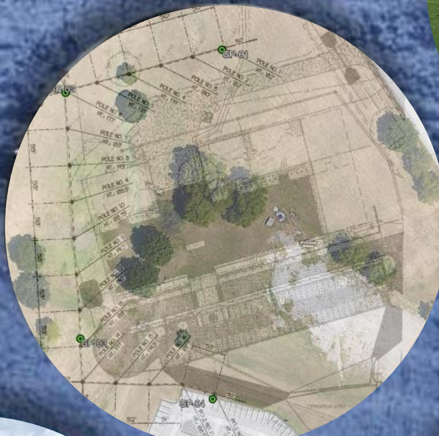

Report of Subsurface Exploration
and Geotechnical Evaluation
Catoosa CDC Golf Netting Poles

Catoosa, Oklahoma

Building & Earth Project No.: TU240174

Prepared For:
Cherokee Nation Business

August 26, 2025

BUILDING & EARTH
Geotechnical, Environmental, and Materials Engineers

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August 26, 2025

Cherokee Nation Business
777 West Cherokee Street
Catoosa, Oklahoma 74015

c/o: Blue River Architects, LLC

Attention: Mr. Kevin Oyler

Subject: Report of Subsurface Exploration and Geotechnical Evaluation
Catoosa CDC Golf Netting Poles
Catoosa, Oklahoma
Building & Earth Project No: TU240174

Dear Mr. Oyler:

Building & Earth Sciences, Inc. has completed the authorized subsurface exploration and geotechnical engineering evaluation for the above referenced project in Catoosa, Oklahoma.

The purpose of this exploration and evaluation was to determine general subsurface conditions at the site and to address applicable geotechnical aspects of the proposed construction and site development. The recommendations in this report are based on a physical reconnaissance of the site and observation and classification of samples obtained from four (4) test borings conducted along the proposed netting alignment. Confirmation of the anticipated subsurface conditions during construction is an essential part of geotechnical services.

We appreciate the opportunity to provide consultation services for the proposed project. If you have any questions regarding the information in this report or need any additional information, please call us.

Respectfully Submitted,
BUILDING & EARTH SCIENCES, INC.
Certificate of Authorization #3975, Expires 06/30/2026

8/26/2025
JOSEPH D. VISTAD
30303

Quinton Mann, E.I.
Staff Professional

Joseph D. Vistad, P.E.
Regional Manager | Principal
OK: 30303

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1.0 PROJECT & SITE DESCRIPTION

The subject site is located approximately 0.1 mile northwest of the Country Club Drive and North 193rd East Avenue intersection in Catoosa, Oklahoma. Photographs depicting the current site conditions are presented on the below.

Based on the information provided to our office, we understand the proposed construction will consist of the installation of eighteen (18) poles to support golf netting to protect the planned development. Each pole will be in the range of 206 to 225 feet in total length. The diameter of the poles will range from 16 to 42 inches. We understand the poles are planned to be supported on a drilled pier foundation system, and each pole is to be embedded within a concrete pier foundation extending to depths ranging from 29 to 32 feet.

Structural loading information for the poles were not provided to our office; we anticipate that the netting structure will be subjected to horizontal shear and overturning moments. ***When loading conditions are available, Building & Earth Sciences should be allowed to review the proposed structural design and its effects on our recommendations for foundation design.***

Figure 1: Near GP-01, facing east

Figure 2: Near boring GP-03, looking southeast

2.0 SCOPE OF SERVICES

The authorized subsurface exploration was performed on August 11th, 2025 in conformance with our proposal TU27257, dated July 16, 2025. Notice to proceed was provided by signing our contract document on July 30, 2025.

The purpose of the geotechnical exploration was to determine general subsurface conditions at specific boring locations and to gather data on which to base a geotechnical evaluation with respect to the proposed construction. The subsurface exploration for this project consisted of four (4) widely spaced test borings.

The site was drilled using an ATV mounted Diedrich D-50 drill rig equipped with hollow stem augers, mud rotary tooling, and an automatic hammer for performing Standard Penetration Tests (SPT) to help evaluate the relative soil strength. See the Appendix for a description of the drilling and sampling procedures.

The boring locations were determined in the field by a representative of our staff using a handheld GPS unit. As such, the boring locations shown on the Boring Location Plan attached to this report should be considered approximate.

The soil and rock samples recovered during our site investigation were visually classified and specific samples were selected by the project engineer for laboratory analysis. The laboratory analysis consisted of:

Test	ASTM	No. of Tests
Natural Moisture Content	D2216	17
Atterberg Limits	D4318	3
Material Finer Than No. 200 Sieve by Washing	D1140	1

Table 1: Scope of Laboratory Tests

The results of the laboratory analysis are presented on the enclosed Boring Logs and in tabular form in the Appendix of this report. Descriptions of the laboratory tests that were performed are also included in the Appendix.

The information gathered from the exploration was evaluated to determine a suitable foundation type for the proposed netting structure. The information was also evaluated to help determine if any special subgrade preparation procedures will be required during the earthwork phase of the project.

The results of the work are presented within this preliminary report that addresses:

- Summary of existing surface conditions.
- A description of the subsurface conditions encountered at the boring locations.
- A description of the groundwater conditions observed in the boreholes during drilling. Long-term monitoring was not included in our scope of work.
- Presentation of laboratory test results.
- Recommendations to be used for foundation design, including appropriate foundation types, bearing pressures, and depths. Soil/rock parameters values for use in lateral pile analysis using L-pile software.
- Presentation of expected total and differential settlements.

3.0 GEOTECHNICAL SITE CHARACTERIZATION

The following discussion is intended to create a general understanding of the site from a geotechnical engineering perspective. It is not intended to be a discussion of every potential geotechnical issue that may arise, nor to provide every possible interpretation of the conditions identified. The following conditions and subsequent recommendations assume that significant changes in subsurface conditions do not occur between boreholes. However, anomalous conditions can occur due to variations in existing fill that is present within the site, or the geologic conditions at the site, and it will be necessary to evaluate the assumed conditions during foundation installation.

3.1 EXISTING SURFACE CONDITIONS

At the time of our subsurface exploration, the ground surface at locations GP-01 through GP-03 were covered with topsoil measuring approximately 4 to 7 inches in thickness. Boring GP-04 was covered with asphalt pavement approximately 8 inches in thickness. Aggregate base was encountered below the asphalt measuring approximately 4 inches in thickness. The topsoil and pavement conditions reported apply only to the specific boring locations and will likely vary at unexplored locations of the project site.

No testing has been performed to verify that soils meet any project requirements of "topsoil". For this report, topsoil is defined as the soil horizon which contains the root mat of the noted light vegetation (grass and weeds).

3.2 SUBSURFACE CONDITIONS

A generalized stratification summary has been prepared using data from the test borings and is presented in the table below. The stratification depicts the general soil/rock conditions and stratum types encountered during our field investigation.

Stratum No.	Typical Thickness	Description	Consistency/Rock Hardness	Lab Testing Data [(3)]
1	2.2 to 7.0'	**Fill Materials:** Lean Clays (CL), and Broken Sandstone Brown, red, and gray in color	Generally medium stiff to stiff	*Atterberg Limits: LL = 28; PI = 9* *Moisture contents: 10 to 27%*
2	3.5 to 18.4'	**Residuum:** Lean Clays (CL) and Sandy Lean Clays (CL) with sandstone fragments and gravel, and ferrous staining Various shades and combinations of red, brown, yellow, and gray in color	Generally stiff to very stiff (1)	*Atterberg Limits: LL = 33 and 34 PI = 16 and 17* *Moisture contents: 16 to 22%*
3 (2)	10 to 12.5'	**Labette Formation:** Weathered Shale Various shades and combinations of olive, brown, yellow, and gray in color	Soft	*Moisture contents: 12%*
4	Termination Layer	**Labette Formation:** Shale and Sandstone Gray and dark gray	*Shales:* Moderately hard to hard *Sandstones: Cemented to well cemented*	*Moisture contents: 10%*

Table 2: Stratification Summary

Notes:

(1) Medium stiff consistencies were encountered in boring GP-02 at a depth of about 5 feet below current grades.

(2) Only encountered in borings GP-03 and GP-04.

(3) For Atterberg Limits: LL = Liquid Limit, PL = Plastic Limit, and PI = Plasticity Index

For specific details on the information obtained from the boring, please refer to the Boring Log included in the Appendix.

3.2.1 AUGER REFUSAL

Auger refusal is the drilling depth at which the borehole can no longer be advanced using soil drilling procedures. Auger refusal can occur on boulders, buried debris or bedrock. Coring or mud rotary drilling is required to sample the material below auger refusal, which was completed in two borings (GP-02 and GP-04). Auger refusal was encountered on well cemented sandstone and hard shale at the approximate depths shown below. Although auger refusal was not recorded in the other borings, auger refusal on well cemented sandstone/hard shale should be anticipated across most of the proposed construction area.

Boring No.	Auger Refusal Depth (ft)	Auger Refusal Elevations (ft)
GP-02	23.5	688.5
GP-04	26.0	650.0

Table 3: Auger Refusal Depths and Elevations

3.2.2 GROUNDWATER

Groundwater was encountered in boring GP-02 at a depth of approximately 13.5 feet during drilling. After drilling and prior to backfilling free water was measured in borings GP-01 and GP-03 at depths of about 31 and 24 feet, respectively. Delayed groundwater readings were not taken in borings GP-02 and GP-04 due to the introduction of water into the borehole during mud rotary drilling techniques.

