ECS Southeast, LLC

Geotechnical Engineering Report

Bon Secour Visitor Center and Administration Building

12295 AL-180
Gulf Shores, AL 36542

ECS Project No. 30:2598

February 12, 2024

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Mr. Robert Bass, P.E.
Wiley|Wilson
5901 Peachtree Dunwoody Road,
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Atlanta, GA 30328

ECS Project No. 30:2598

Reference: Geotechnical Engineering Report
Bon Secour Visitor Center and Administration Building
12295 AL-180
Gulf Shores, Baldwin County, AL

Dear Mr. Bass:

ECS Southeast (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and laboratory testing conducted, and our design and construction recommendations.

It has been our pleasure to be of service to Wiley|Wilson during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify subsurface conditions determined for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

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EXECUTIVE SUMMARY

ECS Southeast, LLP (ECS) has completed the preliminary subsurface exploration for the proposed Bon Secour Visitor Center and Administration Building in Gulf Shores (Bon Secour), Alabama. The project information summarized below is based exclusively on the information made available to us by the client at the time of this report. Our findings, conclusions and recommendations are summarized below.

The following summarizes the main findings of the exploration, particularly those that may have a cost impact on the planned development. Further, our preliminary principal foundation recommendations are summarized. Information gleaned from the Executive Summary should not be utilized in lieu of reading the entire geotechnical report.

PROJECT INFORMATION:

- Site Location: AL-180, Gulf Shores, AL (Bon Secour)
- Building Scope: Visitor Center and Administration Building
- Building Type: Single-Story Pre-engineered Metal Building
- Earthwork: Provided information indicate cuts and fills on the order of 3 feet
- Sitework: Parling and underground utilities

SUBSURFACE CONDITIONS:

- Field Exploration: 3 SPT borings within the proposed building pad
- Surface Material: Vegetation associated with wooded property
- Probable Fill: Not apparent in the soil test borings
- Natural Material: Poorly Graded Silty Sand (SM)
- Groundwater: Encountered approximately from 2 to 8 feet

GEOTECHNICAL CONCERNS

- **Low Consistency Near-Surface Soils (Section 5.1.1)**
- **Moisture Sensitive Surficial Soils (Section 5.1.3)**

DESIGN & CONSTRUCTION RECOMMENDATIONS:

- Shallow Foundations
- Seismic Design: IBC Site Class “D”

1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for the design the Tacky Jacks building addition, the resort clubhouse and the associated parking and driveways. The recommendations developed for this report are based on project information supplied by Wiley|Wilson.

Our services were provided in accordance with our Proposal No.30-3127-P, dated December 22, 2023, as authorized by Wiley|Wilson on January 5, 2024, which includes our Terms and Conditions of Service.

This report contains the procedures and results of our subsurface exploration and laboratory testing programs, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

The report includes the following items.

- *Project Description.*
- *A brief review and description of our field and laboratory test procedures and the results of testing conducted.*
- *A review of surface topographical features and site conditions.*
- *A review of area and site geologic conditions.*
- *Field Exploration Procedures.*
- *Subsurface Conditions.*
- *Final soil exploration/test boring logs.*
- *Recommendations for site preparation and construction of compacted fills, including an evaluation of on-site soils for use as compacted fills and identification of potentially unsuitable soils and/or soils exhibiting excessive moisture at the time of sampling.*
- *Expansion of cut material during fill placement.*
- *Recommended foundation types.*
- *Evaluation and recommendations relative to groundwater control.*
- *An evaluation of soil excavation issues.*
- *Exploration location plan.*

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE/PAST SITE USE

The subject parcel is located along AL-180 adjacent to the existing visitor center in Gulf Shores (Bon Secour), Alabama (outlined red in **Figure 2.1.1**). The parcel is bound by wooded land, residential housing and Mobile Bay to the north, wooded land and residential housing to the east and west and wooded land and AL-180 to the south.

From review of available aerial imagery, the proposed development location has remained wooded since at least 1985. The existing visitor center, maintenance buildings and associated parking appear to have been constructed between 1992 and 1997. The site has overall topographical change on the order of about 7 feet, based on data available from Google Earth.

Figure 2.1.1. Site Location

2.2 PROPOSED CONSTRUCTION

Based on correspondence with the client, we understand that the development plans include the construction of a single-story visitor center and administration building. Structural loads were not provided to us at the time of this report; however, the use of shallow foundations similar to the existing visitor center.

The following information explains our understanding of the planned development including proposed buildings and related infrastructure**:**

SUBJECT	DESIGN INFORMATION / UNDERSTANDINGS
Building	Visitor Center and Administration Building
# of Stories	Single-story
Usage	Public Meeting, Restrooms and Administration
Framing	Pre-engineered metal
Column Loads	Anticipated 30 kips
Wall Loads	Anticipated 1 kip per linear foot (klf) maximum
Lowest Finish Floor Elevation	Estimated 10 feet

At the time of our field activities, ECS observed that the proposed site to have relatively level topography in previously developed areas and slightly rolling topography in undeveloped areas of the site. We have assumed the site will be leveled and have **minimal fill heights of no more than 3 feet for structural design**. **If greater fill depths are planned, ECS should be notified**.

2.3 REGIONAL/SITE GEOLOGY

The subject site lies in the Alluvial, coastal and low terrace deposits which consists of Varicolored fine to coarse quartz sand containing clay lenses and gravel in places. Coastal deposits include fine to medium quartz sand with shell fragments and accessory heavy minerals along Gulf beaches. Please refer to Figure 2.3.1 below for additional information about the geology at the site.

Figure 2.3.1 – Site Geology with Approximate Location of Site Highlighted

(Reed, P.C., 1971, Geologic map of Baldwin County, Alabama, Geological Survey of Alabama, Special Map 94)

3.0 FIELD EXPLORATION

Our exploration procedures are explained in greater detail in Appendix B including the insert titled Subsurface Exploration Procedures. Our scope of work included drilling 3 SPT borings. Our borings (B-1 through B-03) approximate locations are shown on the Boring Location Diagram in the Appendix.

3.1 EXPLORATION METHOD

3.1.1. Standard Penetration Test (SPT Borings)

A truck-mounted drill rig was utilized to perform the soil test borings using hollow stem auger drilling techniques to advance the borehole. The soil borings were generally advanced to a depth of approximately 25 feet below existing grades.

SPT sampling in borings were conducted at regular intervals in general accordance with ASTM D-1586 and ASTM D-1587. Small representative samples were obtained during these tests and were used to classify the soils encountered. The standard penetration resistances obtained provide a general indication of soil shear strength and compressibility.

3.2 SUBSURFACE CHARACTERIZATION

The subsurface conditions encountered were generally consistent with published geological mapping. The following sections provide generalized characterizations of the soil strata. Please refer to the boring logs in the Appendix.

The surficial material consisted of poorly graded silty sand associated with waterfront property. The surficial soils were very loose to loose silty alluvial type sand. These Poorly Graded Silty Sands (SM) became medium dense to dense and extended to boring termination depths. These sands typically appeared as light brown.

3.3 GROUNDWATER OBSERVATIONS

At the time of our field exploration, groundwater was encountered at depths between 7.25 and 10 feet below existing ground surface in the borings immediately following drilling operations. Based on the proposed construction, we anticipate groundwater will not likely affect the construction of the proposed building; however, the contractor should be prepared to dewater during the installation of any underground utilities.

