	3.8					
			Tannish gray silty fine sand, scattered tan echinoid fragments in fine to coarse gravel range, light brownish gray (10YR-6/2), (SM).			
-99.9	5.6					
			Gray to tannish gray silt, light brownish gray (10YR-6/2), (ML).		Comp	Sample #Comp, Depth = 6.0' Comp (0-4.0')
-104.0	9.7					
			Gray silty sand, abundant white shell fragments in fine to medium gravel range, gray (10YR-6/1), (SM).			
-114.6	20.3					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-19

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-19
3. LOCATION COORDINATES: X = 1,938,240 Y = 22,599
4. DRILLING AGENCY: Olsen Associates, Inc
5. CONTRACTOR FILE NO.:
6. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
7. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED; DEG. FROM VERTICAL; BEARING
8. THICKNESS OF OVERBURDEN: 0.0 Ft.
9. DEPTH DRILLED INTO ROCK: 0.0 Ft.
10. TOTAL DEPTH OF BORING: 15.2 Ft.
11. SIZE AND TYPE OF BIT: 4.0 In.
12. COORDINATE SYSTEM/DATUM: State Plane AL; HORIZONTAL: NAD 1983; VERTICAL: NAVD 88
13. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic ☐ AUTO HAMMER ☐ MANUAL HAMMER
14. TOTAL SAMPLES: DISTURBED: UNDISTURBED (UD):
15. TOTAL NUMBER CORE BOXES: 2
16. ELEVATION GROUND WATER:
17. DATE BORING: STARTED 05-01-06 COMPLETED 05-01-06
18. ELEVATION TOP OF BORING: -77.8 Ft.
19. TOTAL RECOVERY FOR BORING: 15.2 Ft.
20. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-77.8	0.0					
			Gray medium quartz sand, abundant gray, tan, and white shell fragments in fine to coarse gravel range, (10YR-6.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-81.6	3.8					
-82.0	4.2		Large whole shells and shell fragments in fine to coarse gravel range, matrix of gray medium to fine sand, (10YR-6.5/1), (GW).		4.0	Sample #4.0, Depth = 4.0'
			Gray medium to fine quartz sand, scattered tan, white, and gray shell fragments in fine to medium gravel range, light gray (10YR-7/1), (SP).			
-86.2	8.4				8.0	Sample #8.0, Depth = 8.0'
			Gray fine quartz sand, (10YR-7.5/1), (SP).			
-89.1	11.3					
			Tannish gray fine quartz sand, some silt, trace of gray clay, light gray (10YR-7/2), (SP).		12.0	Sample #12.0, Depth = 12.0'
-90.7	12.9					
-91.5	13.7		Brownish gray silty fine quartz sand, abundant whole shells and shell fragments in medium to coarse gravel range, (10YR-6.5/2), (SM).		Comp 1	Sample #Comp 1, Depth = 13.5' Comp 1 (0-8.0')
-93.0	15.2		Gray clay and silt, light gray (10YR-7/1), (CL).		Comp 2	Sample #Comp 2, Depth = 15.0' Comp 2 (0-12.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-20

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-20
LOCATION COORDINATES: X = 1,937,523 Y = 83,248

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.3 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -31.0 Ft.

17. TOTAL RECOVERY FOR BORING: 20.3 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-31.0	0.0					
			White to light gray fine quartz sand, some silt, scattered white, gray, and tan shell fragments in medium to coarse gravel range, (10YR-8.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
					3.0	Sample #3.0, Depth = 3.0'
					6.0	Sample #6.0, Depth = 6.0'
-37.8	6.8					
			Light gray fine quartz sand, some silt, white (10YR-8/1), (SP).		9.0	Sample #9.0, Depth = 9.0'
					10.0	Sample #10.0, Depth = 10.0'
-42.5	11.5					
			Light gray silty fine quartz sand, few scattered shell fragments in fine gravel range, (10YR-7.5/1), (SM).		Comp 1	Sample #Comp 1, Depth = 14.0' Comp 1 (0-7.0')
-45.9	14.9					
			Light gray to tannish gray fine quartz sand, some white, gray, and tan shell fragments and whole shells in fine to coarse gravel range, light gray (10YR-7/1), (SP).		Comp 2	Sample #Comp 2, Depth = 18.0' Comp 2 (0-11.0')
-51.3	20.3					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-21

DRILLING LOG

DIVISION		**INSTALLATION**	**SHEET 1 OF 1 SHEETS**

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION BC06-21
LOCATION COORDINATES X = 1,937,520 Y = 82,268

3. DRILLING AGENCY Olsen Associates, Inc
CONTRACTOR FILE NO.

4. NAME OF DRILLER
Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL
BEARING

6. THICKNESS OF OVERBURDEN 0.0 Ft.

7. DEPTH DRILLED INTO ROCK 0.0 Ft.

8. TOTAL DEPTH OF BORING 20.3 Ft.

9. SIZE AND TYPE OF BIT 4.0 In.

10. COORDINATE SYSTEM/DATUM State Plane AL
HORIZONTAL NAD 1983
VERTICAL NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED
UNDISTURBED (UD)

13. TOTAL NUMBER CORE BOXES 2

14. ELEVATION GROUND WATER

15. DATE BORING
STARTED 05-01-06
COMPLETED 05-01-06

16. ELEVATION TOP OF BORING -33.6 Ft.

17. TOTAL RECOVERY FOR BORING 20.3 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR
Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-33.6	0.0					
			Light gray fine quartz sand, scattered white to light gray shell fragments in medium gravel range, white (10YR-8/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-36.4	2.8					
			Gray to brownish gray fine quartz sand, scattered large shell fragments in medium to coarse gravel range, light gray (10YR-7/2), (SP).		5.0	Sample #5.0, Depth = 5.0'
-42.0	8.4					
-42.5	8.9		Gray fine sand, some silt, layer of large shell fragments and whole shells in coarse gravel range, light brownish gray (10YR-6/2), (SW).		10.0	Sample #10.0, Depth = 10.0'
			White fine quartz sand, scattered inclusions of black decayed organic matter, (10YR-8.5/1), (SP).		15.0	Sample #15.0, Depth = 15.0'
-49.2	15.6					
			Tannish gray fine quartz sand, light gray (10YR-7/2), (SP).			
-50.8	17.2					
			White fine quartz sand, inclusions of tan to gray silt and black organic matter, (10YR-8.5/1), (SP).		18.0	Sample #18.0, Depth = 18.0'
					Comp 1	Sample #Comp 1, Depth = 19.0' Comp 1 (0-10.0')
-53.5	19.9					
-53.9	20.3		Tannish gray fine quartz sand, abundant black organic matter, some tan to gray silt, light gray (10YR-7/2), (SP).		Comp 2	Sample #Comp 2, Depth = 20.0' Comp 2 (0-18.0')
			End of Boring			

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 **MODIFIED FOR THE FLORIDA DEP**
JUN 02 **JUN 04**

Boring Designation BC06-22

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search Baldwin County, Alabama		9. SIZE AND TYPE OF BIT: 4.0 In.	
		10. COORDINATE SYSTEM/DATUM: State Plane AL	HORIZONTAL: NAD 1983 / VERTICAL: NAVD 88
2. BORING DESIGNATION: BC06-22	LOCATION COORDINATES: X = 1,933,057 Y = 20,871	11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic	☐ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY: Olsen Associates, Inc	CONTRACTOR FILE NO.	12. TOTAL SAMPLES	DISTURBED / UNDISTURBED (UD)
4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc		13. TOTAL NUMBER CORE BOXES: 2	
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL / BEARING	14. ELEVATION GROUND WATER	
		15. DATE BORING	STARTED: 05-01-06 / COMPLETED: 05-01-06
6. THICKNESS OF OVERBURDEN: 0.0 Ft.		16. ELEVATION TOP OF BORING: -77.2 Ft.	
7. DEPTH DRILLED INTO ROCK: 0.0 Ft.		17. TOTAL RECOVERY FOR BORING: 20.3 Ft.	
8. TOTAL DEPTH OF BORING: 20.3 Ft.		18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-77.2	0.0					
			Gray fine quartz sand, some medium carbonate sand composed of shell fragments, (10YR-6.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-82.6	5.4				5.0	Sample #5.0, Depth = 5.0'
			Gray fine quartz sand, some carbonate sand in medium size range, scattered whole shells and shell fragments in fine to coarse gravel range, (10YR-7.5/1), (SP).		10.0	Sample #10.0, Depth = 10.0'
					15.0	Sample #15.0, Depth = 15.0'
-93.3	16.1					
			Light gray fine quartz sand, inclusions of gray silt in thin layers and collapsed burrows, (10YR-7.5/1), (SP).		18.0	Sample #18.0, Depth = 18.0'
-95.6	18.4					
			Gray fine quartz sand, some silt, very abundant white to tan shell fragments in fine to coarse gravel range, (10YR-7.5/1), (SW).		Comp	Sample #Comp, Depth = 20.0' Comp (0-18.0')
-97.5	20.3					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-23

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-23
3. LOCATION COORDINATES: X = 1,925,375 Y = 72,594
4. DRILLING AGENCY: Olsen Associates, Inc
5. CONTRACTOR FILE NO.:
6. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
7. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
8. DEG. FROM VERTICAL:
9. BEARING:
10. THICKNESS OF OVERBURDEN: 0.0 Ft.
11. DEPTH DRILLED INTO ROCK: 0.0 Ft.
12. TOTAL DEPTH OF BORING: 18.7 Ft.
13. SIZE AND TYPE OF BIT: 4.0 In.
14. COORDINATE SYSTEM/DATUM: State Plane AL; HORIZONTAL: NAD 1983; VERTICAL: NAVD 88
15. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic ☐ AUTO HAMMER ☐ MANUAL HAMMER
16. TOTAL SAMPLES: DISTURBED: UNDISTURBED (UD):
17. TOTAL NUMBER CORE BOXES: 2
18. ELEVATION GROUND WATER:
19. DATE BORING: STARTED 05-01-06 COMPLETED 05-01-06
20. ELEVATION TOP OF BORING: -35.0 Ft.
21. TOTAL RECOVERY FOR BORING: 18.7 Ft.
22. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-35.0	0.0					
-36.1	1.1		White fine quartz sand, very abundant whole shells and shell fragments in fine to coarse gravel range, (10YR-8.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-37.5	2.5		Light gray to tannish gray very fine quartz sand, abundant white, tan, and gray shell fragments and whole shells in fine to coarse gravel range, white (10YR-8/1), (SP).		4.0	Sample #4.0, Depth = 4.0'
			White fine quartz sand, trace of white shell fragments in medium to fine gravel range, (10YR-8.5/1), (SP).		7.0	Sample #7.0, Depth = 7.0'
					10.0	Sample #10.0, Depth = 10.0'
-46.9	11.9		Gray silt, abundant white shell fragments and whole shells in fine to coarse gravel range, (10YR-6.5/1), (ML).		Comp	Sample #Comp, Depth = 16.0' Comp (0-10.0')
-52.3	17.3		Gray silt and some clay, (10YR-6.5/1), (ML).			
-53.7	18.7		End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-24

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-24
LOCATION COORDINATES: X = 1,921,639 Y = 1,163

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.2 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -89.1 Ft.

17. TOTAL RECOVERY FOR BORING: 20.2 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-89.1	0.0					
			Gray fine quartz sand, some inclusions of gray silt and clay, light gray (10YR-7/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-93.8	4.7				4.0	Sample #4.0, Depth = 4.0'
			Gray fine quartz sand, scattered inclusions of gray clay in collapsed burrows, light gray (10YR-7/1), (SP).		9.0	Sample #9.0, Depth = 9.0'
-98.9	9.8					
-99.7	10.6		Gray fine quartz sand, gray clay inclusions, some large whole shells and shell fragments in medium to coarse gravel range, (10YR-6.5/1), (SM).			
-101.2	12.1		Tan to brown fine quartz sand, some silt, pale brown (10YR-6/3), (SP).			
			Brown to grayish brown silty quartz sand, layers of whole shells in coarse gravel range, pale brown (10YR-6/3), (SM).		Comp	Sample #Comp, Depth = 16.0' Comp (0-9.0')
-105.3	16.2					
-107.1	18.0		Tannish gray fine quartz sand, inclusions of gray clay, (10YR-7.5/1), (SP).			
-108.6	19.5		Tannish gray silty fine quartz sand, (10YR-6.5/3), (SM).			
-109.3	20.2		Gray fine quartz sand, (10YR-7.5/1), (SP).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-25

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-25
LOCATION COORDINATES: X = 1,919,292 Y = 58,099

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 14.9 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -48.6 Ft.