Water levels reported are accurate only for the time and date that the borings were drilled. Long term monitoring of the boreholes was not included as part of our subsurface exploration. The borings were backfilled the same day they were drilled.

4.0 FOUNDATION RECOMMENDATIONS

Based on our evaluation of the subsurface conditions, and depending on final design loads, it appears that construction with a drilled pier foundation system is feasible. Drilled piers are a commonly used foundation system structures such as signs and poles which are subjected to higher lateral loads.

Drilled piers should extend through the existing fill and residual materials to competent rock which can be used to support the proposed structures.

The site development recommendations outlined below are intended for development of the site to support construction with a drilled pier foundation system.

4.1 DRILLED PIERS

Based on the information provided to our office, we understand that each pole and associated concrete pier foundation will extend approximately 29 to 32 feet below current grades (Elevations 646.0 to 682.0). The shale/sandstone unit was encountered at depths of about 8.5 to 26 feet below current grades (Elevations 650.0 to 694.0) across the planned netting alignment.

Drilled piers extended to the planned bottom of pier elevations of 646.0 to 682.0 will likely encounter the shale/sandstone unit. Piers extending into the anticipated stratum can be designed using the recommended maximum allowable end bearing pressure (using a Factor of Safety of 2.5), allowable skin friction for compression load resistance, and allowable skin friction for uplift resistance for that portion of the circumference of the pier in direct contact with the recommended rock unit per the following recommended drilled pier design parameters.

Bearing Material	Allowable End Bearing Pressure (ksf)	Allowable Skin Friction for Compression Load Resistance, F_{all} (ksf)	Allowable Skin Friction for Uplift Resistance, T_{all} (ksf)
Shale/Sandstone	60	4.5	3.0

Table 4: Drilled Pier Design Parameters

Total settlement of drilled piers designed and constructed as recommended above is anticipated to be ½ inch or less.

The base of all drilled pier excavations should be free of water and loose material prior to placing concrete. If water is encountered, temporary dewatering should include, at a minimum, pumping the water from the base of the excavation.

Depending on the amount of water seepage, temporary casing extending into the rock formation may be required to seal off groundwater during concrete placement. In addition, temporary casing may be needed if the walls of the shaft start sloughing due to the presence of soft soils within the uncontrolled fill materials.

The contractor should maintain an adequate head of concrete within the temporary casing above the groundwater level during its extraction from the drilled shaft to reduce the risk of contaminating the fresh concrete with groundwater.

Conventional drilling rigs equipped with augers and rock teeth should be able to penetrate the existing and new fill, residual clays, weathered shale.

The contractor should anticipate difficulties advancing the drilled shaft through the well cemented sandstone and hard shale. ***The contractor should anticipate the need for use of a core barrel to extend the drilled shaft through the well cemented sandstone layers to design end bearing elevations.*** The contractor should refer to the boring logs and required foundation end bearing elevations to determine the extent of the hard drilling/coring required within the shale/sandstone unit.

Concrete should be placed the same day the excavation is completed and bearing materials verified by the engineer. If the excavation is left open for an extended period, or if the bearing surfaces are disturbed after the initial observation, the bearing surfaces should be re-evaluated prior to concrete placement.

4.1.1 LATERALLY LOADED PIERS

The tables below provide estimated soil/rock parameter values for input into LPILE for Windows, Version 2019 (2019.11.07) to be used for lateral load analysis of piers based on a typical subsurface profile encountered in the test boring. These values were based on N-values, published correlations, and engineering judgement. No triaxial tests were performed.

Elevations (ft)	Soil Type	Effective Unit Weight (pcf)	Undrained Shear Strength (psf)	Static Horizontal Modulus of Subgrade Reaction, K (pci)	Cyclic Horizontal Modulus of Subgrade Reaction, K (pci)	Strain, E_{50}
706 - 698	Stiff Clays without Groundwater	110	1,000	500	200	0.005
Below 698	Shale/Sandstone	140	15,000	2,000	800	0.002

Table 5: Soil/Rock Parameter Values for Design of Laterally Loaded Piers (Boring GP-01)

Depth (ft)	Soil Type	Effective Unit Weight (pcf)	Undrained Shear Strength (psf)	Static Horizontal Modulus of Subgrade Reaction, K (pci)	Cyclic Horizontal Modulus of Subgrade Reaction, K (pci)	Strain, E_{50}
712 – 698.5	Stiff Clays without Groundwater	110	1,000	500	200	0.005
698.5 – 694.0	Stiff Clays with Groundwater	48	1,500	500	200	0.005
Below 694.0	Shale/Sandstone	140	15,000	2,000	800	0.002

Table 6: Soil/Rock Parameter Values for Design of Laterally Loaded Piers (Boring GP-02)

Depth (ft)	Soil Type	Effective Unit Weight (pcf)	Undrained Shear Strength (psf)	Static Horizontal Modulus of Subgrade Reaction, K (pci)	Cyclic Horizontal Modulus of Subgrade Reaction, K (pci)	Strain, E_{50}
691.0 – 682.5	Stiff Clays without Groundwater	110	1,000	500	200	0.005
682.5 – 672.5	Weathered Shale	130	8,000	2,000	800	0.004
Below 672.5	Shale/Sandstone	140	15,000	2,000	800	0.002

Table 7: Soil/Rock Parameter Values for Design of Laterally Loaded Piers (Boring GP-03)

Depth (ft)	Soil Type	Effective Unit Weight (pcf)	Undrained Shear Strength (psf)	Static Horizontal Modulus of Subgrade Reaction, K (pci)	Cyclic Horizontal Modulus of Subgrade Reaction, K (pci)	Strain, E_{50}
676.0 – 662.5	Stiff Clays without Groundwater	110	1,000	500	200	0.005
662.5 – 650.0	Weathered Shale	130	8,000	2,000	800	0.004
Below 650.0	Shale/Sandstone	140	15,000	2,000	800	0.002

Table 8: Soil/Rock Parameter Values for Design of Laterally Loaded Piers (Boring GP-04)

5.0 CONSTRUCTION MONITORING

Field verification of site conditions is an essential part of the services provided by the geotechnical consultant. In order to confirm our recommendations, it will be necessary for Building & Earth personnel to make periodic visits to the site during foundation installation. Typical construction monitoring services are listed below.

- Observation and verification of the bearing surfaces during drilled pier installation on a continuous basis.
- Reinforcing steel inspections.
- Molding and testing of concrete cylinders.
- Structural steel bolted and welded field connections.

6.0 CLOSING

This report was prepared for Cherokee Nation Business, for specific application to the subject project located in Catoosa, Oklahoma. The information in this report is not transferable. This report should not be used for a different development on the same property without first being evaluated by the engineer.

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GEOTECHNICAL INVESTIGATION METHODOLOGIES

The subsurface exploration, which is the basis of the recommendations of this report, has been performed in accordance with industry standards. Detailed methodologies employed in the investigation are presented in the following sections.

DRILLING PROCEDURES – STANDARD PENETRATION TEST (ASTM D1586)

At each boring location, soil samples were obtained at standard sampling intervals with a split-spoon sampler. The borehole was first advanced to the sample depth by augering and the sampling tools were placed in the open hole. The sampler was then driven 18 inches into the ground with a 140-pound automatic hammer free-falling 30 inches. The number of blows required to drive the sampler each 6-inch increment was recorded. The initial increment is considered the "seating" blows, where the sampler penetrates loose or disturbed soil in the bottom of the borehole.

The blows required to penetrate the final two (2) increments are added together and are referred to as the Standard Penetration Test (SPT) N-value. The N-value, when properly evaluated, gives an indication of the soil's strength and ability to support structural loads. Many factors can affect the SPT N-value, so this result cannot be used exclusively to evaluate soil conditions.

The SPT testing was performed using a drill rig equipped with an automatic hammer. Automatic hammers mechanically control the height of the hammer drop, and doing so, deliver higher energy efficiency (90 to 99 % efficiency) than manual hammers (60 % efficiency) which are dropped using a manually operated rope and cathead system. Because historic data correlations were developed based on use of a manual hammer, it is necessary to adjust the N-values obtained using an automatic hammer to make these correlations valid. Therefore, an energy correction factor of 1.3 was applied to the recorded field N-values from the automatic hammer for the purpose of our evaluation. The N-values discussed or mentioned in this report and shown on the boring logs are recorded field values.

Samples retrieved from the boring locations were labeled and stored in plastic bags at the jobsite before being transported to our laboratory for analysis. The project engineer prepared Boring Logs summarizing the subsurface conditions at the boring locations.

BORING LOG DESCRIPTION

Building & Earth Sciences, Inc. used the gINT software program to prepare the attached boring logs. The gINT program provides the flexibility to custom design the boring logs to include the pertinent information from the subsurface exploration and results of our laboratory analysis. The soil and laboratory information included on our logs is summarized below:

DEPTH AND ELEVATION

The depth below the ground surface and the corresponding elevation are shown in the first two columns.

SAMPLE TYPE

The method used to collect the sample is shown. The typical sampling methods include Split Spoon Sampling, Shelby Tube Sampling, Grab Samples, and Rock Core. A key is provided at the bottom of the log showing the graphic symbol for each sample type.

SAMPLE NUMBER

Each sample collected is numbered sequentially.

BLOWS PER INCREMENT, REC%, RQD%

When Standard Split Spoon sampling is used, the blows required to drive the sampler each 6-inch increment are recorded and shown in column 5. When rock core is obtained the recovery ration (REC%) and Rock Quality Designation (RQD%) is recorded.