Fluctuations in the groundwater elevation should be expected depending on precipitation, run-off, tidal fluctuations, and other factors not evident at the time of our evaluation. Normally, highest groundwater levels occur in summer and early fall and the lowest levels occur in late spring. Depending on time of construction, groundwater may be encountered at shallower depths and locations not explored during this study. If encountered during construction, engineering personnel from our office should be notified immediately.

4.0 LABORATORY TESTING

The laboratory testing performed by ECS for this project consisted of selected tests performed on samples obtained during our field exploration operations. The following paragraphs briefly discusses the procedure and results of the completed laboratory testing program during the execution of the preliminary soil test borings.

4.1 VISUAL CLASSIFICATION

Each soil sample from the test borings was visually classified on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS) and ASTM D-2488 (Description and Identification of Soils-Visual/Manual Procedures). After classification, the various soil types were grouped into the major zones noted on the boring logs in Appendix. The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs are approximate; in situ, the transitions may be gradual.

The soil samples from our current exploration will be retained in our laboratory for a period of six months after the subsurface exploration program is completed, after which they will be discarded unless other instructions are received as to their disposition.

4.2 INDEX TESTING

The index testing performed by ECS for this project consisted of selected tests performed on samples obtained during our field exploration operations. Index property tests were performed on representative soil samples obtained from the test borings in order to aid in classifying soils according to the Unified Soil Classification System (USCS) and to quantify and correlate engineering properties. The index testing program included the following:

- Natural Moisture Content Tests (ASTM D 2216),
- Percent of Soil Passing the No. 200 Sieve (ASTM D 6913)

The results of the laboratory testing results are included in Appendix of this report. Additionally, a summary of testing is provided in the appendix on the laboratory summary.

5.0 DESIGN RECOMMENDATIONS

Our geotechnical assessment of soil conditions at the project site was based on subsurface information and soil test data obtained at the designated test locations as presented in the Appendix of this report. In evaluating the data, we used correlations which have been previously made between Standard Penetration Test values, soil strength data, and behavioral characteristics observed in soil conditions similar to those encountered at the project site. The geotechnical design criteria and recommendation presented in this report are predominately based on guidelines found in Design Manual NAVFAC DM-7 "Soil Mechanics, Foundations, and Earth Structures" prepared by the Department of the Navy and our extensive experience in the project area.

Recommendations are provided below for earthwork operations and the proposed building construction. It is anticipated that there will be site grading that will include cuts and fills on the order of 3 feet or less to achieve the finish site grades. If fill depths greater than 3 feet are planned ECS should be notified so that the design can be re-evaluated based on the actual fill depths.

5.1 SIGNIFICANT GEOTECHNICAL CONSIDERATIONS

The primary purpose of this geotechnical exploration was to help identify and evaluate the general subsurface conditions relative to the proposed construction. ECS has identified the following Significant Geotechnical Considerations associated with the site.

5.1.1 Low Consistency Near Surface Soils

A primary geotechnical consideration at the subject site is the presence of low-consistency surficial soils. Low-consistency soils were encountered at the ground surface in the soil borings and extended to approximate depths of 2 to 5 feet below the existing grade. These soils will require densification prior to the placement of structural fill. Following stripping and grubbing activities, we recommend preparing the low-consistency soils as follows:

Densify the entire stripped area with a large smooth drum vibratory compactor weighing a minimum of 10 tons (Caterpillar CS74B or similarly weighted equipment). The large compactor should be capable of densifying and compacting the soil types encountered across the site to about 3 - 4 feet in depth. The amount of compaction required to achieve densification of the soils should be evaluated using a test pad area at the time of construction.

An ECS representative should be onsite during densification activities to observe and perform density testing. Once the densified area has been observed to be adequate, structural fill can be placed and compacted in accordance with Section 6 of this report.

Following densification activities and prior to placing structural fill we recommend proofrolling (proof compacting) densified areas. Proofrolling should be observed by the ECS engineer or soils technician to observe and document site conditions prior to placement of fill. Soils that continue to exhibit excessive movement or deflection during proofrolling activities should be undercut and replaced with structural fill. An ECS representative should be on site at the time of construction to evaluate the actual depth of

undercut, where required. Please see Section 6.1.2 for additional discussion regarding evaluation of the subgrade.

5.1.2 Moisture Sensitive Surficial Soils

Based on the laboratory test results, the near surface soils are moisture sensitive and will become inadequate when wet or dry of their optimum moisture content as evaluated by ASTM D698. Effective site drainage should be implemented at the onset of construction and maintained during the construction process. Care should be taken to keep construction traffic to a minimum across the site during wet periods. Water should not be allowed to pond on construction areas (building pads or pavement subgrade).

5.2 FOUNDATIONS

Based on the existing structures, we anticipate that the visitor center will be supported on a shallow foundation system. Recommendations for shallow foundations for the visitor center and administration building are included in the following sections.

5.2.1 Shallow Foundation Recommendations

Based on the assumed loads (maximum column loads on the order of 30 kips, maximum wall loads of 1 kip per linear foot) and provided that the recommendations herein are strictly adhered to, the planned clubhouse can be supported on conventional shallow column and continuous wall footings. We recommend the foundation design use the parameters provided in Table 5.3.1.

Table 5.2.2 – Foundation Parameters

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure(1)	1,500 psf	1,500 psf
Acceptable Bearing Soil Material	Densified Natural Soil	Densified Natural Soil
Minimum Width	24 inches	18 inches
Minimum Footing Embedment Depth (below slab or finished grade)	24 inches	24 inches
Estimated Total Settlement (2)	Less than 1- inch	Less than 1- inch
Estimated Differential Settlement (3)	Less than ½ inches between columns	Less than ½ inches

Notes:
(1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.
(2) Based on assumed structural loads. If final loads are different, ECS must be contacted to update foundation recommendations and settlement calculations.
(3) Based on maximum column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are more complete.

If low consistency soils are observed at bearing elevation during footing inspections, the footings should be extended to adequate bearing soils. Undercut areas within the footing excavations should be backfilled with compacted structural fill or lean concrete ($f'_c \geq 1{,}000$ psi at 28 days) to the original design bottom of footing elevation; the original footing should be constructed on top of the hardened lean concrete or

structural fill. If structural fill is used to backfill the undercut footing, the over-excavated footings should be widened accordingly on all sides for each one (1) foot of over excavation as detailed in the figure below. If lean concrete is used for backfill, the over-excavation does not require widening.

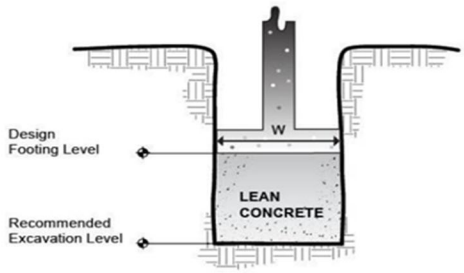


Figure 5.2.1 - Lean Concrete Backfill

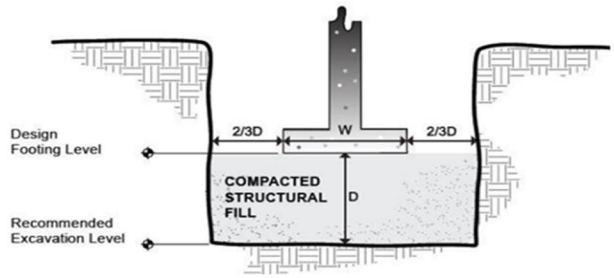


Figure 5.2.2 - Structural Fill Backfill

The net allowable soil bearing pressure refers to that pressure which may be transmitted to the foundation bearing soils in excess of the final minimum surrounding overburden pressure. The final footing elevation should be evaluated by ECS's geotechnical engineering personnel to verify that the bearing soils are capable of supporting the recommended net allowable bearing pressure and adequate for foundation construction. These evaluations should include visual observations using a T-probe or static cone penetrometer, or with the use of a Dynamic Cone Penetrometer (DCP), if necessary. Evaluations should be performed within each column footing excavation (minimum of 2 tests per column footing) and at intervals not greater than 25 feet in continuous footings. The DCP testing should extend at least 2 feet below the final foundation subgrade. A minimum DCP value of 10 blows should be used for the evaluation of the foundations.

