Geotech Report

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Creative Learning Academy Classroom Building

Pensacola, Florida
LMJ File #: 23-203
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Prepared for

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Subsurface Conditions

- The borings generally encountered slightly silty sand and sand with silty sand layers below 13-23 feet. The deeper borings encountered silty sand below 48-53 feet to the bottom of these borings at 61-81 feet.
- Some of the silty sand layers below 17 feet had traces of clay or were slightly clayey.
- The borings were very loose and loose in the upper 13-18 feet and medium dense with some dense zones to the bottom of the 31 and 61-foot borings. Boring B-2 was medium dense to 73 feet and loose to the bottom of this boring at 81 feet.
- Groundwater was encountered in boring B-2 at 47 feet below grade and was estimated at a similar depth in B-1. Groundwater was not encountered in the 6 to 31-foot borings at the time of drilling.
- Groundwater levels will vary with changes in local rainfall and site drainage characteristics and may be different at other times.

General Comments and Recommendations

- The borings encountered very loose soils in the upper 6-8 feet that are a settlement concern for footings.
- Proper compaction of very loose soils beneath footings will be needed to keep settlement at normal levels, and we recommend achieving a *minimum of 3 feet of compaction* under footings per this report.
- Based on our experience, a large vibratory roller should be capable of achieving 3 feet of compaction in sandy soils if they are thoroughly wetted beforehand.
- The vibratory roller could be run down column lines at the bottom of footing elevations.
- Compaction of the full 3 feet below footings should be verified per this report.
- Pavement boring P-1 encountered sand in the top 16 inches with sand and mulch in the top 6 inches. The sand has a strength (LBR Value) lower than typically recommended for pavement subgrade.
- We recommend removing the sand and mulch from pavement subgrade and replacing it with material having a minimum LBR of 40.
- The pond borings encountered moderate draining slightly silty sand and well-draining sand to the bottom of S-2 at 31 feet and to 23 feet in S-1. These conditions are suitable for stormwater disposal using the planned stormwater pond.
- The sand and slightly silty sand soils encountered in the stormwater pond borings can be used as fill in the building area but are likely too low in strength (LBR Value) to be used in the top 12 inches of pavement areas.

Note: *The above summary is an overview of the report and should not be used by itself for planning, design, and/or construction. See the relevant sections for further details.*

Site Information

The site is Creative Learning Academy located at 3151 Hyde Park Road in Pensacola, Florida. The proposed classroom building is planned at the south end of the campus, and this area was grassed at the time of drilling with a concrete basketball court on the west end of the site. Based on the provided survey, grades at the site slope from the northeast end at 51 feet down to the southwest corner at 48 feet.

Proposed Construction

We understand that the project consists of the construction of a 2-story classroom building planned at the south end of the site. The building is planned to be a steel frame structure with an 8,500 ft^2 footprint. Some parking and a driveway is being considered along the west end of the site, and a stormwater pond is planned south of the building. The stormwater pond is anticipated to be 8-10 feet deep. At the time of this report, specific grading and structural loading information for this project was not available.

Subsurface Exploration

Our exploration included five SPT borings: two in the building to 61 and 81 feet, two in the stormwater pond to 31 feet, and one in the pavement to 6 feet. Two CPT soundings were pushed in the building area to 60 feet. The CPT sounding results were not consistent with the SPT results; therefore, we returned to the site and drilled two 31-foot SPT borings at the previous CPT locations, and these borings were consistent with the original SPT borings. It was determined that the data from the two CPT soundings was not accurate, and this data was therefore not included in this report. One additional hand auger boring was drilled for pavement, and this boring was probed to approximate the in-place soil density. The SPT borings were drilled in general accordance with ASTM D1586 using a truck mounted drill rig and were advanced between sampling using solid stem auger and a “mud” jetting technique. The SPT borings were sampled using an autohammer. Two Shelby tube samples were collected from the stormwater pond borings for laboratory testing. The subsurface conditions encountered in the borings can be found on the boring logs here.

The above information is the basis of our recommendations. If the information in this section changes or is incorrect, our office should be notified, and changes to our report may be needed.

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Site Preparation

- The building, pavement, and pond areas should be cleared and stripped of all trees, vegetation, major roots, topsoil, and any other deleterious materials.
- Stripped vegetation, topsoil, and organic materials should be hauled offsite, or suitable topsoil could be stockpiled for use as topsoil in landscaped areas after final grading.
- The proposed parking and driveway areas should be cleared of the existing concrete slab and playground equipment (and any foundations for this equipment).
- Any utilities or irrigation in the proposed pavement, pond, and building areas should also be removed and/or rerouted as needed.
- After stripping, the top of subgrade in the building and pavement areas should be compacted to the requirements in the following tables for a minimum depth of 12 inches.
- Footing preparation recommendations are provided in the foundation section.

Fill Material

- Fill material, if needed, should be the soil types listed in the following table. All fill should be free of organics or other deleterious materials.
- The sand and slightly silty sand soils encountered in the stormwater pond borings can be used as fill in the building area but are likely too low in strength (LBR Value) to be used in the top 12 inches of pavement areas.
- Samples of any imported fill material, if needed, should be submitted to the geotechnical engineer for testing and evaluation prior to shipment to the site.