SOIL DATA

Column 6 is a graphic representation of four different soil parameters. Each of the parameters use the same graph, however, the values of the graph subdivisions vary with each parameter. Each parameter presented on column 6 is summarized below:

- N-value- The Standard Penetration Test N-value, obtained by adding the number of blows required to drive the sampler the final 12 inches, is recorded . The graph labels range from 0 to 50.
- Qu – Unconfined Compressive Strength estimate from the Pocket Penetrometer test in tons per square foot (tsf). The graph labels range from 0 to 5 tsf.
- Atterberg Limits – The Atterberg Limits are plotted with the plastic limit to the left, and liquid limit to the right, connected by a horizontal line. The difference in the plastic and liquid limits is referred to as the Plasticity Index. The Atterberg Limits test results are also included in the Remarks column on the far right of the boring log. The Atterberg Limits graph labels range from 0 to 100%.
- Moisture – The Natural Moisture Content of the soil sample as determined in our laboratory.

SOIL DESCRIPTION

The soil description prepared in accordance with ASTM D2488, Visual Description of Soil Samples. The Munsel Color chart is used to determine the soil color. Strata changes are indicated by a solid line, with the depth of the change indicated on the left side of the line and the elevation of the change indicated on the right side of the line. If subtle changes within a soil type occur, a broken line is used. The Boring Termination or Auger Refusal depth is shown as a solid line at the bottom of the boring.

GRAPHIC

The graphic representation of the soil type is shown. The graphic used for each soil type is related to the Unified Soil Classification chart.   A chart showing the graphic associated with each soil classification is included.

REMARKS

Remarks regarding borehole observations, and additional information regarding the laboratory results and groundwater observations.

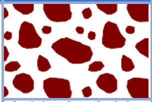
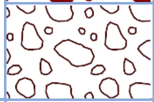
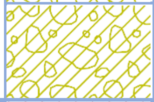
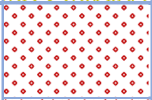
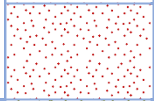
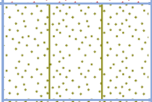
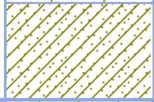
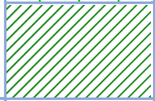
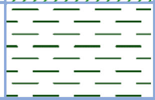
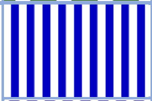
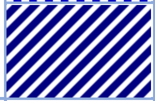
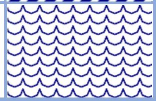
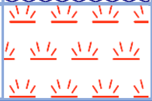
Major Divisions			Symbols		Group Name & Typical Description
			Lithology	Group	
Coarse Grained Soils More than 50% of material is larger than No. 200 sieve size	**Gravel and Gravelly Soils** More than 50% of coarse fraction is larger than No. 4 sieve	**Clean Gravels** (Less than 5% fines)		**GW**	Well-graded 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
	Sand and Sandy Soils More than 50% of coarse fraction is smaller than No. 4 sieve	**Clean Sands** (Less than 5% fines)		**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 More than 50% of material is smaller than No. 200 sieve size	**Silts and Clays** Liquid Limit less than 50	**Inorganic**		**ML**	Inorganic silts and very find sands, rock flour, silty or clayey fine sands or clayey silt with slight plasticity
				**CL**	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		Organic		**OL**	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50	**Inorganic**		**MH**	Inorganic silts, micaceous or diatomaceous fine sand, or silty soils
				**CH**	Inorganic clays of high plasticity
		Organic		**OH**	Organic clays of medium to high plasticity, organic silts
Highly Organic Soils				**PT**	Peat, humus, swamp soils with high organic contents

Table 1: Soil Classification Chart (based on ASTM D2487)

SOIL CLASSIFICATION METHODOLOGY

Building & Earth Sciences classifies soil in general accordance with the Unified Soil Classification System (USCS) presented in ASTM D2487. Table 1 and Figure 1 exemplify the general guidance of the USCS. Soil consistencies and relative densities are presented in general accordance with Terzaghi, Peck, & Mesri's (1996) method, as shown on Table 2, when quantitative field and/or laboratory data is available. Table 2 includes Consistency and Relative Density correlations with N-values obtained using either a manual hammer (60 percent efficiency) or automatic hammer (90 percent efficiency). The *Blows Per Increment* and *SPT N-values* displayed on the boring logs are the unaltered values measured in the field. When field and/or laboratory data is not available, we may classify soil in general accordance with the Visual Manual Procedure presented in ASTM D2488.

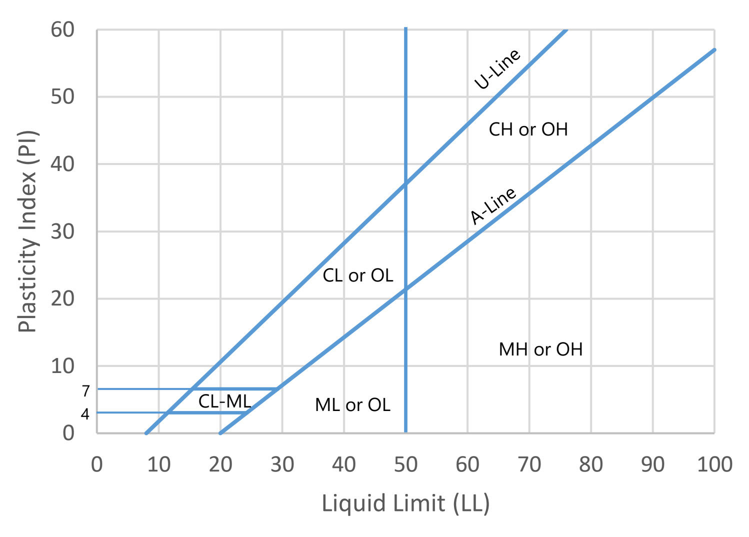


Figure 1: Plasticity Chart (based on ASTM D2487)

<table>
<tr><th colspan="3">Non-cohesive: Coarse-Grained Soil</th><th colspan="4">Cohesive: Fine-Grained Soil</th></tr>
<tr><th colspan="2">SPT Penetration (blows/foot)</th><th rowspan="2">Relative Density</th><th colspan="2">SPT Penetration (blows/foot)</th><th rowspan="2">Consistency</th><th rowspan="2">Estimated Range of Unconfined Compressive Strength (tsf)</th></tr>
<tr><th></th><th></th><th>Automatic Hammer*</th><th>Manual Hammer</th></tr>
<tr><td>Automatic Hammer*</td><td>Manual Hammer</td><td></td><td>< 2</td><td>< 2</td><td>Very Soft</td><td>< 0.25</td></tr>
<tr><td>0 - 3</td><td>0 - 4</td><td>Very Loose</td><td>2 - 3</td><td>2 - 4</td><td>Soft</td><td>0.25 – 0.50</td></tr>
<tr><td>3 - 8</td><td>4 - 10</td><td>Loose</td><td>3 - 6</td><td>4 - 8</td><td>Medium Stiff</td><td>0.50 – 1.00</td></tr>
<tr><td>8 - 23</td><td>10 - 30</td><td>Medium Dense</td><td>6 - 12</td><td>8 - 15</td><td>Stiff</td><td>1.00 – 2.00</td></tr>
<tr><td>23 - 38</td><td>30 - 50</td><td>Dense</td><td>12 - 23</td><td>15 - 30</td><td>Very Stiff</td><td>2.00 – 4.00</td></tr>
<tr><td>> 38</td><td>> 50</td><td>Very Dense</td><td>> 23</td><td>> 30</td><td>Hard</td><td>> 4.00</td></tr>
</table>

Table 2: Soil Consistency and Relative Density (based on Terzaghi, Peck & Mesri, 1996)

* - Modified based on 80% hammer efficiency

KEY TO LOGS

☒	Standard Penetration Test ASTM D1586 or AASHTO T-206	⬇	Dynamic Cone Penetrometer (Sower DCP) ASTM STP-399
▮	Shelby Tube Sampler ASTM D1587	○	No Sample Recovery
▥	Rock Core Sample ASTM D2113	▽	Groundwater at Time of Drilling
▮	Auger Cuttings	▼	Groundwater as Indicated

Table 1: Symbol Legend

Soil	Particle Size	U.S. Standard
Boulders	Larger than 300 mm	N.A.
Cobbles	300 mm to 75 mm	N.A.
Gravel	75 mm to 4.75 mm	3-inch to #4 sieve
Coarse	75 mm to 19 mm	3-inch to ¾-inch sieve
Fine	19 mm to 4.75 mm	¾-inch to #4 sieve
Sand	4.75 mm to 0.075 mm	#4 to #200 Sieve
Coarse	4.75 mm to 2 mm	#4 to #10 Sieve
Medium	2 mm to 0.425 mm	#10 to #40 Sieve
Fine	0.425 mm to 0.075 mm	#40 to #200 Sieve
Fines	Less than 0.075 mm	Passing #200 Sieve
Silt	Less than 5 μm	N.A.
Clay	Less than 2 μm	N.A.