The settlement of a structure is a function of the compressibility of the bearing materials, bearing pressure, actual structural loads, fill depths, and the bearing elevation of footings with respect to the final ground surface elevation. Estimates of settlement for foundations bearing on structural or non- structural fills are strongly dependent on the quality of fill placed. Factors that may affect the quality of fill include maximum loose lift thickness of the fills placed and the amount of compactive effort placed on each lift. If the recommendations outlined in this report are followed, we expect total settlements for the proposed construction to be in the range of 1 inch or less, while the differential settlement will be approximately half of the anticipated total settlement. This evaluation is based on our engineering experience and the anticipated loadings for this type of structure and is intended to aid the structural engineer with the design.

Exposure to the environment may weaken the soils at the foundation bearing level if the foundation excavations remain exposed during periods of inclement weather. Therefore, foundation concrete should be placed the same day that final excavation is achieved, and the design bearing pressure verified. If the bearing soils are softened by surface water absorption or exposure to the environment, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the foundation excavation must remain open overnight, or if rainfall is apparent while the bearing soils are exposed, we recommend that a 1 to 3-inch thick "mud mat" of "lean" concrete be placed over the exposed bearing soils before the placement of reinforcing steel.

If the actual structural loads exceed those discussed with you, we should be notified so that the design bearing pressure can be re-evaluated and revised, if necessary. We recommend that Dynamic Cone Penetrometer (DCP) testing or other appropriate testing be performed to confirm the available bearing capacity of the foundation bearing materials prior to concrete placement.

5.3 SLABS-ON-GRADE

Provided subgrades and structural fills are prepared as discussed herein, the proposed floor slabs can be constructed as ground supported slabs (or slab-on-grade). The slabs will bear on newly compacted fill. The following graphic depicts our soil-supported slab recommendations:

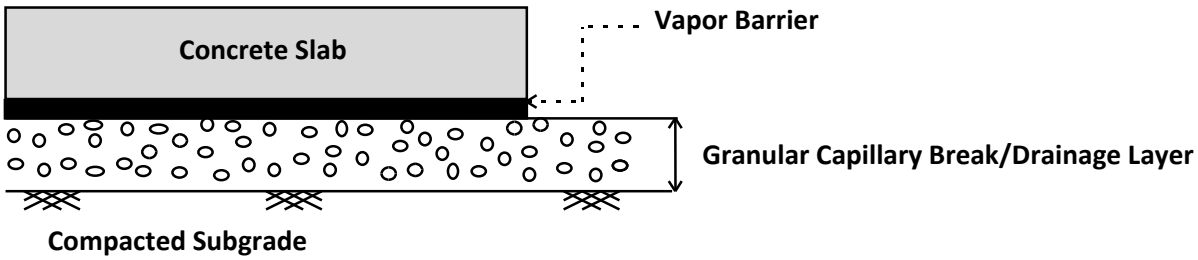


Figure 5.3.1

1. Drainage Layer Thickness: 6 inches
2. Drainage Layer Material: GRAVEL (GP, GW), SAND (SP, SW)

Soft or yielding soils may be encountered in some areas. Those soils should be removed and replaced with compacted structural fill in accordance with the recommendations included in this report.

Subgrade Modulus: Provided the structural fill and granular drainage layer are constructed in accordance with our recommendations, the slab may be designed assuming a modulus of subgrade reaction, k_1 of 100 pci (lbs./cu. inch). The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test basis.

Vapor Barrier: Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture penetration through the floor slab. When a vapor barrier is used, special attention should be given to surface curing of the slab to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the structural engineer and/or the architect may choose to eliminate the vapor barrier.

Slab Isolation: Soil-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration prevents the use of a free-floating slab such as in a drop-down footing/monolithic slab configuration, the slab should be designed with adequate reinforcement and load transfer devices to preclude overstressing of the slab.

5.4 SEISMIC DESIGN CONSIDERATIONS

Seismic Site Classification: The International Building Code (IBC) 2015 requires site classification for seismic design based on the upper 100 feet of a soil profile. At least two methods are utilized in classifying sites, namely the shear wave velocity (v_s) method and the Standard Penetration Resistance (N-value) method. The first method (shear wave velocity) was used in classifying this site.

SEISMIC SITE CLASSIFICATION			
Site Class	**Soil Profile Name**	**Shear Wave Velocity, Vs, (ft./s)**	**N value (bpf)**
A	Hard Rock	Vs > 5,000 fps	N/A
B	Rock	2,500 < Vs ≤ 5,000 fps	N/A
C	Very dense soil and soft rock	1,200 < Vs ≤ 2,500 fps	>50
D	Stiff Soil Profile	600 ≤ Vs ≤ 1,200 fps	15 to 50
E	Soft Soil Profile	Vs < 600 fps	<15

Based upon our interpretation of the subsurface conditions, the appropriate Seismic Site Classification is "D" as shown in the preceding table.

Ground Motion Parameters: In addition to the seismic site classification, ECS has determined the design spectral response acceleration parameters following the IBC methodology. The Mapped Reponses were estimated from the USGS website https://earthquake.usgs.gov/ws/designmaps/. The design responses for the short (0.2 sec, S_{DS}) and 1-second period (S_{D1}) are noted in bold at the far-right end of the following table.

GROUND MOTION PARAMETERS								
Period (sec)	**Mapped Spectral Response Accelerations (g)**		**Values of Site Coefficient for Site Class**		**Maximum Spectral Response Acceleration Adjusted for Site Class (g)**		**Design Spectral Response Acceleration (g)**	
Reference	Figures 1613.3.1 (1) & (2)		Tables 1613.3.3 (1) & (2)		Eqs. 16-37 & 16-38		Eqs. 16-39 & 16-40	
0.2	S_S	0.085	F_a	1.6	$S_{MS}=F_aS_s$	0.135	$S_{DS}=2/3\ S_{MS}$	0.09
1.0	S_1	0.055	F_v	2.4	$S_{M1}=F_vS_1$	0.131	$S_{D1}=2/3\ S_{M1}$	0.087

The Site Class definition should not be confused with the Seismic Design Category designation which the Structural Engineer typically assesses. If a higher site classification is beneficial to the project, we can provide additional testing methods that may yield more favorable results.

6.0 SITE CONSTRUCTION RECOMMENDATIONS

6.1 SUBGRADE PREPARATION

6.1.1 Stripping and Subgrade Preparation

The subgrade preparation should consist of stripping topsoil and other soft or inadequate materials from the 10-feet expanded building limits and 5-feet expanded pavement limits. These activities should include removing loose surface materials (see Section 5.1).