17. TOTAL RECOVERY FOR BORING: 14.9 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-48.6	0.0					
			Gray fine quartz sand, trace of white and gray shell fragments in fine gravel range, (10YR-7.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-51.8	3.2					
			Dark brown fine quartz sand, stained white decayed organic matter, some silt, dark brown (10YR-3/3), (SP).		4.0	Sample #4.0, Depth = 4.0'
-54.8	6.2					
			Gray fine quartz sand, some tan to brown silt, light gray (10YR-7/1), (SP).		8.0	Sample #8.0, Depth = 8.0'
-60.5	11.9					
-60.7	12.1		Dark gray silt and clay, (10YR-4.5/1), (CL).		12.0	Sample #12.0, Depth = 12.0'
			Gray fine quartz sand, some silt, clay inclusions, light gray (10YR-7/1), (SM).		Comp 1	Sample #Comp 1, Depth = 13.5' Comp 1 (0-3.0')
-63.5	14.9				Comp 2	Sample #Comp 2, Depth = 14.9' Comp 2 (0-13.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-26

DRILLING LOG

DIVISION		**INSTALLATION**	**SHEET 1 OF 1 SHEETS**

1. PROJECT Baldwin County, AL 2006 Phase I Sand Search Baldwin County, Alabama		**9. SIZE AND TYPE OF BIT** 4.0 In.	
		10. COORDINATE SYSTEM/DATUM State Plane AL	**HORIZONTAL** NAD 1983 / **VERTICAL** NAVD 88
2. BORING DESIGNATION BC06-26	**LOCATION COORDINATES** X = 1,915,235 Y = 71,847	**11. MANUFACTURER'S DESIGNATION OF DRILL** Pneumatic	☐ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY Olsen Associates, Inc	**CONTRACTOR FILE NO.**	**12. TOTAL SAMPLES**	**DISTURBED** / **UNDISTURBED (UD)**
4. NAME OF DRILLER Alpine Ocean Seismic Survey Inc		**13. TOTAL NUMBER CORE BOXES** 2	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED	**DEG. FROM VERTICAL** / **BEARING**	**14. ELEVATION GROUND WATER**	
		15. DATE BORING	**STARTED** 05-01-06 / **COMPLETED** 05-01-06
6. THICKNESS OF OVERBURDEN 0.0 Ft.		**16. ELEVATION TOP OF BORING** -33.4 Ft.	
7. DEPTH DRILLED INTO ROCK 0.0 Ft.		**17. TOTAL RECOVERY FOR BORING** 15.5 Ft.	
8. TOTAL DEPTH OF BORING 15.5 Ft.		**18. SIGNATURE AND TITLE OF INSPECTOR** Gary Zarillo, PG	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-33.4	0.0					
-35.6	2.2		Light tannish gray medium quartz sand, abundant white and gray shell fragments and whole shells in fine to coarse gravel range, (10YR-8.5/2), (SP).		1.0	Sample #1.0, Depth = 1.0'
-41.8	8.4		Light gray medium to fine quartz sand, some gray, white, and tan shell fragments in fine to coarse gravel range, white (10YR-8/1), (SP).		4.0 8.0	Sample #4.0, Depth = 4.0' Sample #8.0, Depth = 8.0'
-45.1	11.7		Gray fine quartz sand, trace of white shell fragments in fine gravel range, trace of silt and clay, (10YR-7.5/1), (SP).		11.0	Sample #11.0, Depth = 11.0'
-47.6	14.2		Gray silty fine quartz sand, scattered shell fragments in fine to coarse gravel range, gray (10YR-6/1), (SM).		Comp	Sample #Comp, Depth = 14.0' Comp (0-11.0')
-48.9	15.5		Gray silt, some sand, some white shell fragments, (10YR-4.5/1), (ML).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 **MODIFIED FOR THE FLORIDA DEP**
JUN 02 **JUN 04**

Boring Designation BC06-27

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-27
3. LOCATION COORDINATES: X = 1,907,715 Y = 28,983
4. DRILLING AGENCY: Olsen Associates, Inc
5. CONTRACTOR FILE NO.:
6. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
7. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
8. DEG. FROM VERTICAL:
9. BEARING:
10. THICKNESS OF OVERBURDEN: 0.0 Ft.
11. DEPTH DRILLED INTO ROCK: 0.0 Ft.
12. TOTAL DEPTH OF BORING: 20.3 Ft.
13. SIZE AND TYPE OF BIT: 4.0 In.
14. COORDINATE SYSTEM/DATUM: State Plane AL; HORIZONTAL: NAD 1983; VERTICAL: NAVD 88
15. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic ☐ AUTO HAMMER ☐ MANUAL HAMMER
16. TOTAL SAMPLES: DISTURBED: UNDISTURBED (UD):
17. TOTAL NUMBER CORE BOXES: 2
18. ELEVATION GROUND WATER:
19. DATE BORING: STARTED 05-01-06 COMPLETED 05-01-06
20. ELEVATION TOP OF BORING: -68.1 Ft.
21. TOTAL RECOVERY FOR BORING: 20.3 Ft.
22. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-68.1	0.0					
			Gray very fine quartz sand, some silt, scattered white shell fragments in fine to medium gravel range, light gray (10YR-7/2), (SP).		1.0	Sample #1.0, Depth = 1.0'
					4.0	Sample #4.0, Depth = 4.0'
					8.0	Sample #8.0, Depth = 8.0'
-77.7	9.6					
-78.5	10.4		Gray silt, light gray (10YR-7/1), (ML).			
			Gray to tannish gray very fine sand and silt, light gray (10YR-7/2), (SP).		12.0	Sample #12.0, Depth = 12.0'
					16.0	Sample #16.0, Depth = 16.0'
					Comp 1	Sample #Comp 1, Depth = 18.0' Comp 1 (0-9.0')
-87.5	19.4					
-88.4	20.3		Gray silty sand, (10YR-6.5/2), (SM).		Comp 2	Sample #Comp 2, Depth = 20.0' Comp 2 (0-17.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-28

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-28
LOCATION COORDINATES: X = 1,904,718 Y = 68,141

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.2 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -34.1 Ft.

17. TOTAL RECOVERY FOR BORING: 20.2 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-34.1	0.0					
			Very light gray to white fine quartz sand, scattered gray, tan, and white shell fragments in fine to medium gravel range, scattered whole shells in medium to coarse gravel range, (10YR-8.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
					3.0	Sample #3.0, Depth = 3.0'
-40.2	6.1				6.0	Sample #6.0, Depth = 6.0'
			Light gray fine quartz sand, white to gray shell fragments in fine to medium gravel range, scattered whole shells in medium to coarse gravel range, inclusions of gray clay at 6.1-6.6 ft, white (10YR-8/1), (SP).		Comp	Sample #Comp, Depth = 7.0' Comp (0-7.0')
-41.7	7.6					
			Gray silt, some gray clay, trace of iron stained fine quartz sand, grayish brown (10YR-5/2), (ML).			
-54.3	20.2					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-29

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search Baldwin County, Alabama		9. SIZE AND TYPE OF BIT: 4.0 In.	
		10. COORDINATE SYSTEM/DATUM: State Plane AL	HORIZONTAL: NAD 1983 / VERTICAL: NAVD 88
2. BORING DESIGNATION: BC06-29	LOCATION COORDINATES: X = 1,903,036 Y = 81,504	11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic	☐ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY: Olsen Associates, Inc	CONTRACTOR FILE NO.	12. TOTAL SAMPLES	DISTURBED / UNDISTURBED (UD)
4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc		13. TOTAL NUMBER CORE BOXES: 2	
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL / BEARING	14. ELEVATION GROUND WATER	
		15. DATE BORING	STARTED: 05-01-06 / COMPLETED: 05-01-06
6. THICKNESS OF OVERBURDEN: 0.0 Ft.		16. ELEVATION TOP OF BORING: -28.3 Ft.	
7. DEPTH DRILLED INTO ROCK: 0.0 Ft.		17. TOTAL RECOVERY FOR BORING: 19.8 Ft.	
8. TOTAL DEPTH OF BORING: 19.8 Ft.		18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-28.3	0.0					
-30.1	1.8		Light gray fine quartz sand, few white shell fragments in medium gravel range, white (10YR-8/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-31.3	3.0		Light gray fine quartz sand, abundant large shell fragments and whole shells in coarse gravel to cobble range, trace of brown silt, white (10YR-8/1), (SP).			
					5.0	Sample #5.0, Depth = 5.0'
-38.4	10.1		Grayish brown fine quartz sand, some silt, light brownish gray (10YR-6/2), (SP).		10.0	Sample #10.0, Depth = 10.0'
-43.7	15.4		Gray to grayish brown fine silty quartz sand, light brownish gray (10YR-6/2), (SM).		15.0	Sample #15.0, Depth = 15.0'
-46.2	17.9		Gray fine quartz sand, trace of silt, white (10YR-8/1), (SP).		Comp 1	Sample #Comp 1, Depth = 17.0' Comp 1 (0-2.5')
-48.1	19.8		Gray silt and clay, iron staining, light yellowish brown (10YR-6/4), (ML).		Comp 2	Sample #Comp 2, Depth = 19.0' Comp 2 (0-10.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-30

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-30
LOCATION COORDINATES: X = 1,900,736 Y = 52,711

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 17.7 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -40.4 Ft.

17. TOTAL RECOVERY FOR BORING: 17.7 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-40.4	0.0					
-40.8	0.4		White fine quartz sand, abundant white to light gray whole shells and shell fragments in fine to coarse gravel range, (10YR-8.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-43.4	3.0		White fine quartz sand, trace of silt, (10YR-8.5/1), (SP).		Comp	Sample #Comp, Depth = 3.0' Comp (0-2.5')
-45.8	5.4		Light gray clay and silt, white (10YR-8/1), (CL).			
-50.1	9.7		Gray silt, some fine quartz sand, light gray (10YR-7/1), (ML).			
-58.1	17.7		Gray clay, some silt, light gray (10YR-7/1), (CL).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-31

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-31 — LOCATION COORDINATES: X = 1,899,662 Y = 14,619
3. DRILLING AGENCY: Olsen Associates, Inc — CONTRACTOR FILE NO.:
4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG. FROM VERTICAL: — BEARING:
6. THICKNESS OF OVERBURDEN: 0.0 Ft.
7. DEPTH DRILLED INTO ROCK: 0.0 Ft.
8. TOTAL DEPTH OF BORING: 20.3 Ft.
9. SIZE AND TYPE OF BIT: 4.0 In.
10. COORDINATE SYSTEM/DATUM: State Plane AL — HORIZONTAL: NAD 1983 — VERTICAL: NAVD 88
11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic — ☐ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES — DISTURBED: — UNDISTURBED (UD):
13. TOTAL NUMBER CORE BOXES: 2
14. ELEVATION GROUND WATER:
15. DATE BORING — STARTED: 05-01-06 — COMPLETED: 05-01-06
16. ELEVATION TOP OF BORING: -75.1 Ft.
17. TOTAL RECOVERY FOR BORING: 20.3 Ft.
18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-75.1	0.0					
-77.7	2.6		Gray fine quartz sand, abundant shell fragments in medium sand to coarse gravel range, whole shells in fine to coarse gravel range, light gray (10YR-7/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-82.9	7.8		Gray fine quartz sand, scattered layers of whole shells and shell fragments in fine to coarse gravel range, light gray (10YR-7/1), (SP).		4.0 7.0	Sample #4.0, Depth = 4.0' Sample #7.0, Depth = 7.0'
-92.0	16.9		Gray silty sand, scattered shell fragments and whole shells in fine to medium gravel range, articulated mollusk shell at 13.0 ft, (10YR-6.5/1), (SM).		Comp	Sample #Comp, Depth = 12.0' Comp (0-7.5')
-95.4	20.3		Gray silt, some fine sand, scattered white shell fragments in fine to medium gravel range, (10YR-6.5/1), (ML).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-32

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-32
3. LOCATION COORDINATES: X = 1,892,728 Y = 56,241
4. DRILLING AGENCY: Olsen Associates, Inc
5. CONTRACTOR FILE NO.:
6. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
7. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
8. DEG. FROM VERTICAL:
9. BEARING:
10. THICKNESS OF OVERBURDEN: 0.0 Ft.
11. DEPTH DRILLED INTO ROCK: 0.0 Ft.
12. TOTAL DEPTH OF BORING: 19.9 Ft.
13. SIZE AND TYPE OF BIT: 4.0 In.
14. COORDINATE SYSTEM/DATUM: State Plane AL; HORIZONTAL: NAD 1983; VERTICAL: NAVD 88
15. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic ☐ AUTO HAMMER ☐ MANUAL HAMMER
16. TOTAL SAMPLES: DISTURBED: UNDISTURBED (UD):
17. TOTAL NUMBER CORE BOXES: 2
18. ELEVATION GROUND WATER:
19. DATE BORING: STARTED 05-01-06 COMPLETED 05-01-06
20. ELEVATION TOP OF BORING: -42.5 Ft.
21. TOTAL RECOVERY FOR BORING: 19.9 Ft.
22. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-42.5	0.0					
-43.1	0.6		Tannish gray fine quartz sand, abundant shell fragments and whole shells in fine to coarse gravel range, light brownish gray (10YR-6/2), (SW).			
-45.4	2.9		Gray to orange silt, some clay, trace of fine sand, (10YR-6.5/3), (ML).			
-52.2	9.7		Gray to brownish gray silt and clay, scattered whole shells and shell fragments in fine to medium gravel range, light brownish gray (10YR-6/2), (ML).			
-62.4	19.9		Gray clay and silt, gray (10YR-6/1), (CL).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-33

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-33
LOCATION COORDINATES: X = 1,878,688 Y = 26,056

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 18.0 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -65.5 Ft.

