GeoCon
Engineering & Materials Testing, Inc.

Report of Geotechnical Exploration

Proposed Orange Beach Fire Training Facility
Orange Beach Boulevard
Orange Beach, Alabama

GeoCon Project No. DL 4929-25

Prepared For:

Mr. Glenn Smith
City of Orange Beach
Via Email

Date: July 25, 2025

Prepared By:
GeoCon Engineering & Materials Testing, Inc.
22830 McAuliffe Drive
Robertsdale, Alabama 36567

GeoCon
Engineering & Materials Testing, Inc.

July 25, 2025

City of Orange Beach
Via Email

Attn: Mr. Glenn Smith

RE: **Report of Geotechnical Exploration**
Proposed Orange Beach Fire Training Facility
Orange Beach Boulevard
Orange Beach, Alabama
GeoCon Project No. DL 4929-25

Dear Mr. Smith:

GeoCon Engineering & Materials Testing, Inc. is pleased to submit this report of geotechnical exploration for the above referenced project. Included in this report is a summary of our understanding of the project, results of the field exploration, and our recommendations for site grading and foundation design along with pavement build-up recommendations. This testing has been performed in general accordance with our earlier discussions with you.

Enclosed please find our report with evaluations and recommendations followed by an Appendix which includes a Site Location Map, Test Location Plan, graphical logs of the soundings and borings, laboratory test data, a Unified Soil Classification Chart, important notes about your Geotechnical Report and the Terms and Conditions that govern our work.

We appreciate the opportunity to have provided you with our geotechnical engineering services. If you have any questions concerning this report, or if we can be of any further assistance, please contact our office.

Sincerely,

GeoCon, Inc.

ALABAMA LICENSED 7/25/25 No. 26742 PROFESSIONAL ENGINEER DAVID RONALD MCKEE

Hayden R. Mason, E.I.
Staff Engineer

David R. McKee, P.E.
Geotechnical Engineer

22830 McAuliffe Drive Robertsdale, Alabama 36567
Phone (251) 947-1035

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1.0 Project Description

The project subject to this report is the construction of the proposed Orange Beach Fire Training Facility located along the west side of Orange Beach Boulevard in Orange Beach, Alabama. The location of the subject site is shown on the attached Site Location Map (Figure 1). During our July 2025 field exploration, the site was accessible to our equipment.

The information provided indicated that the project will include a proposed building and a future storage building. We anticipate that the buildings will include either metal-frame or CMU construction with concrete slab-on-grade floors and will be supported on shallow foundations. The project also includes related parking and access drive areas. Structural loading information was not available at the time of this report. Based on the provided *Utility Plan* (drawn by City of Orange Beach Community Development, dated June 2025), about one foot of fill will be required to reach final subgrade elevations.

> Note: GeoCon should be notified of any revisions to the project plans. GeoCon should also be provided with structural loading data when available. Additional comments and/or revisions to this report may be required. This report is intended to provide information on the soil conditions at this site and provide general recommendations and geotechnical considerations for developing the site.

2.0 Geotechnical Exploration

Soil conditions were investigated by performing eight (8) Cone Penetration Test (CPT) soundings to depths of about 25 feet below the existing ground surface in the proposed building areas. In addition, eight (8) manual hand auger borings to depths of about 6 feet below the existing ground surface were performed in the proposed pavement areas. The general sounding and boring locations are shown on the attached Test Location Plan (Figure 2).

CPT testing was performed in accordance with ASTM D-5778 using a Vertek S4 electronic CPT rig. CPT testing includes pushing an electronic cone on a series of rods into the ground at a constant rate. The electronic cone collects continuous measurements of the resistance to penetration of the cone tip and side friction sleeve. Correlations between Cone Resistance values and Standard Penetration Test (SPT) “N” values were performed using methods developed by Robertson, Campanella and Wightman. The CPT logs attached in the appendix show the cone tip stress, sleeve stress, pore pressure, correlated “N” value and the soil behavior type (SBT). At each test sounding location, samples were collected of the soils encountered in the upper 4 feet of the soil-profile.

The hand auger test borings performed in the pavement areas included Dynamic Cone Penetrometer (DCP) soundings to evaluate relative soil density/consistency characteristics. With the DCP, a 1½-inch diameter cone is seated to penetrate any loose cuttings and then driven in 1¾-inch increments with blows from a 15-pound weight falling 20 inches. The number of blows required to drive the cone the 1¾-inch increments is an index of relative soil strength and compressibility. The samples collected were visually classified by GeoCon, Inc.

personnel, placed in containers and transported to our laboratory for further testing and for further review by our engineering staff. Samples will be retained at our lab for a period of 60 days after the date of this report.

3.0 Soil Conditions Encountered

Four (4) soundings initially penetrated about 4 to 6 inches of crushed aggregate material. The remaining soundings initially penetrated about 2 to 4 inches of organic topsoil material. Below the crushed aggregate and organic topsoil material, the soundings generally penetrated sand and sand with silt soils to sounding termination at depths of about 25 feet below the existing ground surface.

Borings B-5 through B-8 initially encountered about 2 inches of organic topsoil material. The remaining borings initially encountered about 3 to 4 inches of asphalt pavement or 10 inches of crushed aggregate. Below the organic topsoil material, asphalt pavement, and/or crushed aggregate material, the borings generally encountered sand, sand with silt, and silty sand soils to boring termination at depths of about 6 feet below the existing ground surface.

Based on the cone tip friction and correlated N-values, the soils in the upper 2½ to 3½ feet of the soil profile were generally in a loose to firm condition. The deeper soils were generally in a firm to dense condition. Based on the DCP values, the soils encountered at the boring locations were generally in a loose to very firm condition. The soil conditions encountered are described in more detail on the Sounding and Boring Logs attached in the Appendix.

4.0 Groundwater Conditions Encountered

Groundwater was encountered at fourteen (14) test locations at depths of about 4 to 5 feet below the existing ground surface. Borings B-6 and B-7 did not encounter groundwater for the depths explored at the time of the field exploration. Groundwater conditions are subject to seasonal variations and are expected to fluctuate in response to local variations in precipitation and drainage conditions. Considering the relatively short time frame of the field exploration, groundwater levels may not have had sufficient time to stabilize. Therefore, actual depths to groundwater may vary.

Based on the sounding and boring data, we do not anticipate that groundwater will be encountered during subgrade preparation. However, if groundwater is encountered, the use of well-points, tail ditches, temporary underdrains, etc. may be required to facilitate subgrade preparation.

5.0 Laboratory Testing

The soil samples taken from the site were visually classified in general accordance with the guidelines of ASTM D-2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System). The quantity and type of laboratory tests performed for this geotechnical study were determined and adjusted by GeoCon engineering personnel based on the uniformity and characteristics of the subsurface soil conditions encountered and our experience and knowledge of local soil conditions.

Laboratory soil tests were performed to aid in the classification of the soils and to help in the evaluation of engineering characteristics of the soils. Representative soil samples recovered from the soil test locations were selected for grain-size analysis (7 tests). The laboratory data is shown on the attached lab data sheets.

6.0 Site Preparation Recommendations

6.1 General Site Preparation

Areas beneath and 5 feet beyond the building footprints and 2 feet beyond pavement areas should be designated as "controlled areas". The initial phase of site grading should include the removal of any surface vegetation, organic topsoil, old foundation systems, pavements, crushed aggregate, buried debris, utilities, etc. from within the “controlled areas”. The subgrade soils encountered across the site are prone to rutting and displacing during the initial phases of site grading, especially if wet weather conditions persist during site preparation. We recommend that low ground pressure track mounted equipment be used in the debris/topsoil removal and general site preparation. The use of heavy rubber tire equipment will deteriorate the subgrade soil conditions and increase the risk for excessive rutting or displacing. Dump truck traffic should not be allowed on the native subgrade in the building pad area and as limited as possible on the native subgrade in pavement areas.

6.2 Recommended Subgrade Preparation

Building “Controlled Areas”

Most of the soundings in the building “controlled areas” penetrated subgrade soils that are considered suitable to support the planned structures, provided they are properly moisture conditioned and compacted. Following the initial phase of site grading, the upper 12 inches of the exposed subgrade should be scarified, moisture conditioned and compacted to at least 98% ASTM D-698 standard density. The processed subgrade should be reviewed by a GeoCon earthwork technician. Subgrade soils that fail to properly compact, or are determined to be unsuitable, should be further processed or undercut in accordance with the recommendations of the project Geotechnical Engineer. The structural fill required to reach final subgrade elevations should meet the guidelines of section 6.4 of this report.

Areas Requiring Additional Undercut: Sounding C-8 penetrated unstable subgrade soils to a depth of about 4½ feet below the existing ground surface. To provide a stable and uniform subgrade, we recommend that the areas surrounding sounding C-8 be undercut to a depth 3½ feet below the existing ground surface. Please note that clean, non-organic sand and sand with silt soils removed during the undercut excavation can be stockpiled for use as structural fill material. We also recommend that consideration be given to performing test pit excavations in the areas surrounding sounding C-8. *If unstable soils are not identifiable in the test pit excavations, supplemental hand auger borings and DCP soundings may be required to delineate the extent of the unstable soils.* Following the additional undercut, the exposed subgrade should be reviewed by a GeoCon earthwork technician. Subgrade soils that are determined to be unsuitable should be further undercut in accordance with the recommendation of the project geotechnical engineer of record. The resulting excavation should be backfilled with structural fill per the guidelines provided in section 6.4 of this report.

Pavement "Controlled Areas"

The subgrade soils encountered in the pavement "controlled areas" are considered suitable to support the planned pavement build-up, provided they are properly moisture conditioned and compacted. Following the initial phase of site grading, the upper 12 inches of the exposed subgrade should be scarified, moisture conditioned and compacted to at least 98% ASTM D-698 standard density. The processed subgrade should be reviewed by a GeoCon earthwork technician. Subgrade soils that fail to properly compact, or are determined to be unsuitable, should be further processed or undercut in accordance with the recommendations of the project Geotechnical Engineer. The structural fill required to reach final subgrade elevations should meet the guidelines of section 6.4 of this report.

6.3 Site Drainage

The "controlled areas" should be maintained in a well-drained condition that will promote the continual removal of surface water that may flow over the construction areas. This positive drainage is important for the subgrade soils at the site. Saturation of these soils can result in substantial time delays in the construction and significant decreases in soil strength. During construction (both site grading and building), the contractor should exercise caution during inclement weather to ensure the subgrade and structural fill courses are not degraded by construction traffic. Water should not be allowed to pond against the building and pavements during and following construction. Ponding water adjacent to the building foundations and pavements can lead to settlement due to deterioration of the bearing soils.

6.4 Placement of Structural Fill

Structural fill required to achieve final subgrade elevations should be placed in 8-inch loose lifts and compacted to 98% ASTM D-698 standard density. Structural fill should be placed at moisture contents within +/- 3% of the material's optimal moisture content. Once the surface of each lift of structural fill is ready for the next lift, the exposed soil should be maintained at the placed moisture content until the next lift of fill is placed. Clean, non-organic, non-saturated sand and sand with silt soils stockpiled during on-site excavations can be used as structural fill material. Structural fill required from an off-site borrow source should meet the city and/or county color requirements and the following minimum requirements:

1) Exhibit SP or SP-SM classification according to the Unified Soil Classification System
2) Have a maximum of 10% soil fines passing the No. 200 sieve
3) Have a maximum of 50% soil fines passing the No. 50 sieve
4) Have a maximum Liquid Limit (LL) of 20
5) Have a maximum Plasticity Index (PI) of 0 (non-plastic)
6) Have a minimum standard Proctor (ASTM D-698) maximum dry density of 98 pcf

Special attention should be given to properly backfilling and compacting utility trenches and areas adjacent to structures (i.e. manhole boxes) below the "controlled areas". The top 2 feet of trench/manhole box backfill should be compacted to 100% standard density while backfill below the upper 2 feet should be compacted to at least 95% standard Proctor density. We recommend that both a "plate tamp" and "jumping jack" hand compactor be utilized for utility trench compaction. We also recommend that clean select sand be used as backfill adjacent to and at least 12 inches above utility pipes.

6.5 Weather Considerations

Weather conditions at the time of site preparation will directly impact earthmoving activities. Exposed subgrade soils and structural fill soils can be expected to degrade during wet weather conditions. Additional soil processing and drying efforts are typically required during wet weather conditions.

6.6 Unit Costs

Weather conditions prior to and during site grading will directly impact the condition of the subgrade soils at this site and the amount of undercut required. We recommend that the contract documents establish a unit cost (per cubic yard) for undercutting and replacing unsuitable soil.

6.7 Testing Requirements

The geotechnical consultant should monitor and document the results of the topsoil stripping, debris removal, subgrade proof-rolling, correction of weak soil conditions and the conditions of the final subgrades, foundation construction, and floor slab bearing soils.

During fill placement, field density testing should be performed to confirm that the specified compaction criteria are being achieved. As a general guide, we recommend that at least one (1) compaction test be performed for each lift of fill per 2,000 square feet in the building “controlled areas” and at least one (1) compaction test be performed for each lift of fill per 4,000 square feet in the pavement “controlled areas”. Sufficient samples of on-site soils should be collected for Proctor compaction tests to provide the moisture-density relationships needed for compaction control. Sufficient samples of structural fill materials should be submitted by the contractor for classification and Proctor density tests to show substantial compliance with the specifications and to provide the moisture-density relationships needed for compaction control. It is important that proper quality assurance testing be performed during site grading.

A minimum of one (1) field density test should be performed per each 150 linear feet (per 2 ft. of vertical thickness) of fill placed at utility trenches extending through the "controlled areas". Current OSHA regulations should be followed with respect to excavations for this project. Heavy construction traffic and stockpiling of excavated earth should not be permitted near the top of open unsupported excavations.

Please note that following proper compaction and testing, the subgrade soils should be protected from disturbance. If compacted subgrade soils are left exposed for more than 72 hours or if exposed to inclement weather conditions, freeze/thaw cycles, etc., the exposed subgrade soils should be re-tested to determine if the subgrade meets the recommended moisture condition and compaction criteria.