If soft areas are identified during stripping operations the contractor should undercut the soft soils and replace them with compacted structural fill material or densify the soils in place as described in Section 5 of this report. If undercut is performed, following undercut activities the contractor should then densify the excavation bottom/exposed surface with a large vibratory compactor, and then replace the material in lifts in accordance earthwork operation section 6.2 of this report and with project requirements to prepare the existing soil subgrade for the anticipated sequence of fill placement. Deeper undercut may be required in pavement areas, due to conditions that may exist at time of construction. Where the deeper undercut is required, the placement of bridge lifts or use of geotextiles may be required to stabilize subgrade prior to fill placement. The project documents should include provisions for additional undercut and replacement as needed for these conditions.

The amount and frequency of precipitation will affect the surficial soil conditions following stripping and initial site preparation. The onsite soils are moisture sensitive, and they may become difficult to work with when wet of their optimum moisture content as evaluated by ASTM D-698. Site drainage should be implemented early in the construction process and maintained throughout construction. Further, the contractor should make provisions to keep excavations dry during construction to maintain the integrity of the exposed soils and help reduce the potential for otherwise unnecessary remedial work.

Erosion and sedimentation should be controlled in accordance with Best Management Practices and current state, local, and NPDES requirements. At the appropriate time, we would be pleased to provide a proposal for construction materials testing and NPDES related services.

6.1.2 Proofrolling

Following the stripping operations and prior to the placement of structural fills or structural elements, the exposed subgrade soils should be observed by the ECS geotechnical engineer or their approved representative. Proofrolling using loaded equipment used in compaction, having a weight of at least 10 tons, may be used at this time to aid in identifying localized soft or inadequate materials that should be removed. Soft or inadequate material encountered during proofrolling should be removed to a stable subgrade and replaced with an approved backfill compacted to the criteria given below. A stable subgrade surface will be required for pile installation.

6.1.3 Subgrade Compaction

After completing the clearing and stripping operations and installing the temporary groundwater control measures (if required), the exposed surface should be compacted with multiple passes of the large smooth drum roller having a weight of at least 10 tons to compact the surface soils. Typically, the material should

exhibit moisture contents within ±2 percentage points of the Standard Proctor optimum moisture content (ASTM D-698) during the compaction operations.

Compaction should continue until densities of at least 100 percent of the Standard Proctor maximum dry density (ASTM D-698) have been achieved within the upper one foot of the compacted natural soils at the site.

6.2 EARTHWORK OPERATIONS

6.2.1 Structural Backfill and Fill Soils

After subgrade preparation and observation has been completed and a stable subgrade exists, fill placement may begin. Structural fill materials should not be placed on soils which have been recently subjected to precipitation. Borrow fill materials, if necessary, should not contain wet materials at the time of placement. Wet soils should be removed prior to the placement of engineered fill, granular sub-base materials, foundation/slab concrete, or paving materials. ECS assumed placement of no more than 3 feet of elevated structural fill would be used to raise the site grades. If more than 3 feet of fill is planned ECS should be notified.

Materials used as structural fill for the upper layer of soil subgrade should consist of approved sandy material free of organics, debris, and otherwise deleterious materials and containing between 12 and 25 percent passing the No. 200 sieve and 95 percent or less passing the No. 40 sieve, by mass. In addition, the materials must meet the following criteria:

- Plasticity Index (PI) $\leq$ 10
- Maximum particle size = 4 inches
- Material to be compacted with a vibratory roller

Prior to placement of structural fill, representative bulk samples (about 50 pounds) of on-site and off-site borrow should be submitted to ECS for laboratory testing, which will include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships for compaction. Import materials should be tested prior to being hauled to the site to evaluate if they meet project specifications.

Engineered fill in the building and other built-over areas should be compacted to at least 98 percent of the Standard Proctor maximum dry density (ASTM D-698). The structural fill, consisting of on-site soils or off-site granular borrow material meeting project requirements, or a mixture thereof, should be placed in essentially horizontal lifts with a maximum loose thickness of 8 inches and **+/-2% of the optimum moisture content** per the Standard Proctor method (ASTM D-698).

Each lift of compacted engineered fill should be tested by a representative of the geotechnical engineer prior to placement of subsequent lifts. Compaction testing should be performed at the rate of at least 1 test per 2,500 square feet for each lift of fill within the building pad and at the rate of at least 1 test per 5,000 square feet for each lift of fill outside of the building pad, with a minimum of 3 tests per lift of fill within the building footprint. The elevation and location of the tests should be accurately identified at the time of fill placement. Areas which fail to achieve the required degree of compaction should be recompacted and retested until minimum compaction is achieved. Failing test areas may require adjustments in moisture content or other remedial activities in order to achieve the required compaction.

The expanded limits of the proposed construction areas should be well defined, including the limits of the fill zones for buildings, pavements, and slopes, etc., at the time of fill placement. Grade controls should be maintained throughout the filling operations. Benching of slopes should be planned to facilitate compaction.

Compaction equipment adequate to the soil type being compacted should be used to compact the subgrades and fill materials. Sheepsfoot compaction equipment should be adequate for the fine-grained soils (Clays and Silts). A vibratory steel drum roller should be used for compaction of coarse-grained soils (Sands and Gravels) as well as for sealing compacted surfaces. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 3 to 4 inches may be required to achieve specified degrees of compaction.

At the end of each work day, fill areas should be graded to facilitate drainage of precipitation and the surface should be sealed by use of a smooth-drum roller to limit infiltration of surface water. During placement and compaction of new fill at the beginning of each workday, the contractor may need to scarify existing subgrades to a depth on the order of 4 inches so that a weak plane will not be formed between the new fill and the existing subgrade soils.

Positive site drainage should be maintained during earthwork operations in an effort to maintain the integrity of the site surface soil. When wet, the site soils may degrade quickly with disturbance from contractor operations and will be extremely difficult to stabilize for fill placement. Consequently, the contractor should be prepared to implement aggressive mechanical or chemical drying, depending upon the actual site conditions. We strongly recommend that mass grading for the project be performed during the drier fall months to help facilitate favorable moisture conditions for the site soils. If water must be added to raise the moisture content of the soil, it should be uniformly applied and thoroughly mixed into the soil. Given the average rainfall for the area, adding moisture to the soil should be done with caution.

6.3 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered in our exploration are expected to be generally adequate for support of utility pipes. The pipe subgrade should be observed and probed for stability by the testing agency to evaluate the suitability of the materials encountered. Loose or inadequate materials encountered at the utility pipe subgrade elevation should be removed and replaced with compacted Structural Fill or pipe bedding material meeting project requirements.

Utility Backfilling: The granular bedding material should be at least 4 inches thick, but not less than that specified by the project drawings and specifications. Fill placed for support of the utilities, as well as backfill over the utilities, should satisfy the requirements for structural fill given in this report. Compacted backfill should be free of topsoil, roots, ice, or other material designated as not meeting project requirements. The backfill should be moisture conditioned, placed, and compacted in accordance with the recommendations of this report.

Utility Excavation Dewatering: Depending upon time of year of construction and the resulting potential shallow groundwater, the contractor should be prepared for temporary dewatering in utility excavations. While we did not encounter water in all of our borings, the possibility exists for water to be present in deeper excavations across the site.

6.4 TEMPORARY EXCAVATIONS

During foundation excavation and utility installation, the existing on-site soils should be observed by a geotechnical engineer and should be benched or sloped back at appropriate gradients, in accordance with OSHA 29 CFR 1926. It should be understood that, during wet weather and cold weather conditions, seepage and freeze/thaw conditions may decrease the stability of cuts.