17. TOTAL RECOVERY FOR BORING: 18 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-65.5	0.0					
-68.0	2.5		Brownish gray fine quartz sand, some silt, light brownish gray (10YR-6/2), (SP).		1.0	Sample #1.0, Depth = 1.0'
-69.4	3.9		Brownish gray silty fine quartz sand, gray shell fragments in fine to medium gravel range, (10YR-5.5/2), (SM).			
-70.1	4.6		Gray silt and clay, gray (10YR-6/1), (ML).		Comp	Sample #Comp, Depth = 4.0' Comp (0-2.0')
-75.0	9.5		Brownish gray fine silty quartz sand, gray (10YR-6/1), (SM).			
-78.3	12.8		Gray clay, some silt, moderate plasticity, (10YR-5.5/1), (CL).			
-80.5	15.0		Gray silty fine quartz sand, black bone fragment at 13.7 ft, gray (10YR-6/1), (SM).			
-80.9	15.4		Gray clay and silt, (10YR-5.5/1), (CL).			
-83.5	18.0		Brownish gray silty fine quartz sand, (10YR-6.5/2), (SM).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-34

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-34
LOCATION COORDINATES: X = 1,875,017 Y = 57,020

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 19.6 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -48.6 Ft.

17. TOTAL RECOVERY FOR BORING:

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-48.6	0.0					
			Brown silty fine quartz sand, white, tan, and gray shell fragments in fine to coarse gravel range, rock fragments in the form of clay nodules, (10YR-5.5/4), (SM).		Comp	Sample #Comp, Depth = 4.0' Comp (0-4.0')
-53.7	5.1					
			Gray clay and silt, scattered white shell fragments in fine gravel range, (10YR-5.5/1), (CL).			
-60.8	12.2					
			Dark gray organic clay and silt, very abundant wood chips, (10YR-4.5/1), (OH).			
-68.2	19.6					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-35

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-35
LOCATION COORDINATES: X = 1,869,331 Y = 10,881

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 19.6 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -70.4 Ft.

17. TOTAL RECOVERY FOR BORING: 19.6 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-70.4	0.0		Gray clay and silt, scattered white shell fragments, (10YR-6.5/1), (CL).			
-81.4	11.0		Gray to orange silt, trace of fine quartz sand, very pale brown (10YR-7/4), (ML).			
-85.1	14.7		White silty quartz sand, (10YR-8.5/1), (SM).			
-89.6	19.2		White clay and silt, (10YR-8.5/1), (CL).			
-90.0	19.6		End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-36

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-36 — LOCATION COORDINATES: X = 1,867,189 Y = 33,797
3. DRILLING AGENCY: Olsen Associates, Inc — CONTRACTOR FILE NO.:
4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG. FROM VERTICAL: — BEARING:
6. THICKNESS OF OVERBURDEN: 0.0 Ft.
7. DEPTH DRILLED INTO ROCK: 0.0 Ft.
8. TOTAL DEPTH OF BORING: 20.5 Ft.
9. SIZE AND TYPE OF BIT: 4.0 In.
10. COORDINATE SYSTEM/DATUM: State Plane AL — HORIZONTAL: NAD 1983 — VERTICAL: NAVD 88
11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic — ☐ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES — DISTURBED: — UNDISTURBED (UD):
13. TOTAL NUMBER CORE BOXES: 2
14. ELEVATION GROUND WATER:
15. DATE BORING — STARTED: 05-01-06 — COMPLETED: 05-01-06
16. ELEVATION TOP OF BORING: -59.7 Ft.
17. TOTAL RECOVERY FOR BORING: 20.5 Ft.
18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-59.7	0.0					
-60.3	0.6		Tan fine quartz sand, light gray (10YR-7/2), (SP).			
-61.4	1.7		Gray to orange silt and clay, trace of quartz sand, (10YR-6.5/4), (ML).			
-63.3	3.6		Gray silt, some fine quartz sand, gray (10YR-6/1), (ML).			
-65.3	5.6		Gray clay, gray (10YR-6/1), (CL).			
-66.0	6.3		Tan to brown silt, some fine quartz sand, yellowish brown (10YR-5/4), (ML).			
-66.2	6.5		Gray clay, gray (10YR-6/1), (CL).			
-68.2	8.5		Tannish gray silty quartz sand, (10YR-6.5/2), (SM).			
-68.9	9.2		Tannish gray fine quartz sand, some silt, light gray (10YR-7/2), (SP).			
-69.8	10.1		Tannish gray silty quartz sand, pale brown (10YR-6/3), (SM).			
-71.4	11.7		Gray clay, (10YR-5.5/1), (CL).			
-72.3	12.6		Gray silty quartz sand, inclusions of gray clay, gray (10YR-6/1), (SM).			
-74.3	14.6		Very light gray to white fine quartz sand, trace of silt, (10YR-8.5/1), (SP).			
-74.6	14.9		Gray clay, gray (10YR-6/1), (CL).			
-75.8	16.1		Gray fine quartz sand, inclusions of gray clay, light gray (10YR-7/1), (SP).			
-78.5	18.8		Light gray fine quartz sand, white (10YR-8/1), (SP).			
-78.8	19.1		Gray clay, gray (10YR-6/1), (CL).			
-80.2	20.5		Light tan fine quartz sand, some silt, (10YR-7.5/2), (SP).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-37

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-37
LOCATION COORDINATES: X = 1,861,803 Y = 3,998

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 19.9 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -71.5 Ft.

17. TOTAL RECOVERY FOR BORING: 19.9 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-71.5	0.0					
-73.1	1.6		Gray fine sand, some silt, abundant white and gray shell fragments in fine to medium gravel range, trace of tan silt, gray (10YR-6/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-73.7	2.2		Gray silty sand, abundant gray shell fragments in medium to coarse gravel range, gray (10YR-6/1), (SM).			
-74.7	3.2		Gray fine sand, some silt, (10YR-6.5/1), (SP).			
-75.3	3.8		Gray silty sand, gray and white shell fragments in fine to medium gravel range, gray (10YR-6/1), (SM).			
-77.6	6.1		Gray silt and clay, (10YR-6.5/1), (CL).			
-83.1	11.6		Gray silt, some clay, trace of quartz sand, scattered white shell fragments in fine to coarse gravel range, articulation of mollusk shell at 8.1 ft, (10YR-5.5/1), (ML).			
-86.3	14.8		Gray to tannish gray clay and silt, black organic matter at 14.7-14.8 ft, light gray (10YR-7/2), (CL).			
-91.4	19.9		Light gray clay and silt, (10YR-7.5/1), (CL).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-38

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search Baldwin County, Alabama		9. SIZE AND TYPE OF BIT: 4.0 In.	
		10. COORDINATE SYSTEM/DATUM: State Plane AL	HORIZONTAL: NAD 1983 / VERTICAL: NAVD 88
2. BORING DESIGNATION: BC06-38	LOCATION COORDINATES: X = 1,855,552 Y = 26,298	11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic	☐ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY: Olsen Associates, Inc	CONTRACTOR FILE NO.	12. TOTAL SAMPLES	DISTURBED / UNDISTURBED (UD)
4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc		13. TOTAL NUMBER CORE BOXES: 2	
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL / BEARING	14. ELEVATION GROUND WATER	
		15. DATE BORING	STARTED: 05-01-06 / COMPLETED: 05-01-06
6. THICKNESS OF OVERBURDEN: 0.0 Ft.		16. ELEVATION TOP OF BORING: -57.8 Ft.	
7. DEPTH DRILLED INTO ROCK: 0.0 Ft.		17. TOTAL RECOVERY FOR BORING: 17.2 Ft.	
8. TOTAL DEPTH OF BORING: 17.2 Ft.		18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-57.8	0.0					
-60.7	2.9		Dark gray clay and silt, white shell fragments in fine to medium gravel range, (10YR-4.5/1), (CL).			
-63.4	5.6		Gray silty sand, scattered white shell fragments in fine to medium gravel range, gray (10YR-6/1), (SM).			
-75.0	17.2		Gray silt and clay, gray (10YR-6/1), (CL).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-39

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search Baldwin County, Alabama		9. SIZE AND TYPE OF BIT: 4.0 In.	
		10. COORDINATE SYSTEM/DATUM: State Plane AL	HORIZONTAL: NAD 1983 / VERTICAL: NAVD 88
2. BORING DESIGNATION: BC06-39	LOCATION COORDINATES: X = 1,845,069 Y = 71,169	11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic	☐ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY: Olsen Associates, Inc	CONTRACTOR FILE NO.	12. TOTAL SAMPLES	DISTURBED / UNDISTURBED (UD)
4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc		13. TOTAL NUMBER CORE BOXES: 2	
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL / BEARING	14. ELEVATION GROUND WATER	
		15. DATE BORING	STARTED: 05-01-06 / COMPLETED: 05-01-06
6. THICKNESS OF OVERBURDEN: 0.0 Ft.		16. ELEVATION TOP OF BORING: -28.5 Ft.	
7. DEPTH DRILLED INTO ROCK: 0.0 Ft.		17. TOTAL RECOVERY FOR BORING: 19.4 Ft.	
8. TOTAL DEPTH OF BORING: 19.4 Ft.		18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG	

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-28.5	0.0					
-30.4	1.9		Light tannish gray fine quartz sand, gray to black shell fragments in fine to medium gravel range, very pale brown (10YR-8/2), (SP).		1.0	Sample #1.0, Depth = 1.0'
					4.0	Sample #4.0, Depth = 4.0'
			Light gray fine quartz sand, abundant gray, tan, and black shell fragments in fine to coarse gravel range, trace of clay inclusions, (10YR-7.5/1), (SP).		8.0	Sample #8.0, Depth = 8.0'
					12.0	Sample #12.0, Depth = 12.0'
-41.6	13.1					
			Gray to light gray fine quartz sand, scattered shell fragments in fine to medium gravel range, scattered inclusions of clay, white (10YR-8/1), (SP).		16.0	Sample #16.0, Depth = 16.0'
					18.0	Sample #18.0, Depth = 18.0'
-47.9	19.4				Comp	Sample #Comp, Depth = 19.0' Comp (0-18.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-40

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-40
3. LOCATION COORDINATES: X = 1,844,941 Y = 67,262
4. DRILLING AGENCY: Olsen Associates, Inc
5. CONTRACTOR FILE NO.:
6. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
7. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
8. DEG. FROM VERTICAL:
9. BEARING:
10. THICKNESS OF OVERBURDEN: 0.0 Ft.
11. DEPTH DRILLED INTO ROCK: 0.0 Ft.
12. TOTAL DEPTH OF BORING: 18.8 Ft.
13. SIZE AND TYPE OF BIT: 4.0 In.
14. COORDINATE SYSTEM/DATUM: State Plane AL; HORIZONTAL: NAD 1983; VERTICAL: NAVD 88
15. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic ☐ AUTO HAMMER ☐ MANUAL HAMMER
16. TOTAL SAMPLES: DISTURBED: UNDISTURBED (UD):
17. TOTAL NUMBER CORE BOXES: 2
18. ELEVATION GROUND WATER:
19. DATE BORING: STARTED 05-01-06 COMPLETED 05-01-06
20. ELEVATION TOP OF BORING: -30.4 Ft.
21. TOTAL RECOVERY FOR BORING: 18.8 Ft.
22. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-30.4	0.0					
			Light gray fine quartz sand, gray shell fragments and whole shells in fine to medium gravel range, trace of gray silt in thin layers and mixed with sand, (10YR-7.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-35.2	4.8					
					5.0	Sample #5.0, Depth = 5.0'
			Medium gray fine quartz sand, some gray silt, scattered gray and white shell fragments in fine gravel range, light gray (10YR-7/1), (SP).		10.0	Sample #10.0, Depth = 10.0'
					15.0	Sample #15.0, Depth = 15.0'
-46.6	16.2					
					Comp 1	Sample #Comp 1, Depth = 16.5' Comp 1 (0-10.0')
			Gray silty fine quartz sand, light gray (10YR-7/1), (SM).		Comp 2	Sample #Comp 2, Depth = 18.0' Comp 2 (0-15.0')
-49.2	18.8					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-41

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-41
LOCATION COORDINATES: X = 1,843,227 Y = 69,461

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.3 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -28.2 Ft.

17. TOTAL RECOVERY FOR BORING: 20.3 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-28.2	0.0					
			Light tannish gray medium to fine quartz sand, gray shell fragments in fine to medium gravel range, scattered gray whole shells in coarse gravel range, (10YR-7.5/2), (SP).		1.0	Sample #1.0, Depth = 1.0'
					3.0	Sample #3.0, Depth = 3.0'
-34.3	6.1				6.0	Sample #6.0, Depth = 6.0'
			Light gray fine quartz sand, scattered white shell fragments in fine to medium gravel range, white (10YR-8/1), (SP).		10.0	Sample #10.0, Depth = 10.0'
-41.4	13.2				13.0	Sample #13.0, Depth = 13.0'
			Tannish gray fine quartz sand, some tan silt, light gray (10YR-7/2), (SP).		16.0	Sample #16.0, Depth = 16.0'
-45.4	17.2				Comp 1	Sample #Comp 1, Depth = 18.0' Comp 1 (0-13.0')
			Tannish brown silty fine quartz sand, pale brown (10YR-6/3), (SM).		Comp 2	Sample #Comp 2, Depth = 20.0' Comp 2 (0-17.0')
-48.5	20.3					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-42

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-42
LOCATION COORDINATES: X = 1,839,694 Y = 28,174

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 18.3 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -47.6 Ft.