7.0 Shallow Foundation Recommendations

Provided the building “controlled areas” are prepared in accordance with this report, the proposed buildings can be supported by typical reinforced concrete spread foundations bearing at shallow depths in properly compacted structural fill. Foundations can be designed using a net allowable soil bearing pressure up to 2,000 psf. The allowable soil bearing pressure applies to dead loads plus design live loads. Perimeter wall foundations should bear at a minimum depth of 24 inches below finished subgrade levels. The bottom of interior foundations should bear at a minimum depth of 18 inches below the top of the concrete floor slabs. The bottom of all foundation footings should be compacted to at least 95% standard Proctor density prior to reinforcing steel (rebar) and concrete placement.

Lateral and uplift loads can be resisted by passive pressure of the soil acting against the side of the individual footings and/or the friction developed between the base of the footings and the underlying soils. For compacted backfill, the passive pressure may be taken as the equivalent to the pressure exerted by a fluid weighing 350 pounds per cubic foot (pcf). A coefficient of friction equal to 0.32 may be used for calculating the frictional resistance at the base of spread footings. These lateral resistance values are based on the assumption that the foundations can withstand horizontal movements on the order of ¼ inch. Spread foundation depths can be increased for uplift resistance as required. A soil unit weight of 100 pcf can be used for backfill atop foundations.

Soils exposed in the bottom of all satisfactory excavations should be protected against disturbance, excessive drying, freezing or rain. Surface runoff should be drained away from excavations and not allowed to pond. The saturation of soils at the footing bearing elevation level can reduce their strength and load carrying ability. Concrete for foundations should be placed as soon after completion of the excavations as possible. If a delay in concrete placement is expected or if exposed to wet weather, the footings will require being undercut by a minimum depth of 12 inches below the planned bottom of footing excavation. The resulting excavation should be replaced with a clean open-graded crushed aggregate (similar to No. 57 or 67 stone). The initial 6 inches of stone should be “choked” into the subgrade soils. The remaining stone should be placed in 6-inch lifts and be seated in-place with a mechanical compactor.

The "frost penetration" depth in the areas of this project is generally taken to be less than 10 inches. Provided our recommendations for the development of the foundations and floor slabs are followed, we do not expect that the "frost penetration" will have any detrimental effects on the performance of the foundations or floor slabs.

8.0 Ground Floor Slabs

The subgrade soil beneath all ground supported floor slabs should consist of properly compacted structural fill as described in this report. At a minimum, a 10-mil plastic vapor barrier should be installed over the subgrade prior to installation of the floor slabs. The plastic vapor barrier should be properly lapped, and all joints and intrusions properly taped and sealed. Special attention should be given to properly compacting utility trenches in the “controlled areas”. Utility trenches below the slab areas should be compacted to 95% ASTM D-698 standard density.

If moisture sensitive floor coverings are to be used or if interior slab moisture is critical, we recommend that a porous drainage layer (min. 4 inch) also be placed below the slab. A clean, free-draining pea gravel, crushed stone or coarse sand should prove satisfactory for the drainage layer. We recommend that the drainage layer material exhibit no more than 50% passing the No. 50 sieve and no more than 5% passing the No. 200 sieve.

9.0 Pavements

9.1 Pavement Subgrade

The pavement recommendations provided below are based on a low volume of passenger vehicles (light-duty traffic) and low volume tractor trailers, delivery trucks, and fire trucks (medium-duty). The scope of this investigation did not include laboratory CBR testing for pavement design. Pavement design has been based on an estimated CBR value of 8 for the structural fill soils.

The recommendations in the Site Preparation Recommendations section of this report should be followed in the pavement areas. Prior to base placement, subgrade improvements should also include scarifying, moisture conditioning, and compacting the upper 6 inches of the pavement "controlled areas" to at least 100% ASTM D-698 standard density. Drainage improvements at subgrade levels should include slopes, 2% minimum, which are designed to discharge water (which may tend to pond over the subgrade) toward low collection points which are provided with positive relief to side drainage ditches or buried storm drainage. Areas which exhibit unsuitable materials, or which fail to compact properly should be corrected as per the geotechnical consultant's recommendations.

9.2 Asphalt Pavement

Based on a light-duty traffic classification (passenger vehicles only) and medium-duty classification, pavements which bear over compacted structural fill soils could be constructed as follows:

Light-Duty Asphalt Pavement Section (up to 2.8E+04 ESAL's)

1½"	ALDOT Section 424A, Bituminous Wearing Surface (165 lb/sy)
6"	ALDOT Section 825 Crushed Aggregate Base (100% standard density)
-	Geotextile Separation Fabric (Mirafi 160N or approved equivalent)
-	Compacted Subgrade (top 6 inches compacted to 100% standard density)

Medium-Duty Asphalt Pavement Section (up to 2.3E+05 ESAL's)

1½"	ALDOT Section 424A, Bituminous Wearing Surface (165 lb/sy)
-	ALDOT Section 405 Tack Coat
2"	ALDOT Section 424B, Bituminous Binder (220 Ib/sy)
6"	ALDOT Section 825 Crushed Aggregate Base (100% standard density)
-	Geotextile Separation Fabric (Mirafi 160N or approved equivalent)
-	Compacted Subgrade (top 6 inches compacted to 100% standard density)

Provided the moisture content of the base layer is at or within 2% of the base material's optimal moisture content at the time of paving, a prime coat over the base is not required. Periodic maintenance should be performed on the pavement sections to help prolong the pavement's lifespan.

A quality crushed concrete material that meets the gradation requirements of ALDOT Section 825 Crushed Aggregate Base could be used. If the owner elects to use granular soil base to reduce upfront construction cost, a minimum of 12 inches of granular base that meets the requirements of ALDOT Section 821 could be used instead of the crushed aggregate base. However, it should be noted that we highly recommend the use of crushed aggregate base for this project.

9.3 Concrete Pavement

Light-duty Portland Cement Concrete (PCC) pavement could be used in light-duty traffic areas (passenger vehicles only).

Light-Duty Pavement Section

5” Concrete Pavement (4,000 psi compressive strength, 550 psi flexural strength)
6" ALDOT Section 825 Crushed Aggregate Base (100% standard density)
- Geotextile Separation Fabric (Mirafi 160N or approved equivalent)
- Compacted Subgrade (top 6 inches compacted to 100% standard density)

Heavy-duty Portland Cement Concrete (PCC) pavement should be used in truck unloading areas, dumpster pad locations or other areas subject to maneuvering or parking of garbage trucks or delivery trucks.

Heavy-Duty Pavement Section

8” Concrete Pavement (4,000 psi compressive strength, 550 psi flexural strength)
6" ALDOT Section 825 Crushed Aggregate Base (100% standard density)
- Geotextile Separation Fabric (Mirafi 160N or approved equivalent)
- Compacted Subgrade (top 6 inches compacted to 100% standard density)

Final pavement grades should be adequately sloped for positive drainage. The subgrade below concrete pavement areas should be prepared in accordance with the Site Preparation Recommendations section of this report. PCC pavements should be placed at a slump of 4 inches or less.

Joints should be installed in the PCC pavements to limit stresses resulting from expansion and contraction. Contraction joints should be formed by sawing as soon as the concrete has hardened enough to prevent raveling. These joints should extend to a depth of at least ¼ inch of the pavement thickness and be placed on a 12 to 15 foot spacing. The design and location of all pavement joints should be in accordance with the recommendations of the Portland Cement Association (PCA) and ACI 330.

Isolation joint material should comply with ASTM D-1752. The upper one inch of the joint material should be removed and the joint sealed with a self-leveling elastomeric joint sealant immediately after the curing period and prior to opening to traffic. Construction joints should be properly cleaned and sealed with the same type of joint sealant. Dowel sizing and spacing for construction joints should conform to the recommendations of ACI 330.

10.0 Closure

This report has been prepared for the exclusive use of the City of Orange Beach and their project design professionals for specific application to the above referenced project in accordance with generally accepted current standards of geotechnical engineering practice common to the local area.

The comments and recommendations of this report provide manageable and reasonable solutions to the advancement of the project based on the collected test data and the design information provided. Significant changes in site conditions or project design may result in alternative solutions to the design required or may permit more manageable and economical construction techniques. Should such significant changes occur, we will be available to offer supplemental comments.

The comments and recommendations of this report are based upon our interpretation of the information supplied by the client, the data collected at the eight (8) CPT soundings, the eight (8) borings and the site conditions observed at the time of testing. A significant amount of interpolation was necessary. Because it is not possible to know or predict detailed conditions hidden beneath the ground surface, our comments and recommendations are presented as opinions and judgements, as opposed to statements of fact.

Improper site preparation, extremes in climatic conditions, significant changes in grade, time, etc., can affect the groundwater, surface, and subsurface conditions. If conditions are encountered as the construction advances which vary significantly from those described by this report, we should be contacted for additional comment.

We have not intended to reflect specific volumes of subsurface conditions at the site. Volumetric estimates often require a large number of borings placed on a close grid with the collected data associated with civil engineering cross-sections. If volume estimates are required of us for the design/development of this project to advance, please contact us for further comment.

Again, we appreciate the opportunity to provide our geotechnical engineering services for this project. We recommend that the owner retain GeoCon, Inc. to provide construction observation and construction materials testing for the project.

APPENDIX

Figure 1	NOT TO SCALE **SITE LOCATION MAP** Proposed Orange Beach Fire Training Facility Orange Beach Boulevard Orange Beach, AL DL 4929-25	***GEOCON, INC.*** 22830 McAuliffe Drive Robertsdale, Alabama 36567
Date 7/9/2025		

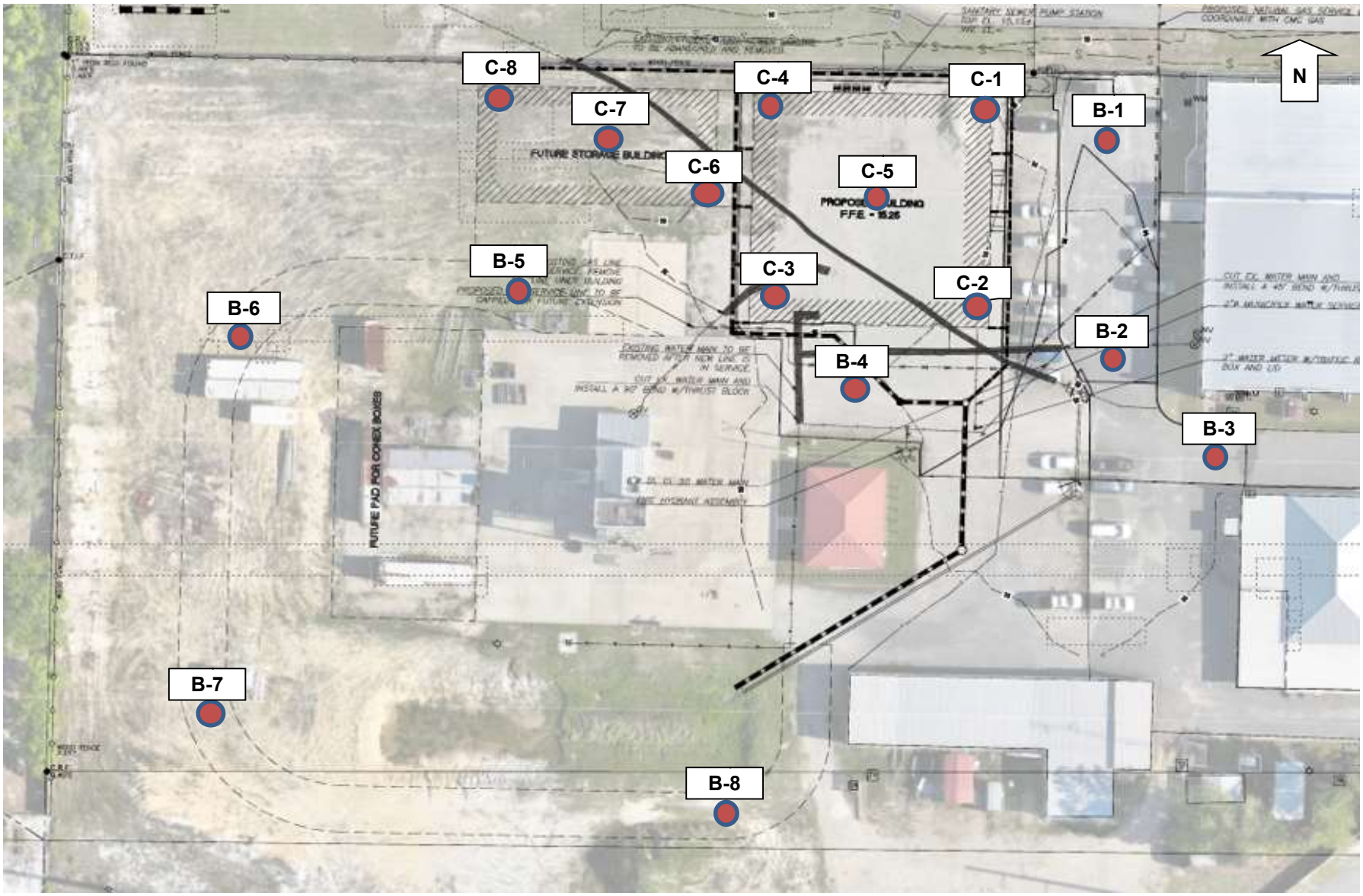
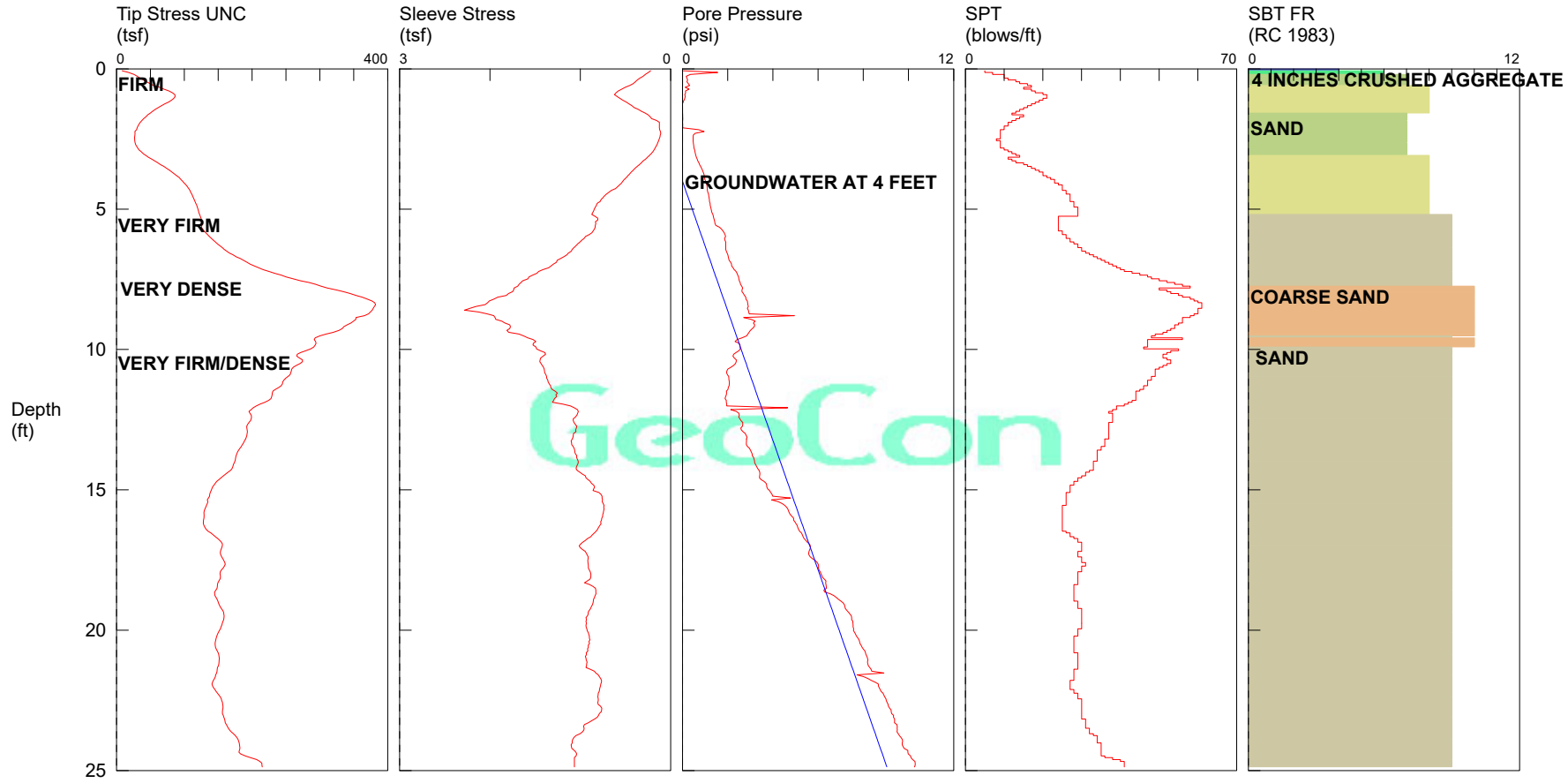