During construction, temporary slopes should be regularly evaluated for signs of movement, seepage, or an unsafe condition. Soil slopes should be covered for protection from rain and surface runoff conditions. Stormwater runoff should not be permitted to overtop the crests of slopes, and therefore must be diverted away from the slopes.

6.5 GENERAL CONSTRUCTION CONSIDERATIONS

Subgrade Protection: Measures should also be taken to limit site disturbance, especially from rubber-tired heavy construction equipment, and to control and remove surface water from development areas, including structural and pavement areas. It would be advisable to designate a haul road and construction staging area to limit the areas of disturbance and to prevent construction traffic from excessively degrading subgrade soils.

Excavation Safety: Cuts or excavations associated with utility excavations may require forming or bracing, slope flattening, or other physical measures to control sloughing and/or prevent slope failures. Contractors should be familiar with applicable OSHA codes to ensure that adequate protection of the excavations and trench walls is provided.

Erosion Control: Install soil erosion and sedimentation control devices, as well as temporary stormwater management facilities, as specified by Site/Civil Engineer. Maintain positive drainage conditions throughout construction, avoiding unnecessary ponding of stormwater in excavations or low areas of the site. Seal-roll exposed soil or subgrade surfaces prior to rain or snow events, and promptly remove standing water immediately afterwards.

6.6 CONSTRUCTION OBSERVATION AND TESTING

Regardless of the thoroughness of a geotechnical engineering study, there is always a possibility that subsurface conditions between test borings may be different from those encountered at the test boring locations, that conditions are not as anticipated by the designers, or that the demolition or construction process has altered the subsurface conditions.

Therefore, geotechnical engineering construction observation should be performed under the supervision of ECS, since we are familiar with the intent of the recommendations presented in this report. Such observation services are recommended to evaluate whether the conditions anticipated in the design actually exist, or whether the recommendations presented in the report should be standard where necessary.

7.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation, expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by Wiley|Wilson. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

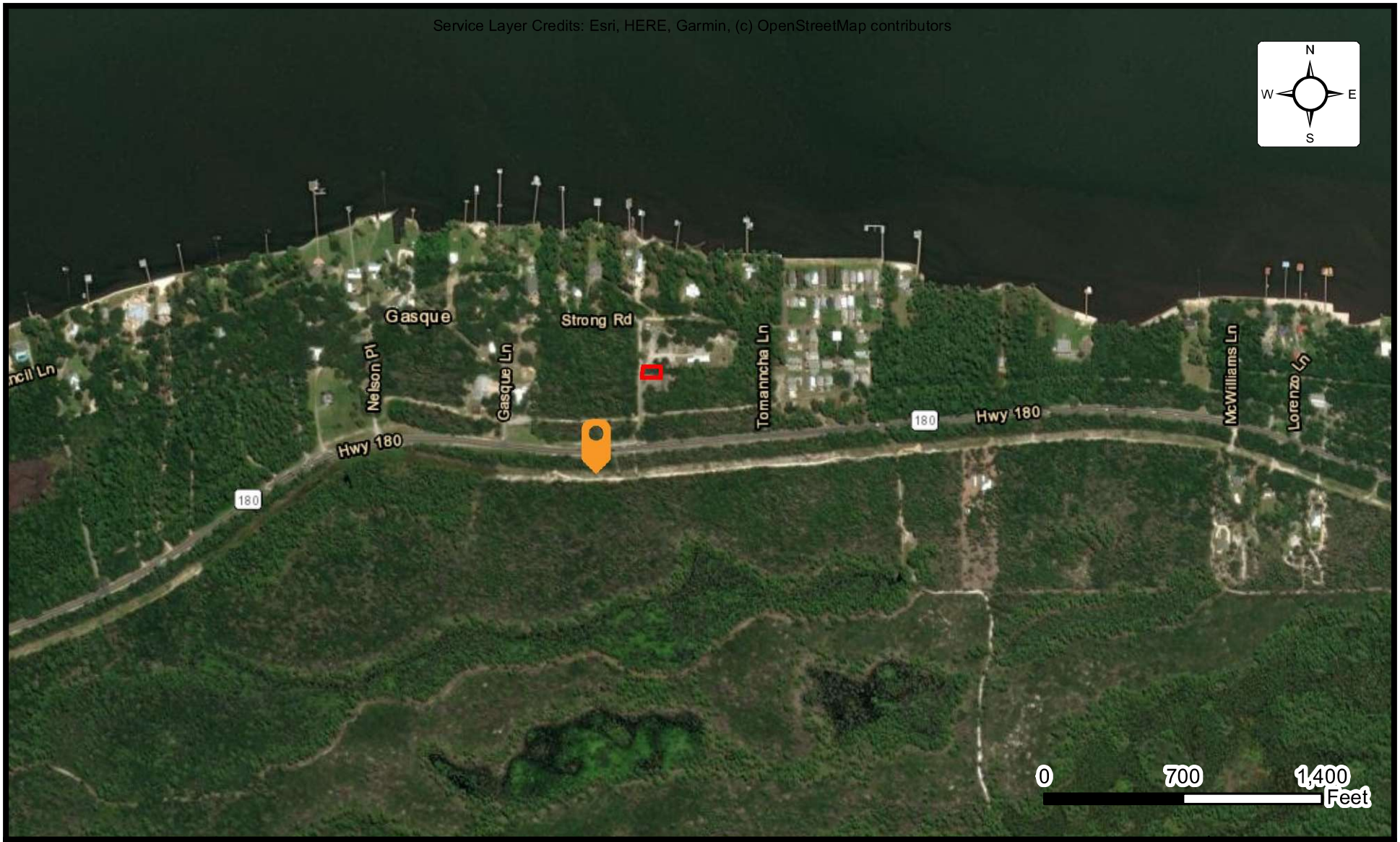
We recommend that ECS review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

Field observations, and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

Appendix A - Drawings and Reports

Site Location Diagram
Boring Location Diagram(s)