17. TOTAL RECOVERY FOR BORING: 18.3 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-47.6	0.0					
			Light gray fine quartz sand, abundant gray and white shell fragments in fine to medium gravel range, white (10YR-8/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-51.4	3.8					
			Light gray fine quartz sand, scattered gray to white shell fragments and whole shells in fine to medium gravel range, white (10YR-8/1), (SP).		4.0	Sample #4.0, Depth = 4.0'
-53.5	5.9					
-54.2	6.6		Light gray fine quartz sand, very abundant gray to white shell fragments and whole shells in fine to coarse gravel range, white (10YR-8/1), (SP).			
					8.0	Sample #8.0, Depth = 8.0'
			Light tannish gray fine quartz sand, abundant shell fragments and whole shells in fine to coarse gravel range, very pale brown (10YR-8/2), (SP).			
-59.9	12.3				12.0	Sample #12.0, Depth = 12.0'
			Light gray to white fine quartz sand, scattered gray and tan shell fragments in fine to medium gravel range, (10YR-8.5/1), (SP).		16.0	Sample #16.0, Depth = 16.0'
-65.9	18.3				18.0	Sample #18.0, Depth = 18.0'
			End of Boring		Comp	Sample #Comp, Depth = 18.3' Comp (0-18.0')

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-43

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-43
LOCATION COORDINATES: X = 1,839,530 Y = 64,204

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 17.4 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -35.0 Ft.

17. TOTAL RECOVERY FOR BORING: 17.4 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-35.0	0.0					
			Light gray fine quartz sand, scattered gray, white, and tan shell fragments in fine to coarse gravel range, scattered inclusions of gray clay, (10YR-7.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
					4.0	Sample #4.0, Depth = 4.0'
-42.1	7.1					
-42.5	7.5		Light gray fine quartz sand, very abundant whole shells and shell fragments in fine to coarse gravel range, inclusions of gray clay, (10YR-7.5/1), (SP).		8.0	Sample #8.0, Depth = 8.0'
			Light gray fine quartz sand, some gray, white, and tan shell fragments in fine to medium gravel range, scattered inclusions of gray clay, (10YR-7.5/1), (SP).		12.0	Sample #12.0, Depth = 12.0'
-49.5	14.5					
			Light gray fine quartz sand, some silt, scattered white and gray shell fragments and whole shells in fine to coarse gravel range, (10YR-7.5/1), (SP).		16.0	Sample #16.0, Depth = 16.0'
-52.4	17.4				Comp	Sample #Comp, Depth = 17.0' Comp (0-16.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-44

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-44 — LOCATION COORDINATES: X = 1,834,845 Y = 50,095
3. DRILLING AGENCY: Olsen Associates, Inc — CONTRACTOR FILE NO.:
4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED — DEG. FROM VERTICAL: — BEARING:
6. THICKNESS OF OVERBURDEN: 0.0 Ft.
7. DEPTH DRILLED INTO ROCK: 0.0 Ft.
8. TOTAL DEPTH OF BORING: 18.8 Ft.
9. SIZE AND TYPE OF BIT: 4.0 In.
10. COORDINATE SYSTEM/DATUM: State Plane AL — HORIZONTAL: NAD 1983 — VERTICAL: NAVD 88
11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic — ☐ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES — DISTURBED: — UNDISTURBED (UD):
13. TOTAL NUMBER CORE BOXES: 2
14. ELEVATION GROUND WATER:
15. DATE BORING — STARTED: 05-01-06 — COMPLETED: 05-01-06
16. ELEVATION TOP OF BORING: -46.6 Ft.
17. TOTAL RECOVERY FOR BORING: 18.8 Ft.
18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-46.6	0.0					
			Light gray fine quartz sand, inclusions and thin layers of gray clay, (10YR-7.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-49.1	2.5					
			Light gray to white fine quartz sand and scattered inclusions of gray clay in burrow linings and collapsed burrow linings, (10YR-8.5/1), (SP).		6.0	Sample #6.0, Depth = 6.0'
-56.1	9.5					
			White to near white fine quartz sand, few scattered inclusions of gray clay in thin layers in collapsed burrow linings, (10YR-8.5/1), (SP).		12.0	Sample #12.0, Depth = 12.0'
					18.0	Sample #18.0, Depth = 18.0'
-65.4	18.8				Comp	Sample #Comp, Depth = 18.8' Comp 90-18.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-45

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-45
LOCATION COORDINATES: X = 1,834,850 Y = 60,213

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 17.0 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -39.2 Ft.

17. TOTAL RECOVERY FOR BORING: 17 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-39.2	0.0					
			Gray fine quartz sand, abundant gray to white shell fragments and whole shells in fine to coarse gravel range, light gray (10YR-7/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
					4.0	Sample #4.0, Depth = 4.0'
-44.9	5.7					
			Gray medium to fine quartz sand, very abundant gray, tan, and white shell fragments in fine to coarse gravel range, whole shells in medium to coarse gravel range, light gray (10YR-7/1), (SP).			
-46.7	7.5				8.0	Sample #8.0, Depth = 8.0'
			Gray fine quartz sand, abundant gray shell fragments in fine to medium gravel range, large whole oyster shell at 9.0 ft, scattered inclusions of gray silt and clay, light gray (10YR-7/1), (SP).			
-51.0	11.8					
			Gray fine silty sand, inclusions of gray clay, scattered white, tan, and gray shell fragments in fine to coarse gravel range, (10YR-6.5/1), (SM).		13.0	Sample #13.0, Depth = 13.0'
					Comp 1	Sample #Comp 1, Depth = 15.0' Comp 1 (0-12.0')
-56.2	17.0				Comp 2	Sample #Comp 2, Depth = 17.0' Comp 2 (0-14.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-46

DRILLING LOG

DIVISION	
INSTALLATION	
SHEET 1 OF 1 SHEETS	

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-46
3. LOCATION COORDINATES: X = 1,827,728 Y = 54,354
4. DRILLING AGENCY: Olsen Associates, Inc
5. CONTRACTOR FILE NO.:
6. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
7. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
8. DEG. FROM VERTICAL:
9. BEARING:
10. THICKNESS OF OVERBURDEN: 0.0 Ft.
11. DEPTH DRILLED INTO ROCK: 0.0 Ft.
12. TOTAL DEPTH OF BORING: 18.2 Ft.
13. SIZE AND TYPE OF BIT: 4.0 In.
14. COORDINATE SYSTEM/DATUM: State Plane AL; HORIZONTAL: NAD 1983; VERTICAL: NAVD 88
15. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic ☐ AUTO HAMMER ☐ MANUAL HAMMER
16. TOTAL SAMPLES: DISTURBED: UNDISTURBED (UD):
17. TOTAL NUMBER CORE BOXES: 2
18. ELEVATION GROUND WATER:
19. DATE BORING: STARTED 05-01-06 COMPLETED 05-01-06
20. ELEVATION TOP OF BORING: -41.5 Ft.
21. TOTAL RECOVERY FOR BORING: 18.2 Ft.
22. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-41.5	0.0					
			Light gray fine quartz sand, some white to gray shell fragments and whole shells in fine to coarse gravel range, trace of silt, light gray (10YR-7/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-44.2	2.7					
			Tannish gray silty fine quartz sand, scattered shell fragments and whole shells, (10YR-6.5/2), (SM).		4.0	Sample #4.0, Depth = 4.0'
-46.6	5.1					
			Very light gray fine quartz sand, scattered dark gray shell fragments in fine to medium gravel range, white (10YR-8/1), (SP).		8.0	Sample #8.0, Depth = 8.0'
-49.6	8.1					
			White fine quartz sand, scattered dark gray shell fragments and whole shells in fine to coarse gravel range, scattered inclusions and gravel size nodules of tan silt, (10YR-8.5/1), (SP).		12.0	Sample #12.0, Depth = 12.0'
					16.0	Sample #16.0, Depth = 16.0'
-59.7	18.2				Comp	Sample #Comp, Depth = 18.0' Comp (0-16.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-47

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-47
LOCATION COORDINATES: X = 1,957,215 Y = 90,822

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.3 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -32.6 Ft.

17. TOTAL RECOVERY FOR BORING: 20.3 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-32.6	0.0					
-33.1	0.5		White fine quartz sand, gray to white shell fragments in fine to medium gravel range, (10YR-9/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
					4.0	Sample #4.0, Depth = 4.0'
			White to very light tan fine quartz sand, trace of tan silt, white (10YR-8/1), (SP).		8.0	Sample #8.0, Depth = 8.0'
					12.0	Sample #12.0, Depth = 12.0'
-45.8	13.2					
-46.5	13.9		Tan silty fine quartz sand, (10YR-6.5/3), (SM).			
-46.8	14.2		Gray silt, gray (10YR-6/1), (ML).			
			Gray clay and silt, gray (10YR-6/1), (CL).		Comp	Sample #Comp, Depth = 18.0' Comp (0-12.0')
-52.9	20.3					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-48

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-48
LOCATION COORDINATES: X = 1,821,438 Y = 48,038

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 19.2 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -46.4 Ft.

17. TOTAL RECOVERY FOR BORING: 19.2 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-46.4	0.0					
			Light gray fine quartz sand, gray, tan, and white shell fragments and whole shells in fine to coarse gravel range, (10YR-7.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
					5.0	Sample #5.0, Depth = 5.0'
-52.7	6.3					
			Brownish gray fine quartz sand, some gray silt, scattered gray shell fragments in fine to coarse gravel range, light brownish gray (10YR-6/2), (SP).		10.0	Sample #10.0, Depth = 10.0'
					12.0	Sample #12.0, Depth = 12.0'
-60.0	13.6					
			Brownish gray silty fine quartz sand, scattered gray shell fragments in medium gravel range, light brownish gray (10YR-6/2), (SM).		Comp	Sample #Comp, Depth = 16.0' Comp (0-12.0')
-65.6	19.2					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-49

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-49
LOCATION COORDINATES: X = 1,818,057 Y = 21,433

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.3 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -56.1 Ft.

17. TOTAL RECOVERY FOR BORING: 20.3 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-56.1	0.0					
			Gray fine quartz sand, scattered gray to black shell fragments in fine to medium gravel range, some silt, (10YR-6.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
					3.0	Sample #3.0, Depth = 3.0'
					6.0	Sample #6.0, Depth = 6.0'
-63.6	7.5					
			Tannish gray silty sand, trace of white shell fragments in fine gravel range, (10YR-6.5/2), (SM).		Comp	Sample #Comp, Depth = 10.0' Comp (0-6.0')
-68.9	12.8					
			Gray silt, some fine quartz sand, scattered tan and white shell fragments in fine gravel range, light gray (10YR-7/1), (ML).			
-76.4	20.3					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-50

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-50
LOCATION COORDINATES: X = 1,924,401 Y = 74,014

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 16.4 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -37.1 Ft.

17. TOTAL RECOVERY FOR BORING: 16.4 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-37.1	0.0					
-38.3	1.2		Light gray medium to fine quartz sand, scattered gray and white shell fragments in fine to coarse gravel range, white (10YR-8/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-39.1	2.0		Grayish brown silty fine quartz sand, abundant shell fragments and whole shells in fine to coarse gravel range, (10YR-6.5/2), (SM).			
-43.1	6.0		Dark gray clay, scattered white shell fragments and whole shells in fine to coarse gravel range, (10YR-4.5/1), (CL).			
-45.7	8.6		Gray silt, some sand, scattered white, tan, and gray shell fragments and whole shells in fine to coarse gravel range, (10YR-6.5/1), (ML).			
-52.4	15.3		Gray to orange silt, some sand, (10YR-6.5/3), (ML).		Comp	Sample #Comp, Depth = 10.0' Comp (0-10.0')
-53.5	16.4		Gray silt and clay, gray (10YR-5/1), (ML).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-51

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-51
LOCATION COORDINATES: X = 1,807,057 Y = 65,107

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 18.2 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -33.4 Ft.

