GEOTECHNICAL INVESTIGATION

PROPOSED DEVELOPMENTS
STENNIS INTERNATIONAL AIRPORT AND
PORT BIENVILLE INDUSTRIAL PARK
PARCEL #6
HANCOCK COUNTY, MISSISSIPPI

TBG PROJECT NO. 4696 MS(G)

Prepared for:

NEEL-SCHAFFER, INC.

HATTIESBURG, MISSISSIPPI

TheBetaGroup
engineering and construction services

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engineering and construction services

June 28, 2017

Neel-Schaffer, Inc.
704 Hardy Street.
Hattiesburg, MS. 39401

Attn: Mr. Jeffery L. Lee, P.E.

Reference: Report of Geotechnical Investigation
Proposed Developments
Stennis International Airport and Port Bienville Industrial Park
Hancock County, MS
TBG Report No. 4696G

Dear Mr. Lee:

The Beta Group, LLC (TBG) has performed a Geotechnical Investigation for the above referenced sites in Hancock County, Mississippi. As authorized by you, this project was completed in accordance with the TBG proposal dated April 4, 2017. The attached report presents our understanding of the project, reviews our exploration procedures, describes existing site and general subsurface conditions, and presents our evaluations and recommendations.

We have enjoyed working with you on this project and look forward to assisting you during the continuing design and construction activities. Please contact us at anytime if you have any questions regarding this report or need further service.

Sincerely,
THE BETA GROUP, LLC

Alex Jaramillo, P.E.
Senior Project Engineer

Mark A. Cheek
MARK A. CHEEK
14491
Mark A. Cheek, P.E., FACI
Vice President

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PURPOSE AND SCOPE OF SERVICES

PURPOSE OF SERVICES

The purpose of the Geotechnical Investigation was to explore the subsurface conditions at various project location sites for the Proposed Development, site preparation, earthwork and quality control measures related to these design aspects.

SCOPE OF SERVICES

To accomplish the stated purpose, we executed the following:

1. Documented existing surface conditions and features at the project site and the marked boring locations.

2. Performed a subsurface exploration consisting of a total of ten (10) undisturbed soil test borings to the depth 20 feet below the existing ground surface.

3. Performed laboratory testing on selected soil samples to ascertain soil properties for engineering purposes.

4. Evaluated the findings of the subsurface exploration and laboratory data relative to general subsurface characterization, support, and other geotechnical aspects of the project.

Our scope of services did not include a survey of the boring locations and elevations, quantity of estimates, preparation of plans or specifications, or the identification and evaluation of environmental aspects of the project site.

PROPOSED PROJECT DESCRIPTION

The project site was located at Port Bienville in Hancock County, Mississippi. We understand that the project site is for developing land at Site #6 (as referenced as Figure 1 in the Appendix) at Port Bienville. We also understand Site #6 is approximately 43 acres. As per Mr. Jeffrey Lee's instructions, one (1) soil boring was needed approximately every five (5) acres.

SUBSURFACE EXPLORATION

FIELD EXPLORATION

The subsurface exploration consisted of a total of ten (10) undisturbed soil test borings (designated as Site number followed by boring number) performed between April 11th , 2017 and May 26th, 2017 at the referenced sites and at the approximate locations shown on the attached Boring Location Plan (Figures No. 1).

The soil test boring locations were located in the field by a TBG representative inside the footprint of the proposed Development. The boring locations were plotted and topographical information was estimated. The methods used in the determination of the boring locations shown on the Boring Location Plan should be considered approximate.

The soil test borings were drilled utilizing a truck mounted drill rig at the designated locations shown on the Boring Location Plan. Undisturbed sampling was performed continuously in the upper 10 feet and on 5 ft. centers thereafter, with a 3-inch diameter thin-walled tube sampler. Representative samples were removed from the tubes and placed in moisture-proof containers for laboratory testing.

When cohesionless material was encountered, which could not be sampled by undisturbed methods, the Standard Penetration Test was performed. This test consists of driving a two inch diameter splitspoon sampler 1 ft. (after first seating it 6 inches) with a 140 lb. hammer falling 30 inches. The number of blows required to drive the sampler gives an indication of the density of the material.

The soil test borings were advanced through the soil overburden to the assigned termination depth of 20 feet below the existing ground surface.

Subsurface water level readings were obtained at the soil test borings immediately upon completion of the drilling process and after a period of 15 minutes. Upon completion of the drilling activities, the boreholes were backfilled with auger cuttings (soil) and/or high-strength concrete as per MDOT requirements.

LABORATORY TESTING

Laboratory tests were conducted on selected samples in general accordance with ASTM standards. The laboratory testing performed for this project consisted of:

- Atterberg Limits
- Unconfined Compression Tests
- Natural Moisture Content
- Unit Weight Determination
- Percent Passing #200 Sieve

The test results are summarized on the individual Boring Logs in the Appendix of this report.

SITE AND SUBSURFACE CONDITIONS SITE #6

TBG performed reconnaissance of the site on April 10th, 2017. The site is located within Port Bienville located south of Port and Harbor Dr. in Hancock County, Mississippi. The site is approximately 43 acres and is heavily wooded.