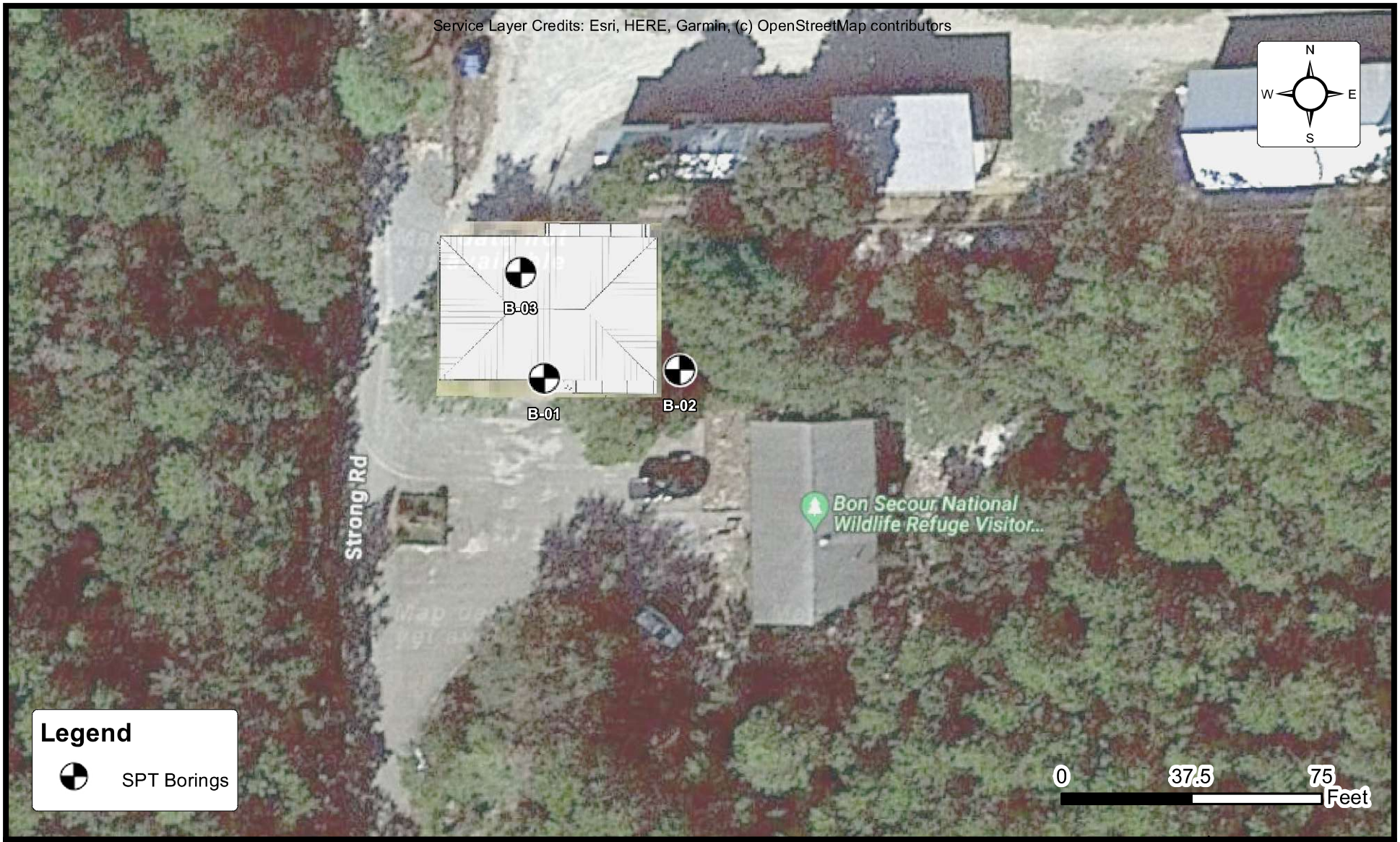


SITE LOCATION DIAGRAM
BON SECOUR VISITOR CENTER & ADMINISTRATION

12295 AL-180, BON SECOUR, ALABAMA

WILEY|WILSON

ENGINEER	WBH5
SCALE	AS NOTED
PROJECT NO.	30:2598
FIGURE	1 OF 1
DATE	1/9/2024



BORING LOCATION DIAGRAM
BON SECOUR VISITOR CENTER & ADMINISTRATION

12295 AL-180, BON SECOUR, ALABAMA
WILEY|WILSON

ENGINEER	WBH5
SCALE	AS NOTED
PROJECT NO.	30:2598
FIGURE	1 OF 1
DATE	1/9/2024

Appendix B – Field Operations

Reference Notes
Exploration Procedures
Boring Logs

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]

		ASPHALT
		CONCRETE
		GRAVEL
		TOPSOIL
		VOID
		BRICK
		AGGREGATE BASE COURSE
	GW	WELL-GRADED GRAVEL gravel-sand mixtures, little or no fines
	GP	POORLY-GRADED GRAVEL gravel-sand mixtures, little or no fines
	GM	SILTY GRAVEL gravel-sand-silt mixtures
	GC	CLAYEY GRAVEL gravel-sand-clay mixtures
	SW	WELL-GRADED SAND gravelly sand, little or no fines
	SP	POORLY-GRADED SAND gravelly sand, little or no fines
	SM	SILTY SAND sand-silt mixtures
	SC	CLAYEY SAND sand-clay mixtures
	ML	SILT non-plastic to medium plasticity
	MH	ELASTIC SILT high plasticity
	CL	LEAN CLAY low to medium plasticity
	CH	FAT CLAY high plasticity
	OL	ORGANIC SILT or CLAY non-plastic to low plasticity
	OH	ORGANIC SILT or CLAY high plasticity
	PT	PEAT highly organic soils

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

DESIGNATION		PARTICLE SIZES
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, Q_P[4]	SPT[5] (BPF)	CONSISTENCY[7] (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective *(ex: "Silty")*	25 - 45	30 - 45

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT[5]	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

WATER LEVELS[6]

- WL (First Encountered)
- WL (Completion)
- WL (Seasonal High Water)
- WL (Stabilized)

FILL AND ROCK

FILL | POSSIBLE FILL | PROBABLE FILL | ROCK

[1]Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

[2]To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

[3]Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].

[4]Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

[5]Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

[6]The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

[7]Minor deviation from ASTM D 2488-17 Note 14.

[8]Percentages are estimated to the nearest 5% per ASTM D 2488-17.

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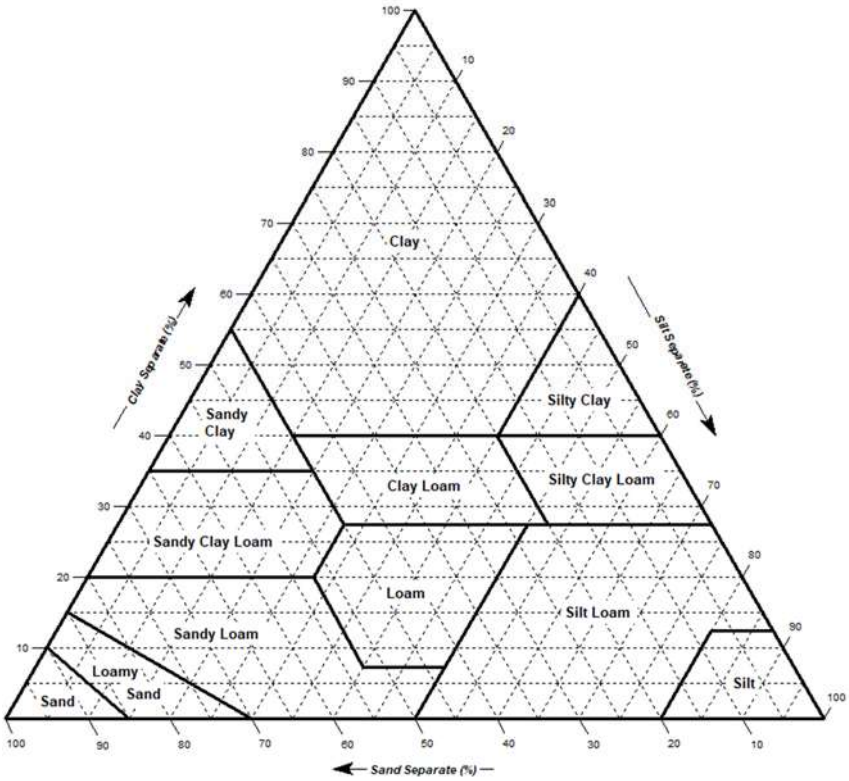
U.S. Department of Agriculture (USDA) Soil Classification System

Texture Triangle

Fine Earth Texture Classes (▬)