Table 2: Standard Sieve Sizes

N-Value ☐	Standard Penetration Test Resistance calculated using ASTM D1586 or AASHTO T-206. Calculated as sum of original, field recorded values.	Atterberg Limits ├─┤ PL LL	A measure of a soil's plasticity characteristics in general accordance with ASTM D4318. The soil Plasticity Index (PI) is representative of this characteristic and is bracketed by the Liquid Limit (LL) and the Plastic Limit (PL).
Qu ▲	Unconfined compressive strength, typically estimated from a pocket penetrometer. Results are presented in tons per square foot (tsf).	% Moisture ●	Percent natural moisture content in general accordance with ASTM D2216.

Table 3: Soil Data

Hollow Stem Auger	Flights on the outside of the shaft advance soil cuttings to the surface. The hollow stem allows sampling through the middle of the auger flights.
Mud Rotary / Wash Bore	A cutting head advances the boring and discharges a drilling fluid to support the borehole and circulate cuttings to the surface.
Solid Flight Auger	Flights on the outside bring soil cuttings to the surface. Solid stem requires removal from borehole during sampling.
Hand Auger	Cylindrical bucket (typically 3-inch diameter and 8 inches long) attached to a metal rod and turned by human force.

Table 4: Soil Drilling Methods

Descriptor	Meaning
Trace	Likely less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

Table 5: Descriptors

Manual Hammer	The operator tightens and loosens the rope around a rotating drum assembly to lift and drop a sliding, 140-pound hammer falling 30 inches.
Automatic Trip Hammer	An automatic mechanism is used to lift and drop a sliding, 140-pound hammer falling 30 inches.
Dynamic Cone Penetrometer (Sower DCP) ASTM STP-399	Uses a 15-pound steel mass falling 20 inches to strike an anvil and cause penetration of a 1.5-inch diameter cone seated in the bottom of a hand augered borehole. The blows required to drive the embedded cone a depth of 1-3/4 inches have been correlated by others to N-values derived from the Standard Penetration Test (SPT).

Table 6: Sampling Methods

Non-plastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be re-rolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be re-rolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

Table 7: Plasticity

Dry	Absence of moisture, dusty, dry to the touch.
Moist	Damp but no visible water.
Wet	Visible free water, usually soil is below water table.

Table 8: Moisture Condition

Stratified	Alternating layers of varying material or color with layers at least ½ inch thick.
Laminated	Alternating layers of varying material or color with layers less than ¼ inch thick.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensides	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

Table 9: Structure

KEY TO HATCHES

Hatch	Description	Hatch	Description	Hatch	Description
▨	***GW*** *- Well-graded gravels, gravel – sand mixtures, little or no fines*	▨	*Asphalt*	▨	*Clay with Gravel*
▨	***GP*** *- Poorly-graded gravels, gravel – sand mixtures, little or no fines*	▨	*Aggregate Base*	▨	*Sand with Gravel*
▨	***GM*** *- Silty gravels, gravel – sand – silt mixtures*	▨	*Topsoil*	▨	*Silt with Gravel*
▨	***GC*** *- Clayey gravels, gravel – sand – clay mixtures*	▨	*Concrete*	▨	*Gravel with Sand*
▨	***SW*** *- Well-graded sands, gravelly sands, little or no fines*	▨	*Coal*	▨	*Gravel with Clay*
▨	***SP*** *- Poorly-graded sands, gravelly sands, little or no fines*	▨	***CL-ML*** *- Silty Clay*	▨	*Gravel with Silt*
▨	***SM*** *- Silty sands, sand – silt mixtures*	▨	*Sandy Clay*	▨	*Limestone*
▨	***SC*** *- Clayey sands, sand – clay mixtures*	▨	*Clayey Chert*	▨	*Chalk*
▨	***ML*** *- Inorganic silts and very find sands, rock flour, silty or clayey fine sands or clayey silt with slight plasticity*	▨	*Low and High Plasticity Clay*	▨	*Siltstone*
▨	***CL*** *- Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays*	▨	*Low Plasticity Silt and Clay*	▨	*Till*
▨	***OL*** *- Organic silts and organic silty clays of low plasticity*	▨	*High Plasticity Silt and Clay*	▨	*Sandy Clay with Cobbles and Boulders*
▨	***MH*** *- Inorganic silts, micaceous or diatomaceous fine sand, or silty soils*	▨	*Fill*	▨	*Sandstone with Shale*
▨	***CH*** *- Inorganic clays of high plasticity*	▨	*Weathered Rock*	▨	*Coral*
▨	***OH*** *- Organic clays of medium to high plasticity, organic silts*	▨	*Sandstone*	▨	*Boulders and Cobbles*
▨	***PT*** *- Peat, humus, swamp soils with high organic contents*	▨	*Shale*	▨	*Soil and Weathered Rock*

Table 1: Key to Hatches Used for Boring Logs and Soil Profiles

BORING LOCATION PLAN

REFERENCE USED TO PRODUCE THIS DRAWING:

Google Earth Satellite Imagery dated 8/11/2022 with Pole Layout Plan Overlay, prepared by Engel & Company Engineers, dated 6/13/2025

BORING LOCATION PLAN

DATE: 8/11/2025

PROJECT NO.	**PROJECT NAME / LOCATION:**	**SCALE:**
TU250174	Catoosa CDC Golf Netting Poles Catoosa, Oklahoma	As Shown

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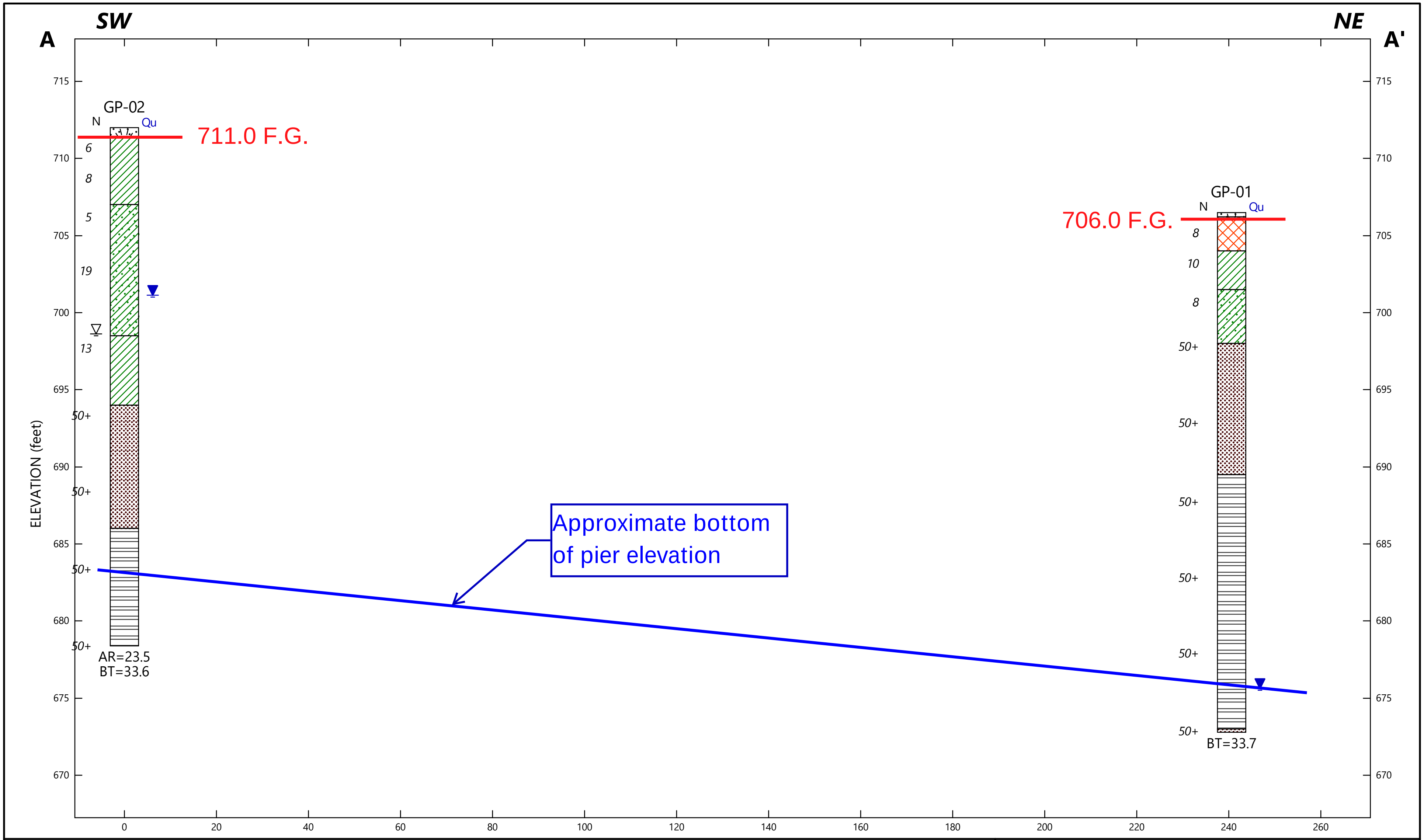
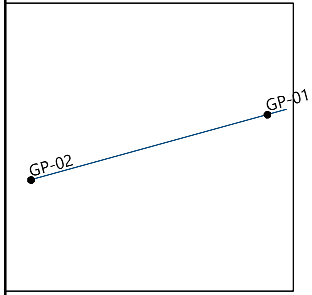
Geotechnical, Environmental, and Materials Engineers

SUBSURFACE PROFILES





Site Map Scale 1 inch equals 190 feet

Key to Hatches

- Topsoil
- Fill
- USCS Low Plasticity Clay
- USCS Low Plasticity Sandy Clay
- Sandstone
- Shale

Legend

BT=Boring Termination, TPT=Test Pit Terminated
AR=Auger Refusal, ER=Excavation Refusal
N=Standard Penetration Test N-Value
Qu=Unconfined compressive strength estimate from pocket penetrometer test (tsf)
▽ Water Level Reading at time of drilling.
▼ Water Level Reading after drilling.