Fill Recommendations

Material Type	Lift Thickness (in)		Equipment Type	
	Large Equipment	Hand Operated Equipment	Large	Hand Operated
Sand or Slightly Silty Sand	10-12	6	Vibratory Roller	Plate Tamper
Silty/Clayey Sand	6-8	4	Rubber Tire or Vibratory Roller	Jumping Jack

Compaction

- The slightly silty sand and sand soils encountered in the borings should be relatively easy to compact but will need ample moisture to achieve compaction. Dry soils should be wetted to within 2% of their optimum moisture content prior to compaction.
- Fill should be compacted to the requirements in the following table. Compaction under structures and pavements should extend 5 feet beyond edges where practical.
- We note that large vibratory rollers can damage/disturb nearby structures, and we do not recommend using large vibratory rollers near (within 50 feet) existing structures.

Compaction Recommendations

Site Element	Minimum Compaction (ASTM D1557)	Minimum Compaction Testing Frequency Per Lift
Under Structures	95%	1 per 2,500 square feet
Fill Beneath Pavement	95%	1 per 5,000 square feet
Top 12 inches of Pavement Subgrade	98%	1 per 5,000 square feet
Utility Trench Backfill	95%	1 per 150 linear feet

- Backfill for utility excavations or any excavations in the building and pavement areas should be per the above tables.
- Soils immediately beneath all structures, slabs-on-grade, and footings should be compacted to the requirements in the above table for a minimum depth of 12 inches.
- The bottom of all utility excavations should be evaluated by LMJ staff prior to the placement of utilities.
- Loose soils not suitable for pipe bedding would need to be compacted until suitably firm.

Foundation Recommendations

- The borings encountered very loose soils in the upper 6-8 feet that are a settlement concern for footings.
- Proper compaction of the very loose soils beneath footings will be needed to keep settlement at normal levels, and we recommend achieving a *minimum of 3 feet of compaction* under footings (95% of Modified Proctor, ASTM D1557). We recommend putting a note on the structural drawings requiring this.
- Based on our experience, a large vibratory roller should be capable of achieving 3 feet of compaction in sandy soils if they are thoroughly wetted beforehand.
- The vibratory roller could be run down column lines at the bottom of footing elevation.
- Compaction of the full 3 feet below footings should be verified per this report.
- Footings that are prepared in accordance with this report can be designed based on the parameters in the following table.

Footing Design Parameters

Minimum Width (in)	Minimum Embedment Depth (in)	Net Allowable Bearing Pressure (psf)	Estimated Settlement (in)	
			Total	Differential
24	24	1,500	1	½ or less

- The settlements in the above table are from the sandy soils immediately beneath the footings, and this settlement should occur during construction and soon after first loading.

Footing Testing and Observations

- All footing excavations should be evaluated by the geotechnical engineer or their authorized representative prior to steel or concrete placement.
- We recommend running in-place nuclear density tests on the bottom of footings at a minimum frequency of one test per 75 linear foot of wall footing and half of column footings.
- At each footing density test location, three compaction tests should be run to verify compaction of soils for the *full 3 feet beneath footings*.
- At each test location, run one test on the bottom of the footing and dig holes 1 and 2 feet below the bottom of the footing elevation and test the soils from 1-2 and 2-3 feet.
- We recommend that LMJ perform the compaction testing for this project to verify the above recommendations have been followed.

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Subgrade Recommendations

Pavement boring P-1 encountered sand in the top 16 inches with sand and mulch in the top 6 inches. The sand has a strength (LBR Value) lower than typically recommended for pavement subgrade. The west end of the site where the driveway is being considered was used for playgrounds, and we recommend removing the sand and mulch from pavement subgrade and replacing it with material having a minimum LBR of 40. The top 12 inches of pavement subgrade should be prepared per the earthwork section of this report.

Base Recommendations

- We recommend using graded aggregate base (GAB) or limerock base for this project. These materials are higher in strength and will have increased pavement life.
- Base materials should meet FDOT requirements.
- A sample of any proposed base material should be submitted to our lab for testing and approval prior to shipment to the site.

Pavement Subgrade and Base Parameters

Layer	Minimum Compaction	Proctor Type	ASTM	Minimum LBR Value
Subgrade[1]	98%	Modified	D1557	40
Base	100%			100

[1]Top 12 inches of subgrade

Asphalt Recommendations

- Asphalt should be FDOT structural course Superpave Asphaltic Concrete meeting the requirements of Section 334 (SP-9.5 or 12.5 is preferred).
- Limit the amount of Recycled Asphalt Pavement (RAP) to no more than 25% of the mixture since mixtures over 25% RAP have a higher potential for quality issues.
- The asphalt should be compacted to a target of 92% of the laboratory maximum specific gravity (G_{mm} or Rice Specific Gravity) as determined by FM 1-T 209.

Typical local pavement sections are shown in the following table. If requested, we can prepare a site-specific pavement design if specific traffic loading data is provided.

Typical Minimum Pavement Sections

Loading	Minimum Thickness (in)	
	Base	Asphalt
Light Duty	6	2

Pavement Testing Recommendations

- Run density tests on compacted subgrade at a minimum frequency of one test per 5,000 square feet of pavement area. Test the base for compaction at the same frequency.
- After paving, we recommend coring the asphalt to determine thickness and compaction. The bulk specific gravity (G_{mb}) of the cores should be determined using FM 1-T 166.