Figure 2	NOT TO SCALE **TEST LOCATION PLAN** Proposed Orange Beach Fire Training Facility Orange Beach Boulevard Orange Beach, AL DL 4929-25	***GEOCON, INC.*** 22830 McAuliffe Drive Robertsdale, AL 36567
Date 7/9/2025		

C-1

CPT Testing Done By: GeoCon
Proposed: Orange Beach Fire Training Center
CUSTOMER: City of Orange Beach
LOCATION: Orange Beach, AL
HOLE NUMBER: C-1

JOB NUMBER: DL 4929-25
TEST DATE: 7/8/2025
OPERATOR: Bryant Volovecky
GPS (LAT,LON,ALT): 3017.0450N,08735.0600W,27.0



1 sensitive fine grained
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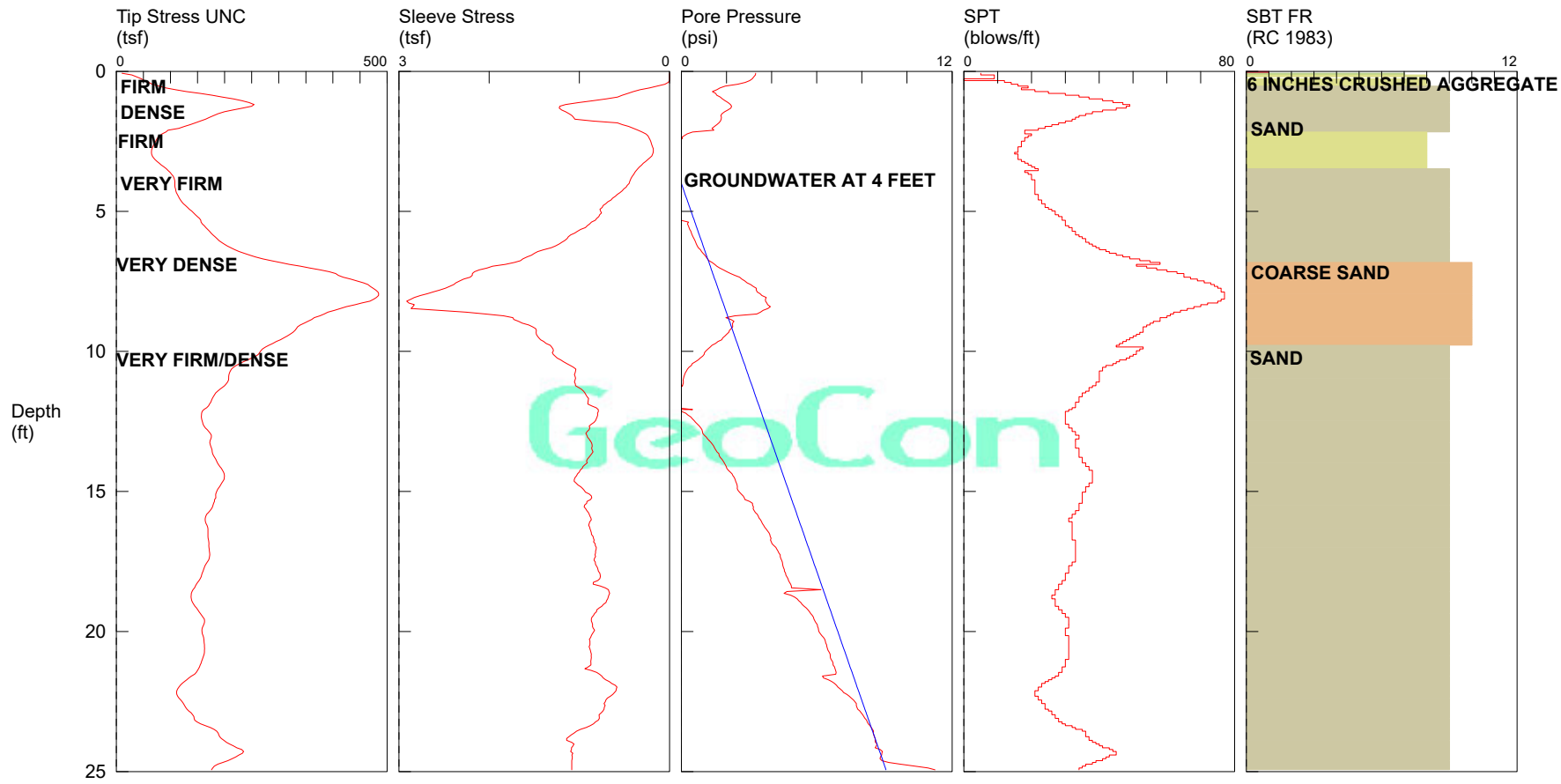
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

C-2

CPT Testing Done By: GeoCon
Proposed: Orange Beach Fire Training Center
CUSTOMER: City of Orange Beach
LOCATION: Orange Beach, AL
HOLE NUMBER: C-2

JOB NUMBER: DL 4929-25
TEST DATE: 7/8/2025
OPERATOR: Bryant Volovecky
GPS (LAT,LON,ALT): 3017.0310N,08735.0600W,27.0



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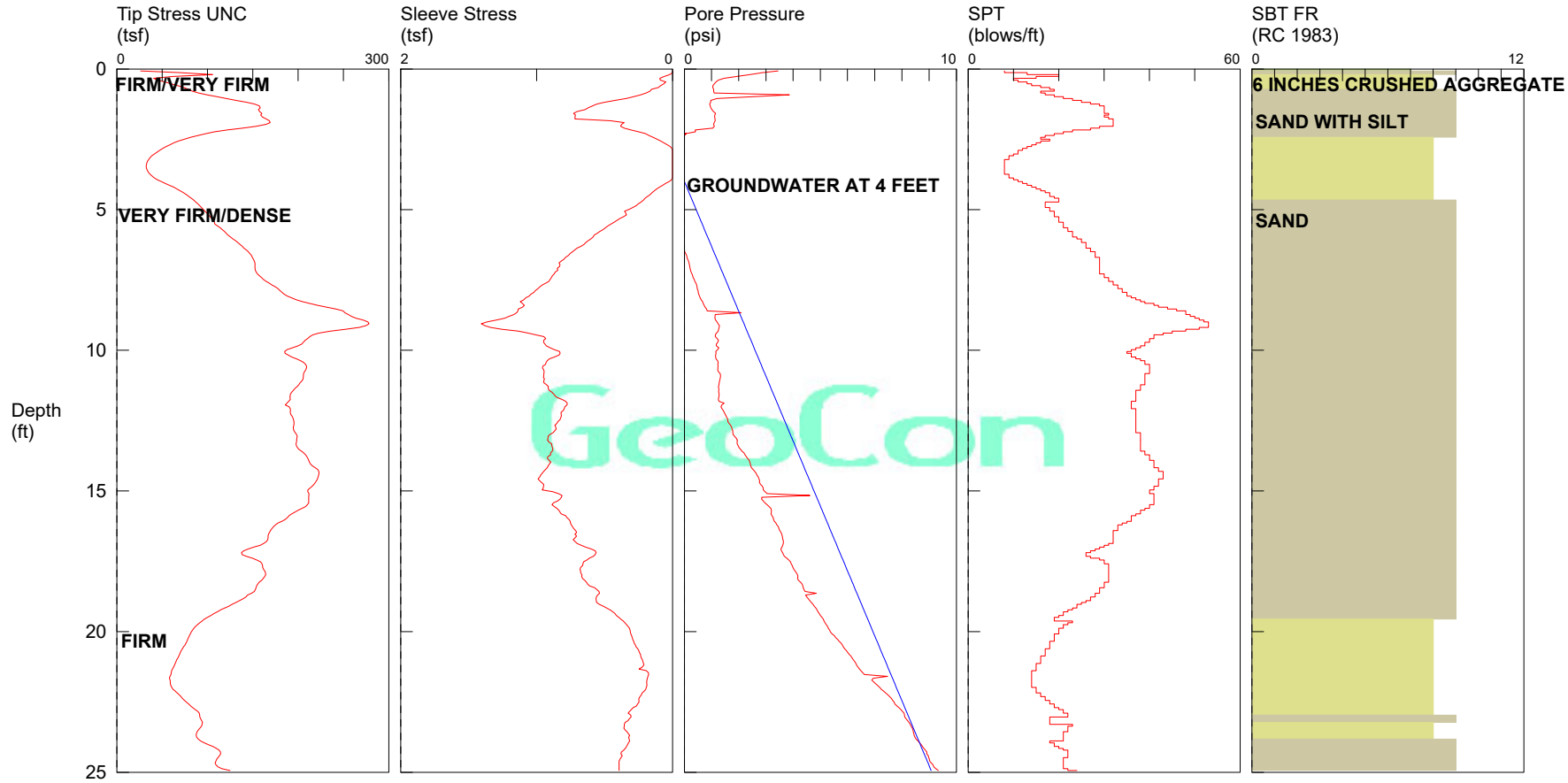
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

C-3

CPT Testing Done By: GeoCon
Proposed: Orange Beach Fire Training Center
CUSTOMER: City of Orange Beach
LOCATION: Orange Beach, AL
HOLE NUMBER: C-3

JOB NUMBER: DL 4929-25
TEST DATE: 7/8/2025
OPERATOR: Bryant Volovecky
GPS (LAT,LON,ALT): 3017.0310N,08735.0770W,27.0



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*SBT/SPT CORRELATION: UBC-1983

C-4

CPT Testing Done By: GeoCon
Proposed: Orange Beach Fire Training Center
CUSTOMER: City of Orange Beach
LOCATION: Orange Beach, AL
HOLE NUMBER: C-4