0 31
Horizontal Scale (feet)
Vertical Exaggeration: 3.5x

Building & Earth Sciences, Inc.
1403 South 70th East Avenue, Tulsa, OK 74112

Catoosa CDC Golf Netting Poles
Catoosa, OK

A-A': Subsurface Profile

PROJECT NO: TU250174
PLATE NO: A-1
DATE: 8/22/25

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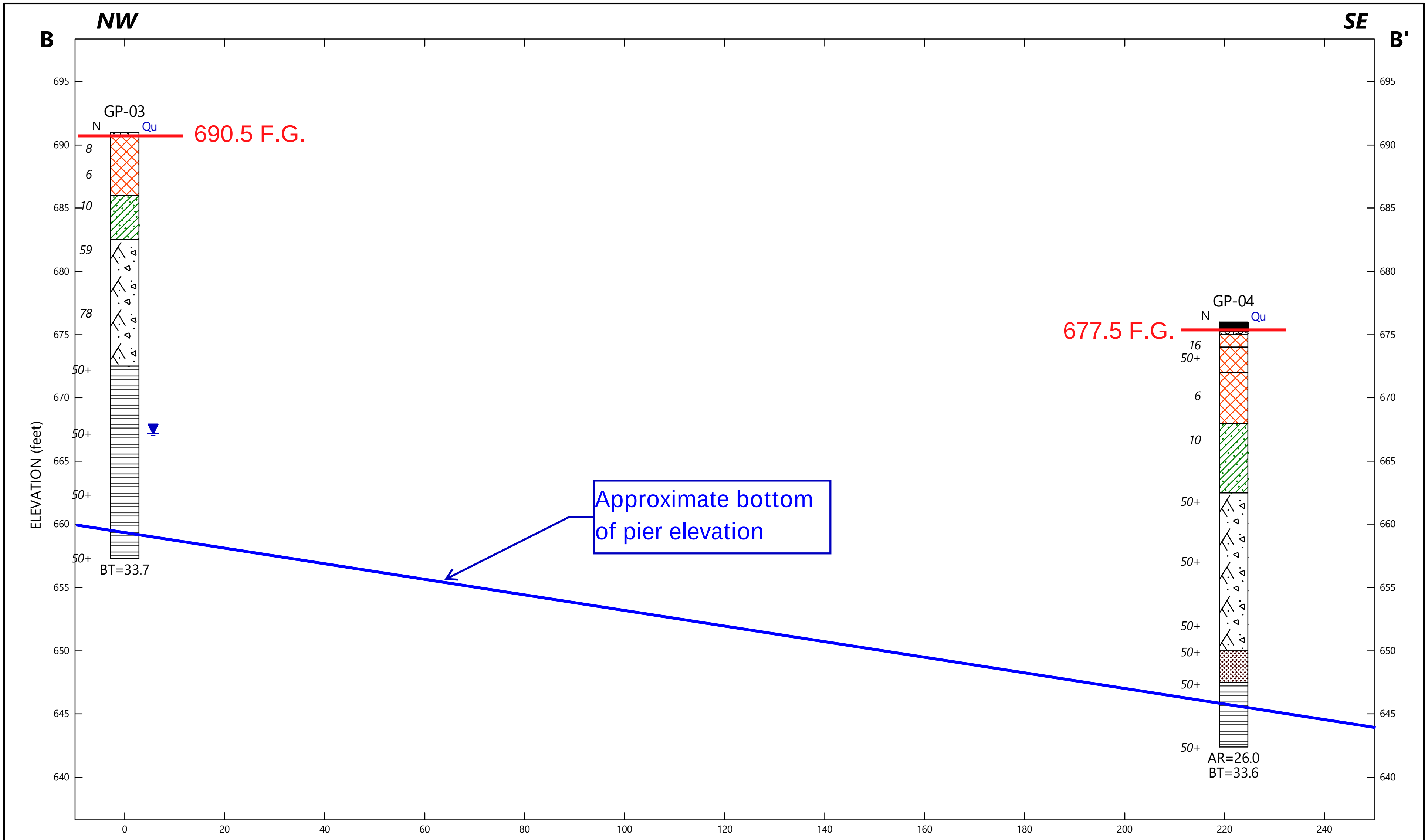
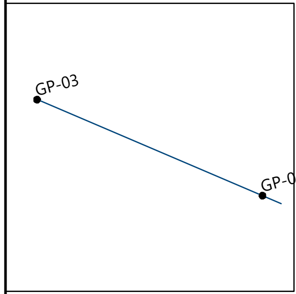
Geotechnical, Environmental, and Materials Engineers





Site Map Scale 1 inch equals 175 feet

Key to Hatches

- ▨ Topsoil
- ▨ Weathered Rock
- ▨ Aggregate Base Material
- 🟥 Fill
- ▤ Shale
- ▨ Sandstone
- 🟩 USCS Low Plasticity Sandy Clay
- ■ Asphalt

Legend

BT=Boring Termination, TPT=Test Pit Terminated
AR=Auger Refusal, ER=Excavation Refusal
N=Standard Penetration Test N-Value
Qu=Unconfined compressive strength estimate from pocket penetrometer test (tsf)
▽ Water Level Reading at time of drilling.
▼ Water Level Reading after drilling.

0 28
Horizontal Scale (feet)
Vertical Exaggeration: 2.5x

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1403 South 70th East Avenue, Tulsa, OK 74112

Catoosa CDC Golf Netting Poles
Catoosa, OK

B-B': Subsurface Profile

PROJECT NO: TU250174	PLATE NO: B-1	DATE: 8/22/25

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BORING LOGS

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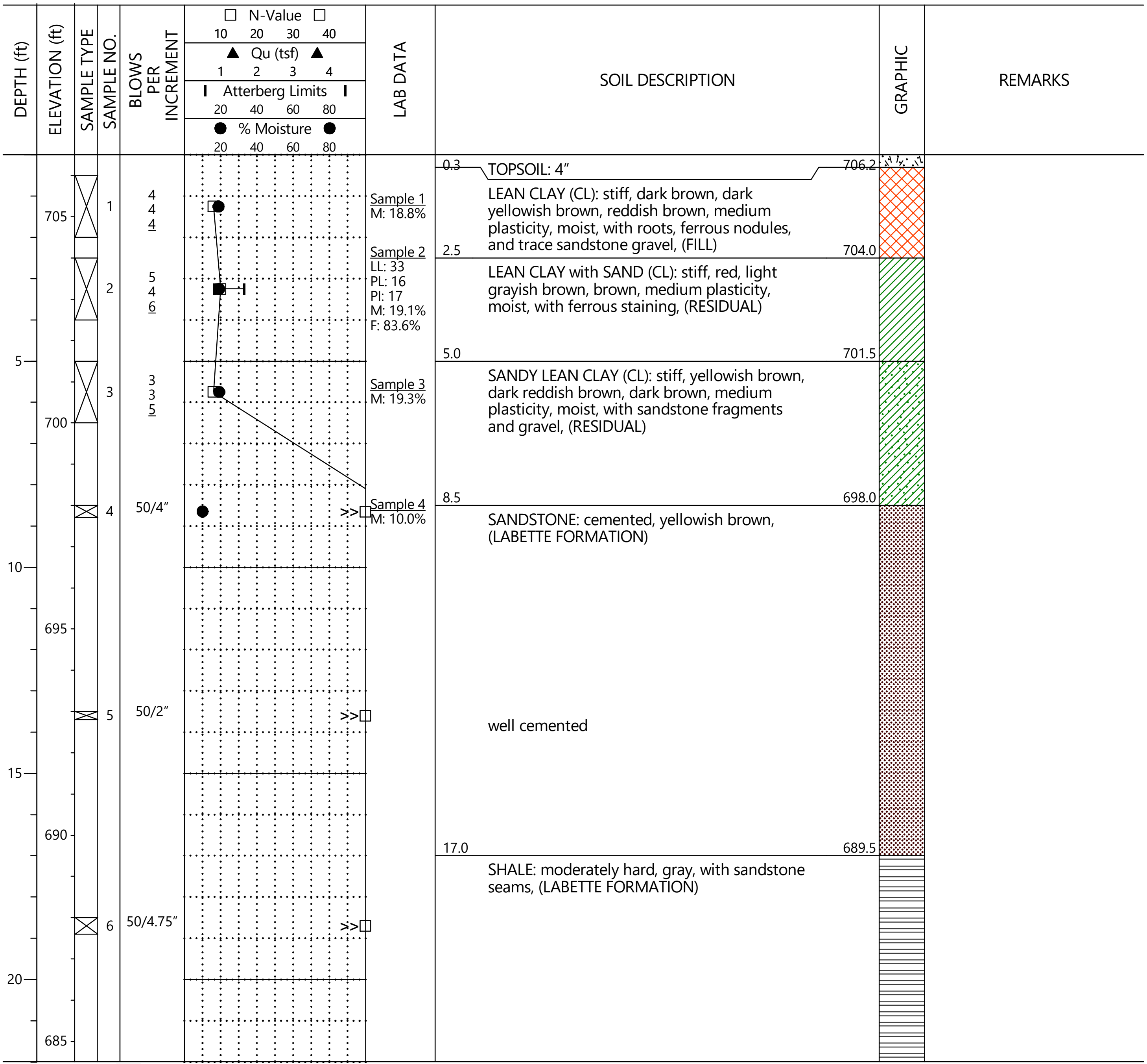
Geotechnical, Environmental, and Materials Engineers