Pond Recommendations

- The pond borings encountered moderate draining slightly silty sand and well-draining sand to the bottom of S-2 at 31 feet and to 23 feet in S-1. These conditions are suitable for stormwater disposal using the planned stormwater pond.
- S-1 encountered poorly draining silty sand with trace clay at 23 feet, and this should be considered the bottom of the aquifer.
- The sand and slightly silty sand soils encountered in the stormwater pond borings can be used as fill in the building area but are likely too low in strength (LBR Value) to be used in the top 12 inches of pavement areas.
- The estimated seasonal high water table for this project is expected to be below the bottom of the 31-foot pond borings.
- The fillable porosity was calculated from the unit weights of the Shelby tube samples.
- Effective vertical and horizontal hydraulic conductivities were calculated based on the boring and lab results and published formulas.
- Our recommended parameters for stormwater pond analysis and design are summarized in the following table for an 8 and 10-foot-deep pond. If the pond is another depth, our office should be contacted so that new design rates can be calculated.

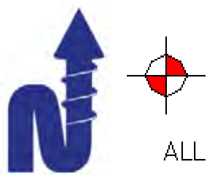
Pond Design Parameters Summary

Pond Depth (ft)	Saturated Vertical Hydraulic Conductivity (K_{vs}) (ft/day)	Saturated Horizontal Hydraulic Conductivity (K_{hs}) (ft/day)	Depth[1] of Bottom of Aquifer (ft)	Fillable Porosity	ESHWT* Depth[1] (ft)
8	28.7	53.9	27	0.27	31+
10	31.4	57.4			

*ESHWT = Estimated Seasonal High Water Table
[1]Average depth below grade at the time of drilling

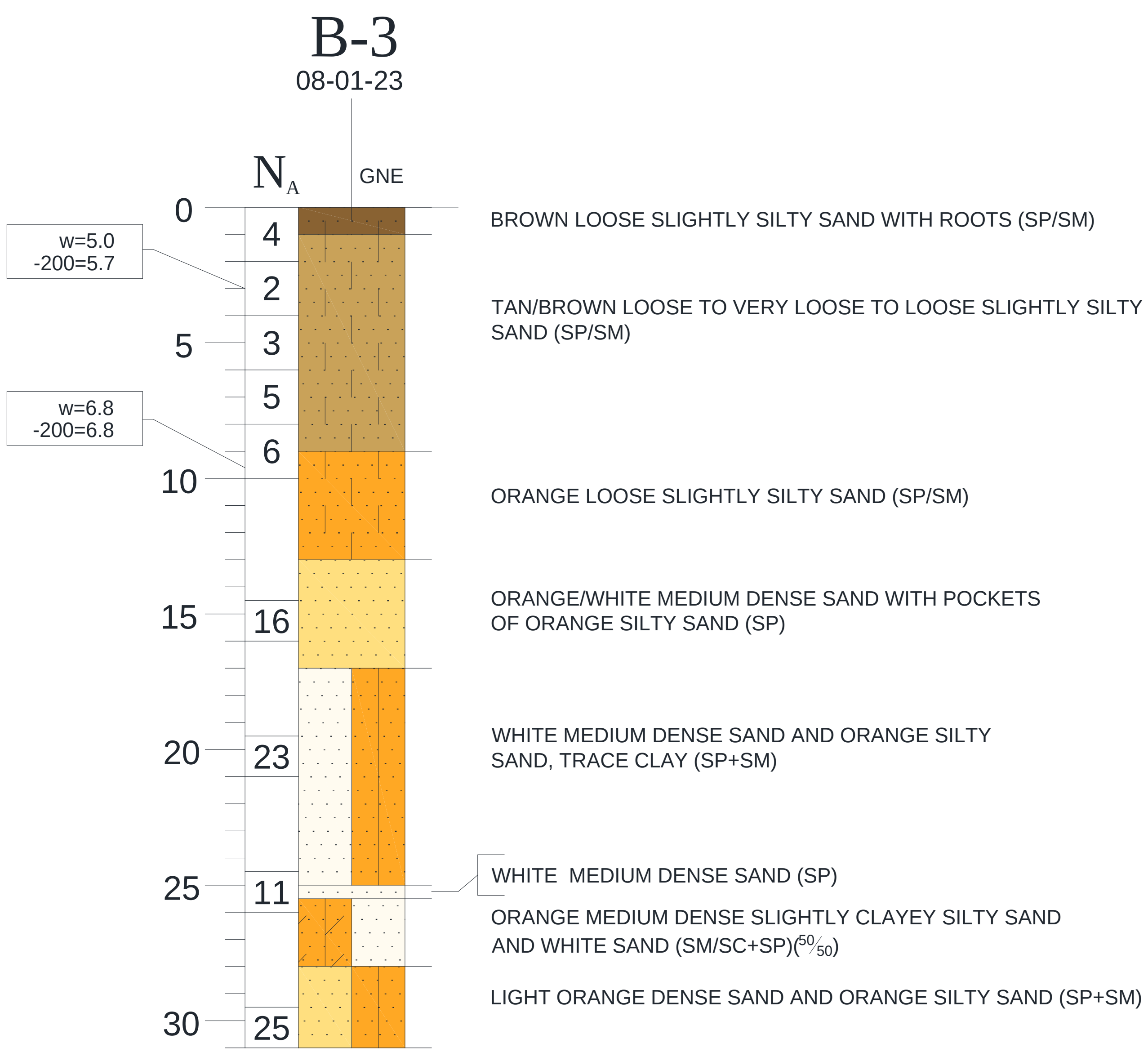
- The above parameters do not include a factor of safety, and appropriate safety factors should be used when designing the stormwater pond(s).
- Note that the NWFWMD limits the maximum hydraulic conductivity for design to 40 ft/day.