Texture Class

Texture Class or Subclass	Code	
	Conv.	NASIS
Coarse Sand	cos	COS
Sand	s	S
Fine Sand	fs	FS
Very Fine Sand	vfs	VFS
Loamy Coarse Sand	lcos	LCOS
Loamy Sand	ls	LS
Loamy Fine Sand	lfs	LFS
Loamy Very Fine Sand	lvfs	LVFS
Coarse Sandy Loam	cosl	COSL
Sandy Loam	sl	SL
Fine Sandy Loam	fsl	FSL
Very Fine Sandy Loam	vfsl	VFSL
Loam	l	L
Silt Loam	sil	SIL
Silt	si	SI
Sandy Clay Loam	scl	SCL
Clay Loam	cl	CL
Silty Clay Loam	sicl	SICL
Sandy Clay	sc	SC
Silty Clay	sic	SIC
Clay	c	C

Texture Modifiers – Conventions for using "Rock Fragment Texture Modifiers" and for using textural adjectives that convey the "% volume" ranges for **Rock Fragments – Size and Quantity.**

Fragment Content % By Volume	Rock Fragment Modifier Usage
< 15	No texture adjective is used (noun only; e.g., *loam*).
15 to < 35	Use adjective for appropriate size; e.g., *gravelly*.
35 to < 60	Use "very" with the appropriate size adjective; e.g., *very gravelly.*
60 to < 90	Use "extremely" with the appropriate size adjective; e.g., *extremely gravelly.*
≥ 90	No adjective modifier. If ≤ 10% fine earth, use the appropriate noun for the dominant size class; e.g., *gravel.* **Use terms in lieu of texture.**

Texture Modifiers – (Adjectives)

Rock Fragments: Size and Quantity	Code		Criteria: Percent (by volume) of total rock fragments and dominated by (*name size*):
	Conv.	PDP/ NASIS	
Rock Fragments (> 2mm; ≥ Strongly Cemented)			
Gravelly	GR	GR	≥ 15% but < 35% gravel
Fine Gravelly	FGR	GRF	≥ 15% but < 35% fine gravel
Medium Gravelly	MGR	GRM	≥ 15% but < 35% med. gravel
Coarse Gravelly	CGR	GRC	≥ 15% but <35% coarse gravel
Very Gravelly	VGR	GRV	≥ 35% but < 60% gravel
Extremely Gravelly	XGR	GRX	≥ 60% but < 90% gravel
Cobbly	CB	CB	≥ 15% but < 35% cobbles
Very Cobbly	VCB	CBV	≥ 35% but < 60% cobbles
Extremely Cobbly	XCB	CBX	≥ 60% but < 90% cobbles
Stony	ST	ST	≥ 15% but < 35% stones
Very Stony	VST	STV	≥ 35% but < 60% stones
Extremely Stony	XST	STX	≥ 60% but < 90% stones
Boudlery	BY	BY	≥ 15% but < 35% boulders
Very Bouldery	VBY	BYV	≥ 35% but < 60% boulders
Extremely Bouldery	XBY	BYX	≥ 60% but < 90% boulders
Channery	CN	CN	≥ 15% but < 35% channers
Very Channery	VCN	CNV	≥ 35% but < 60% channers
Extremely Channery	XCN	CNX	≥ 60% but < 90% channers
Flaggy	FL	FL	≥ 15% but < 35% flagstones
Very Flaggy	VFL	FLV	≥ 35% but < 60% flagstones
Extremely Flaggy	XFL	FLX	≥ 60% but < 90% flagstones

SUBSURFACE EXPLORATION PROCEDURE: STANDARD PENETRATION TESTING (SPT) ASTM D 1586 Split-Barrel Sampling

Standard Penetration Testing, or **SPT**, is the most frequently used subsurface exploration test performed worldwide. This test provides samples for identification purposes, as well as a measure of penetration resistance, or N-value. The N-Value, or blow counts, when corrected and correlated, can approximate engineering properties of soils used for geotechnical design and engineering purposes.

SPT Procedure:

- Involves driving a hollow tube (split-spoon) into the ground by dropping a 140-lb hammer a height of 30-inches at desired depth

- Recording the number of hammer blows required to drive split-spoon a distance of 18-24 inches (in 3 or 4 Increments of 6 inches each)

- Auger is advanced* and an additional SPT is performed

- One SPT typically performed for every two to five feet. An approximate 1.5 inch diameter soil sample is recovered.

**Drilling Methods May Vary*— The predominant drilling methods used for SPT are open hole fluid rotary drilling and hollow-stem auger drilling.

ECS Southeast, LLP
724 Lakeside Drive
Mobile, AL 36693

BORING NUMBER B-01

CLIENT Wiley Wilson, Inc.
PROJECT NAME Bon Secour Visitor Center and Administration Building
PROJECT NUMBER 30.2598
PROJECT LOCATION Gulf Shores, AL
DATE STARTED 1/23/24 **COMPLETED** 1/23/24
GROUND ELEVATION 18 ft **HOLE SIZE** 4 inches
DRILLING CONTRACTOR Southern Testing & Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Continuous Flight Auger
AT TIME OF DRILLING 8.00 ft / Elev 10.00 ft
LOGGED BY D. Westbrook **CHECKED BY** L. Chandler
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Asphalt (3 inches)										
		(SM) Very Loose, Orange, Sand										
			SPT 01		1-2-2 (4)			6				51
5			SPT 02		2-2-3 (5)			5				47
		(SM) Loose to Medium Dense, White, Sand	SPT 03		3-4-5 (9)			14				46
10			SPT 04		5-6-8 (14)			20				48
15			SPT 05		8-10-12 (22)			19				41
20			SPT 06		7-11-12 (23)			19				41
25			SPT 07		9-11-11 (22)			21				43

Bottom of borehole at 25.5 feet.

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ECS Southeast, LLP
724 Lakeside Drive
Mobile, AL 36693

BORING NUMBER B-02

CLIENT Wiley Wilson, Inc.
PROJECT NAME Bon Secour Visitor Center and Administration Building
PROJECT NUMBER 30.2598
PROJECT LOCATION Gulf Shores, AL
DATE STARTED 1/23/24 **COMPLETED** 1/23/24
GROUND ELEVATION 18 ft **HOLE SIZE** 4 inches
DRILLING CONTRACTOR Southern Testing & Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Continuous Flight Auger
AT TIME OF DRILLING 8.17 ft / Elev 9.83 ft
LOGGED BY D. Westbrook **CHECKED BY** L. Chandler
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Topsoil (1 inch)										
		(SM) Very Loose, Lt. Brown, Sand										
		(SM) Very Loose, Orange, Sand	SPT 01		1-1-1 (2)			6				40
5			SPT 02		1-1-2 (3)			5				41
		(SM) Medium Dense, White, Sand	SPT 03		2-3-4 (7)			6				43
10			SPT 04		4-6-11 (17)			22				37
15			SPT 05		6-11-13 (24)			21				40
20			SPT 06		7-11-12 (23)			22				40
25		(SM) Medium Dense, Gray, Sand	SPT 07		6-10-11 (21)			20				41

Bottom of borehole at 25.5 feet.