JOB NUMBER: DL 4929-25
TEST DATE: 7/8/2025
OPERATOR: Bryant Volovecky
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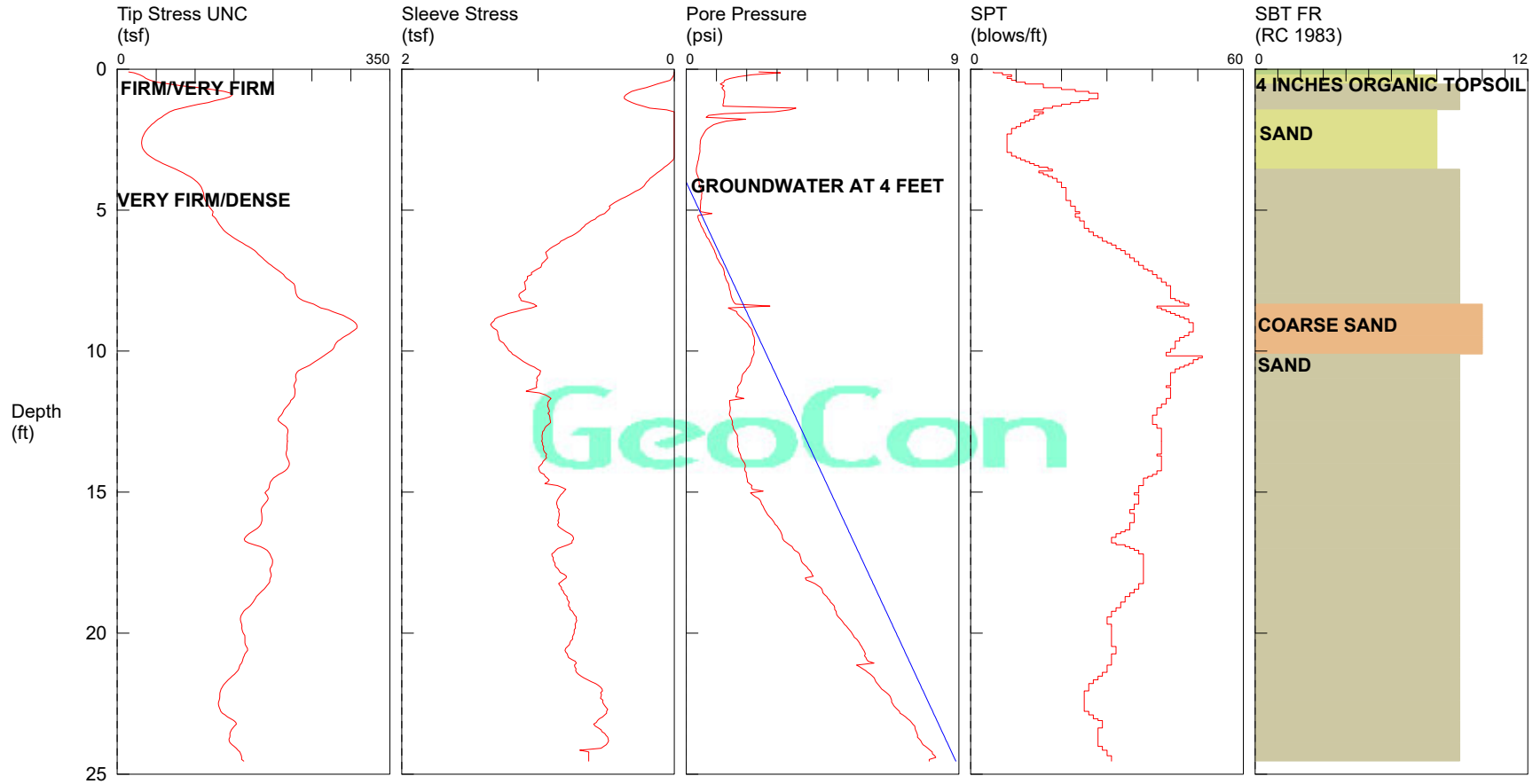

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9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

C-5

CPT Testing Done By: GeoCon
Proposed: Orange Beach Fire Training Center
CUSTOMER: City of Orange Beach
LOCATION: Orange Beach, AL
HOLE NUMBER: C-5

JOB NUMBER: DL 4929-25
TEST DATE: 7/8/2025
OPERATOR: Bryant Volovecky
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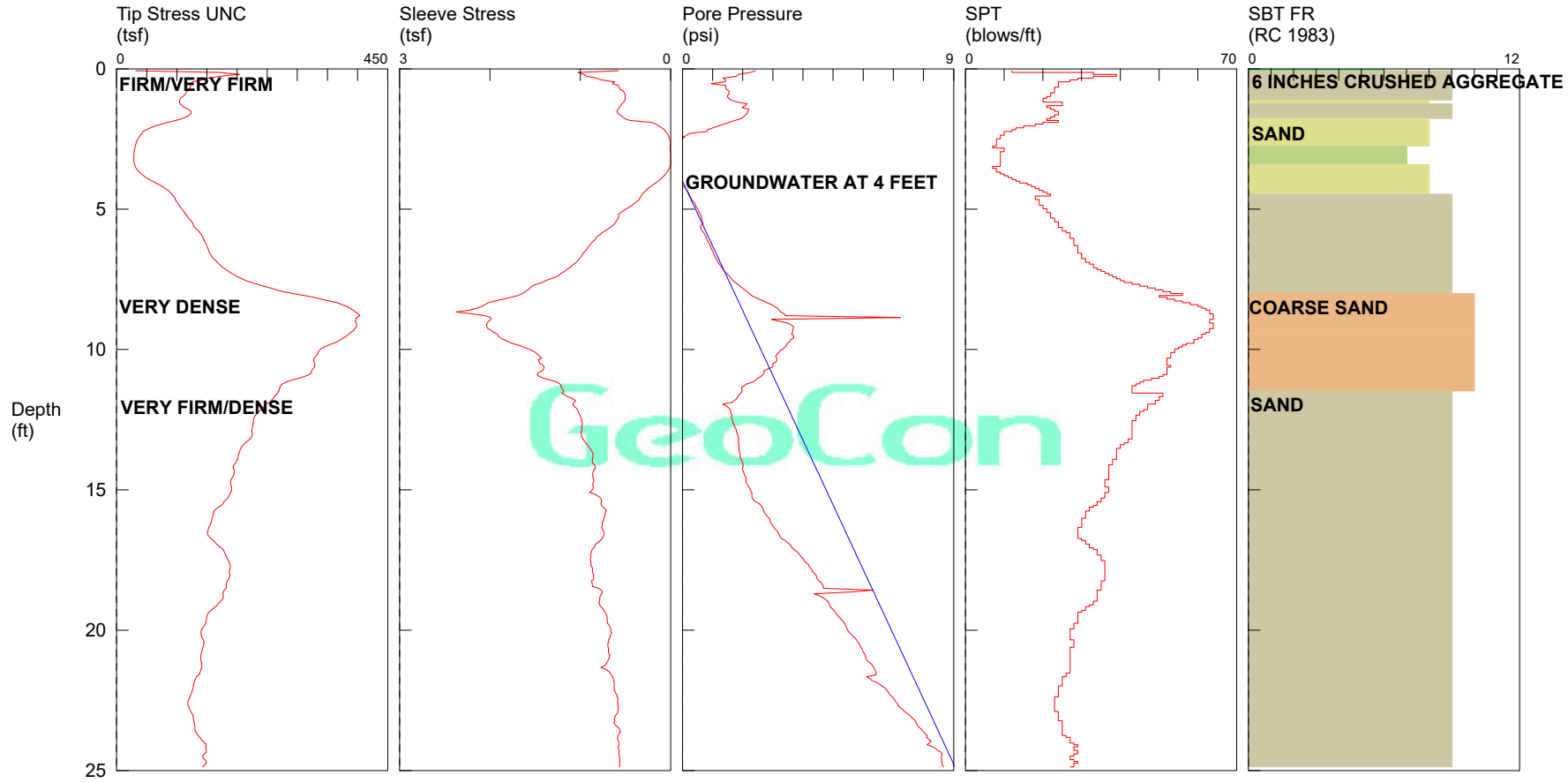

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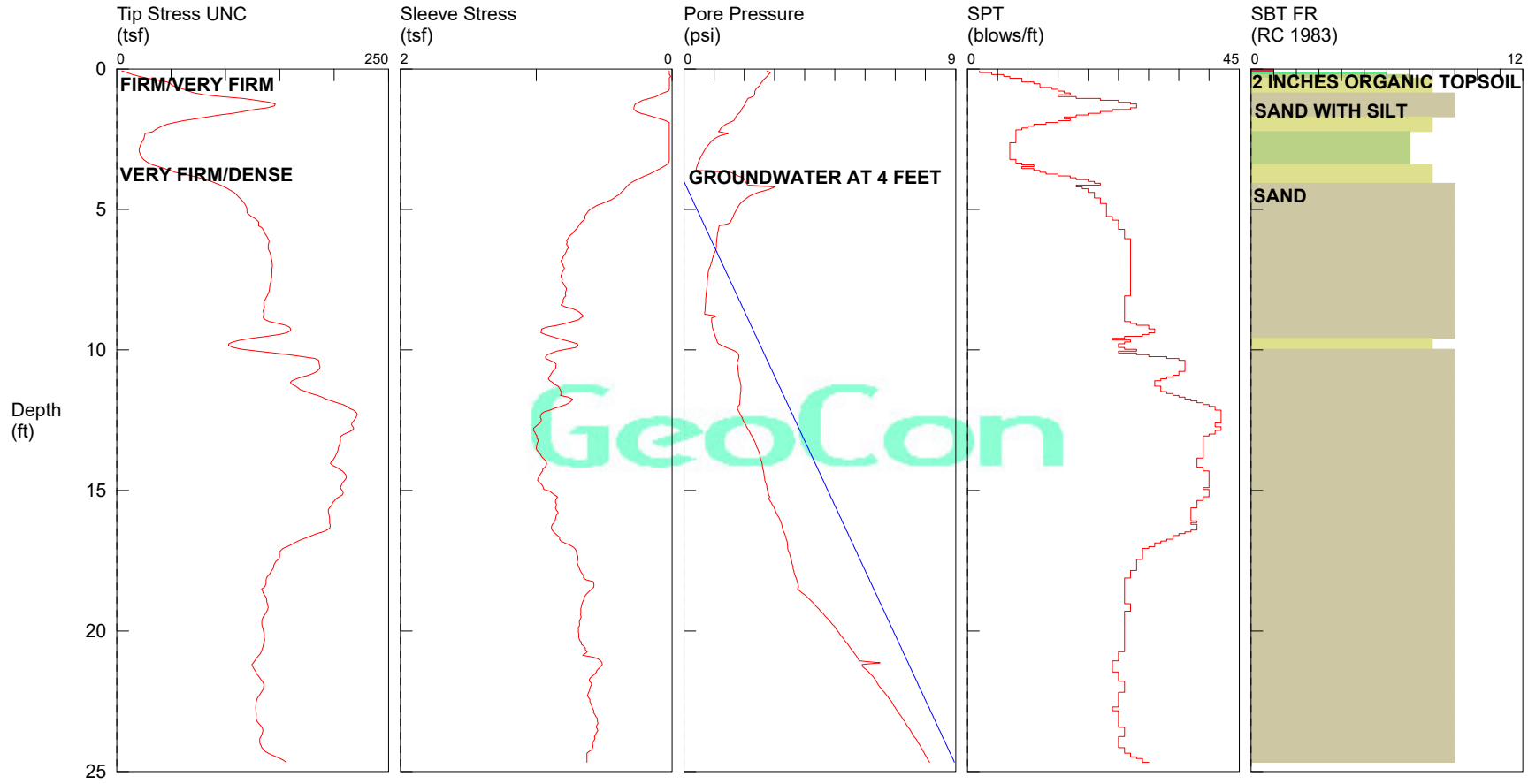
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

C-6

CPT Testing Done By: GeoCon
Proposed: Orange Beach Fire Training Center
CUSTOMER: City of Orange Beach
LOCATION: Orange Beach, AL
HOLE NUMBER: C-6

JOB NUMBER: DL 4929-25
TEST DATE: 7/8/2025
OPERATOR: Bryant Volovecky
GPS (LAT,LON,ALT): 3017.0390N,08735.0820W,27.0



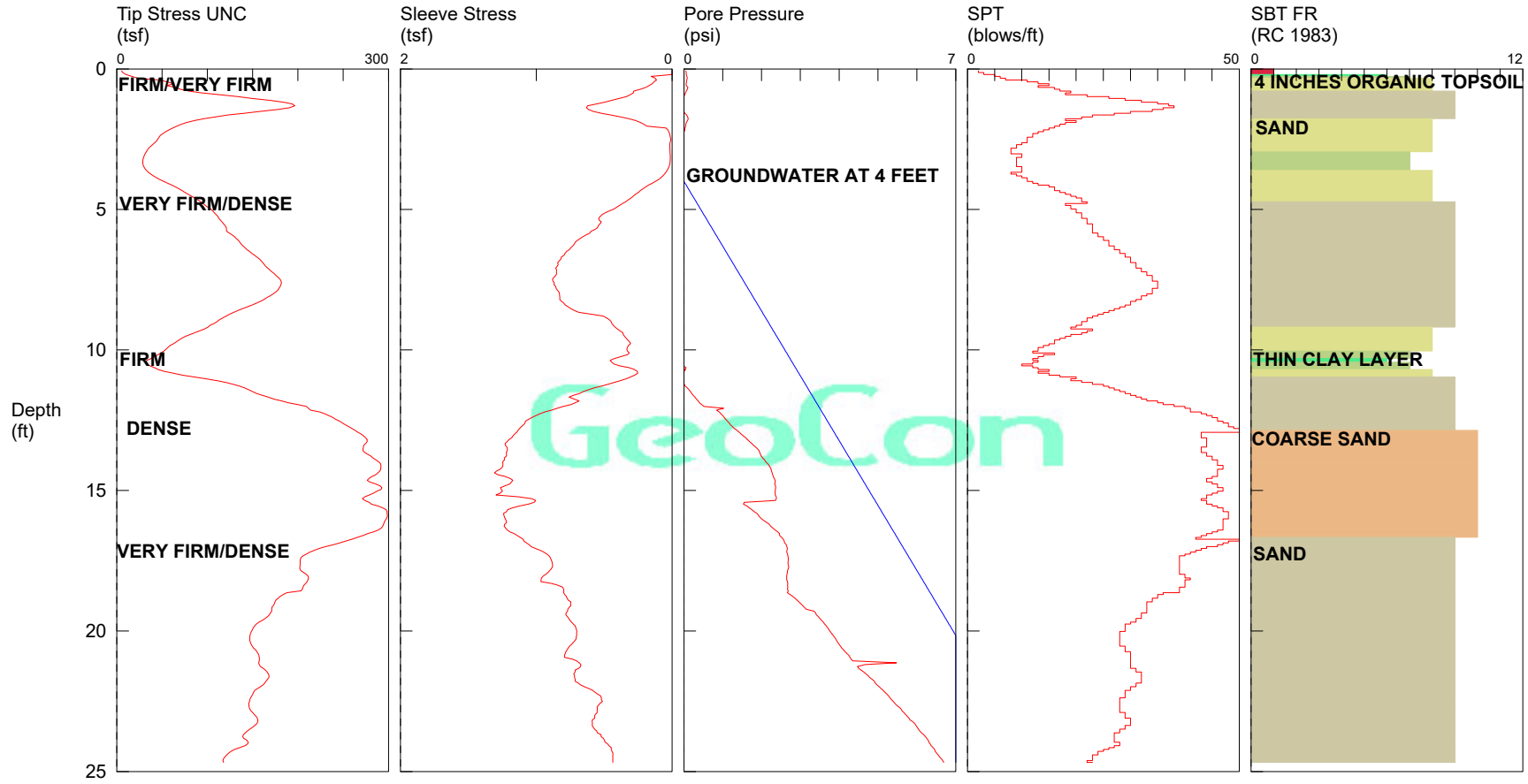
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