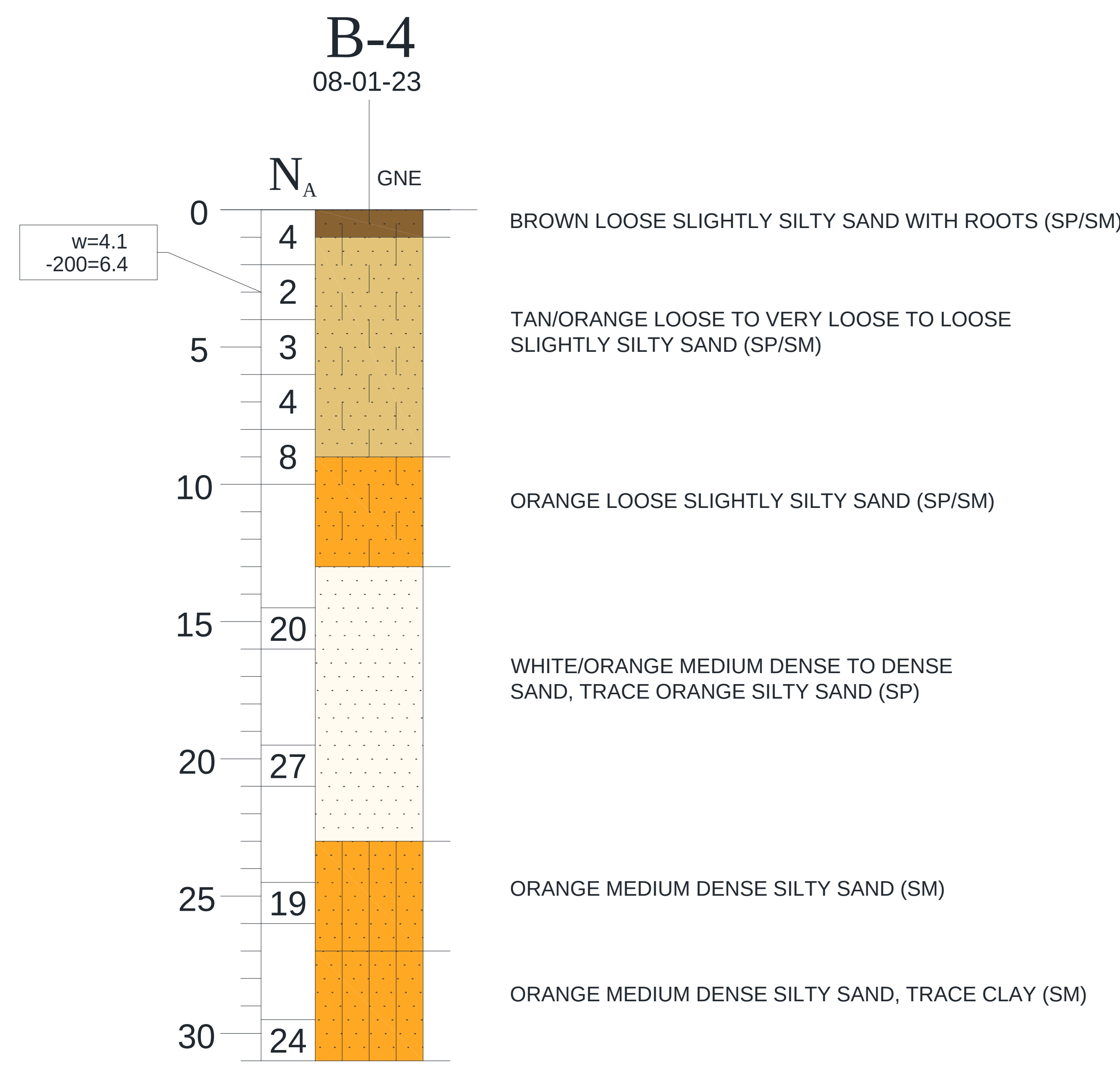
Boring Locations

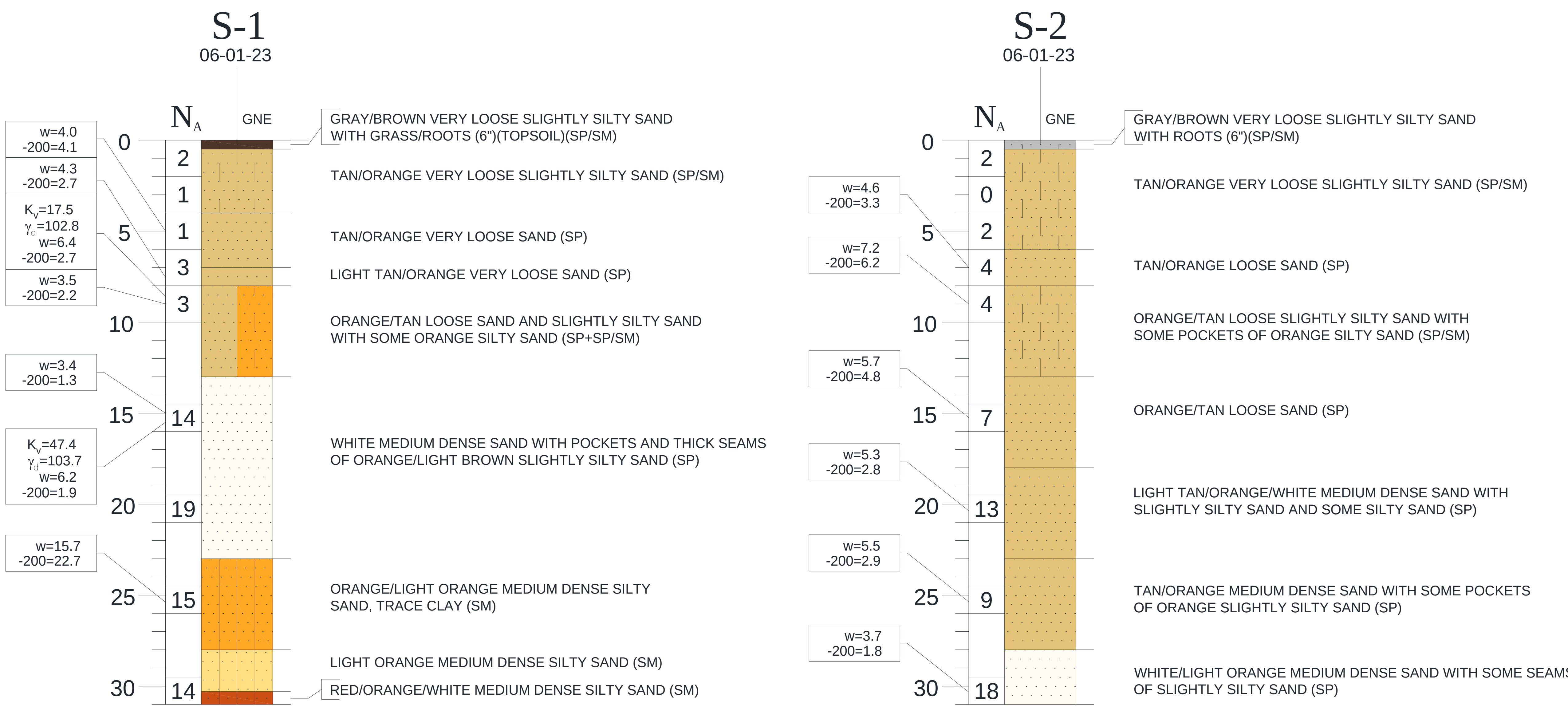


Borings

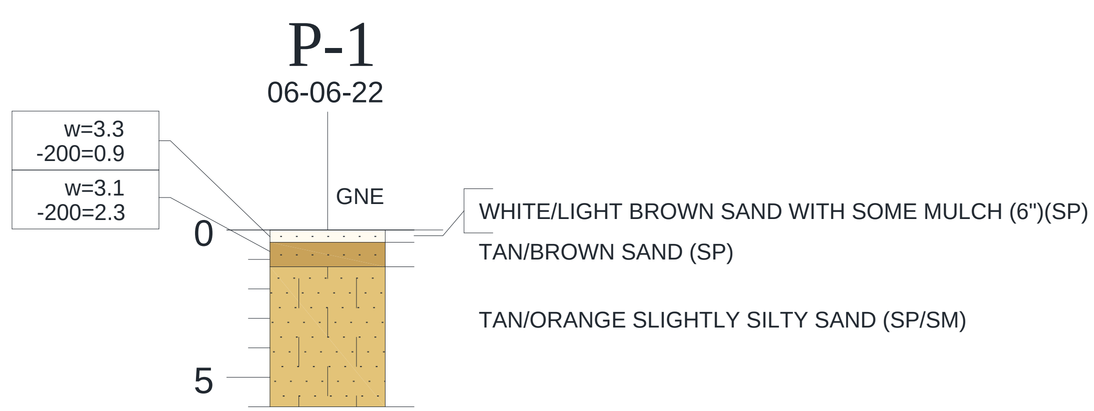

B-1
06-01-23
NA
w=3.8
-200=3.7
GRAY/BROWN LOOSE SILTY SAND WITH ROOTS (6")(SM)
TAN/BROWN LOOSE SLIGHTLY SILTY SAND (6")(SP/SM)
TAN/ORANGE LOOSE TO VERY LOOSE SLIGHTLY SILTY SAND (SP/SM)
LIGHT TAN/ORANGE VERY LOOSE SAND (SP)
LIGHT TAN/ORANGE LOOSE SLIGHTLY SILTY SAND (SP/SM)
LIGHT TAN/ORANGE LOOSE SAND (SP)
WHITE/LIGHT ORANGE MEDIUM DENSE SAND WITH SOME ORANGE SLIGHTLY SILTY SAND SEAMS (SP+SP/SM)
ORANGE/TAN MEDIUM DENSE SILTY SAND, TRACE CLAY (SM)
LIGHT ORANGE MEDIUM DENSE SILTY SAND (SM)
WHITE/LIGHT ORANGE MEDIUM DENSE SLIGHTLY SILTY WITH SMALL POCKETS OF SILTY SAND (SM/SP)
WHITE/VERY LIGHT TAN MEDIUM DENSE SAND (SP)
YELLOW/ORANGE/WHITE MEDIUM DENSE SILTY SAND (SM)
ORANGE/PINK/WHITE/YELLOW MEDIUM DENSE TO DENSE SILTY SAND WITH SOME LIGHT TAN/ORANGE SLIGHTLY SILTY SAND (SM)
NOTE: 2-INCH WHITE/ORANGE SAND SEAM AT 29 FEET
B-2
05-31-23
NA
w=5.4
-200=7.5