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ECS Southeast, LLP
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Mobile, AL 36693

BORING NUMBER B-03

CLIENT Wiley Wilson, Inc.
PROJECT NAME Bon Secour Visitor Center and Administration Building
PROJECT NUMBER 30.2598
PROJECT LOCATION Gulf Shores, AL
DATE STARTED 1/23/24 **COMPLETED** 1/23/24
GROUND ELEVATION 18 ft **HOLE SIZE** 4 inches
DRILLING CONTRACTOR Southern Testing & Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Continuous Flight Auger
AT TIME OF DRILLING 7.25 ft / Elev 10.75 ft
LOGGED BY D. Westbrook **CHECKED BY** L. Chandler
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		(GP) Crushed Gravel (2 inches)										
		(SM) Very Loose, Lt. Brown, Sand										
			SPT 01		2-2-3 (5)			3				43
5			SPT 02		2-2-2 (4)			1				45
		(SM) Loose to Medium Dense, White, Sand										
		▽	SPT 03		2-3-4 (7)			15				42
10			SPT 04		3-5-7 (12)			17				38
15			SPT 05		7-9-12 (21)			13				42
20			SPT 06		6-10-11 (21)			16				38
25			SPT 07		7-11-12 (23)			20				38

Bottom of borehole at 25.5 feet.

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Mobile, AL 36693

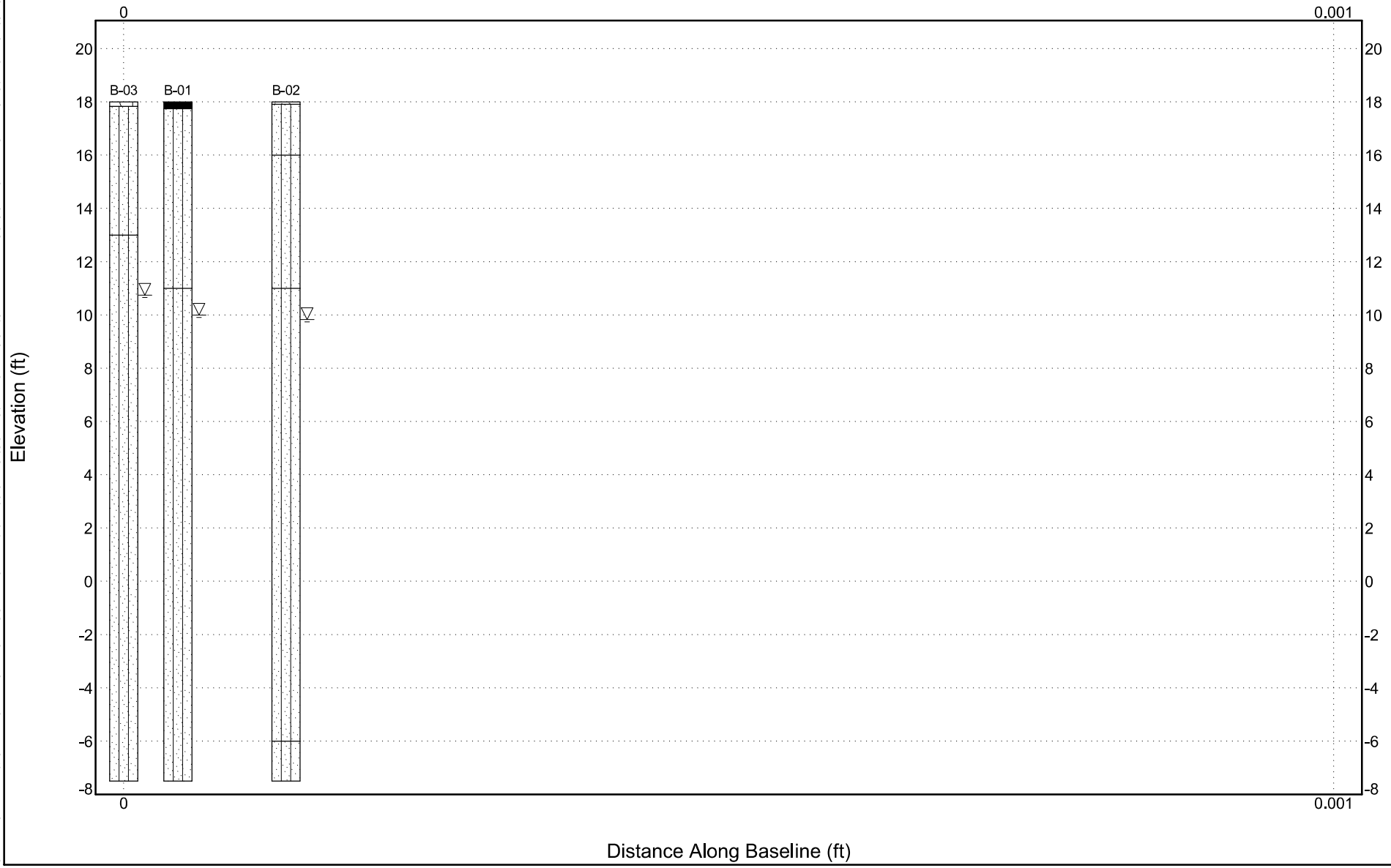
SUBSURFACE DIAGRAMS

CLIENT Wiley Wilson, Inc.

PROJECT NAME Bon Secour Visitor Center and Administration Building

PROJECT NUMBER 30.2598

PROJECT LOCATION Gulf Shores, AL



STRATIGRAPHY & GW - A SIZE - GINT STD US LAB.GDT - 2/1/24 09:31 - C:\USERS\DWESTBROOK\ONEDRIVE - ECS CORPORATE SERVICES\DESKTOP\GEOTECH\NEW GEO\30.2598\30.2598.GPJ

Appendix C – Laboratory Testing

Laboratory Testing Summary

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724 Lakeside Drive
Mobile, AL 36693

SUMMARY OF LABORATORY RESULTS

CLIENT Wiley Wilson, Inc.

PROJECT NAME Bon Secour Visitor Center and Administration Building

PROJECT NUMBER 30.2598

PROJECT LOCATION Gulf Shores, AL

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
B-01	1.5	--	--	--	4.75	51		5.5			
B-01	4.0	--	--	--	4.75	47	SM	5.2			
B-01	6.5	--	--	--	4.75	46	SM	14.0			
B-01	9.0	--	--	--	4.75	48	SM	19.7			
B-01	14.0	--	--	--	4.75	41	SM	18.8			
B-01	19.0	--	--	--	4.75	41	SM	19.4			
B-01	24.0	--	--	--	4.75	43	SM	20.7			
B-02	1.5	--	--	--	4.75	40	SM	5.9			
B-02	4.0	--	--	--	4.75	41	SM	5.0			
B-02	6.5	--	--	--	4.75	43	SM	5.9			
B-02	9.0	--	--	--	4.75	37	SM	21.8			
B-02	14.0	--	--	--	4.75	40	SM	20.9			
B-02	19.0	--	--	--	4.75	40	SM	21.6			
B-02	24.0	--	--	--	4.75	41	SM	19.9			
B-03	1.5	--	--	--	4.75	43	SM	3.3			
B-03	4.0	--	--	--	4.75	45	SM	1.2			
B-03	6.5	--	--	--	4.75	42	SM	14.9			
B-03	9.0	--	--	--	4.75	38	SM	17.3			
B-03	14.0	--	--	--	4.75	42	SM	13.2			
B-03	19.0	--	--	--	4.75	38	SM	15.9			
B-03	24.0	--	--	--	4.75	38	SM	20.5			

LAB SUMMARY - GINT STD US LAB.GDT - 2/1/24 09:31 - C:\USERS\DWESTBROOK\ONEDRIVE - ECS CORPORATE SERVICES\DESKTOP\GEOTECH\NEW GEO\30.2598\30.2598.GPJ

Appendix D – Other Information

GBA - Geotechnical Engineering Report Information Sheet

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

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