LOG OF BORING
Designation: GP-01
Sheet 1 of 2

1403 South 70th East Avenue
Tulsa, OK 74112
Office: (918) 439-9005

PROJECT NAME: Catoosa CDC Golf Netting Poles
PROJECT NUMBER: TU250174
DRILLING METHOD: Hollow Stem Auger
EQUIPMENT USED: Diedrich D-50
HAMMER TYPE: Automatic
BORING LOCATION: Pole Location #1

LOCATION: Catoosa, OK
DATE DRILLED: 8/11/25
WEATHER: Partly cloudy
ELEVATION: 706.5
DRILL CREW: Building & Earth
LOGGED BY: J. Swyden



SAMPLE NO.	BLOWS PER INCREMENT	LAB DATA
1	4 4 4	Sample 1 M: 18.8%
2	5 4 6	Sample 2 LL: 33 PL: 16 PI: 17 M: 19.1% F: 83.6%
3	3 3 5	Sample 3 M: 19.3%
4	50/4"	Sample 4 M: 10.0%
5	50/2"	
6	50/4.75"	

	SOIL DESCRIPTION	
0.3	TOPSOIL: 4"	706.2
2.5	LEAN CLAY (CL): stiff, dark brown, dark yellowish brown, reddish brown, medium plasticity, moist, with roots, ferrous nodules, and trace sandstone gravel, (FILL)	704.0
5.0	LEAN CLAY with SAND (CL): stiff, red, light grayish brown, brown, medium plasticity, moist, with ferrous staining, (RESIDUAL)	701.5
8.5	SANDY LEAN CLAY (CL): stiff, yellowish brown, dark reddish brown, dark brown, medium plasticity, moist, with sandstone fragments and gravel, (RESIDUAL)	698.0
17.0	SANDSTONE: cemented, yellowish brown, (LABETTE FORMATION) well cemented	689.5
	SHALE: moderately hard, gray, with sandstone seams, (LABETTE FORMATION)	

SAMPLE TYPE ☒ Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206)
% MOISTURE PERCENT NATURAL MOISTURE CONTENT
▽ GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING
▼ STABILIZED GROUNDWATER LEVEL
REC RECOVERY
RQD ROCK QUALITY DESIGNATION
UD UNDISTURBED
Qu POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH
LL: LIQUID LIMIT
PL: PLASTIC LIMIT
PI: PLASTICITY INDEX
M: NATURAL MOISTURE CONTENT
F: PERCENT PASSING NO. 200 SIEVE

LOG OF BORING

Designation: GP-01

Sheet 2 of 2

PROJECT NAME: Catoosa CDC Golf Netting Poles
PROJECT NUMBER: TU250174
DRILLING METHOD: Hollow Stem Auger
EQUIPMENT USED: Diedrich D-50
HAMMER TYPE: Automatic
BORING LOCATION: Pole Location #1

LOCATION: Catoosa, OK
DATE DRILLED: 8/11/25
WEATHER: Partly cloudy
ELEVATION: 706.5
DRILL CREW: Building & Earth
LOGGED BY: J. Swyden

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	□ N-Value □ 10 20 30 40 ▲ Qu (tsf) ▲ 1 2 3 4 I Atterberg Limits I 20 40 60 80 ● % Moisture ● 20 40 60 80	LAB DATA	SOIL DESCRIPTION	GRAPHIC	REMARKS
							SHALE: moderately hard, gray, with sandstone seams, (LABETTE FORMATION)*(continued from 17.0 feet.)*		
		☒	7	50/4"	>>□				
25									
	680								
		☒	8	50/0.75"	>>□		hard		
30									
							▼		Free water was measured at 31', approximately one hour after completion of drilling.
	675								
33.5	673.0								
33.7	672.8	☒	9	50/2"	>>□		SANDSTONE: well cemented, gray, (LABETTE FORMATION)		
							Boring Terminated at 33.7 feet.		
35									
	670								
40									
	665								Borehole backfilled on date drilled unless otherwise noted. Consistency/Relative Density based on correction factor for Automatic hammer.

SAMPLE TYPE ☒ Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY	**LL:** LIQUID LIMIT	**M:** NATURAL MOISTURE CONTENT
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	**RQD**	ROCK QUALITY DESIGNATION	**PL:** PLASTIC LIMIT	**F:** PERCENT PASSING NO. 200 SIEVE
∇	GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING	**UD**	UNDISTURBED	**PI:** PLASTICITY INDEX	
▼	STABILIZED GROUNDWATER LEVEL	**Qu**	POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH		

Geotechnical, Environmental, and Materials Engineers

LOG OF BORING

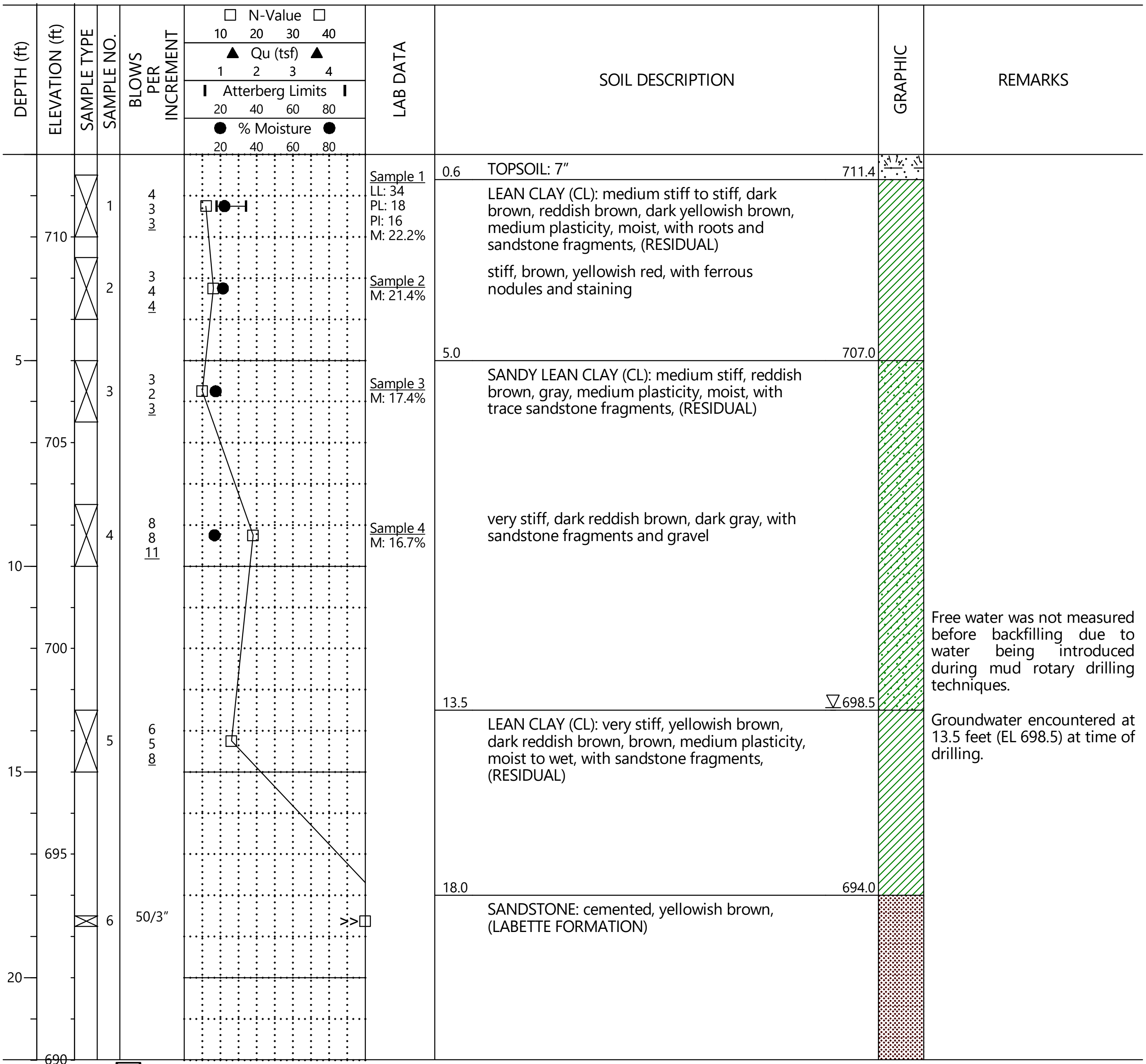
Designation: GP-02

Sheet 1 of 2

1403 South 70th East Avenue
Tulsa, OK 74112
Office: (918) 439-9005

PROJECT NAME: Catoosa CDC Golf Netting Poles
PROJECT NUMBER: TU250174
DRILLING METHOD: Hollow Stem Auger/Mud Rotary Drilling
EQUIPMENT USED: Diedrich D-50
HAMMER TYPE: Automatic
BORING LOCATION: Pole Location #6

LOCATION: Catoosa, OK
DATE DRILLED: 8/11/25
WEATHER: Partly cloudy
ELEVATION: 712
DRILL CREW: Building & Earth
LOGGED BY: J. Swyden



DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	LAB DATA	SOIL DESCRIPTION	REMARKS
0.6	711.4					TOPSOIL: 7"	
		☒	1	4 3 3	Sample 1 LL: 34 PL: 18 PI: 16 M: 22.2%	LEAN CLAY (CL): medium stiff to stiff, dark brown, reddish brown, dark yellowish brown, medium plasticity, moist, with roots and sandstone fragments, (RESIDUAL)	
		☒	2	3 4 4	Sample 2 M: 21.4%	stiff, brown, yellowish red, with ferrous nodules and staining	
5.0	707.0	☒	3	3 2 3	Sample 3 M: 17.4%	SANDY LEAN CLAY (CL): medium stiff, reddish brown, gray, medium plasticity, moist, with trace sandstone fragments, (RESIDUAL)	
		☒	4	8 8 11	Sample 4 M: 16.7%	very stiff, dark reddish brown, dark gray, with sandstone fragments and gravel	Free water was not measured before backfilling due to water being introduced during mud rotary drilling techniques.
13.5	▽698.5	☒	5	6 5 8		LEAN CLAY (CL): very stiff, yellowish brown, dark reddish brown, brown, medium plasticity, moist to wet, with sandstone fragments, (RESIDUAL)	Groundwater encountered at 13.5 feet (EL 698.5) at time of drilling.
18.0	694.0	☒	6	50/3"		SANDSTONE: cemented, yellowish brown, (LABETTE FORMATION)	

SAMPLE TYPE ☒ Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206)
% MOISTURE PERCENT NATURAL MOISTURE CONTENT
▽ GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING
▼ STABILIZED GROUNDWATER LEVEL

REC RECOVERY
RQD ROCK QUALITY DESIGNATION
UD UNDISTURBED
Qu POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH

LL: LIQUID LIMIT
PL: PLASTIC LIMIT
PI: PLASTICITY INDEX
M: NATURAL MOISTURE CONTENT
F: PERCENT PASSING NO. 200 SIEVE

LOG OF BORING

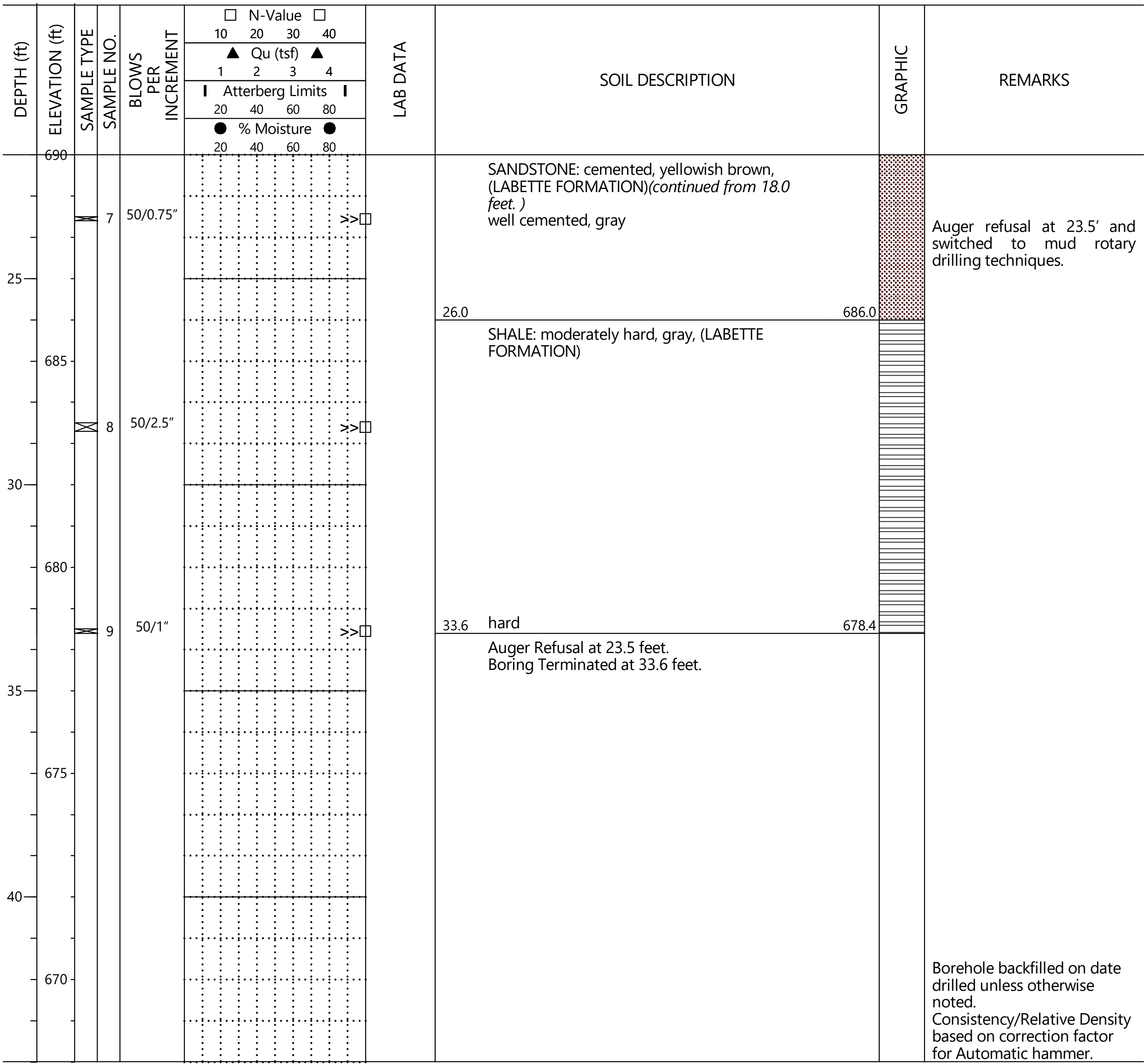
Designation: GP-02

Sheet 2 of 2

1403 South 70th East Avenue
Tulsa, OK 74112
Office: (918) 439-9005

PROJECT NAME: Catoosa CDC Golf Netting Poles
PROJECT NUMBER: TU250174
DRILLING METHOD: Hollow Stem Auger/Mud Rotary Drilling
EQUIPMENT USED: Diedrich D-50
HAMMER TYPE: Automatic
BORING LOCATION: Pole Location #6

LOCATION: Catoosa, OK
DATE DRILLED: 8/11/25
WEATHER: Partly cloudy
ELEVATION: 712
DRILL CREW: Building & Earth
LOGGED BY: J. Swyden



SAMPLE NO.	BLOWS PER INCREMENT
7	50/0.75"
8	50/2.5"
9	50/1"

SANDSTONE: cemented, yellowish brown, (LABETTE FORMATION)*(continued from 18.0 feet.)*
well cemented, gray

26.0 — 686.0

SHALE: moderately hard, gray, (LABETTE FORMATION)

33.6 hard — 678.4

Auger Refusal at 23.5 feet.
Boring Terminated at 33.6 feet.

REMARKS:

Auger refusal at 23.5' and switched to mud rotary drilling techniques.

Borehole backfilled on date drilled unless otherwise noted.
Consistency/Relative Density based on correction factor for Automatic hammer.

SAMPLE TYPE ☒ Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206)
% MOISTURE PERCENT NATURAL MOISTURE CONTENT
▽ GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING
▼ STABILIZED GROUNDWATER LEVEL
REC RECOVERY
RQD ROCK QUALITY DESIGNATION
UD UNDISTURBED
Qu POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH
LL: LIQUID LIMIT
PL: PLASTIC LIMIT
PI: PLASTICITY INDEX
M: NATURAL MOISTURE CONTENT
F: PERCENT PASSING NO. 200 SIEVE