SUBSURFACE CONDITIONS

Boring S06-01: Reference to the log of boring S06-01 shows that beginning at the ground surface there is 4 ft. of medium stiff to stiff light gray and tan sandy clay followed by loose to medium dense light gray and tan silty sand to at least the boring's termination depth of 20 ft.

Boring S06-02: Reference to the log of boring S06-02 shows that beginning at the ground surface there is 2 ft. of soft light gray and tan sandy clay followed by stiff light gray and tan sandy clay to the 4 ft. depth. This clay is underlain by loose to medium dense tan silty sand to at least the boring's termination depth of 20 ft.

Boring S06-03: Reference to the log of boring S06-03 shows that beginning at the ground surface there is 4 ft. of soft to medium stiff light gray and tan sandy clay followed by medium dense light gray and tan silty sand to at least the boring's termination depth of 20 ft.

Boring S06-04: Reference to the log of boring S06-04 shows that beginning at the ground surface there is 4 ft. of medium stiff light gray and tan sandy clay followed by loose to medium dense light gray and tan silty sand to at least the boring's termination depth of 20 ft.

Boring S06-05: Reference to the log of boring S06-05 shows that beginning at the ground surface there is 4 ft. of soft to medium stiff light gray and tan sandy clay followed by medium dense light gray and tan silty sand to at least the boring's termination depth of 20 ft.

Boring S06-06: Reference to the log of boring S06-06 shows that beginning at the ground surface there is 6 ft. of loose to medium dense light gray and tan clayey sand followed by loose to medium dense light gray and tan silty sand to at least the boring's termination depth of 20 ft.

Boring S06-07: Reference to the log of boring S06-07 shows that beginning at the ground surface there is 4 ft. of soft light gray sandy clay followed by loose to medium dense light gray and tan silty sand to at least the boring's termination depth of 20 ft.

Boring S06-08: Reference to the log of boring S06-08 shows that beginning at the ground surface there is 6 ft. of medium dense light gray and tan clayey sand followed by loose to medium dense light gray and tan silty sand to at least the boring's termination depth of 20 ft.

Boring S06-09: Reference to the log of boring S06-09 shows that beginning at the ground surface there is 2 ft. of loose light gray and tan clayey sand followed by soft to medium stiff light gray and tan sandy clay to the 6 ft. depth. This clay is underlain by loose to medium dense light gray and tan silty sand to at least the boring's termination depth of 20 ft.

Boring S06-10: Reference to the log of boring S06-010 shows that beginning at the ground surface there is 6 ft. of soft to medium stiff to stiff light gray and tan sandy clay followed by loose to medium dense light gray and tan silty sand to at least the boring's termination depth of 20 ft.

GROUNDWATER CONDITIONS

At the time of making the borings, free water was detected at about the 8 ft. depth below the existing ground surface for soil borings S06-01 thru S06-07. The free water detected for borings S06-09 and S06-10 was detected at the 9 ft. depth and water was detected at the 7 ft. depth for boring S06-08. The groundwater level rose to about the 6 ft. depth in borings S06-01 thru S06-06 after about 15 minute waiting period. The groundwater level rose to the 7 ft. depth for borings S06-07 through S06-10 after a 15 minute waiting period. It should be noted that groundwater levels tend to fluctuate with seasonal and climatic changes, the proximity to any water bodies, as well as with some types of construction operations. As such, groundwater levels at other times of the year may be different than those described in this report. These observations were made while completing the borings and may not have become fully static at the time of measurement. If groundwater is important to construction, it should be measured at that time.

ENGINEERING EVALUATION & RECOMMENDATIONS

The following evaluations and recommendations are based on our observations at the site, interpretation of the field and soil laboratory data obtained during this exploration, and our experience with similar subsurface conditions and projects. Subsurface conditions in unexplored locations may vary from those encountered. If the project location changes, we request that we be advised so that we may re-evaluate our recommendations.

Design recommendations for Site #6 for the given locations are dependent on the soil and site conditions. The subsurface exploration aids the geotechnical engineer in determining the necessary geotechnical recommendations needed. In addition, since the method of construction greatly affects the soils intended for the proposed development, consideration must be given to the implementation of suitable methods of site preparation, material compaction, and other aspects of construction. Based on our analysis, it is our opinion that the proposed site is suitable for the planned construction.

The near surface sandy clays and clayey sands are fair in bearing quality and believed capable of supporting the proposed structure on spread, shallow, footing foundations assuming that some settlements can be tolerated. This assumes that the footing excavations are well drained during construction and that good rigidity in the structure foundation is assured to minimize movements due to settlements. In view of this, analyses were made with regard to shallow footing foundations. Should the settlements or bearing values provided in this report not be tolerable, deep foundations should be used to support the structure. In addition, careful observation should be made during the footing excavations to assure any tree roots, if encountered, are undercut and replaced with compacted structural fill, as the roots may cause excessive settlement due to possibly lowering the existing groundwater table.