17. TOTAL RECOVERY FOR BORING: 18.2 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-33.4	0.0					
-34.9	1.5		Light gray fine quartz sand, trace of silt, (10YR-7.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-37.5	4.1		Light gray fine quartz sand, inclusions of gray clay, (10YR-7.5/1), (SP).		3.0	Sample #3.0, Depth = 3.0'
-38.5	5.1		Light gray fine quartz sand, white (10YR-8/1), (SP).			
-38.7	5.3		Gray clay, gray (10YR-5/1), (CL).			
-41.3	7.9		Tannish gray silty fine quartz sand, inclusions of gray clay, light brownish gray (10YR-6/2), (SM).		6.0	Sample #6.0, Depth = 6.0'
					9.0	Sample #9.0, Depth = 9.0'
					13.0	Sample #13.0, Depth = 13.0'
					16.0	Sample #16.0, Depth = 16.0'
					Comp 1	Sample #Comp 1, Depth = 17.0' Comp 1 (0-5.0')
-51.6	18.2				Comp 2	Sample #Comp 2, Depth = 18.0' Comp 2 (0-18.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-52

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-52
3. LOCATION COORDINATES: X = 1,803,312 Y = 74,454
4. DRILLING AGENCY: Olsen Associates, Inc
5. CONTRACTOR FILE NO.:
6. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
7. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
8. DEG. FROM VERTICAL:
9. BEARING:
10. THICKNESS OF OVERBURDEN: 0.0 Ft.
11. DEPTH DRILLED INTO ROCK: 0.0 Ft.
12. TOTAL DEPTH OF BORING: 20.4 Ft.
13. SIZE AND TYPE OF BIT: 4.0 In.
14. COORDINATE SYSTEM/DATUM: State Plane AL; HORIZONTAL: NAD 1983; VERTICAL: NAVD 88
15. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic; ☐ AUTO HAMMER ☐ MANUAL HAMMER
16. TOTAL SAMPLES: DISTURBED: UNDISTURBED (UD):
17. TOTAL NUMBER CORE BOXES: 2
18. ELEVATION GROUND WATER:
19. DATE BORING: STARTED 05-01-06; COMPLETED 05-01-06
20. ELEVATION TOP OF BORING: -18.4 Ft.
21. TOTAL RECOVERY FOR BORING: 20.4 Ft.
22. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-18.4	0.0					
			White medium to fine quartz sand, scattered gray and white shell fragments in coarse sand to fine gravel range, (10YR-8.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
					4.0	Sample #4.0, Depth = 4.0'
					8.0	Sample #8.0, Depth = 8.0'
					12.0	Sample #12.0, Depth = 12.0'
					16.0	Sample #16.0, Depth = 16.0'
-35.1	16.7					
			White fine quartz sand, few scattered gray and white shell fragments in fine gravel range, (10YR-8.5/1), (SP).		Comp	Sample #Comp, Depth = 18.0' Comp (0-18.0')
-38.8	20.4					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-53

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-53
3. LOCATION COORDINATES: X = 1,801,833 Y = 69,367
4. DRILLING AGENCY: Olsen Associates, Inc
5. CONTRACTOR FILE NO.:
6. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
7. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
8. DEG. FROM VERTICAL:
9. BEARING:
10. THICKNESS OF OVERBURDEN: 0.0 Ft.
11. DEPTH DRILLED INTO ROCK: 0.0 Ft.
12. TOTAL DEPTH OF BORING: 18.2 Ft.
13. SIZE AND TYPE OF BIT: 4.0 In.
14. COORDINATE SYSTEM/DATUM: State Plane AL; HORIZONTAL: NAD 1983; VERTICAL: NAVD 88
15. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic ☐ AUTO HAMMER ☐ MANUAL HAMMER
16. TOTAL SAMPLES: DISTURBED: UNDISTURBED (UD):
17. TOTAL NUMBER CORE BOXES: 2
18. ELEVATION GROUND WATER:
19. DATE BORING: STARTED 05-01-06 COMPLETED 05-01-06
20. ELEVATION TOP OF BORING: -21.5 Ft.
21. TOTAL RECOVERY FOR BORING: 18.2 Ft.
22. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-21.5	0.0					
-23.3	1.8		Tannish gray fine quartz sand, scattered inclusions of gray clay in burrow linings, (10YR-7.5/2), (SP).		1.0	Sample #1.0, Depth = 1.0'
-26.5	5.0		Gray fine quartz sand, abundant thin layers of gray clay, burrow linings of gray clay, (10YR-7.5/1), (SP).		4.0	Sample #4.0, Depth = 4.0'
-37.0	15.5		Light gray fine quartz sand, trace of gray clay in collapsed burrows, white (10YR-8/1), (SP).		8.0	Sample #8.0, Depth = 8.0'
					12.0	Sample #12.0, Depth = 12.0'
-39.7	18.2		Light gray fine quartz sand, inclusions of gray clay in burrow linings, (10YR-7.5/1), (SP).		17.0	Sample #17.0, Depth = 17.0'
			End of Boring		Comp	Sample #Comp, Depth = 18.0' Comp (0-17.0')

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-54

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-54
LOCATION COORDINATES: X = 1,812,511 Y = 75,019

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 19.8 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -30.8 Ft.

17. TOTAL RECOVERY FOR BORING: 19.8 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-30.8	0.0					
-32.6	1.8		Gray medium to fine quartz sand, inclusions of gray silt and clay, scattered white and gray shell fragments in fine to medium gravel range, (10YR-7.5/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-34.4	3.6		Gray medium to fine quartz sand, scattered shell fragments in fine gravel range, (10YR-7.5/1), (SP).		4.0	Sample #4.0, Depth = 4.0'
					8.0	Sample #8.0, Depth = 8.0'
			Light gray medium to fine quartz sand, abundant shell fragments in fine to medium gravel range, scattered whole shells in medium to coarse gravel range, white (10YR-8/1), (SP).		12.0	Sample #12.0, Depth = 12.0'
					15.0	Sample #15.0, Depth = 15.0'
-47.0	16.2					
-48.5	17.7		Gray silty sand, some clay, (10YR-5.5/1), (SM).		Comp	Sample #Comp, Depth = 18.0' Comp (0-16.0')
-50.6	19.8		Gray clay, some silt, (10YR-5.5/1), (CL).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-55

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-55
LOCATION COORDINATES: X = 1,801,725 Y = 63,615

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.3 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -26.4 Ft.

17. TOTAL RECOVERY FOR BORING: 20.3 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-26.4	0.0					
-28.0	1.6		Light tannish gray fine quartz sand, scattered gray and tan shell fragments in fine gravel range, scattered whole shells in coarse gravel range, (10YR-7.5/2), (SP).		1.0	Sample #1.0, Depth = 1.0'
					4.0	Sample #4.0, Depth = 4.0'
-36.2	9.8		Light gray to white fine quartz sand, scattered inclusions of gray clay, (10YR-8.5/1), (SP).		8.0	Sample #8.0, Depth = 8.0'
-40.3	13.9		Light tannish gray fine quartz sand, inclusions of gray silt, (10YR-7.5/2), (SP).		12.0	Sample #12.0, Depth = 12.0'
-42.6	16.2		Light gray fine quartz sand, scattered inclusions of gray clay, white (10YR-8/1), (SP).		15.0	Sample #15.0, Depth = 15.0'
-44.6	18.2		Brownish gray silty quartz sand, light brownish gray (10YR-6/2), (SM).		Comp	Sample #Comp, Depth = 18.0' Comp (0-15.0')
-46.7	20.3		Tannish gray fine quartz sand, light gray (10YR-7/2), (SP).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-56

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-56
LOCATION COORDINATES: X = 1,800,446 Y = 72,834

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.4 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -15.3 Ft.

17. TOTAL RECOVERY FOR BORING: 20.4 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-15.3	0.0				1.0	Sample #1.0, Depth = 1.0'
					4.0	Sample #4.0, Depth = 4.0'
					8.0	Sample #8.0, Depth = 8.0'
			White medium to fine quartz sand, a few scattered gray to white shell fragments in fine gravel range, (10YR-8.5/1), (SP).		12.0	Sample #12.0, Depth = 12.0'
					16.0	Sample #16.0, Depth = 16.0'
-32.8	17.5					
			White fine quartz sand, few scattered white to gray shell fragments in fine gravel range, scattered whole shells in medium gravel range, (10YR-8.5/1), (SP).		Comp	Sample #Comp, Depth = 18.0' Comp (0-18.0')
-35.7	20.4					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-57

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-57
3. LOCATION COORDINATES: X = 1,798,151 Y = 58,837
4. DRILLING AGENCY: Olsen Associates, Inc
5. CONTRACTOR FILE NO.:
6. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
7. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
8. DEG. FROM VERTICAL:
9. BEARING:
10. THICKNESS OF OVERBURDEN: 0.0 Ft.
11. DEPTH DRILLED INTO ROCK: 0.0 Ft.
12. TOTAL DEPTH OF BORING: 15.8 Ft.
13. SIZE AND TYPE OF BIT: 4.0 In.
14. COORDINATE SYSTEM/DATUM: State Plane AL; HORIZONTAL: NAD 1983; VERTICAL: NAVD 88
15. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic ☐ AUTO HAMMER ☐ MANUAL HAMMER
16. TOTAL SAMPLES: DISTURBED: UNDISTURBED (UD):
17. TOTAL NUMBER CORE BOXES: 2
18. ELEVATION GROUND WATER:
19. DATE BORING: STARTED 05-01-06 COMPLETED 05-01-06
20. ELEVATION TOP OF BORING: -29.1 Ft.
21. TOTAL RECOVERY FOR BORING: 15.8 Ft.
22. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-29.1	0.0					
			Gray fine quartz sand, trace of white and gray shell fragments in fine gravel range, white (10YR-8/1), (SP).		1.0	Sample #1.0, Depth = 1.0'
-32.3	3.2					
					4.0	Sample #4.0, Depth = 4.0'
			Gray fine quartz sand, inclusions of dark gray clay, (10YR-7.5/1), (SP).		8.0	Sample #8.0, Depth = 8.0'
					12.0	Sample #12.0, Depth = 12.0'
-42.3	13.2					
-42.8	13.7		Gray silty fine quartz sand, (10YR-6.5/1), (SM).		Comp 1	Sample #Comp 1, Depth = 14.0' Comp 1 (0-10.0')
-44.4	15.3		Gray fine quartz sand, some silt, light gray (10YR-7/1), (SP).			
-44.9	15.8		Dark gray silt, gray (10YR-5/1), (ML).		Comp 2	Sample #Comp 2, Depth = 15.8' Comp 2 (0-13.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 **MODIFIED FOR THE FLORIDA DEP** JUN 04

Boring Designation BC06-58

DRILLING LOG

DIVISION		INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT: Baldwin County, AL 2006 Phase I Sand Search; Baldwin County, Alabama
2. BORING DESIGNATION: BC06-58
3. LOCATION COORDINATES: X = 1,798,987 Y = 67,681
4. DRILLING AGENCY: Olsen Associates, Inc
5. CONTRACTOR FILE NO.:
6. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc
7. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
8. DEG. FROM VERTICAL:
9. BEARING:
10. THICKNESS OF OVERBURDEN: 0.0 Ft.
11. DEPTH DRILLED INTO ROCK: 0.0 Ft.
12. TOTAL DEPTH OF BORING: 20.4 Ft.
13. SIZE AND TYPE OF BIT: 4.0 In.
14. COORDINATE SYSTEM/DATUM: State Plane AL; HORIZONTAL: NAD 1983; VERTICAL: NAVD 88
15. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic ☐ AUTO HAMMER ☐ MANUAL HAMMER
16. TOTAL SAMPLES: DISTURBED: UNDISTURBED (UD):
17. TOTAL NUMBER CORE BOXES: 2
18. ELEVATION GROUND WATER:
19. DATE BORING: STARTED 05-01-06 COMPLETED 05-01-06
20. ELEVATION TOP OF BORING: -16.4 Ft.
21. TOTAL RECOVERY FOR BORING: 20.4 Ft.
22. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-16.4	0.0					
			Light tannish gray medium to fine quartz sand, gray, tan, and white shell fragments in fine to medium gravel range, very pale brown (10YR-8/2), (SP).		1.0	Sample #1.0, Depth = 1.0'
-19.5	3.1					
					5.0	Sample #5.0, Depth = 5.0'
					10.0	Sample #10.0, Depth = 10.0'
			Very light gray fine quartz sand, trace of gray shell fragments in fine gravel and coarse sand range, white (10YR-8/1), (SP).		15.0	Sample #15.0, Depth = 15.0'
					18.0	Sample #18.0, Depth = 18.0'
-36.8	20.4				Comp	Sample #Comp, Depth = 20.0' Comp (0-18.0')
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-59

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-59
LOCATION COORDINATES: X = 1,796,181 Y = 61,378

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.2 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -18.0 Ft.