C-7

CPT Testing Done By: GeoCon
Proposed: Orange Beach Fire Training Center
CUSTOMER: City of Orange Beach
LOCATION: Orange Beach, AL
HOLE NUMBER: C-7

JOB NUMBER: DL 4929-25
TEST DATE: 7/8/2025
OPERATOR: Bryant Volovecky
GPS (LAT,LON,ALT): 3017.0420N,08735.09W,27.0



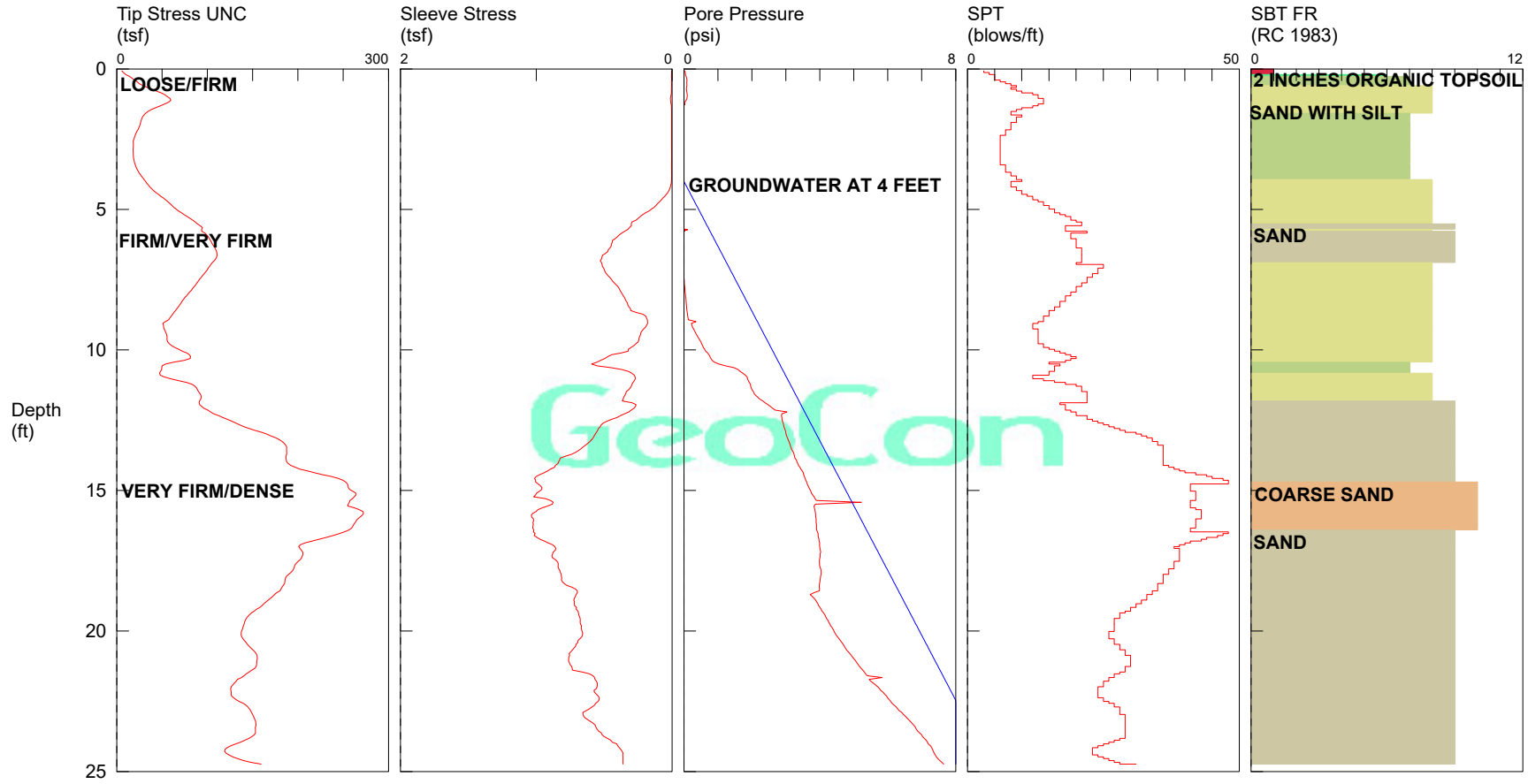
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

C-8

CPT Testing Done By: GeoCon
Proposed: Orange Beach Fire Training Center
CUSTOMER: City of Orange Beach
LOCATION: Orange Beach, AL
HOLE NUMBER: C-8

JOB NUMBER: DL 4929-25
TEST DATE: 7/8/2025
OPERATOR: Bryant Volovecky
GPS (LAT,LON,ALT): 3017.0450N,08735.0980W,27.0



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

DRILL HOLE LOG
BORING NO.: B-1

PROJECT: Proposed Orange Beach Fire Training Facility
CLIENT: City of Orange Beach
LOCATION: Orange Beach, AL
DRILLER: Bryant Volovecky
DRILL RIG:
DEPTH TO WATER> INITIAL ▽ : 4 AT COMPLETION ▼ :

PROJECT NO.: DL 4929-25
DATE: 7-8-2025
ELEVATION:
LOGGED BY: Bryant Volovecky

ELEVATION/ DEPTH	WELL DETAIL	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	Description	NM	DD	STANDARD PENETRATION TEST DEPTH	STANDARD PENETRATION TEST N	STANDARD PENETRATION TEST CURVE
0				3 Inches of Asphalt Pavement					
1			SP	Tan Sand, Very Firm				20+	
2			SM	Tan Silty Sand, Loose				8	
3								9	
4			SP	White Sand, Firm Perched Groundwater at 4 Feet				12	
5				Very Firm				20+	
6				Boring Terminated at 6 Feet					
7									

10 30 50

"N Value" Equal to DCP Soundings

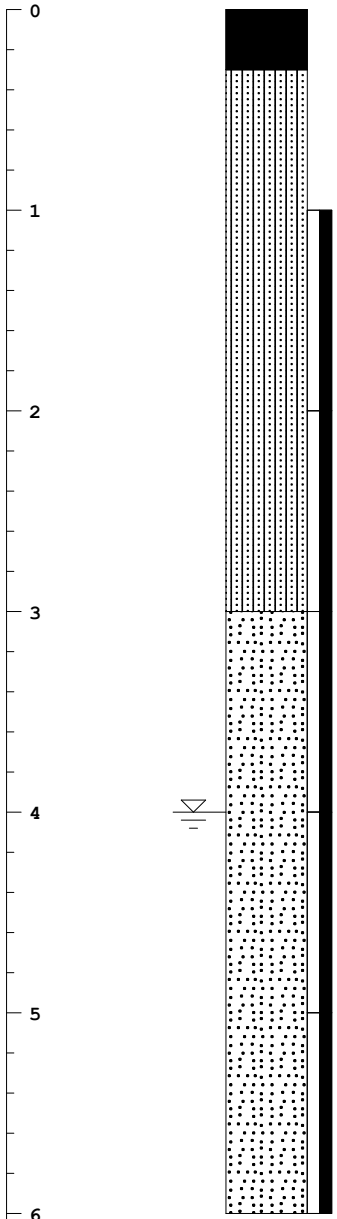
This information pertains only to this boring and should not be interpreted as being indicative of the site.

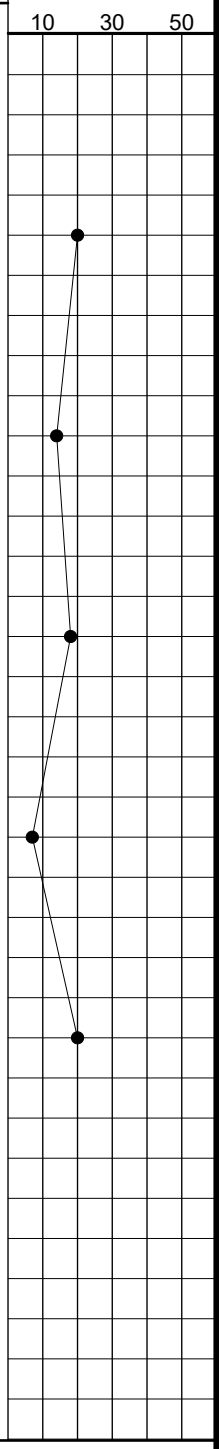
DRILL HOLE LOG
BORING NO.: B-2

PROJECT: Proposed Orange Beach Fire Training Facility
CLIENT: City of Orange Beach
LOCATION: Orange Beach, AL
DRILLER: Bryant Volovecky
DRILL RIG:
DEPTH TO WATER> INITIAL ▽ : 4 AT COMPLETION ▼ :

PROJECT NO.: DL 4929-25
DATE: 7-8-2025
ELEVATION:
LOGGED BY: Bryant Volovecky

ELEVATION/ DEPTH	WELL DETAIL	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	Description	NM	DD	STANDARD PENETRATION TEST DEPTH	STANDARD PENETRATION TEST N	STANDARD PENETRATION TEST CURVE
0				4 Inches of Asphalt Pavement					
1			SM	Tan Silty Sand, Very Firm				20+	
2				Firm				14	
3			SP	White Sand				18	
4		▽		Loose Perched Groundwater at 4 Feet				7	
5				Very Firm				20+	
6				Boring Terminated at 6 Feet					
7									





"N Value" Equal to DCP Soundings

This information pertains only to this boring and should not be interpreted as being indicative of the site.

DRILL HOLE LOG
BORING NO.: B-3

PROJECT: Proposed Orange Beach Fire Training Facility
CLIENT: City of Orange Beach
LOCATION: Orange Beach, AL
DRILLER: Bryant Volovecky
DRILL RIG:
DEPTH TO WATER> INITIAL ▽ : 5 AT COMPLETION ▼ :

PROJECT NO.: DL 4929-25
DATE: 7-8-2025
ELEVATION:
LOGGED BY: Bryant Volovecky

ELEVATION/ DEPTH	WELL DETAIL	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	Description	NM	DD	STANDARD PENETRATION TEST DEPTH	N	CURVE
0				4 Inches of Asphalt Pavement					
				6 Inches Red Sandy Fill Material					
1			SP-SM	Tan Sand with Silt, Very Firm				20+	
2			SM	Tan Silty Sand, Firm				16	
3								18	
4			SP	White Sand, Firm				15	
5		▽		Firm Perched Groundwater at 5 Feet				10	
6				Boring Terminated at 6 Feet					
7									

10 30 50

"N Value" Equal to DCP Soundings

This information pertains only to this boring and should not be interpreted as being indicative of the site.

DRILL HOLE LOG
BORING NO.: B-4

PROJECT: Proposed Orange Beach Fire Training Facility
CLIENT: City of Orange Beach
LOCATION: Orange Beach, AL
DRILLER: Bryant Volovecky
DRILL RIG:
DEPTH TO WATER> INITIAL ▽ : 5 AT COMPLETION ▼ :

PROJECT NO.: DL 4929-25
DATE: 7-8-2025
ELEVATION:
LOGGED BY: Bryant Volovecky

ELEVATION/ DEPTH	WELL DETAIL	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	Description	NM	DD	STANDARD PENETRATION TEST DEPTH	N	CURVE
0				10 Inches of Crushed Aggregate					
1			SM	Tan Silty Sand, Very Firm				20+	
2			SP	Tan Sand				20+	
3			SM	Tan Silty Sand, Firm				10	
4			SP	White Sand				15	
5		▽		Very Firm Perched Groundwater at 5 Feet				20+	
6				Boring Terminated at 6 Feet					
7									

10 30 50

"N Value" Equal to DCP Soundings

This information pertains only to this boring and should not be interpreted as being indicative of the site.

DRILL HOLE LOG
BORING NO.: B-5

PROJECT: Proposed Orange Beach Fire Training Facility
CLIENT: City of Orange Beach
LOCATION: Orange Beach, AL
DRILLER: Bryant Volovecky
DRILL RIG:
DEPTH TO WATER> INITIAL ▽ : 5 AT COMPLETION ▼ :

PROJECT NO.: DL 4929-25
DATE: 7-8-2025
ELEVATION:
LOGGED BY: Bryant Volovecky

ELEVATION/ DEPTH	WELL DETAIL	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	Description	NM	DD	STANDARD PENETRATION TEST DEPTH	N	CURVE
0				2 Inches Organic Topsoil					
1			SP	Tan Sand, Very Firm				20	
2				Firm				11	
3			SM	Tan Silty Sand, Loose				6	
4								7	
5		▽	SP	White Sand Perched Groundwater at 5 Feet				20+	
6				Boring Terminated at 6 Feet					
7									

CURVE: 10 30 50

"N Value" Equal to DCP Soundings

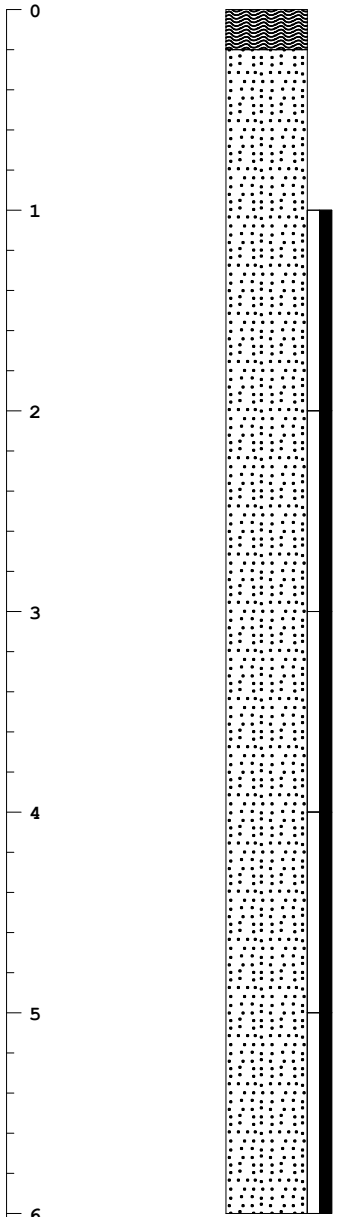
This information pertains only to this boring and should not be interpreted as being indicative of the site.