SHALLOW FOUNDATION

ALLOWABLE SOIL BEARING CAPACITIES

Based on an analysis of borings S06-01 thru S06-10, it has been determined that an allowable soil bearing capacity of 1,200 lbs. per sq. ft. is available for design of square spread footings up to 6 ft. in width. For continuous footings up to 2 ft. in width, an allowable soil bearing capacity of

900 lbs. per sq. ft. is recommended for design. These allowable soil bearing capacities assume that the spread footings are seated in firm, naturally occurring sandy clays and/or clayey sands. They contain a factor of safety of 3.0 against failure which is recommended for design, but do not preclude settlements or the effects of volumetric change.

RECTANGULAR FOOTINGS AND OVERTURNING

Rectangular footings may be designed for a pressure computed from the formula:

$$q_r = q_w (1 + 0.20 B/L)$$

Where:

q_r = Net Allowable Bearing Capacity for Rectangular Footings (psf)
q_w = Net Allowable Bearing Capacity for Wall Footings (psf)
B = Footing Width (feet)
L = Footing Length (feet)

Note: $q_r > q_w$
$L > B$

For overturning (eccentric loading), footings should be sized by considering only that portion of the footing which is centered on the force to be effective as distributing load to the soil. The dimensions B' and L' of an equivalent concentric footing should be used as follows:

$$B' = B - 2e_b$$
$$L' = L - 2e_L$$

Where: e_b and e_L are the eccentricities in each respective direction
e = (overturning moment in representative direction)/(applied load)

Prior to construction, the area of the proposed foundation should be stripped of all vegetation, soft or loose surface soils, deleterious material, etc. and should be well drained. All excavated material should be replaced with controlled-compacted structural fill. This fill, which could also be used for purpose of raising the site grade, could consist of a red clay-sand type material having less than 30 percent fines passing the No. 200 Sieve. It should have a maximum liquid limit of 40 and plastic limit of 15. It should also be compacted to at least 98 percent of Maximum Dry Density at Optimum Moisture Content according to ASTM D-698A. In-place density measurements should be taken to assure that this degree of compaction is achieved. For this case, footings could be seated in the structural fill using the above mentioned allowable soil bearing capacities Site #6.

ESTIMATED SETTLEMENT

No detailed settlement analyses were made since the design structural loads are not known at this time. However, settlements of 6 ft. square spread footings and 2 ft. wide continuous footings and using the recommended allowable soil bearing capacities are estimated to be on the order of ¼ to 1 inch. Settlements would increase with the size of the spread footing and, if larger footings are needed for support, detailed settlement analyses should be made.

In view of the magnitude of the estimated settlements and to bridge any undetected soft areas, good rigidity should be assured in the proposed foundation to minimize detrimental effects of differential settlements. Design loads should not exceed our recommended values or stated assumptions regarding settlement. The project structural engineer should determine if the structure can tolerate the provided settlement estimates.

Areal Settlements

It should be recognized that some areal settlements will probably occur due to the load imposed by the fill that will be used to raise the site grade in the area of Site #6. In view of this, analyses were made to estimate long term consolidation settlements that should be expected to occur due to fill load over the area of Site #6. A fill thickness of up to 3¼ ft., long term settlements due to consolidation of the subsoils are estimated to be on the order of 1 to 2 inches. The estimated settlements would occur over most of the filled area, while settlements at the perimeter or edge of the fill would be approximately one-half (1/2) of the center settlements and would occur only over a limited range near the perimeter. The estimated settlements given above are based on uniform fill thickness over a large filled area and unit weight of about 120 pounds per cubic foot. These estimates are ultimate values due to fill loads. Additional settlements could occur due to lowering of groundwater with improved drainage or shrinkage of cohesive fill.

Areal settlement should be considered in design, particularly where unsupported appurtenances (driveway, walkways, planters, etc.) adjoin other structures. At these vulnerable locations, it may be desirable to structurally tie such unsupported elements into the structure to minimize the effects of differential settlement. Also, the effect of areal settlement should be considered where utility lines connect to and underlie structures. Flexibility should be incorporated into the lines to allow for settlement and "pulling" of the lines.

VOLUMETRIC CHANGE

Swelling of expansive soils occurs as a result of absorption of water while shrinkage occurs due to loss of moisture. Some of the near surface soils at this site are predominately cohesive. Therefore, it is believed that they may experience swelling due to any increase in their moisture content with time after construction. This is of particular importance considering the potential for developing a "perched" groundwater condition and flooding at the site.

Based on the soil borings and laboratory test data, the naturally occurring soils that were encountered in the borings are believed to be only slightly susceptible to swelling and shrinkage. Therefore, there is some potential for heave and shrinkage during periods of heavy precipitation and severe drought, respectively. In view of this, it is recommended that good rigidity of the structure foundation be assured to minimize detrimental effects of differential movements. This could consist of stiffening grade beams tying individual foundation elements together and forming a rigid or "waffle" like pattern, or using a post-tensioned slab and foundation system.

Good drainage should be assured, both during and subsequent to construction, to divert the flow of surface waters from the area of the structure foundation. By precluding surface waters from saturating the potentially expansive soils, the resulting volumetric movements would be minimized. In this regard, good roof and surface drainage should be assured with positive collection and runoff of these waters. The surrounding ground should slope away from the structure to divert surface runoff away from the structure foundation. Inspection of footing excavations by a qualified geotechnical engineer or technician should be performed prior to steel placement to ensure that the proper bearing surface is present. The soils that form the bearing stratum will be clays (if the footings are not seated in the structural backfill) and can undergo severe loss of strength when wetted. Traffic in the foundation excavations should be limited.