17. TOTAL RECOVERY FOR BORING: 20.2 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-18.0	0.0					
			Very light tan to white medium to fine quartz sand, scattered tan, gray, and white shell fragments in fine to medium gravel range, scattered whole shells in medium gravel range, (10YR-8.5/2), (SP).		1.0	Sample #1.0, Depth = 1.0'
-21.2	3.2					
					4.0	Sample #4.0, Depth = 4.0'
					8.0	Sample #8.0, Depth = 8.0'
			White medium to fine quartz sand, scattered gray and white shell fragments and whole shells in fine to medium gravel range, (10YR-8.5/1), (SP).		12.0	Sample #12.0, Depth = 12.0'
					16.0	Sample #16.0, Depth = 16.0'
					Comp	Sample #Comp, Depth = 18.0' Comp (0-18.0')
-38.2	20.2					
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

Boring Designation BC06-60

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT
Baldwin County, AL 2006 Phase I Sand Search
Baldwin County, Alabama

2. BORING DESIGNATION: BC06-60
LOCATION COORDINATES: X = 1,794,965 Y = 57,650

3. DRILLING AGENCY: Olsen Associates, Inc
CONTRACTOR FILE NO.:

4. NAME OF DRILLER: Alpine Ocean Seismic Survey Inc

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL:
BEARING:

6. THICKNESS OF OVERBURDEN: 0.0 Ft.

7. DEPTH DRILLED INTO ROCK: 0.0 Ft.

8. TOTAL DEPTH OF BORING: 20.3 Ft.

9. SIZE AND TYPE OF BIT: 4.0 In.

10. COORDINATE SYSTEM/DATUM: State Plane AL
HORIZONTAL: NAD 1983
VERTICAL: NAVD 88

11. MANUFACTURER'S DESIGNATION OF DRILL: Pneumatic
☐ AUTO HAMMER ☐ MANUAL HAMMER

12. TOTAL SAMPLES
DISTURBED:
UNDISTURBED (UD):

13. TOTAL NUMBER CORE BOXES: 2

14. ELEVATION GROUND WATER:

15. DATE BORING
STARTED: 05-01-06
COMPLETED: 05-01-06

16. ELEVATION TOP OF BORING: -26.1 Ft.

17. TOTAL RECOVERY FOR BORING: 20.3 Ft.

18. SIGNATURE AND TITLE OF INSPECTOR: Gary Zarillo, PG

ELEV. (ft)	DEPTH (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-26.1	0.0				1.0	Sample #1.0, Depth = 1.0'
					4.0	Sample #4.0, Depth = 4.0'
					8.0	Sample #8.0, Depth = 8.0'
					12.0	Sample #12.0, Depth = 12.0'
					16.0	Sample #16.0, Depth = 16.0'
-43.4	17.3		White fine quartz sand, trace of silt, trace of gray to dark gray shell fragments in coarse sand to fine gravel range, (10YR-8.5/1), (SP).		Comp	Sample #Comp, Depth = 18.0' Comp (0-16.0')
-46.4	20.3		White fine quartz sand, abundant layers of tannish gray silt, (10YR-8.5/1), (SM).			
			End of Boring			

0 5 10 15 20 25

FLORIDA DEP ROSS OLSEN BALDWIN_FINAL.GPJ FL DEP ROSS.GDT 9/25/06

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DEP JUN 04

APPENDIX B AOSS FIELD DATA COLLECTION REPORT

FINAL REPORT
GEOPHYSICAL SURVEY SERVICES
OFFSHORE BALDWIN COUNTY, ALABAMA

Prepared for:

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FINAL REPORT
GEOPHYSICAL SURVEY
OFFSHORE BALDWIN COUNTY, ALABAMA

INTRODUCTION

In April 2006, Alpine Ocean Seismic Survey, under contract to Olsen Associates, of Jacksonville, Florida, conducted a Vibracore, Subbottom Seismic and Bathymetric survey of potential sand borrow sites offshore of the southeast coast of Alabama. The work was conducted using the R/V Atlantic Twin. The survey included 60 Vibracore samples to 20 feet below sea floor, and the results of the Vibracore survey were included in a separate report. The cores were forwarded to SEA, Inc., of Melbourne, Florida, where the cores were split, described, sampled and logged. The core logs were then forwarded to Olsen Associates by SEA.

This report presents the methods and results of the subbottom seismic survey work which was conducted by Alpine at the conclusion of the Vibracore sampling. The survey track lines are shown in Figure 1 below, with the coastline shown for reference.

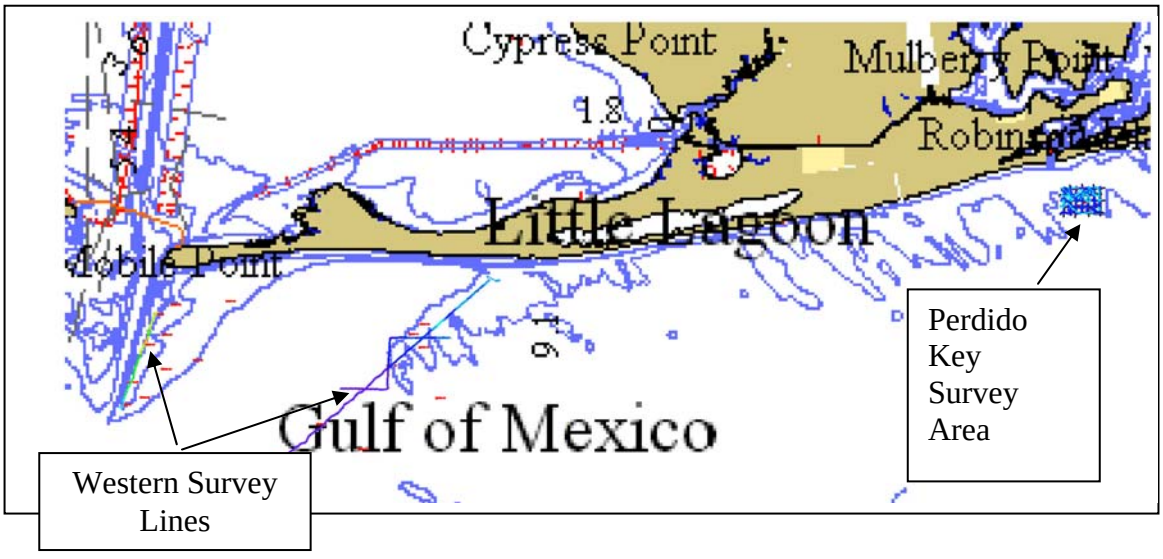


Figure 1, Survey Area Locations

The geophysical survey was conducted in two parts. The first part was located offshore of the area between Orange Beach and the entrance to Mobile Bay. This part of the survey was a regional scale survey to determine if there were any significant changes in the subbottom layering across that portion of the work area. A long line, oriented NE-SW, with a set of four cross lines was run down the axis of a shallower area, outlined as shown on the figure. In addition, a line oriented north-south was run up the shoal on the east side of the entrance to Mobile Bay. The majority of the cores conducted in these portions of the site contained relatively fine grained sediments.

The second part of the survey was concentrated around a borrow area offshore of Perdido Key, Alabama. This portion of the survey was conducted as a series of parallel and perpendicular survey lines spaced at 1000 feet. Several Vibracore samples had been

collected in this portion of the survey area, and many of those contained a unit of clean white sand, between 10 and 15 feet thick. The geophysical survey in this area was conducted to determine the extent of this white sand unit.

METHODS

Equipment

Subbottom Seismic Profiling:
The geophysical survey was conducted using a GeoAcoustics GeoPulse 3.5 KHz subbottom profiler system. That system consisted of a model 5430 Transmitter, a model 5210 receiver, and a set of four model 137D transducers. The transducers were mounted on a gimble on the side of the survey vessel. A Trimble model 320B Heave Compensator was used to reduce the effect of waves on the data. The data were recorded on an EPC recorder. The EPC transmitted key pulses through the heave compensator to the GeoPulse system at 0.125 second intervals. The EPC recorder was set to record the first 50 milliseconds of data.

Navigation:
Navigation was controlled by Trimble DGPS input into Hypack Max software. The vessel location was plotted and recorded continuously along each survey line. Navigation Fix marks were generated by Hypack and transmitted to the EPC recorder and the Echo Sounder recorder at 150 foot intervals along the track lines.

Bathymetry:
Water depths were collected along all survey lines using an Innerspace Model 440 digital echo sounder. The water depths were recorded continuously in Hypack along the survey lines. These data were then corrected for tidal variation above Mean Low Water using the actual data available on the NOAA site for the gage to MobileBay entrance.

DATA PRESENTATION

The survey track lines and associated cores collected in the first part of the survey are included in Appendix 1 as Navigation Post Plot 2. The water depths collected along the lines run in the first part of the survey were not contoured, as the lines were not close enough to warrant contouring.

The survey track lines and borings located in the second portion of the survey are shown below in Figure 2. The full size version of this figure is included in Appendix 1 as Navigation Post Plot 1 of 2.

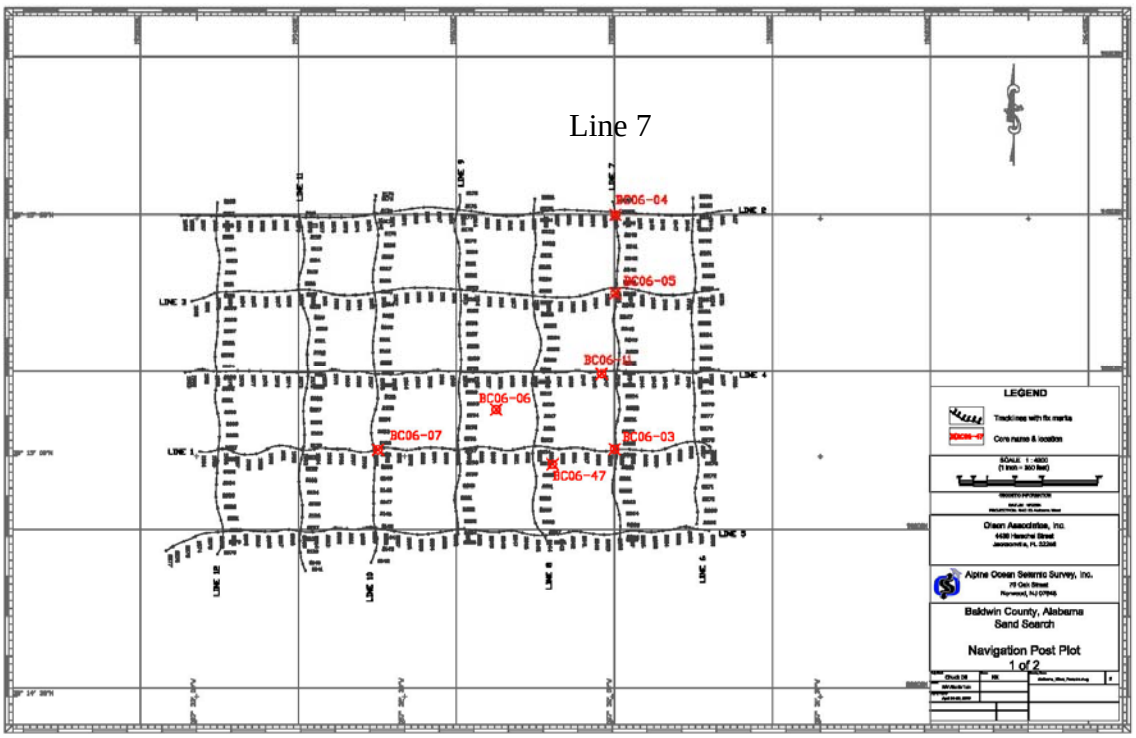


Figure 2, Perdido Key Survey Navigation Post Plot and Core Locations

Bathymetry

The corrected water depths were used to contour the data in the second portion of the survey area, and these contours are shown in Figure 3 and in Appendix 1. The previous borrow area is outlined by the deeper water depths along the north central part of the surveyed block as shown on Figure 3.

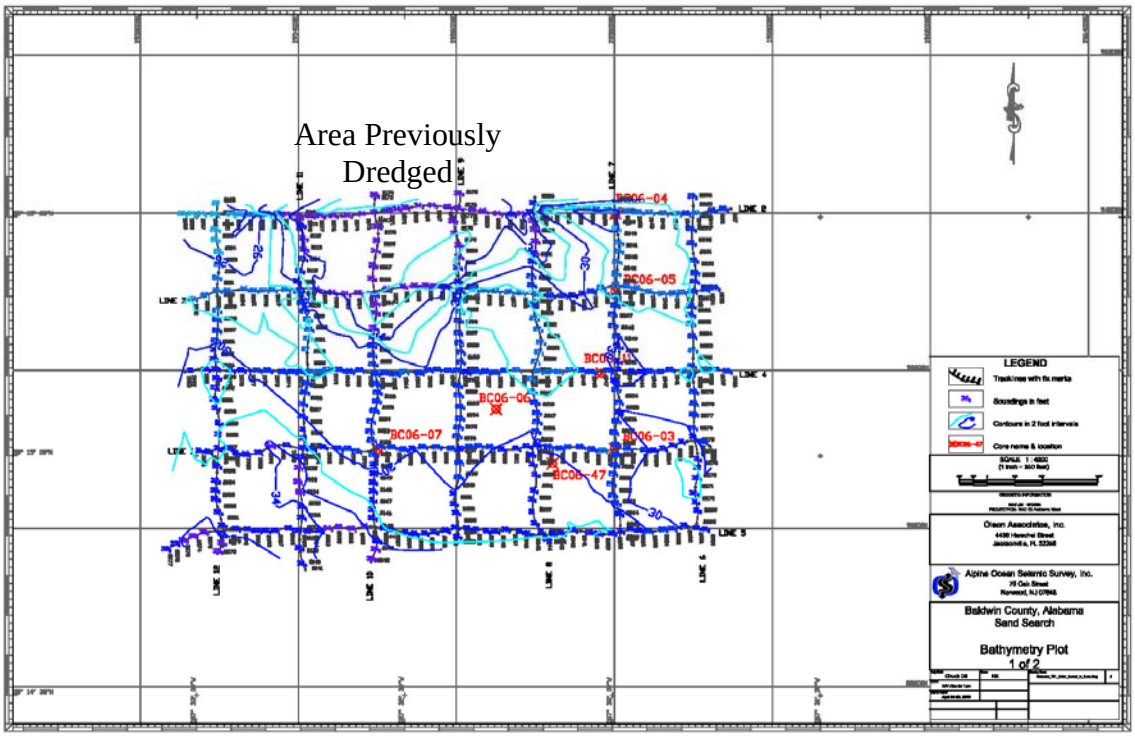


Figure 3, Bathymetric Contours

Geological Interpretation

The geological logs of the cores collected in the area of the previous borrow sites were used to correlate between the various reflectors shown on the geophysical data. A relatively prominent change, from cross-bedded layering above to generally horizontal layering below was marked by a significant seismic reflector present across the majority of the survey area. An example of the seismic data from line 7 at cores 4 and 5 is shown in Figure 4. The depth in feet to that reflector, based on the cores, was then contoured across the borrow area, resulting in the isopach map presented in Figure 5.