w=5.0
-200=6.0
w=6.1
-200=4.9
GRAY/BROWN VERY LOOSE SLIGHTLY SILTY SAND, WITH ROOTS/GRASS (3")(TOPSOIL)(SP/SM)
BROWN/TAN VERY LOOSE SLIGHTLY SILTY SAND (9")(SP/SM)
TAN/ORANGE VERY LOOSE SLIGHTLY SILTY SAND (SP/SM)
LIGHT TAN/ORANGE VERY LOOSE TO LOOSE SAND (SP)
ORANGE LOOSE SAND (SP)
LIGHT TAN/ORANGE MEDIUM DENSE SAND WITH SOME ORANGE SILTY SAND SEAMS (SP+SM)
ORANGE MEDIUM DENSE SILTY SAND, TRACE CLAY (SM)
LIGHT ORANGE MEDIUM DENSE SILTY SAND, TRACE CLAY (SM)
WHITE MEDIUM DENSE SAND WITH POCKETS OF SILTY SAND (SP)
PINK/WHITE MEDIUM DENSE FINE SAND (SP)
WHITE MEDIUM DENSE SAND (SP)
LIGHT ORANGE/YELLOW MEDIUM DENSE SLIGHTLY SILTY SAND WITH LAYERS OF SILTY SAND (SP/SM)
LIGHT TAN/WHITE MEDIUM DENSE SAND WITH SOME ORANGE/YELLOW SLIGHTLY SILTY SAND (SP)
LIGHT TAN/YELLOW/ORANGE MEDIUM DENSE SILTY SAND (SM)
LIGHT YELLOW/ORANGE/SOME RED MEDIUM DENSE SILTY FINE SAND WITH TRACE WHITE CLAYEY SAND SEAMS (SM)
PINK/YELLOW/ORANGE LOOSE SILTY FINE SAND, TRACE CLAY (SM)
YELLOW/LIGHT GRAY/PURPLE LOOSE SLIGHTLY CLAYEY SILTY FINE SAND (SM/SC)