Consideration could be given to placing an impervious membrane below flowerbeds in the immediate vicinity of the structure to prevent water infiltration into the subsoils in the area of the structure foundation. Also, a distance of at least one-half (1/2) the expected height of fullygrown trees should be maintained between any trees and the structure foundation. It is also recommended that trees and shrubbery with heavy moisture demand not be placed in close proximity to the structure foundation.

EARTHWORK CONSIDERATIONS

The site will require earthwork associated with grading and backfill. The following paragraphs provide pertinent recommendations associated with potential earthwork activities.

SITE PREPARATION

Significant site preparation problems will develop unless good drainage is provided throughout the project duration. Proper site drainage should be maintained during and after construction. Providing drainage during the construction process will facilitate construction by reducing the potential for compaction problems.

FILL MATERIALS

We recommend a select fill material free from debris, deleterious material or organic matter be used. This could consist of a red clay-sand type material having less than 30 percent fines passing the No. 200 Sieve. It should have a maximum liquid limit of 40 and plastic limit of 15. Reference is also made to the State of Mississippi, Department of Transportation, and Standard Specifications for Roads and Bridges, Latest Edition for additional guidelines ad recommendations regarding building construction. This includes subgrade preparation; stripping; placement method and compaction requirements; and general construction conditions; etc.

FILL PLACEMENT AND COMPACTION

Cohensionless fill should be placed in 6 to 8 inch loose lifts. Stuctural backfill should be compacted to a minimum dry density of 98% of its maximum dry density as determined by ASTM D 698A. Any other backfill needed should be compacted to a minimum dry density of 95% of its maximum dry density as determined by ASTM D 698A. Proper drainage should be provided in order to facilitate fill placement during both dry and wet weather constructions. Reference is also made to the State of Mississippi, Department of Transportation, and Standard Specifications for Roads and Bridges, Latest Edition for additional guidelines ad recommendations regarding building construction.

QUALITY CONTROL

The use of the correct fill materials and the proper placement and compaction are critical in any earthwork where subsequent construction of driveways or structures is planned. Construction monitoring by a qualified geotechnical engineer or technician is recommended to document that proper fill construction has been accomplished.

The responsibilities of the quality control representative generally include observation of excavations, documentation of material types, and fill placement and compaction techniques. The geotechnical engineer or technician should make sure the fill is the proper material type, and is placed in the correct manner. Any deviation from the design should be reported to the design engineer.

CONSTRUCTION QUALITY CONTROL

The Geotechnical Engineer of record should be retained to monitor and test earthwork activities, subgrade preparations, as well as any additional construction activities. We recommend that TBG be employed to monitor the earthwork construction, and to report that the recommendations contained in this report are completed in a satisfactory manner. Our continued involvement on the project will aid in the proper implementation of the recommendations discussed herein.

The following is a recommended scope of services:

- Review of project plans and construction specifications to verify that the recommendations presented in this report have been properly interpreted and implemented.
- Observe the earthwork process to document that subsurface conditions encountered during construction are consistent with the conditions anticipated in this report.
- Observe the subgrade conditions before placing structural materials.
- Observe the placement and compaction of all structural materials, and perform laboratory and field compaction testing.