DRILL HOLE LOG
BORING NO.: B-6

PROJECT: Proposed Orange Beach Fire Training Facility
CLIENT: City of Orange Beach
LOCATION: Orange Beach, AL
DRILLER: Bryant Volovecky
DRILL RIG:
DEPTH TO WATER> INITIAL ▽ : AT COMPLETION ▼ :

PROJECT NO.: DL 4929-25
DATE: 7-8-2025
ELEVATION:
LOGGED BY: Bryant Volovecky

ELEVATION/ DEPTH	WELL DETAIL	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	Description	NM	DD	STANDARD PENETRATION TEST DEPTH	N	CURVE
0				2 Inches Organic Topsoil					
1			SP	Tan Sand, Firm				17	
2								14	
3								11	
4								8	
5			SP	White Sand				6	
6				Boring Terminated at 6 Feet					
7									



10 30 50

"N Value" Equal to DCP Soundings

This information pertains only to this boring and should not be interpreted as being indicative of the site.

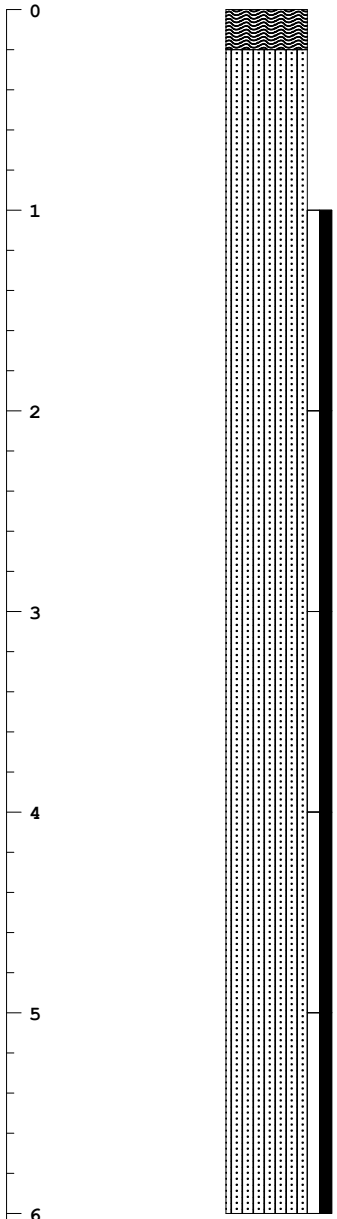
DRILL HOLE LOG
BORING NO.: B-7

PROJECT: Proposed Orange Beach Fire Training Facility
CLIENT: City of Orange Beach
LOCATION: Orange Beach, AL
DRILLER: Bryant Volovecky
DRILL RIG:
DEPTH TO WATER> INITIAL ▽ : AT COMPLETION ▼ :

PROJECT NO.: DL 4929-25
DATE: 7-8-2025
ELEVATION:
LOGGED BY: Bryant Volovecky

ELEVATION/ DEPTH	WELL DETAIL	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	Description	NM	DD	STANDARD PENETRATION TEST DEPTH	N	CURVE
0				2 Inches Organic Topsoil					
1			SM	Tan Silty Sand, Firm				10	
2								13	
3								10	
4								8	
5								6	
6				Boring Terminated at 6 Feet					
7									

CURVE: 10 30 50



"N Value" Equal to DCP Soundings

This information pertains only to this boring and should not be interpreted as being indicative of the site.

DRILL HOLE LOG
BORING NO.: B-8

PROJECT: Proposed Orange Beach Fire Training Facility
CLIENT: City of Orange Beach
LOCATION: Orange Beach, AL
DRILLER: Bryant Volovecky
DRILL RIG:
DEPTH TO WATER> INITIAL ▽ : 5 AT COMPLETION ▼ :

PROJECT NO.: DL 4929-25
DATE: 7-8-2025
ELEVATION:
LOGGED BY: Bryant Volovecky

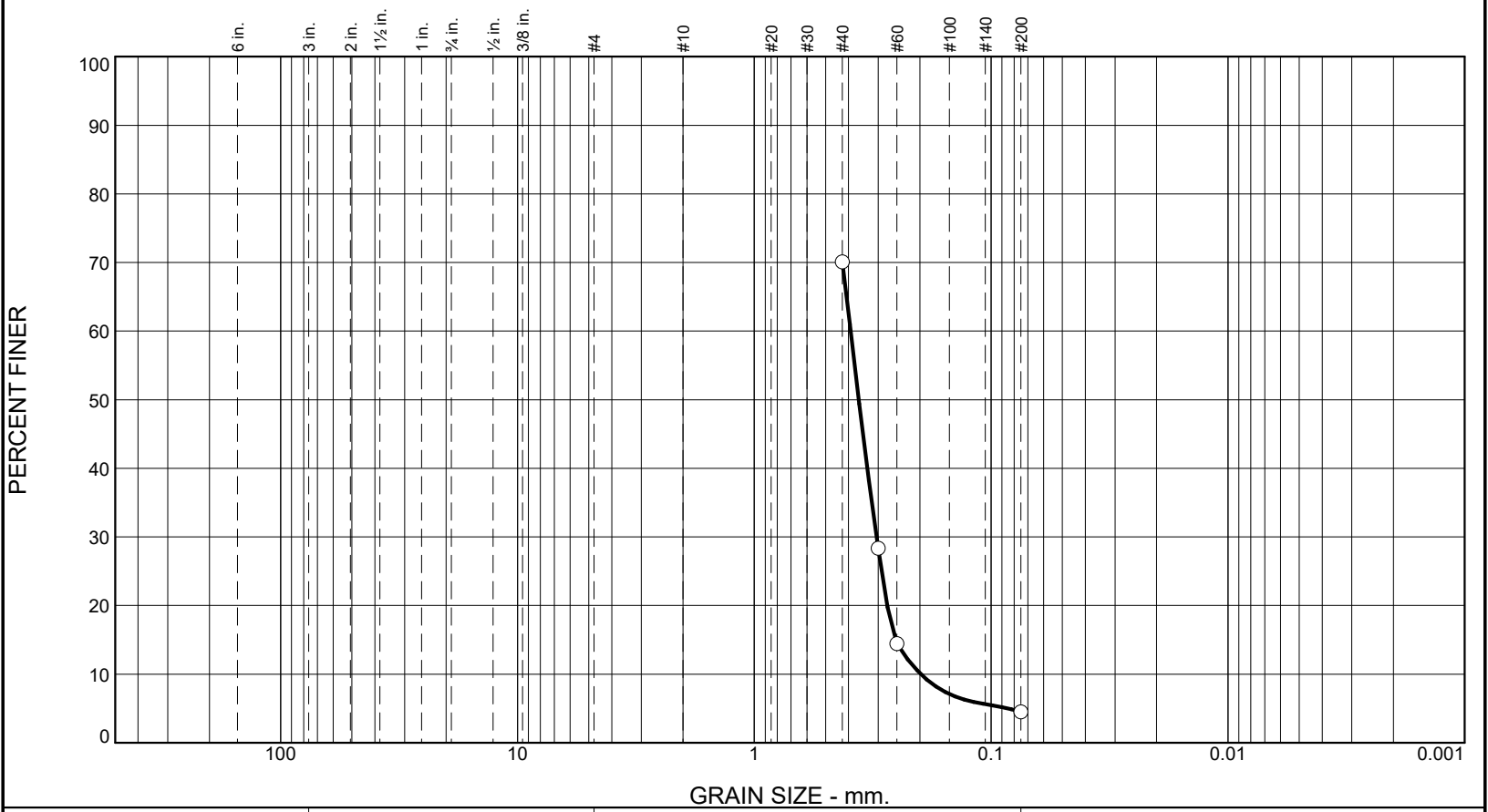
ELEVATION/ DEPTH	WELL DETAIL	SOIL SYMBOLS, SAMPLERS AND TEST DATA	USCS	Description	NM	DD	STANDARD PENETRATION TEST DEPTH	N	CURVE
0				2 Inches Organic Topsoil					
1			SP	Gray Sand, Firm				16	
2				White Sand, Very Firm				20+	
3			SM	Tan Silty Sand, Firm				10	
4								10	
5		▽		Perched Groundwater at 5 Feet				10	
6				Boring Terminated at 6 Feet					
7									

10 30 50

"N Value" Equal to DCP Soundings

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
					65.6	4.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#40	70.1		
#50	28.3		
#60	14.5		
#200	4.5		

* (no specification provided)

Soil Description

Light Gray Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= D_{85}= D_{60}= 0.3917
D_{50}= 0.3620 D_{30}= 0.3050 D_{15}= 0.2543
D_{10}= 0.1984 C_u= 1.97 C_c= 1.20

Classification

USCS= SP AASHTO=

Remarks

Location: Orange Beach, AL
Sample Number: C-1 **Depth:** 0 to 2 Feet **Date:** 7/16/2025

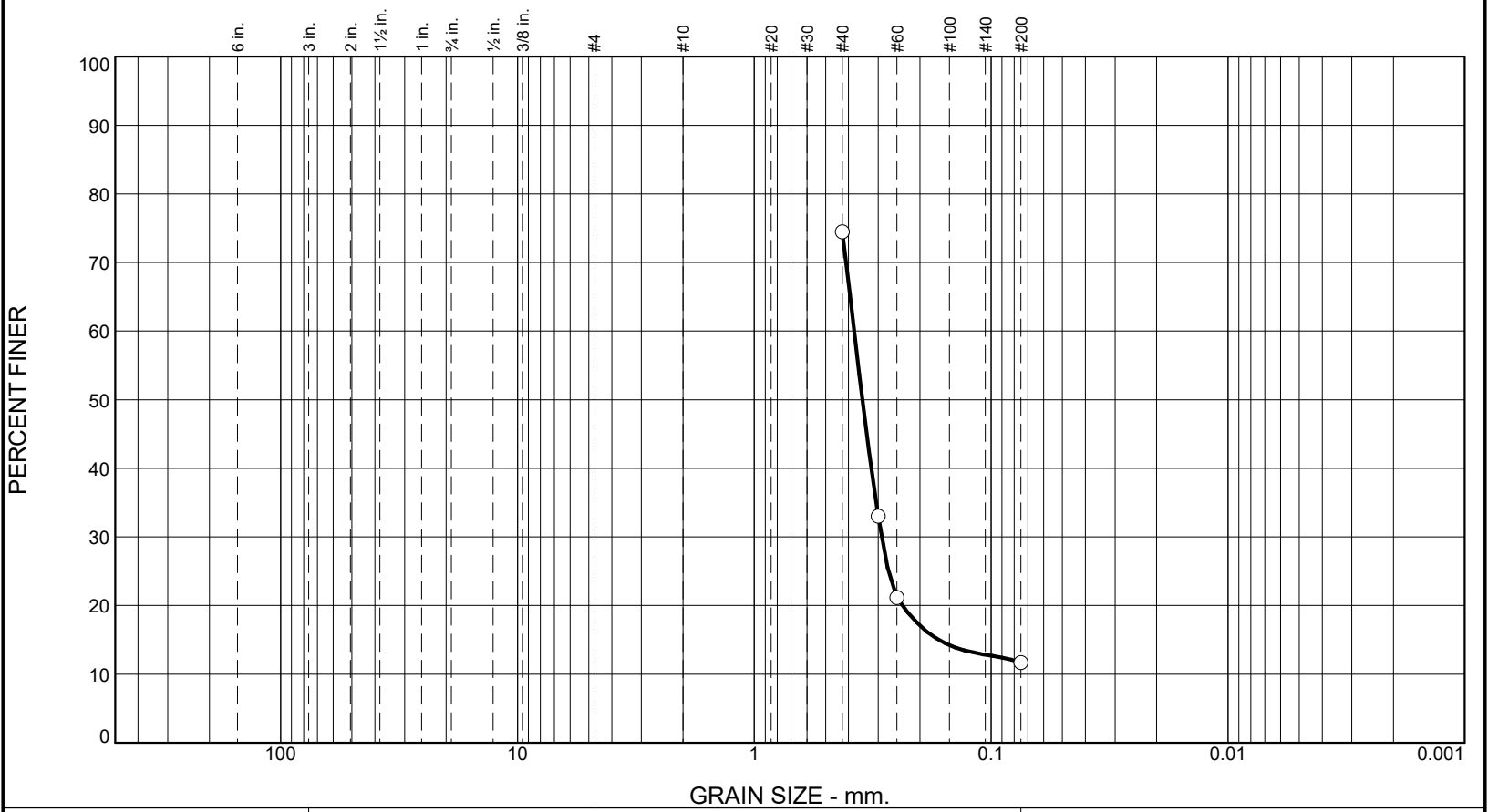
GeoCon

Robertsdale, Alabama

Client: City of Orange Beach
Project: Proposed Orange Beach Fire Training Facility
Project No: DL 4929-25 **Figure**

Tested By: WS **Checked By:** DM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
					62.8	11.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#40	74.5		
#50	33.0		
#60	21.2		
#200	11.7		

* (no specification provided)

Soil Description

Light Tan Sand with Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= D_{85}= D_{60}= 0.3785
D_{50}= 0.3498 D_{30}= 0.2900 D_{15}= 0.1666
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO=

Remarks

Location: Orange Beach, AL
Sample Number: C-3 **Depth:** 2 to 4 Feet **Date:** 7/16/2025