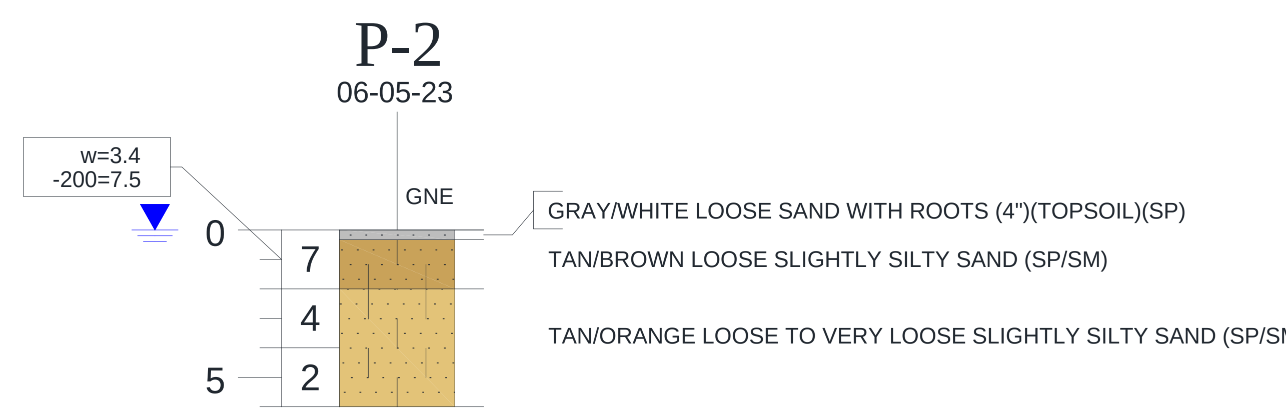

B-3
08-01-23
N A
GNE
0
5
10
15
20
25
30
4
2
3
5
6
16
23
11
25
w=5.0
-200=5.7
w=6.8
-200=6.8
BROWN LOOSE SLIGHTLY SILTY SAND WITH ROOTS (SP/SM)
TAN/BROWN LOOSE TO VERY LOOSE TO LOOSE SLIGHTLY SILTY SAND (SP/SM)
ORANGE LOOSE SLIGHTLY SILTY SAND (SP/SM)
ORANGE/WHITE MEDIUM DENSE SAND WITH POCKETS OF ORANGE SILTY SAND (SP)
WHITE MEDIUM DENSE SAND AND ORANGE SILTY SAND, TRACE CLAY (SP+SM)
WHITE MEDIUM DENSE SAND (SP)
ORANGE MEDIUM DENSE SLIGHTLY CLAYEY SILTY SAND AND WHITE SAND (SM/SC+SP)(50/50)
LIGHT ORANGE DENSE SAND AND ORANGE SILTY SAND (SP+SM)


B-4
08-01-23
N A
GNE
0
5
10
15
20
25
30
4
2
3
4
8
20
27
19
24
w=4.1
-200=6.4
BROWN LOOSE SLIGHTLY SILTY SAND WITH ROOTS (SP/SM)
TAN/ORANGE LOOSE TO VERY LOOSE TO LOOSE SLIGHTLY SILTY SAND (SP/SM)
ORANGE LOOSE SLIGHTLY SILTY SAND (SP/SM)
WHITE/ORANGE MEDIUM DENSE TO DENSE SAND, TRACE ORANGE SILTY SAND (SP)
ORANGE MEDIUM DENSE SILTY SAND (SM)
ORANGE MEDIUM DENSE SILTY SAND, TRACE CLAY (SM)