CONSULTATION

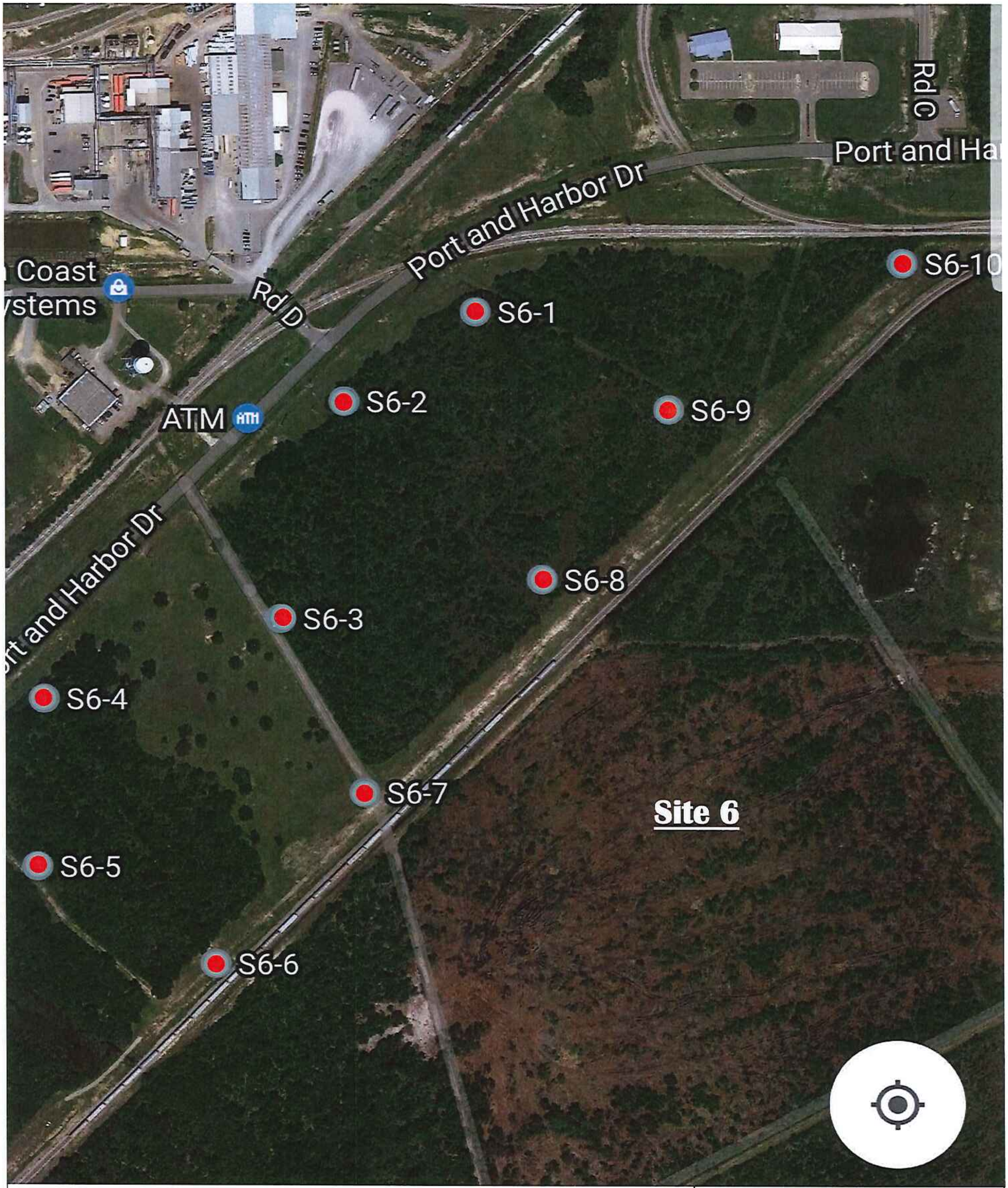
Often during final design and/or construction, questions can arise or services are needed to complete the project. TBG offers various construction services such as pile logging, vibration monitoring, pile load tests, subgrade preparation testing, etc. At your request, TBG would be pleased to discuss these services with a brief phone call or conference.

LIMITATIONS

This report has been prepared for the exclusive use of Neel-Schaffer, Inc. and his assigns for specific application to the referenced property in accordance with generally accepted geotechnical engineering practices.

No other warranty, expressed or implied, is made. These recommendations do not reflect variations in subsurface conditions that may be intermediate of the boring locations or in unexplored areas of the site. Should such variations become apparent during construction, we reserve the right to re-evaluate our recommendations based upon on-site observations of the conditions. In the event changes are made in the proposed construction plans, the recommendations presented in this report shall not be considered valid unless reviewed by our firm and modified or verified in writing.

Appendix



BORING LOCATION PLAN ● **BORING LOCATION** | **North** ▲

THE BETA GROUP, LLC.
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504-227-2273 fax: 504-227-2274
Betagroupgc.com

Client:	Neel Schaffer Inc.
Project:	Proposed Development
Location:	Hancock County, Mississippi
TBG Project No:	4696G
Date:	6/6/2017
	Scale: Not To Scale

Figure 1


SITE 6 (50 ACRES)

Proposed Development Parcel
Stennis International Airport
Hancock County, MS

Neel-Schaffer, Inc
704 Hardy St.
Hattisburg, MS

LOG OF SOIL BORING S06-01

TheBetaGroup
engineering and construction services

Sheet 1 of 1

File:	4696MSG
Date:	4/11/17
Logged by:	T.Roche
Driller:	E. Laizer
Rig:	CME 75

Location: Lat. 30° 14' 26"
Long. 89° 33' 10"

Surface Elevation:

FIELD DATA				LABORATORY DATA									
							Atterberg Limits						
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	LL	PL	PI	Percent Passing #200 Sieve	Organic Content	Soil Type	Description
			4.0 (P)	1.20	12	133							Medium Stiff to Stiff Light Gray and Tan SANDY CLAY (CL)
			2.25 (P)	0.83	17	129	20	7	13				
	5		14 b/f 7-8-6		18					18			Loose to Medium Dense Light Gray and Tan SILTY SAND (SM)
▼													
			14 b/f 5-7-7		22								
▽													
			10 b/f 5-5-5		25					10			
	10												
			10 b/f 4-5-5		24								
			4 b/f 2-2-2		26					8			
	15												
			4 b/f 3-2-2		24								
	20												Boring completed at 20 ft.
	25												
	30												

Ground Water Level Data

▽ Free water first encountered

▼ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

Proposed Development Parcel
Stennis International Airport
Hancock County, MS

Neel-Schaffer, Inc
704 Hardy St.
Hattisburg, MS

LOG OF SOIL BORING S06-02

TheBetaGroup
engineering and construction services

Sheet 1 of 1

File:	4696MSG
Date:	4/11/17
Logged by:	T.Roche
Driller:	E. Laizer
Rig:	CME 75

Location: Lat. 30° 14' 23"
Long. 89° 33' 15"