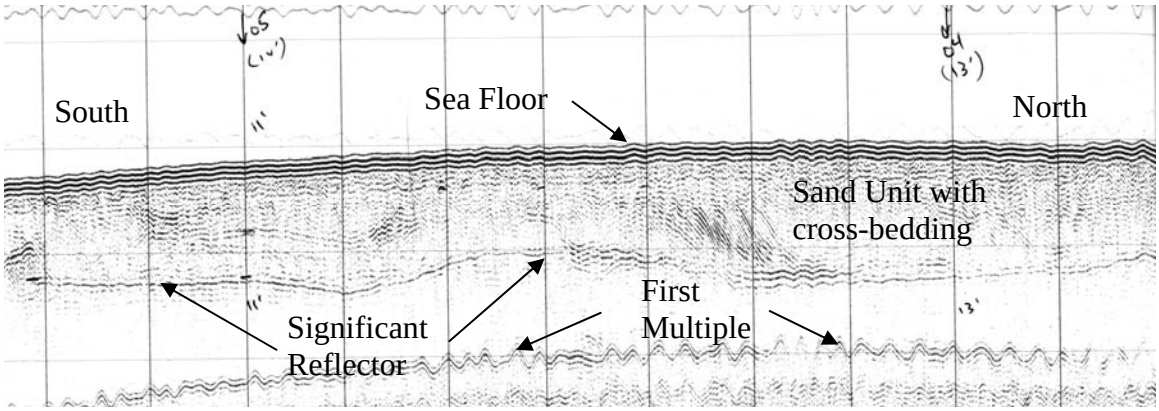


Figure 4, Seismic Line 7, with Cores 4 and 5

The speed of sound in sediments, determined by correlating the depth to the bottom of the white sand in the cores to the round trip travel time to the major reflector, was determined to be 5000 feet per second. This speed resulted in a relatively conservative or shallow depth to the reflector. The sediments below this reflector varied in this portion of the survey from a tan-gray sand to a clay unit, none of which would be suitable for beach fill. Use of a higher speed of sound in the sediments would have resulted in a deeper depth in feet to the bottom of the white sand. However, the slower speed was used to help prevent dredging into undesirable sediments below the clean sand.

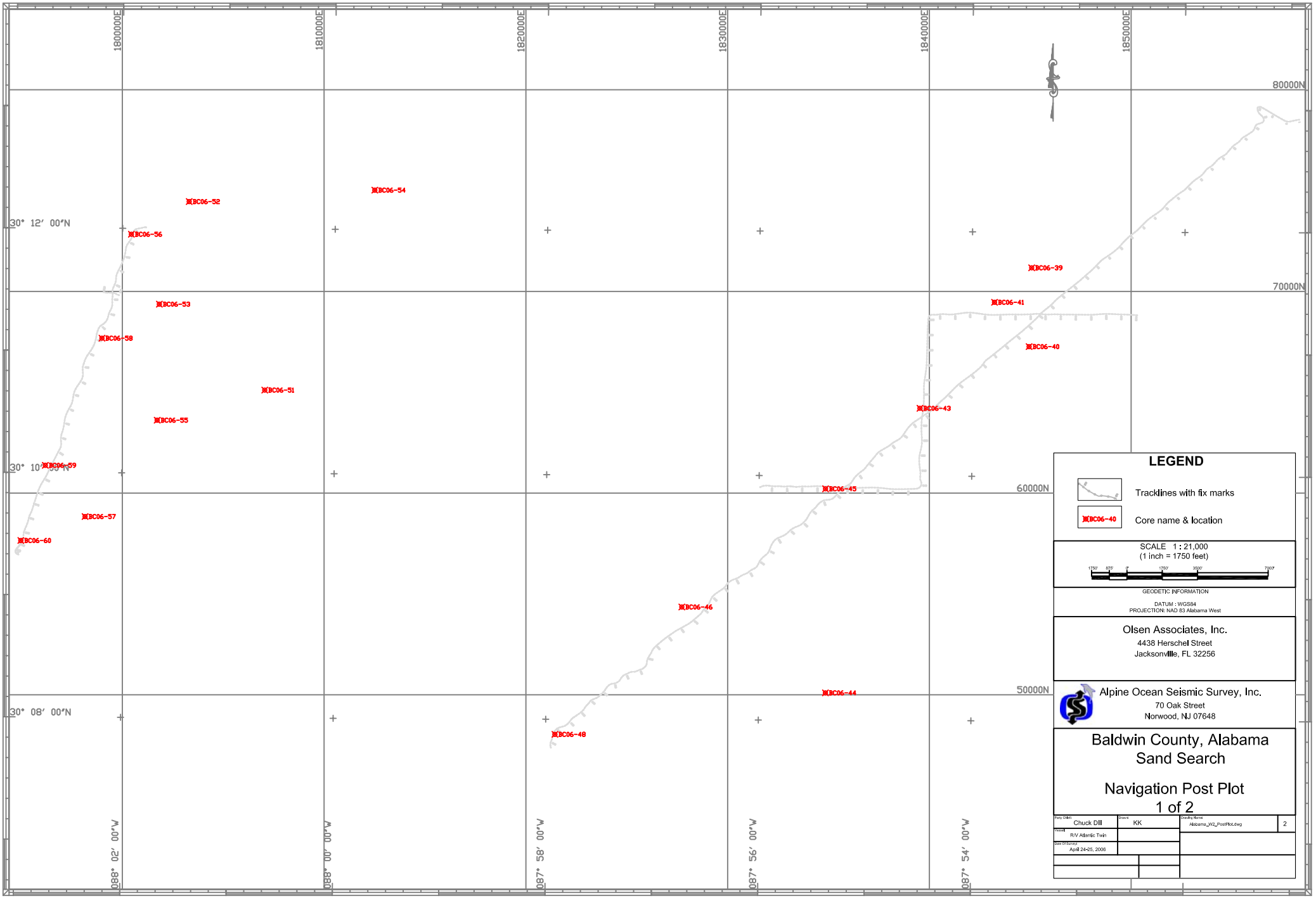
The depth to the primary seismic reflector, as shown in Figure 5 in Appendix 1, was plotted in cross section for three survey lines, namely lines 1, 3 and 7. These three lines were chosen as Vibracore samples were taken along these lines.

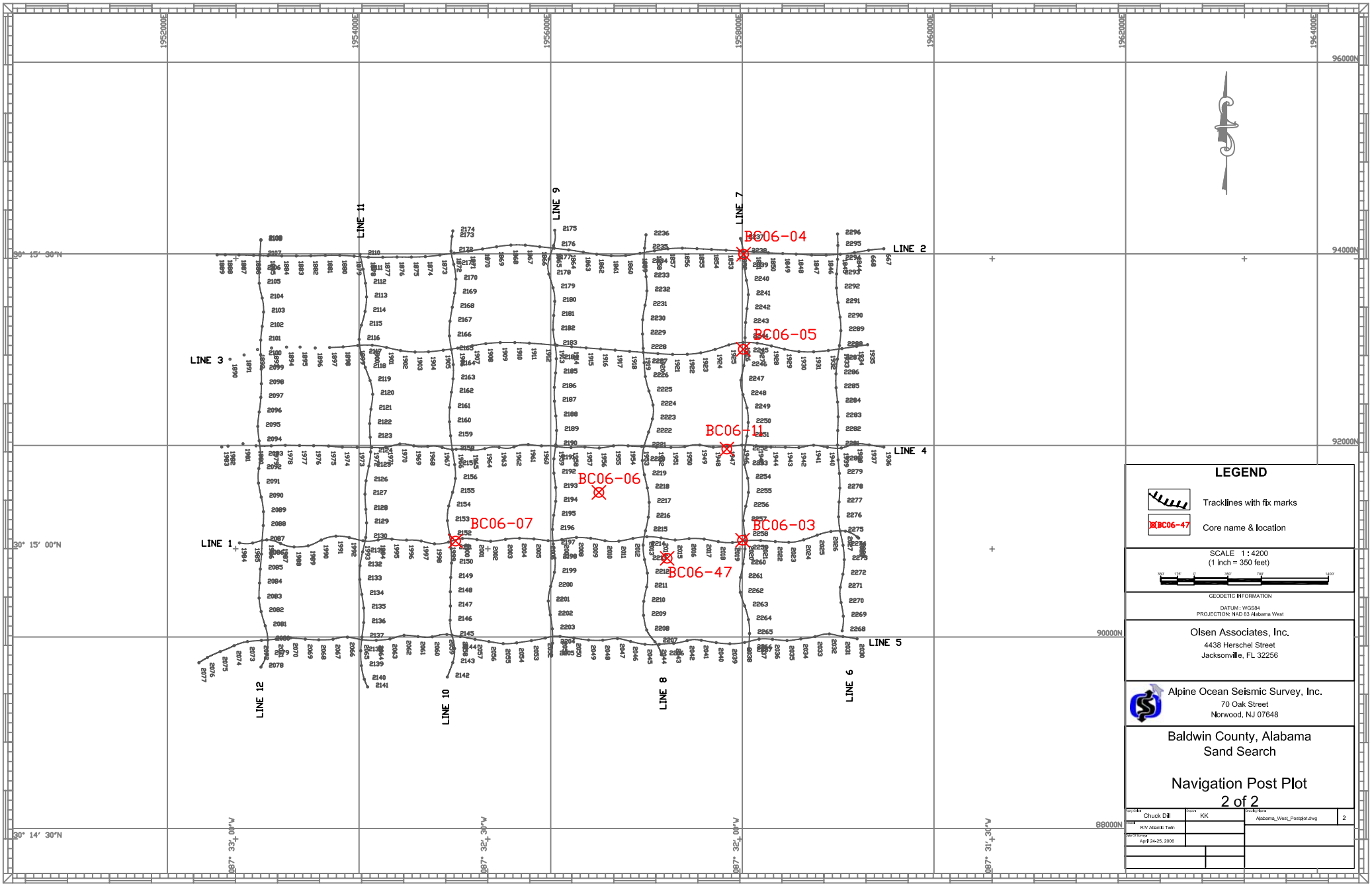
The data from these three lines were used as the basis of correlation to extend the data throughout the rest of the survey area. The results were contoured as an isopach map to show the thickness of the white sand unit. The average thickness for the white sand unit across the survey block, based on the data, is between 10 and 15 feet, as shown in the Isopach map, which is contained in Appendix 1.

CONCLUSIONS

A geophysical survey has been conducted along portions of the Alabama coast in order to correlate between Vibracore samples previously collected in the area. The survey was conducted in two area, namely the western part of the area offshore of Baldwin County, and the area around a borrow site southeast of Perdido Inlet. The latter survey block consisted of 5 survey lines run in the east-west direction and 7 lines run in the north-south direction. This survey area was run to determine the location and extent of additional sand resources outside and south of a small borrow area previously used for reconstruction of local beaches.

The survey around this block found that a white sand layer approximately four yards thick covered an area 2000 yards long parallel to the shore and 1000 yards wide perpendicular to the shore, for a total volume of approximately 8 million cubic yards of potentially suitable borrow sand.


1800000E
1810000E
1820000E
1830000E
1840000E
1850000E
80000N
70000N
60000N
50000N
30° 12′ 00″N
30° 10′ 00″N
30° 08′ 00″N
088° 02′ 00″W
088° 00′ 00″W
087° 58′ 00″W
087° 56′ 00″W
087° 54′ 00″W
BC06-52
BC06-54
BC06-56
BC06-39
BC06-53
BC06-41
BC06-58
BC06-40
BC06-51
BC06-43
BC06-55
BC06-59
BC06-45
BC06-57
BC06-60
BC06-46
BC06-44
BC06-48
LEGEND
Tracklines with fix marks
BC06-40
Core name & location
SCALE 1 : 21,000
(1 inch = 1750 feet)
1750' 875' 0' 1750' 3500' 7000'
GEODETIC INFORMATION
DATUM : WGS84
PROJECTION: NAD 83 Alabama West
Olsen Associates, Inc.
4438 Herschel Street
Jacksonville, FL 32256
Alpine Ocean Seismic Survey, Inc.
70 Oak Street
Norwood, NJ 07648
Baldwin County, Alabama
Sand Search
Navigation Post Plot
1 of 2
Party Chief: Chuck Dill
Drawn: KK
Drawing Name: Alabama_W2_PostPlot.dwg
2
Vessel: R/V Atlantic Twin
Date Of Survey: April 24-25, 2006



LEGEND

Tracklines with fix marks

BC06-47 Core name & location

SCALE 1 : 4200
(1 inch = 350 feet)