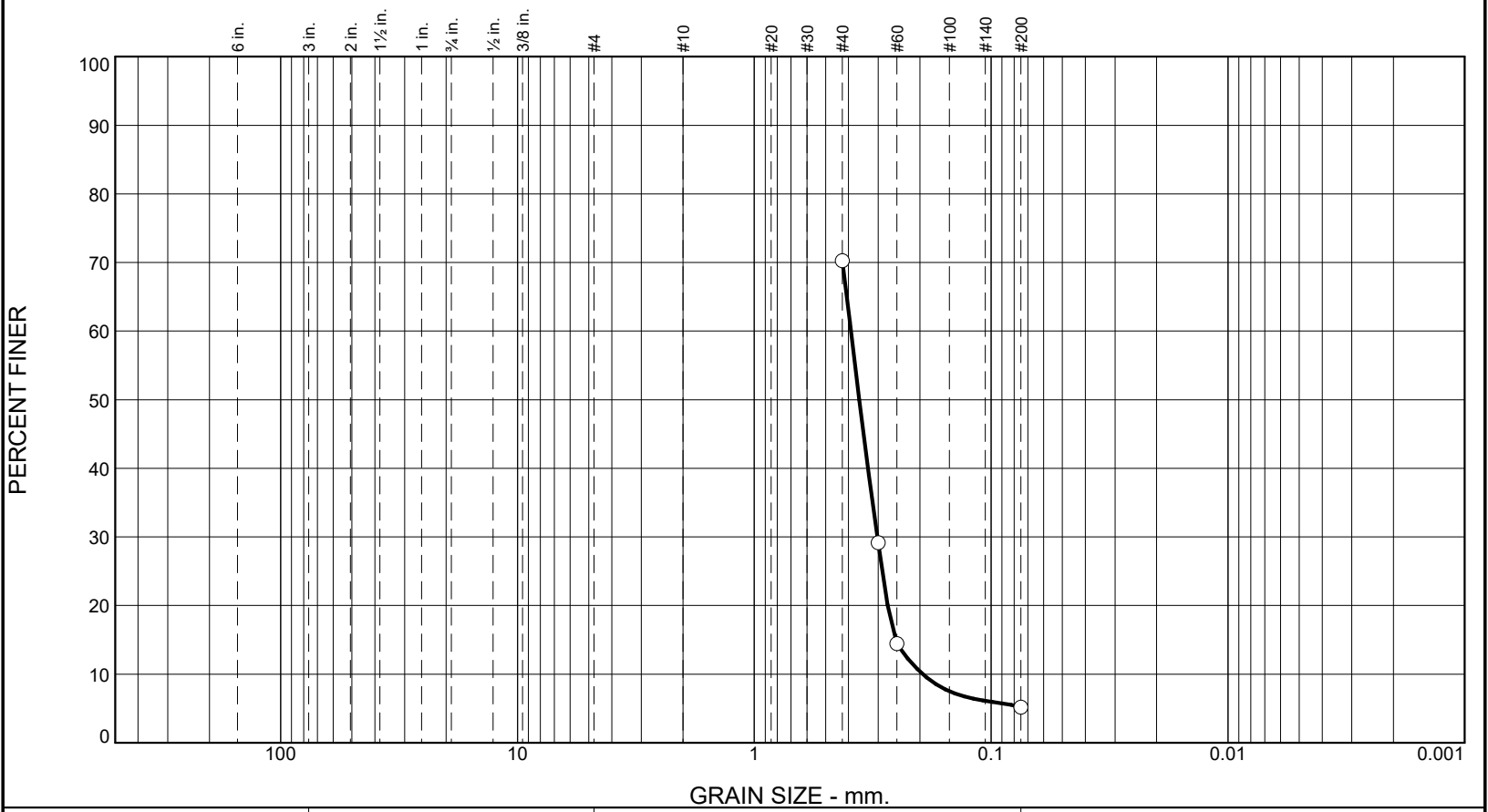
GeoCon

Robertsdale, Alabama

Client: City of Orange Beach
Project: Proposed Orange Beach Fire Training Facility
Project No: DL 4929-25 **Figure**

Tested By: WS **Checked By:** DM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
					65.1	5.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#40	70.3		
#50	29.1		
#60	14.4		
#200	5.2		

* (no specification provided)

Soil Description

Dark Gray Sand with Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= D_{85}= D_{60}= 0.3905
D_{50}= 0.3603 D_{30}= 0.3026 D_{15}= 0.2545
D_{10}= 0.1946 C_u= 2.01 C_c= 1.20

Classification

USCS= SP-SM AASHTO=

Remarks

Location: Orange Beach, AL
Sample Number: C-6 **Depth:** 0 to 2 Feet **Date:** 7/16/2025

GeoCon

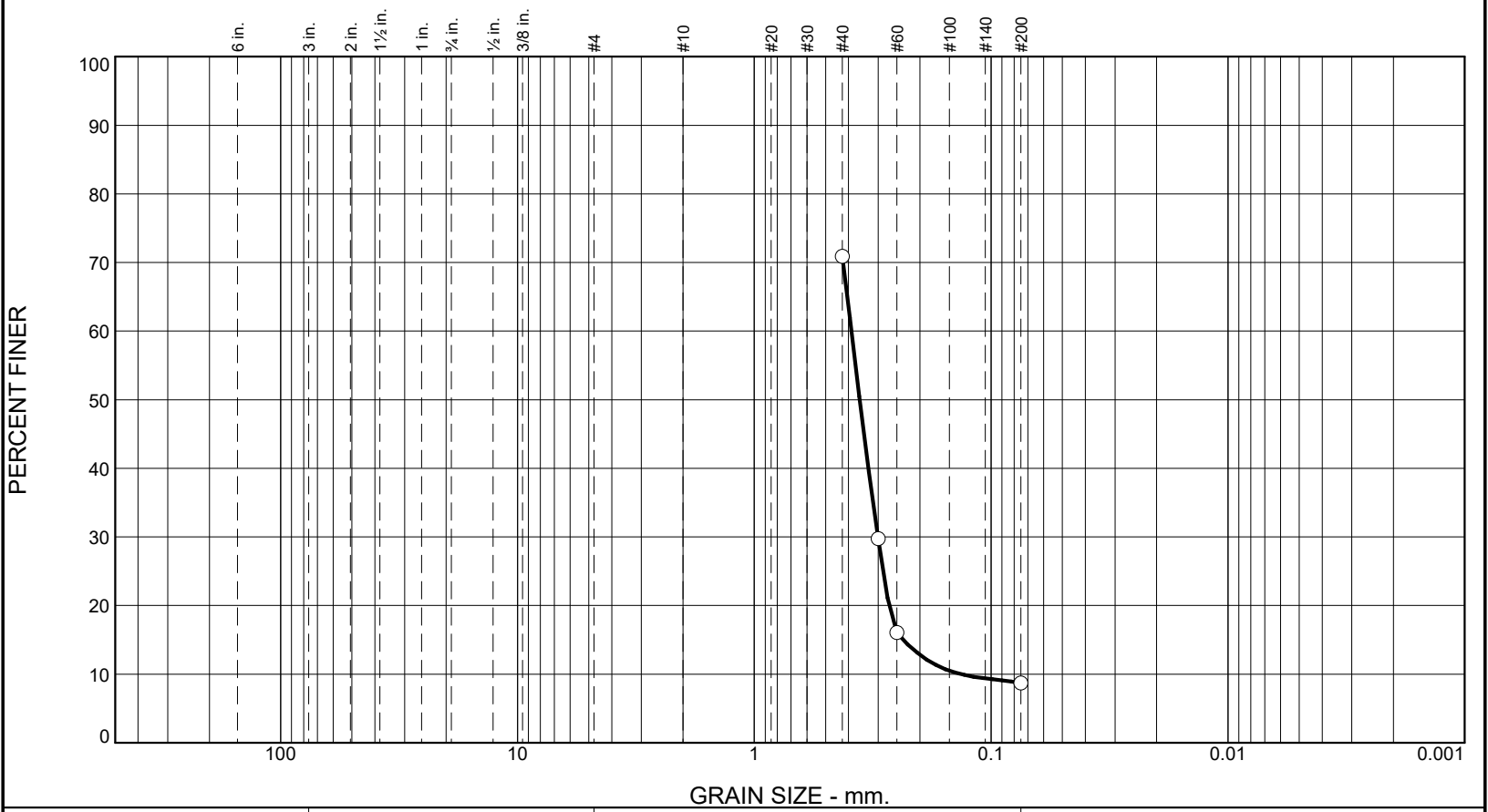
Robertsdale, Alabama

Client: City of Orange Beach
Project: Proposed Orange Beach Fire Training Facility

Project No: DL 4929-25 **Figure**

Tested By: WS **Checked By:** DM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
					62.2	8.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#40	70.9		
#50	29.7		
#60	16.0		
#200	8.7		

* (no specification provided)

Soil Description

Tan Sand with Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= D_{85}= D_{60}= 0.3888
D_{50}= 0.3589 D_{30}= 0.3008 D_{15}= 0.2351
D_{10}= 0.1346 C_u= 2.89 C_c= 1.73

Classification

USCS= SP-SM AASHTO=

Remarks

Location: Orange Beach, AL
Sample Number: C-8 **Depth:** 0 to 2 Feet **Date:** 7/16/2025

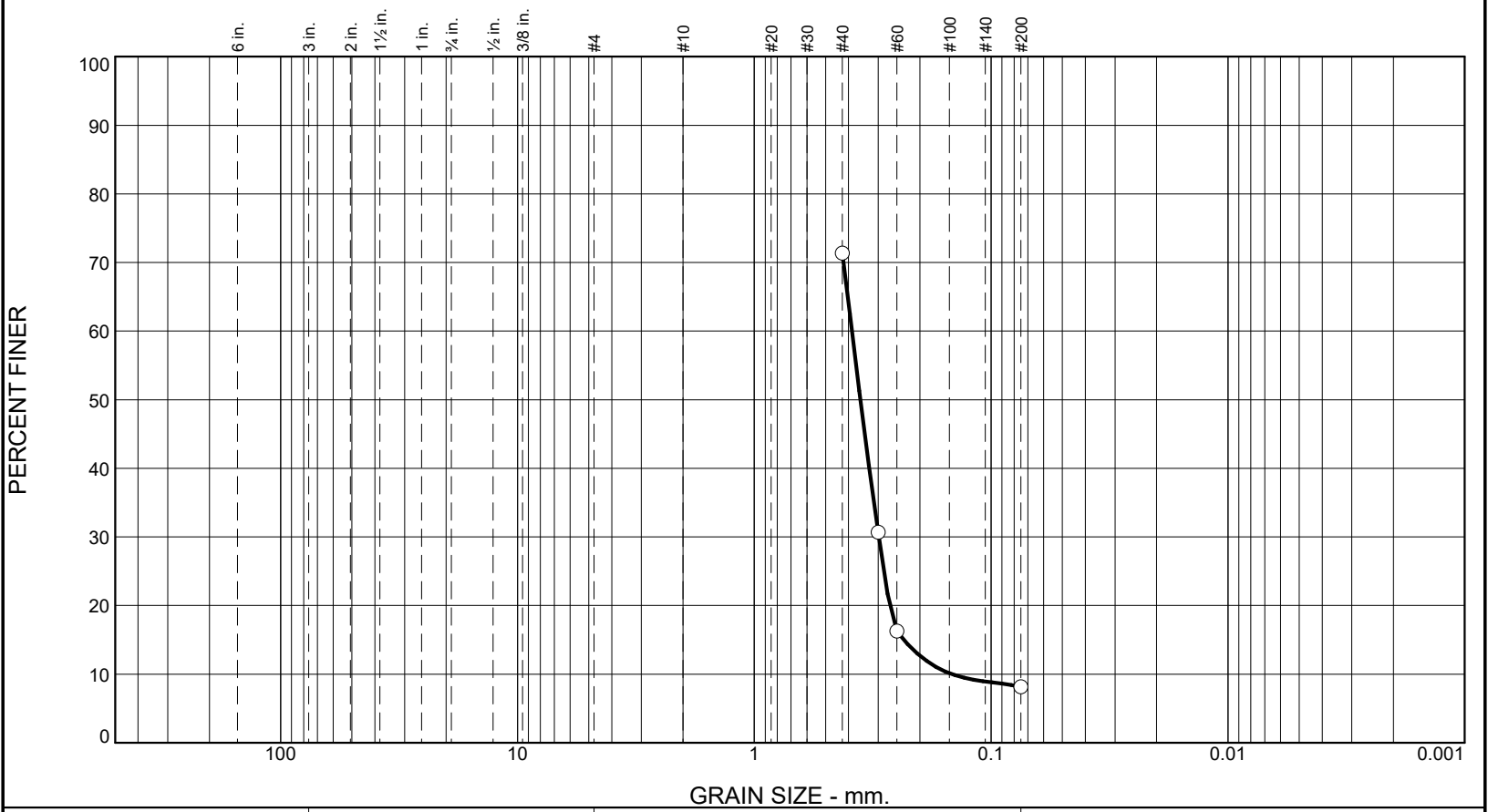
GeoCon

Robertsdale, Alabama

Client: City of Orange Beach
Project: Proposed Orange Beach Fire Training Facility
Project No: DL 4929-25 **Figure**

Tested By: WS **Checked By:** DM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
					63.1	8.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#40	71.3		
#50	30.7		
#60	16.3		
#200	8.2		

* (no specification provided)

Soil Description

Tan Sand with Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= D_{85}= D_{60}= 0.3868
D_{50}= 0.3565 D_{30}= 0.2980 D_{15}= 0.2337
D_{10}= 0.1464 C_u= 2.64 C_c= 1.57

Classification

USCS= SP-SM AASHTO=

Remarks

Location: Orange Beach, AL
Sample Number: C-8 **Depth:** 2 to 4 Feet **Date:** 7/16/2025