Surface Elevation:

FIELD DATA				LABORATORY DATA									
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Organic Content	Soil Type	Description
		■	2.0 (P)	0.43	14	130	18	6	12			▨	Soft Light Light Gray and Tan SANDY CLAY (CL)
		■	2.0 (P)	1.06	21	125						▨	Stiff Light Gray and Tan SANDY CLAY (CL)
▼	5	☒	16 b/f 6-8-8		18							░	Loose to Medium Dense Tan SILTY SAND (SM)
▽		☒	14 b/f 6-6-8		20					16		░	
		☒	12 b/f 4-6-6		23							░	
	10	☒	11 b/f 5-6-5		25					9		░	
	15	☒	7 b/f 2-3-4		27							░	
	20	☒	4 b/f 3-2-2		27					7		░	
													Boring completed at 20 ft.
	25												
	30												

Ground Water Level Data

▽ Free water first encountered

▼ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

Proposed Development Parcel
Stennis International Airport
Hancock County, MS

Neel-Schaffer, Inc
704 Hardy St.
Hattisburg, MS

LOG OF SOIL BORING S06-03

TheBetaGroup
engineering and construction services

Sheet 1 of 1

File:	4696MSG
Date:	4/11/17
Logged by:	T.Roche
Driller:	E. Laizer
Rig:	CME 75

Location: Lat. 30° 14' 19"
Long. 89° 33' 16"

Surface Elevation:

FIELD DATA				LABORATORY DATA									
							Atterberg Limits						
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	LL	PL	PI	Percent Passing #200 Sieve	Organic Content	Soil Type	Description
			2.25 (P)	0.53	14	129							Soft to Medium Stiff Light Gray and Tan SANDY CLAY (CL)
			2.5 (P)	0.48	18	131	20	9	11				
▼	5		13 b/f 6-6-7		18					25			Medium Dense Light Gray and Tan SILTY SAND (SM)
▽			14 b/f 2-7-7		20								
			11 b/f 5-5-6		21					12			
	10		11 b/f 4-5-6		23								
	15		10 b/f 3-4-6		26					8			
	20		12 b/f 5-6-6		24								
													Boring completed at 20 ft.
	25												
	30												

Ground Water Level Data

▽ Free water first encountered

▼ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

Proposed Development Parcel
Stennis International Airport
Hancock County, MS

Neel-Schaffer, Inc
704 Hardy St.
Hattisburg, MS

LOG OF SOIL BORING S06-04

TheBetaGroup
engineering and construction services

Sheet 1 of 1

File:	4696MSG
Date:	4/12/17
Logged by:	T.Roche
Driller:	E. Laizer
Rig:	CME 75

Location: Lat. 30° 14' 17"
Long. 89° 33' 22"

Surface Elevation:

FIELD DATA				LABORATORY DATA									
							Atterberg Limits						
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	LL	PL	PI	Percent Passing #200 Sieve	Organic Content	Soil Type	Description
		■	3.75 (P)	0.89	11	135	24	9	15			▨	Medium Stiff Light Gray and Tan SANDY CLAY (CL)
		■	2.5 (P)	0.58	19	131						▨	
	5	☒	13 b/f 5-6-7		19							░	Looseto Medium Dense Light Gray and Tan SILTY SAND (SM)
▼												░	
		☒	14 b/f 4-6-8		20					14		░	
▽												░	
		☒	11 b/f 5-5-6		23							░	
	10											░	
		☒	11 b/f 4-5-6		23					10		░	
		☒	6 b/f 2-2-4		26							░	
	15											░	
		☒	9 b/f 3-4-5		28					8		░	
	20												Boring completed at 20 ft.
	25												
	30												

Ground Water Level Data

▽ Free water first encountered

▼ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

Proposed Development Parcel
Stennis International Airport
Hancock County, MS

Neel-Schaffer, Inc
704 Hardy St.
Hattisburg, MS

LOG OF SOIL BORING S06-05

TheBetaGroup
engineering and construction services

Sheet 1 of 1

File:	4696MSG
Date:	4/12/17
Logged by:	T.Roche
Driller:	E. Laizer
Rig:	CME 75

Location: Lat. 30° 14' 12"
Long. 89° 33' 22"

Surface Elevation:

FIELD DATA				LABORATORY DATA									
							Atterberg Limits						
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	LL	PL	PI	Percent Passing #200 Sieve	Organic Content	Soil Type	Description
			2.0 (P)	0.36	15	132						▨	Soft to Medium Stiff Light Gray and Tan SANDY CLAY (CL)
			3.75 (P)	0.79	17	126	28	12	16			▨	
▼	5	☒	17 b/f 6-9-8		18					21		⁘	Medium Dense Light Gray and Tan SILTY SAND (SM)
▽		☒	15 b/f 4-8-7		20							⁘	
		☒	11 b/f 6-5-6		22					9		⁘	
	10	☒	12 b/f 5-6-6		24							⁘	
		☒	10 b/f 5-5-5		22					7		⁘	
	15											⁘	
		☒	11 b/f 4-5-6		25							⁘	
	20												Boring completed at 20 ft.
	25												
	30												