GEODETIC INFORMATION

DATUM : WGS84
PROJECTION: NAD 83 Alabama West

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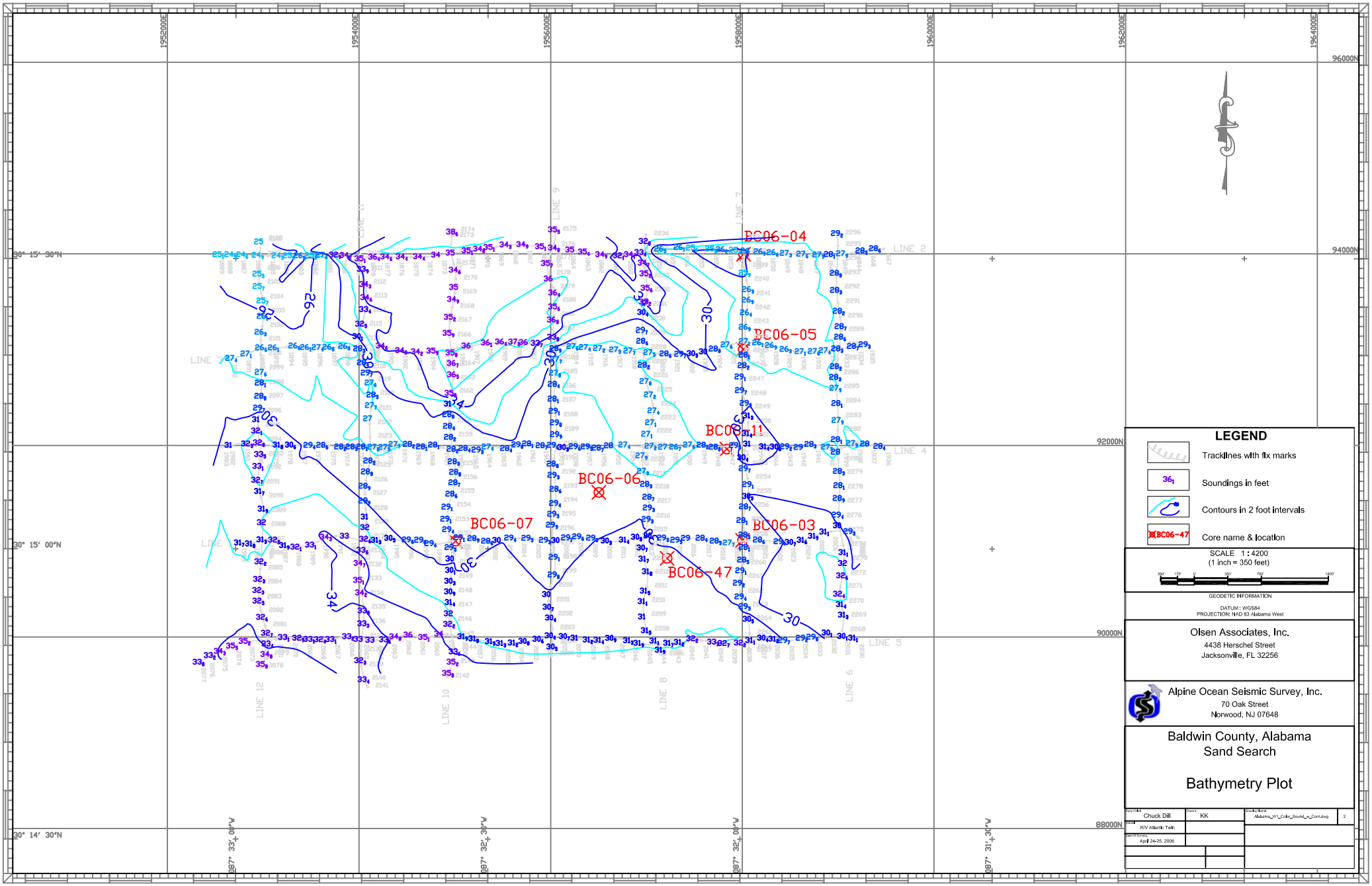
Navigation Post Plot
2 of 2

Survey Crew: Chuck Dill	Drawn: KK	Drawing Name: Alabama_West_Postplot.dwg	2
Vessel: R/V Atlantic Twin			
Date Of Survey: April 24-25, 2006			


BC06-04
BC06-05
BC06-11
BC06-06
BC06-07
BC06-03
BC06-47
LINE 1
LINE 2
LINE 3
LINE 4
LINE 5
LINE 6
LINE 7
LINE 8
LINE 9
LINE 10
LINE 11
LINE 12
1952000E
1954000E
1956000E
1958000E
1960000E
1962000E
1964000E
96000N
94000N
92000N
90000N
88000N
30° 15' 30"N
30° 15' 00"N
30° 14' 30"N
087° 33' 00"W
087° 32' 30"W
087° 32' 00"W
087° 31' 30"W
LEGEND
Tracklines with fix marks
Soundings in feet
Contours in 2 foot intervals
Core name & location
SCALE 1 : 4200
(1 inch = 350 feet)
GEODETIC INFORMATION
DATUM : WGS84
PROJECTION: NAD 83 Alabama West
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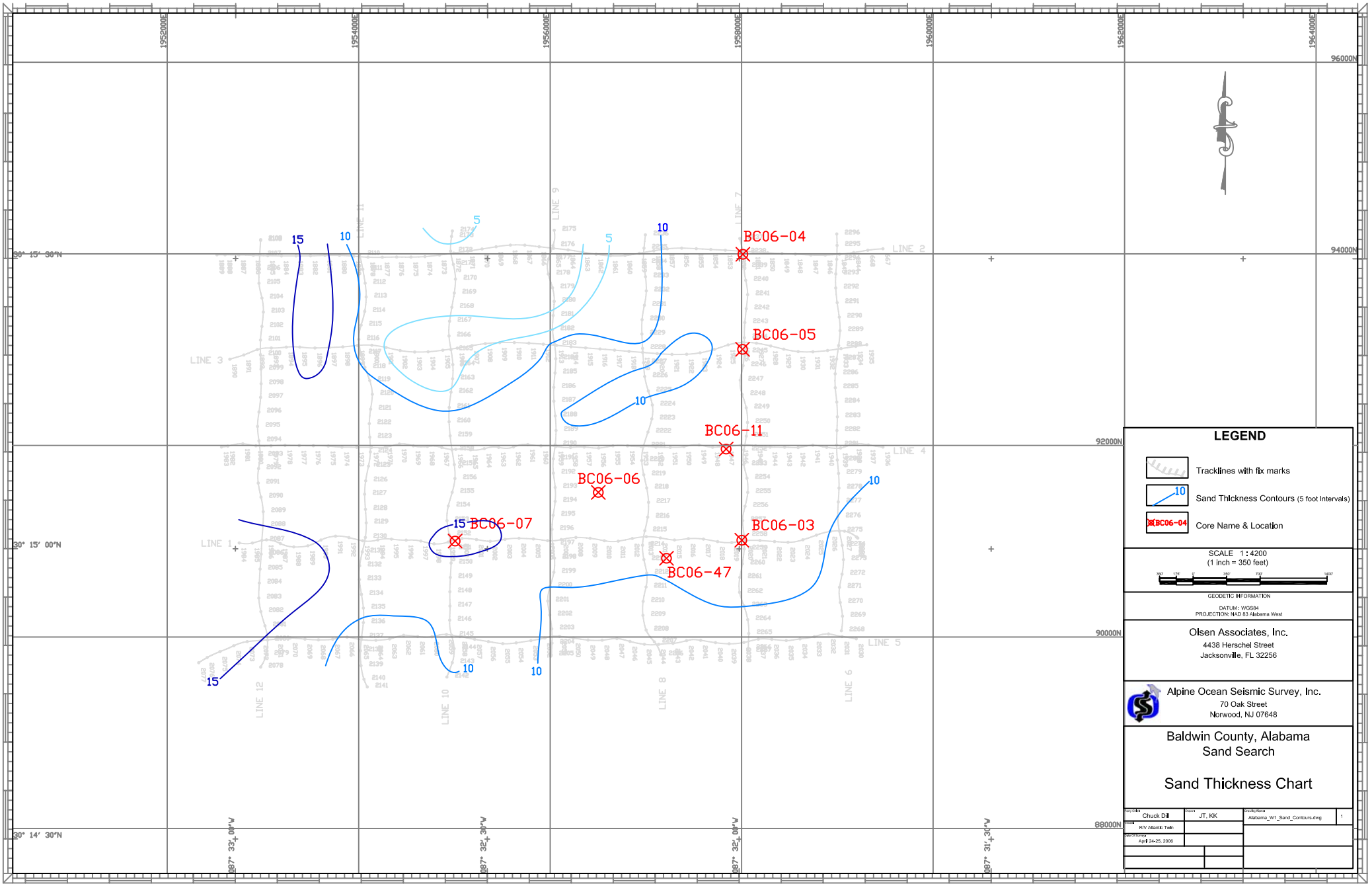
70 Oak Street
Norwood, NJ 07648
Baldwin County, Alabama
Sand Search
Bathymetry Plot
Chuck Dill
KK
R/V Atlantic Twin
April 24-25, 2006


1952000E
1954000E
1956000E
1958000E
1960000E
1962000E
1964000E
96000N
94000N
92000N
90000N
88000N
30° 15' 30"N
30° 15' 00"N
30° 14' 30"N
087° 33' 00"W
087° 32' 30"W
087° 32' 00"W
087° 31' 30"W
LINE 1
LINE 2
LINE 3
LINE 4
LINE 5
LINE 6
LINE 7
LINE 8
LINE 9
LINE 10
LINE 11
LINE 12
BC06-04
BC06-05
BC06-11
BC06-06
BC06-07
BC06-03
BC06-47
5
10
15
LEGEND
Tracklines with fix marks
Sand Thickness Contours (5 foot Intervals)
Core Name & Location
SCALE 1 : 4200
(1 inch = 350 feet)
GEODETIC INFORMATION
DATUM : WGS84
PROJECTION: NAD 83 Alabama West
Olsen Associates, Inc.
4438 Herschel Street
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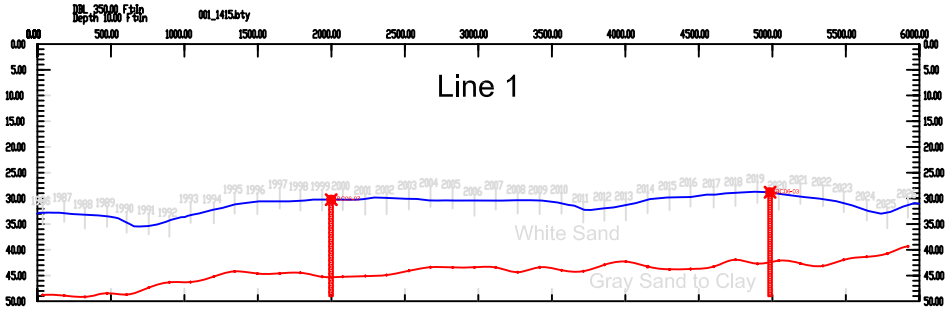
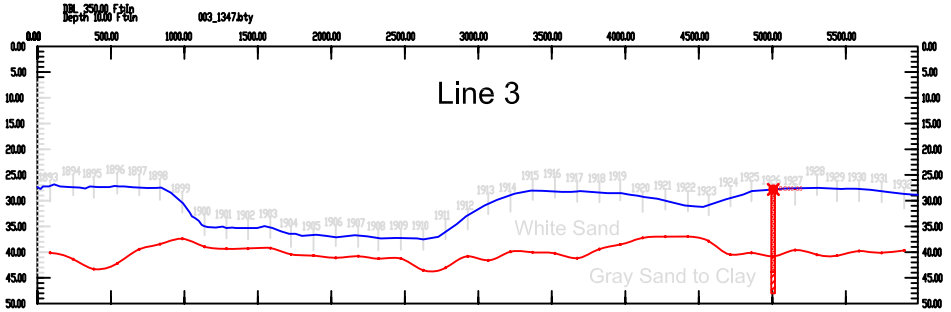
70 Oak Street
Norwood, NJ 07648
Baldwin County, Alabama
Sand Search
Sand Thickness Chart
Chuck Dill
JT, KK
Alabama_W1_Sand_Contours.dwg
R/V Atlantic Twin
April 24-25, 2006

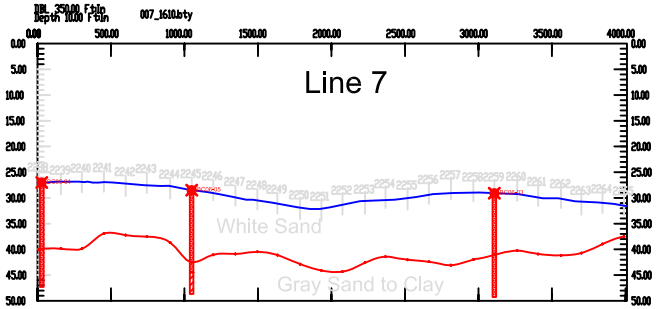
West East



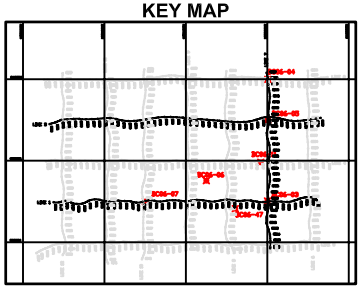
West East



North South



KEY MAP



LEGEND

Bathymetric Profile with Fix Marks

Reflector digitized from subbottom profile

Core Name & Location

Sand (as recorded on drilling logs)

Clay (as recorded on drilling logs)

SCALE 1 : 4200
(1 Inch = 350 feet)

Vertical scale 1 inch = 10 feet

GEODETIC INFORMATION

DATUM : WGS84
PROJECTION: NAD 83 Alabama West

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Geologic Profiles

Party Chief: Chuck Dill	Drawn: KK, JT	Drawing Name: Alabama_W1_Profiles.dwg	1
Vessel: R/V Atlantic Twin			
Date Of Survey: April 24-25, 2008			