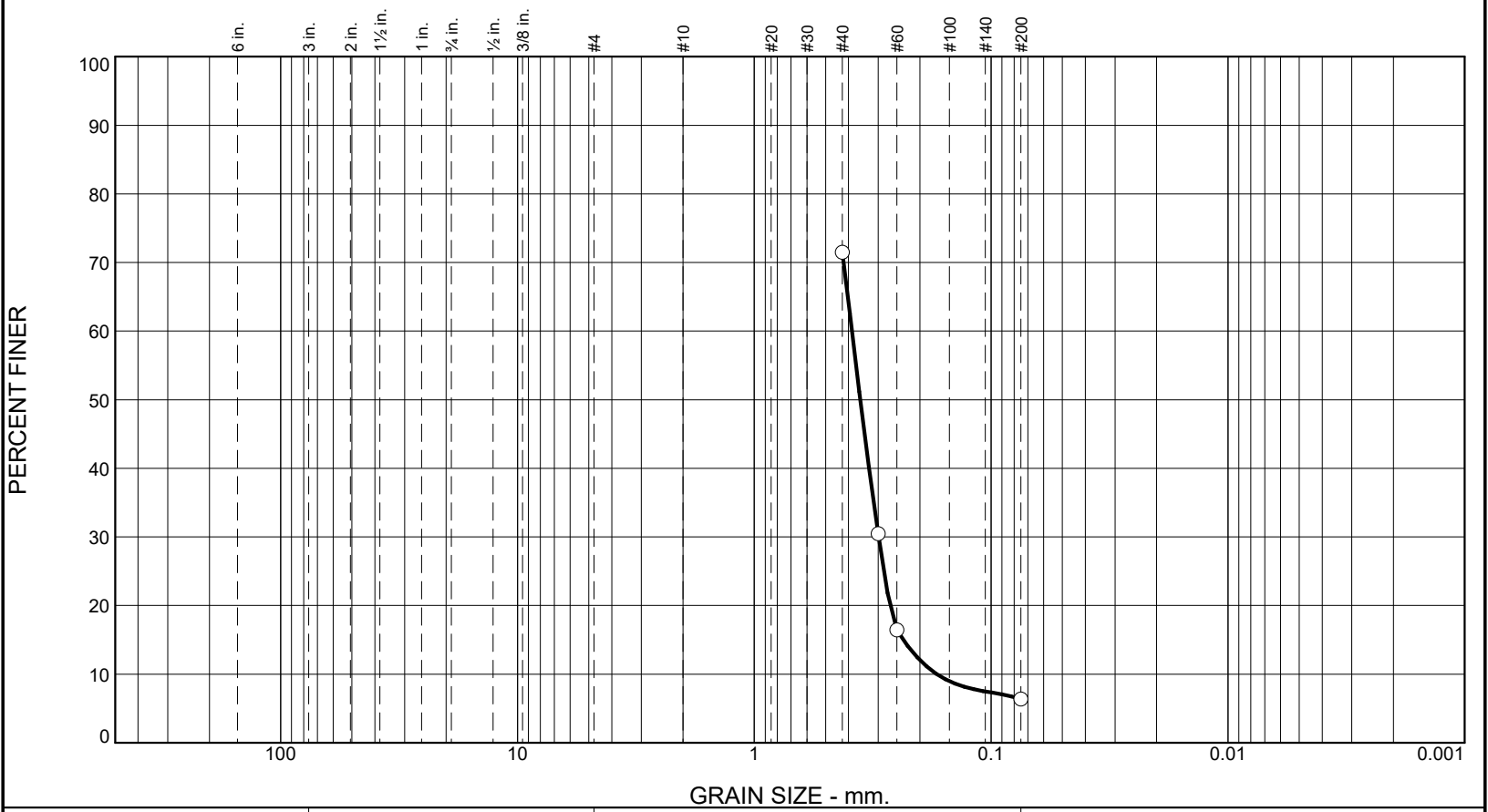
GeoCon

Robertsdale, Alabama

Client: City of Orange Beach
Project: Proposed Orange Beach Fire Training Facility
Project No: DL 4929-25 **Figure**

Tested By: WS **Checked By:** DM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
					65.1	6.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#40	71.5		
#50	30.5		
#60	16.4		
#200	6.4		

* (no specification provided)

Soil Description

Light Tan Sand with Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= D_{85}= D_{60}= 0.3868
D_{50}= 0.3568 D_{30}= 0.2986 D_{15}= 0.2349
D_{10}= 0.1697 C_u= 2.28 C_c= 1.36

Classification

USCS= SP-SM AASHTO=

Remarks

Location: Orange Beach, AL
Sample Number: B-3 **Depth:** 0 to 1.5 Feet **Date:** 7/16/2025

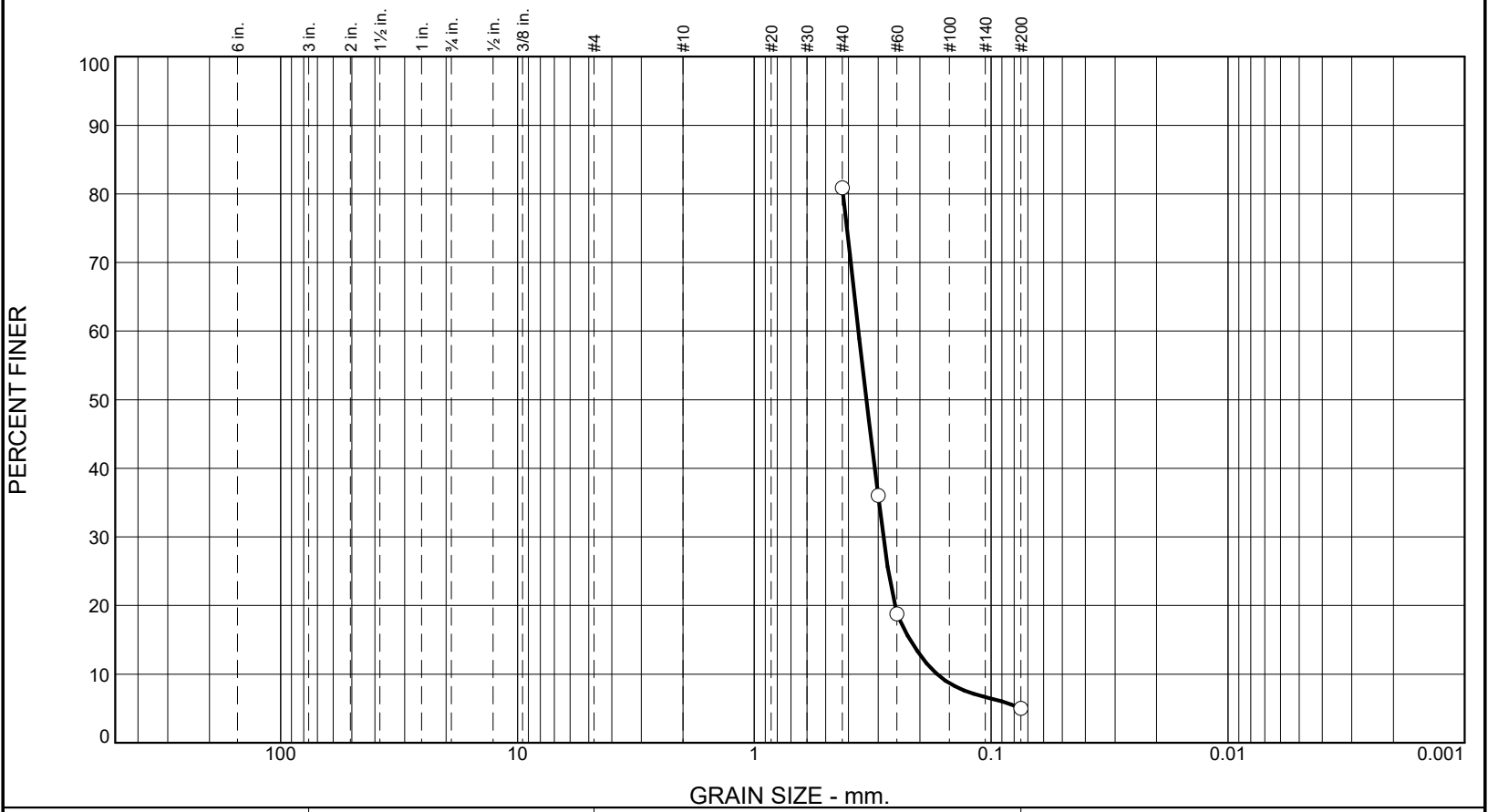
GeoCon

Robertsdale, Alabama

Client: City of Orange Beach
Project: Proposed Orange Beach Fire Training Facility
Project No: DL 4929-25 **Figure**

Tested By: WS **Checked By:** DM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
					75.9	5.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#40	80.9		
#50	36.0		
#60	18.8		
#200	5.0		

* (no specification provided)

Soil Description

Tan Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= D_{85}= D_{60}= 0.3632
D_{50}= 0.3366 D_{30}= 0.2847 D_{15}= 0.2199
D_{10}= 0.1691 C_u= 2.15 C_c= 1.32

Classification

USCS= SP-SM AASHTO=

Remarks

Location: Orange Beach, AL
Sample Number: B-6 **Depth:** 0 to 3.5 Feet **Date:** 7/16/2025

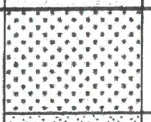
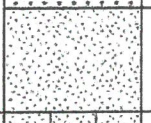
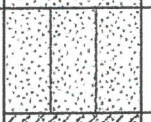
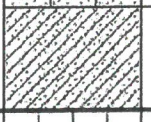
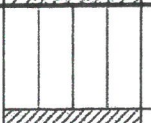
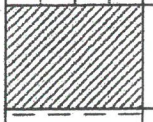
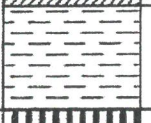
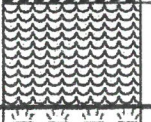
GeoCon

Robertsdale, Alabama

Client: City of Orange Beach
Project: Proposed Orange Beach Fire Training Facility
Project No: DL 4929-25 **Figure**

Tested By: WS **Checked By:** DM

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

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.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

TERMS AND CONDITIONS

SERVICES TO BE PROVIDED. GeoCon Engineering & Material Testing, Inc. (hereinafter GeoCon) is an independent consultant and agrees to provide Client, for its sole benefit and exclusive use, consulting services set forth in our proposal.

PAYMENT TERMS. Client agrees to pay our invoice upon receipt. If payment is not received within 30 days from the invoice date, Client agrees to pay a service charge on the past due amount at a rate of 1.5% per month, and GeoCon reserves the right to suspend all work until payment is received. No deduction shall be made from our invoice on account of liquidated damages or other sums withheld from payments to contractors or others.

TERMINATION. Either party may terminate this Agreement without cause upon 20 days advance notice in writing. In the event Client requests termination prior to completion of the proposed services. Client agrees to pay GeoCon for all costs incurred plus reasonable charges associated with termination of the work.

PROFESSIONAL LIABILITY. Notwithstanding any other provision of this Agreement, the Engineer's and GeoCon's total liability to the Owner for any loss or damages from claims arising out of or in connection with this Agreement from any cause including the Engineer's strict liability, breach of contract, or professional negligence, errors and omissions (whether claimed in tort, contract, strict liability, nuisance, by statute or otherwise) shall not exceed the lesser of the total contract price of this Agreement or the proceeds paid under Engineer's liability insurance in effect at the time such claims are made. The Owner hereby releases the Engineer from any liability exceeding such amount. In no event shall either party to this Agreement be liable to the other for special, indirect, incidental or consequential damages, whether or not such damages were foreseeable at the time of the commencement of the work under this Agreement.

SITE OPERATIONS. Client will arrange for right-of-entry to all applicable properties for the purpose of performing studies, tests and evaluations pursuant to the agreed services. Client represents that it possesses necessary permits and licenses required for its activities at the site.

OWNERSHIP AND USE OF PROJECT DOCUMENTS. All documents are instruments of service in respect to the Services, and Engineer shall retain an ownership and proprietary property interest therein (including the right of reuse at the discretion of the Engineer) whether or not the Services are completed. Client may make and retain copies of documents for information and reference in connection with the services by Client. Such documents are not intended or represented to be suitable for reuse by Client or others on extensions of the services or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Client's sole risk and without liability or legal exposure to Engineer or to Engineer's consultants. Client shall indemnify and hold harmless Engineer and Engineer's consultants from all claims. Damages, and expenses including attorneys' fees arising out of or resulting therefrom.

ADDITIONAL SERVICES OF CONSULTANT. If authorized in writing by the Client, GeoCon shall furnish additional services that are not considered as an integral part of the Scope of Services outlined in the Proposal Acceptance Sheet. Under this Agreement, all costs for additional services will be negotiated as to activities and compensation. In addition, it is possible that unforeseen conditions may be encountered that could substantially alter the original scope of services. If this occurs, GeoCon will promptly notify and consult with Client and any additional services will be negotiated.

ASSIGNABILITY. GeoCon shall not assign any interest on this Agreement, and shall not transfer any interest in the same (whether by assignment or novation) without the prior written consent of the Client; provided, however, that claims for money by GeoCon against Client under this Agreement may be assigned to a bank, trust company, or other financial institution without such approval. Written notice of any such assignment or transfer shall be promptly furnished to the Client.

SERVICES TO BE CONFIDENTIAL. All services, including opinions, designs, drawings, plans, specifications, reports and other services and information, to be furnished by GeoCon under this Agreement are confidential and shall not be divulged, in whole or in part, to any person, other than to duly authorized representatives of the Client, without prior written approval of the Client, except by testimony under oath in a judicial proceeding or as otherwise required by law. GeoCon shall take all necessary steps to ensure that no member of its organization divulges any such information except as may be required by law.

CLAIMS. The parties agree to attempt to resolve any dispute without resort to litigation. However, in the event a claim is made that results in litigation, and the claimant does not prevail at trial, then the claimant shall pay all costs incurred in defending the claim, including reasonable attorney's fees. The claim will be considered proven if the judgment obtained and retained through any applicable appeal is at least ten percent greater than the sum offered to resolve the matter prior to the commencement of trial.

SEVERABILITY. It is understood and agreed by the parties hereto, that if any part, term or provisions of this Agreement is held by any court of competent jurisdiction to be illegal or in conflict with any applicable law, the validity of the remaining portion or portions of this Agreement shall not be affected and the rights and obligations of the parties shall be construed and enforced as if the Agreement did not contain the particular part, term or provision held to be invalid.

SURVIVAL. All obligations arising prior to the termination of this Agreement and all provisions of this Agreement allocating responsibility or liability between Client and GEOCON shall survive the completion of the services and the termination of this Agreement.

INTEGRATION. This Agreement, the attached documents and those incorporated herein constitute the entire Agreement between the parties and cannot be changed except by a written instrument signed by both parties.

GOVERNING LAW. This Agreement shall be governed in all respects by the laws of the State of Alabama and venue shall be in Baldwin County, Alabama