Ground Water Level Data

▽ Free water first encountered
▼ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

Proposed Development Parcel
Stennis International Airport
Hancock County, MS

Neel-Schaffer, Inc
704 Hardy St.
Hattisburg, MS

LOG OF SOIL BORING S06-06

TheBetaGroup
engineering and construction services

Sheet 1 of 1

File:	4696MSG
Date:	4/17/17
Logged by:	T.Roche
Driller:	E. Laizer
Rig:	CME 75

Location: Lat. 30° 14' 10"
Long. 89° 33' 19"

Surface Elevation:

FIELD DATA				LABORATORY DATA									
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sleve	Organic Content	Soil Type	Description
		☒	5 b/f 4-2-3		11					38			Loose to Medium Dense Light Gray and Tan CLAYEY SAND (SC)
		☒	10 b/f 3-4-6		14								
▼	5	☒	16 b/f 7-8-8		19					18			
▽		☒	13 b/f 5-6-7		22								Loose to Medium Dense Light Gray and Tan SILTY SAND (SM)
		☒	10 b/f 3-4-6		22					6			
	10	☒	12 b/f 4-6-6		23								
		☒	9 b/f 2-3-6		22					4			
	15												
		☒	18 b/f 9-8-10		22								
	20												Boring completed at 20 ft.
	25												
	30												

Ground Water Level Data	Boring Advancement Method	Notes
▽ Free water first encountered ▼ Water level after 15 mins.	4" Nom. Dia. Short Flight Auger: 0 to 20 ft.	
	Boring Abandonment Method	
	Borehole backfilled with soil upon completion	

Strata Boundaries May Not Be Exact

Proposed Development Parcel
Stennis International Airport
Hancock County, MS

Neel-Schaffer, Inc
704 Hardy St.
Hattisburg, MS

LOG OF SOIL BORING S06-07

TheBetaGroup
engineering and construction services

Sheet 1 of 1

File:	4696MSG
Date:	4/12/17
Logged by:	T.Roche
Driller:	E. Laizer
Rig:	CME 75

Location: Lat. 30° 14' 15"
Long. 89° 33' 14"

Surface Elevation:

FIELD DATA				LABORATORY DATA									
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Organic Content	Soil Type	Description
			1.5 (P)	0.40	15	134	31	11	20				Soft Light Gray SANDY CLAY (CL)
			3.75 (P)		23					54			
▼	5		17 b/f 5-8-9		19								Loose to Medium Dense Light Gray and Tan SILTY SAND (SM)
			12 b/f 4-7-5		20					17			
▽													
			8 b/f 4-4-4		24								
	10												
			11 b/f 4-5-6		24					10			
			6 b/f 2-3-3		23								
	15												
			9 b/f 3-4-5		23					6			
	20												Boring completed at 20 ft.
	25												
	30												

Ground Water Level Data

▽ Free water first encountered

▼ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

Proposed Development Parcel
Stennis International Airport
Hancock County, MS

Neel-Schaffer, Inc
704 Hardy St.
Hattisburg, MS

LOG OF SOIL BORING S06-08

TheBetaGroup
engineering and construction services

Sheet 1 of 1

File:	4696MSG
Date:	4/26/17
Logged by:	T.Roche
Driller:	E. Laizer
Rig:	CME 75

Location: Lat. 30° 14' 21"
Long. 89° 33' 8"

Surface Elevation:

FIELD DATA				LABORATORY DATA									
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Organic Content	Soil Type	Description
		☒	10 b/f 4-4-6		18					43		▨	Medium Dense Light Gray and Tan CLAYEY SAND (SC)
		☒	13 b/f 6-6-7		19							▨	
	5	☒	18 b/f 6-8-10		18					29		▨	
∇		☒	13 b/f 8-7-6		21							░	Loose to Medium Dense Light Gray and Tan SILTY SAND (SM)
		☒	8 b/f 3-4-4		23					11		░	
	10	☒	10 b/f 4-5-5		24							░	
	15	☒	11 b/f 3-5-6		24					5		░	
	20	☒	6 b/f 3-2-4		22							░	
													Boring completed at 20 ft.
	25												
	30												

Ground Water Level Data

∇ Free water first encountered

▼ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

Proposed Development Parcel
Stennis International Airport
Hancock County, MS

Neel-Schaffer, Inc
704 Hardy St.
Hattisburg, MS

LOG OF SOIL BORING S06-09

Sheet 1 of 1

File:	4696MSG
Date:	4/26/17
Logged by:	T.Roche
Driller:	E. Laizer
Rig:	CME 75

Location: Lat. 30° 14' 24"
Long. 89° 33' 25"

Surface Elevation:

FIELD DATA				LABORATORY DATA									
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Organic Content	Soil Type	Description
		☒	5 b/f 4-4-1		16					44		▨	Loose Light Gray and Tan CLAYEY SAND (SC)
		☒	5 b/f 3-1-4		22					50		▨	Soft to Medium Stiff Light Gray and Tan SANDY CLAY (CL)
	5	■	3.5 (P)	0.45	18	128						▨	
▼		☒	14 b/f 6-7-7		18					17		▨	Loose to Medium Dense Light Gray and Tan SILTY SAND (SM)
▽		☒	8 b/f 4-4-4		22							▨	
	10	☒	9 b/f 4-4-5		26					7		▨	
	15	☒	4 b/f 3-2-2		26							▨	
	20	☒	5 b/f 2-2-3		24					6		▨	
													Boring completed at 20 ft.
	25												
	30												