NOTE: SHELBY TUBE TAKEN AT 7-9 FEET AND 14-16 FEET
FROM ADJACENT BOREHOLE





DEPTH (FT)	PROBE (IN)
SURFACE	13
1.5	10
2.5	11
3.5	5
4	6+

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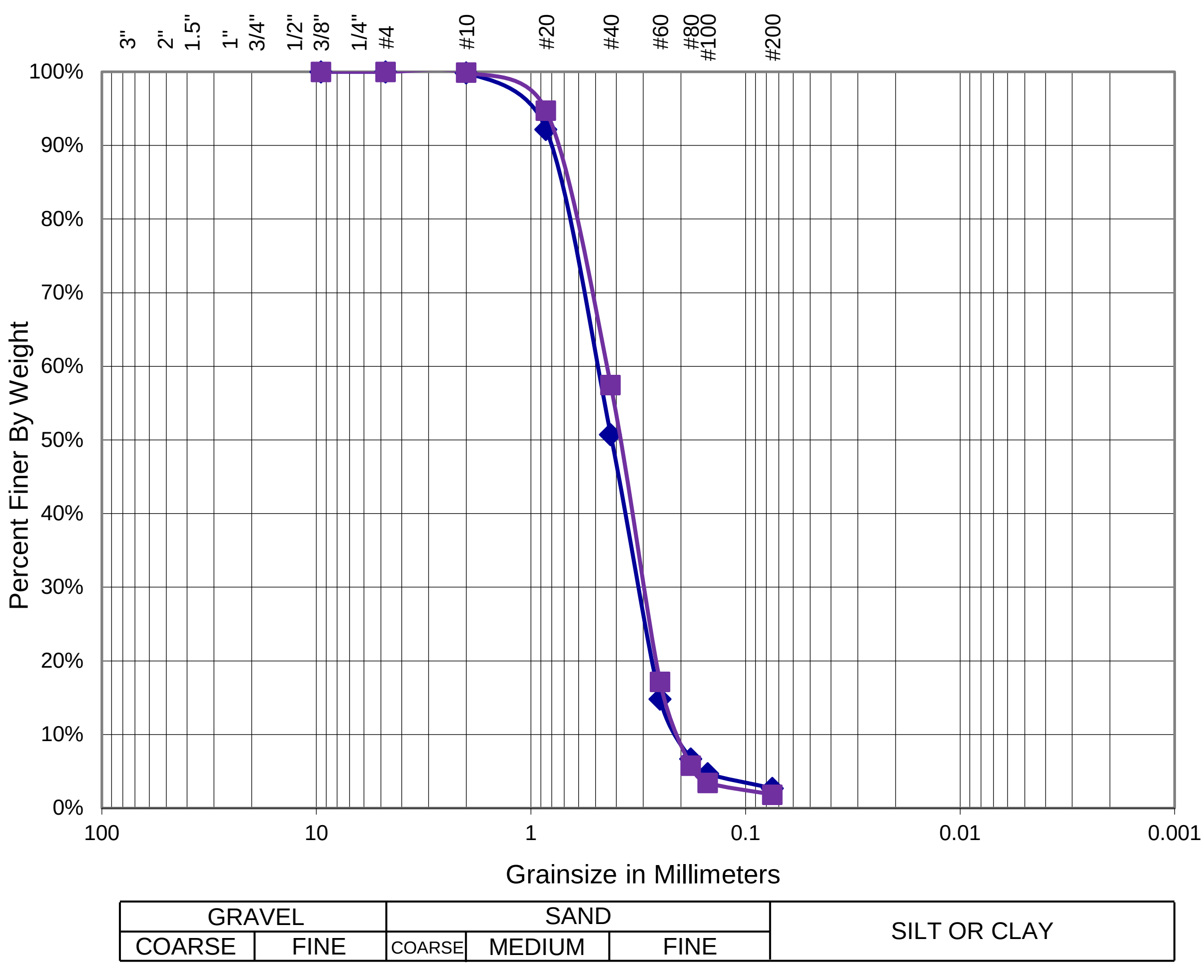
Lab Test Results

Laboratory testing for this project included wash #200 sieve and natural moisture content tests and two falling head permeability tests run on the Shelby tube samples. The results of the lab tests are shown on the boring logs adjacent to the samples tested. The falling head permeability test results are summarized in the following table. The Shelby tube from 8-9 feet yielded a permeability that was higher than expected, and this sample was remolded in a standard Proctor mold to near the estimated in-place density based on the SPT results and our experience.

Falling Head Permeability Test Results

Boring	Sample Depth (ft)	Soil Description	Dry Unit Weight (pcf)	Saturated Vertical Hydraulic Conductivity (K_{vs}) (ft/day)	% Fines
◆ S-1	8-9	Tan/Orange Sand	102.8	17.5*	2.2
■ S-1	15-16	White/Light Orange Sand w/ Pockets of Slightly Silty Sand	103.7	47.4	1.9

*Remolded test



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Basis of Recommendations

Recommendations rendered herein are based on assumed and/or design information available at the time of this report, the subsurface conditions encountered in the test borings, generally accepted geotechnical engineering principles and practices, and our experience with similar soil and groundwater conditions. Should final project information or existing conditions differ from the information used in this report, or should any soil conditions not discussed in this report be encountered during construction, our office should be notified and retained so that this report can be modified as needed. LMJ should be provided the final plans and specifications for review to determine if any changes to our report are needed based on the final design and that our recommendations have been properly interpreted.