Ground Water Level Data

▽ Free water first encountered

▼ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

Proposed Development Parcel
Stennis International Airport
Hancock County, MS

Neel-Schaffer, Inc
704 Hardy St.
Hattisburg, MS

LOG OF SOIL BORING S06-10

TheBetaGroup
engineering and construction services

Sheet 1 of 1

File:	4696MSG
Date:	4/26/17
Logged by:	T.Roche
Driller:	E. Laizer
Rig:	CME 75

Location: Lat. 30° 14' 27"
Long. 89° 33' 0"

Surface Elevation:

FIELD DATA				LABORATORY DATA									
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Organic Content	Soil Type	Description
			2.75 (P)	0.70	24	120							Soft to Medium Stiff Light Gray and Tan SANDY CLAY (CL)
			0.25 (P)	0.25	19	129	22	11	11				
	5		3.5 (P)	0.68	16	131							
▼			12 b/f 4-6-6		18								Loose to Medium Dense Light Gray and Tan SILTY SAND (SM)
▽			6 b/f 4-3-3		21					9			
	10		5 b/f 3-2-3		24								
			4 b/f 2-2-2		24					7			
	15												
			5 b/f 3-3-2		24								
	20												Boring completed at 20 ft.
	25												
	30												

Ground Water Level Data

▽ Free water first encountered

▼ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

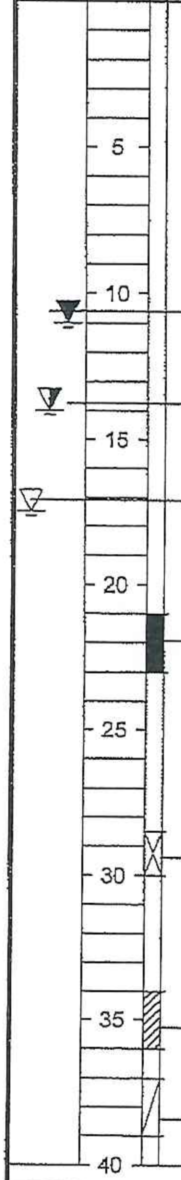
Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

DESCRIPTION OF TERMS AND SYMBOLS
USED ON SOIL BORING LOG

FIELD DATA				LABORATORY DATA								
							Atterberg Limits					
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Dry Unit Weight (pcf)	LL	PL	PI	Other	Soil Type	DESCRIPTION



3.5 (P)

13 b/f
(3-7-6)

Description

Classifications are based on visual observations by field & lab representatives as well as results of laboratory data (when available).

Laboratory Data

Compressive Strength

Value based on peak compressive strength. Determined by unconfined compression test unless otherwise noted.

Dry Unit Weight

As determined by method similar to ASTM D-2937.

Water Content

As determined by pertinent portions of ASTM D-2216.

Atterberg Limits

LL : Liquid Limit
PL : Plastic Limit
PI : Plasticity Index
(= Liquid Limit - Plastic Limit)

Other

Results of other tests such as consolidation, permeability, grain size or notes associated with testing program.

Soil Type

Graphical representation of soil type. In accordance with USCS Symbols.

Ground Water Levels

Long-Term Depth

Depth to water after boring is completed (time noted).

Short-Term Depth

Depth to water after initial water encountered prior to proceeding with boring (time noted).

Initially Encountered

Depth where free water was initially encountered during augering.

Sampling/Field Data

Undisturbed

3" dia. Tube sample

Pocket Penetrometer (P)

Penetration resistance (tons/sq. ft.).

Torvane (T)

Shearing resistance (tons/sq. ft.)

Split Spoon

Std. penetration test

Std. Penetration

No. of blows per foot (blows per each six inch increments).

Auger

Disturbed (auger) collected in accordance with ASTM D-1452.

No Recovery

Sampling attempted but no sample retrieved.

Ground Water Level Data

Boring Advancement Method

Boring Abandonment Method

Notes

Form LOGTERMS

Strata Boundaries May Not Be Exact

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
	Clean Gravels (Less than 5% fines)		
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	▨	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	▨	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)		
	▨	GM	Silty gravels, gravel-sand-silt mixtures
	▨	GC	Clayey gravels, gravel-sand-clay mixtures
	Clean Sands (Less than 5% fines)		
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	▨	SW	Well-graded sands, gravelly sands, little or no fines
	▨	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)		
	▨	SM	Silty sands, sand-silt mixtures
	▨	SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%	▥	ML	Inorganic silts and very fine sands, rock flour, silty of 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
SILTS AND CLAYS Liquid limit 50% or greater	▥	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	▨	CH	Inorganic clays of high plasticity, fat clays
	▨	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	▨	PT	Peat and other highly organic soils

LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent .... GW, GP, SW, SP
More than 12 percent .... GM, GC, SM, SC
5 to 12 percent .... Borderline cases requiring dual symbols

PLASTICITY CHART