This report and any correspondence are intended for the exclusive use of our client for the specific application to the project discussed. LMJ is not responsible for the interpretations, conclusions, or recommendations made by others based on the information in this report.

Regardless of the care exercised in performing a Geotechnical Exploration, the possibility always exists that soil and/or groundwater conditions will differ from those encountered at the specific boring locations. In addition, construction operations may alter the soil conditions. Therefore, it is recommended that a representative from LMJ be involved during the construction phases discussed in this report.

Test Methods

Standard Penetration Test

The Standard Penetration Test (SPT) consists of driving a 2-inch diameter split spoon sampler into the ground using a 140-pound hammer dropped 30 inches. The number of blows required to drive the sampler one foot (after seating it 6 inches) is referred to as the blow count or “N” value and represents the relative density of subsurface soils. “N” values can be found on the boring logs. The SPT borings were drilled in general accordance with ASTM D1586 using a truck mounted drill rig and were advanced between sampling using a “mud” jetting technique. Each sample was removed from the sampler, classified in the field by the driller, and packaged for visual classification by our engineering staff and laboratory testing. The borings were sampled using an autohammer. FDOT converts autohammer to safety hammer using a factor of 1.24.

Other Test Methods

Atterberg Limits (ASTM D4318), Wash #200 Sieve (ASTM D1140), Moisture Content (ASTM D2216), Sieve Analysis (ASTM C136), Falling Head Permeability (ASTM D5856).

LEGEND

SAND	SLIGHTLY SILTY SAND
SILTY SAND	SILT
CLAY	CLAYEY SAND
PEAT	GRAVEL

NOTES

1) SPT BORINGS PERFORMED IN GENERAL ACCORDANCE WITH ASTM D1586
2) SUBSURFACE CONDITIONS ARE AT BORING LOCATIONS AND ACTUAL CONDITIONS BETWEEN BORINGS MAY VARY
3) ALL CLASSIFICATIONS ARE BASED ON VISUAL EXAMINATION UNLESS ACCOMPANIED BY LABORATORY TEST RESULTS
4) BOUNDARIES BETWEEN SOIL LAYERS SHOULD BE CONSIDERED APPROXIMATE AS THE ACTUAL TRANSITION MAY BE GRADUAL
5) DEPTH OF BORING IS BELOW EXISTING GRADE AT TIME OF DRILLING
6) ELEVATIONS, IF SHOWN, WERE ESTIMATED FROM PROVIDED TOPOGRAPHIC SURVEY
7) COLORS USED FOR BORING HATCHING MAY NOT REPRESENT THE ACTUAL SOIL COLORS

GNE
GROUNDWATER NOT ENCOUNTERED AT TIME OF DRILLING

N
STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT

N_A
STANDARD PENETRATION RESISTANCE USING AUTOHAMMER

ENCOUNTERED GROUNDWATER LEVEL

ENCOUNTERED PERCHED WATER LEVEL

50/2"
NUMBER OF BLOWS REQUIRED (50) TO ADVANCE SPLIT SPOON SAMPLER A SPECIFIC DISTANCE (2) INCHES

HW
SPLIT SPOON SAMPLE ADVANCED UNDER WEIGHT OF ROD AND HAMMER

HA
HAND AUGER

SHELBY TUBE SAMPLER

w
NATURAL MOISTURE CONTENT (%)

-200
FINES PASSING #200 SIEVE (%)

O.C.
ORGANIC CONTENT (%)

LL
LIQUID LIMIT

PL
PLASTIC LIMIT

LI
LIQUIDITY INDEX

C≈
APPROXIMATE COHESION VALUE (PSF) BASED ON POCKET PENETROMETER READINGS

K_V
SATURATED VERTICAL HYDRAULIC CONDUCTIVITY (FT/DAY)

γ_d
DRY UNIT WEIGHT (PCF)

γ_m
ESTIMATED MOIST UNIT WEIGHT (PCF)

γ_b
ESTIMATED BUOYANT UNIT WEIGHT (PCF)

ϕ
ESTIMATED ANGLE OF INTERNAL FRICTION (DEGREES)

SAFETY HAMMER

GRANULAR SOILS

SPT BLOWS/FOOT (N)	RELATIVE DENSITY
0-3	VERY LOOSE
4-10	LOOSE
11-30	MEDIUM DENSE
31-50	DENSE
> 50	VERY DENSE

COHESIVE SOILS

SPT BLOWS/FOOT (N)	RELATIVE DENSITY
0-1	VERY SOFT
2-4	SOFT
5-8	MEDIUM STIFF
9-15	STIFF
16-30	VERY STIFF
> 30	HARD

AUTOMATIC HAMMER

GRANULAR SOILS

SPT BLOWS/FOOT (N)	RELATIVE DENSITY
0-2	VERY LOOSE
3-8	LOOSE
9-24	MEDIUM DENSE
25-40	DENSE
> 40	VERY DENSE

COHESIVE SOILS

SPT BLOWS/FOOT (N)	RELATIVE DENSITY
<1	VERY SOFT
1-3	SOFT
4-6	MEDIUM STIFF
7-12	STIFF
13-24	VERY STIFF
> 24	HARD