BUILDING & EARTH
Geotechnical, Environmental, and Materials Engineers

LOG OF BORING
Designation: GP-03
Sheet 1 of 2

1403 South 70th East Avenue
Tulsa, OK 74112
Office: (918) 439-9005

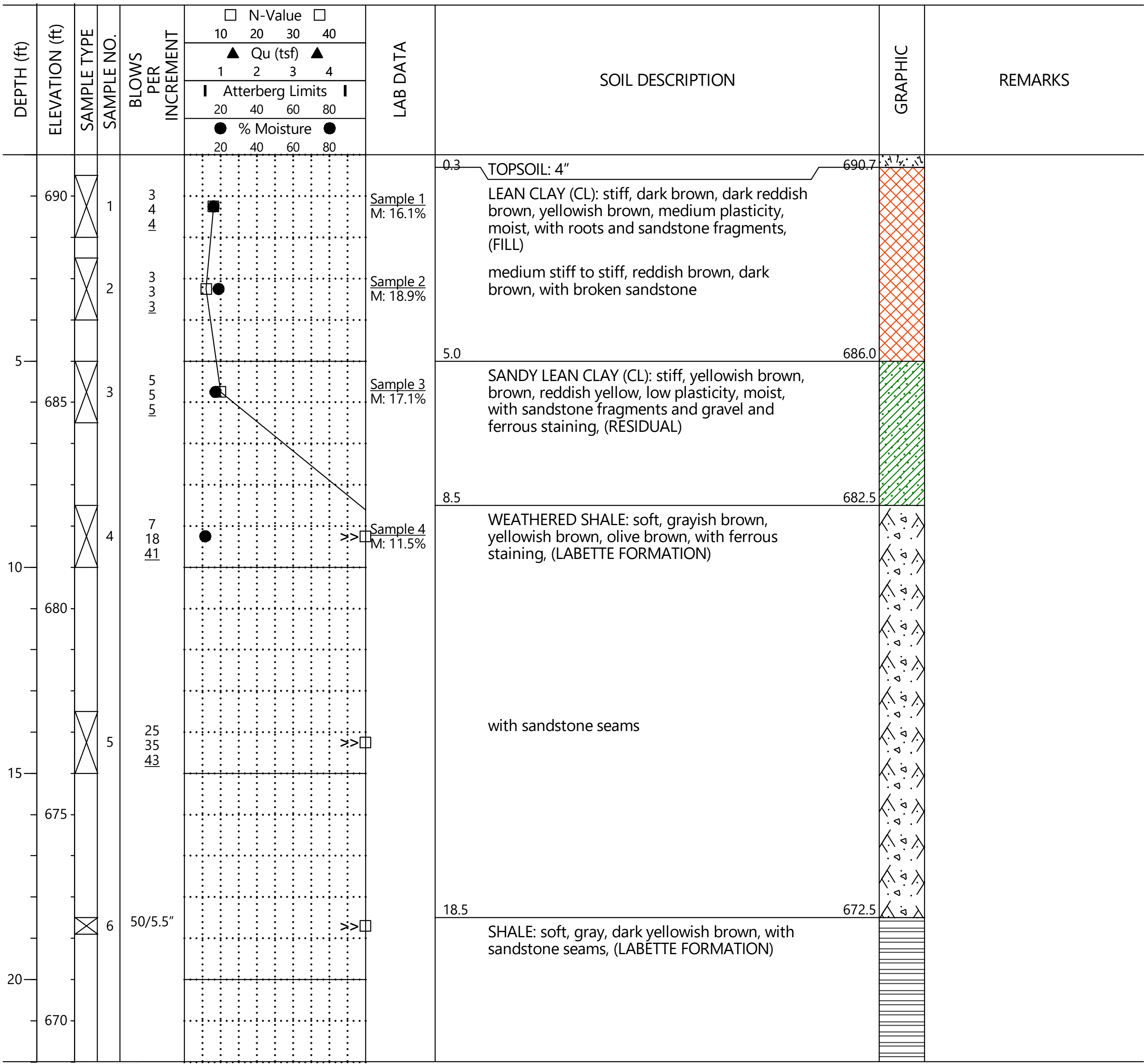
PROJECT NAME: Catoosa CDC Golf Netting Poles
PROJECT NUMBER: TU250174
DRILLING METHOD: Hollow Stem Auger
EQUIPMENT USED: Diedrich D-50
HAMMER TYPE: Automatic
BORING LOCATION: Pole Location #13

LOCATION: Catoosa, OK
DATE DRILLED: 8/11/25
WEATHER: Partly cloudy
ELEVATION: 691
DRILL CREW: Building & Earth
LOGGED BY: J. Swyden

SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	LAB DATA
☒	1	3 4 4	Sample 1 M: 16.1%
☒	2	3 3 3	Sample 2 M: 18.9%
☒	3	5 5 5	Sample 3 M: 17.1%
☒	4	7 18 41	Sample 4 M: 11.5%
☒	5	25 35 43	
☒	6	50/5.5"	

DEPTH (ft)	ELEVATION (ft)	SOIL DESCRIPTION
0.3	690.7	TOPSOIL: 4"
		LEAN CLAY (CL): stiff, dark brown, dark reddish brown, yellowish brown, medium plasticity, moist, with roots and sandstone fragments, (FILL) medium stiff to stiff, reddish brown, dark brown, with broken sandstone
5.0	686.0	SANDY LEAN CLAY (CL): stiff, yellowish brown, brown, reddish yellow, low plasticity, moist, with sandstone fragments and gravel and ferrous staining, (RESIDUAL)
8.5	682.5	WEATHERED SHALE: soft, grayish brown, yellowish brown, olive brown, with ferrous staining, (LABETTE FORMATION) with sandstone seams
18.5	672.5	SHALE: soft, gray, dark yellowish brown, with sandstone seams, (LABETTE FORMATION)

REMARKS



SAMPLE TYPE ☒ Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY	**LL:** LIQUID LIMIT	**M:** NATURAL MOISTURE CONTENT
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	**RQD**	ROCK QUALITY DESIGNATION	**PL:** PLASTIC LIMIT	**F:** PERCENT PASSING NO. 200 SIEVE
∇	GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING	**UD**	UNDISTURBED	**PI:** PLASTICITY INDEX	
▼	STABILIZED GROUNDWATER LEVEL	**Qu**	POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH		

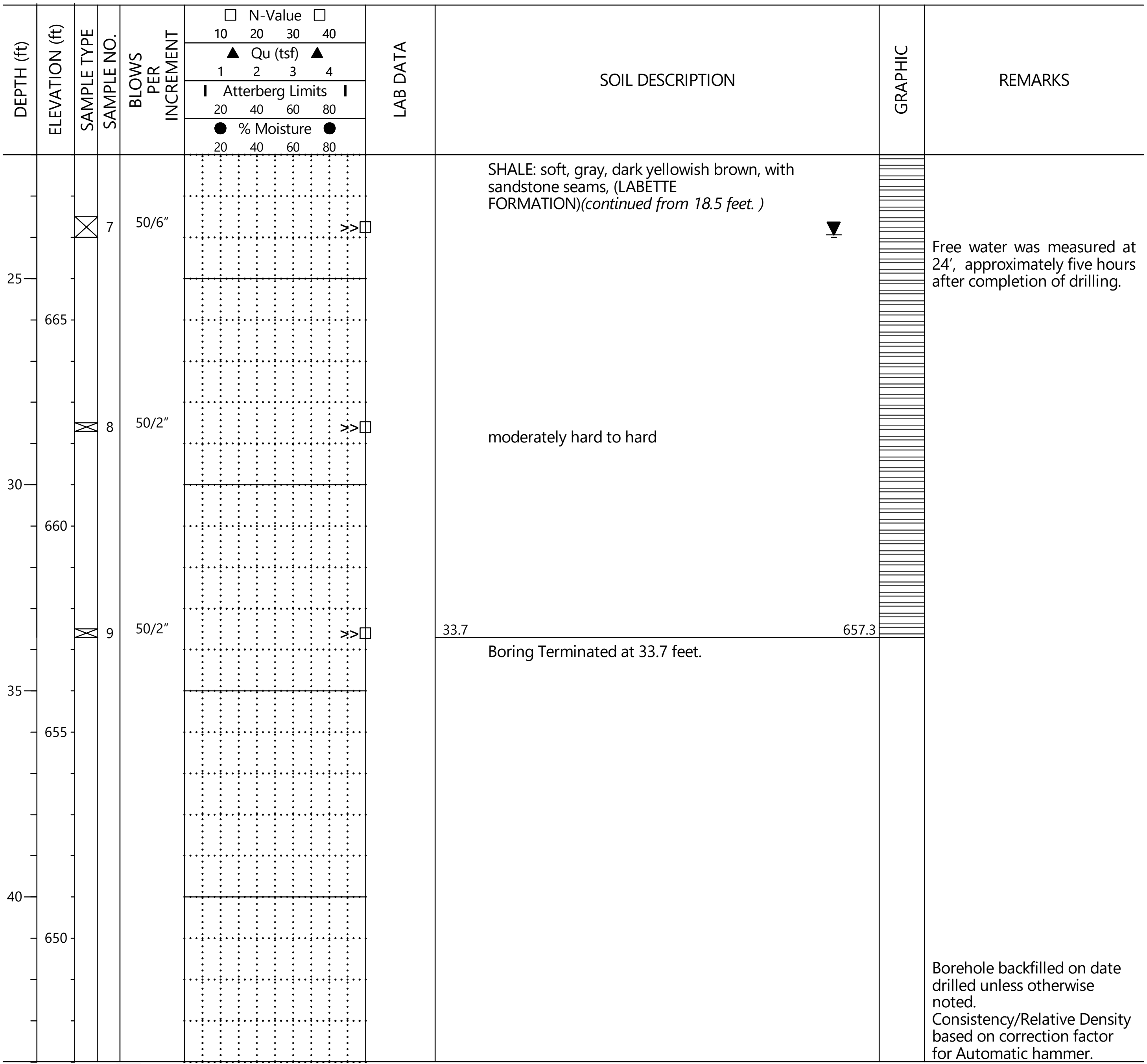
BUILDING & EARTH
Geotechnical, Environmental, and Materials Engineers

LOG OF BORING
Designation: GP-03
Sheet 2 of 2

1403 South 70th East Avenue
Tulsa, OK 74112
Office: (918) 439-9005

PROJECT NAME: Catoosa CDC Golf Netting Poles
PROJECT NUMBER: TU250174
DRILLING METHOD: Hollow Stem Auger
EQUIPMENT USED: Diedrich D-50
HAMMER TYPE: Automatic
BORING LOCATION: Pole Location #13

LOCATION: Catoosa, OK
DATE DRILLED: 8/11/25
WEATHER: Partly cloudy
ELEVATION: 691
DRILL CREW: Building & Earth
LOGGED BY: J. Swyden



SHALE: soft, gray, dark yellowish brown, with sandstone seams, (LABETTE FORMATION)*(continued from 18.5 feet.)*

moderately hard to hard

Boring Terminated at 33.7 feet.

Free water was measured at 24', approximately five hours after completion of drilling.

Borehole backfilled on date drilled unless otherwise noted.
Consistency/Relative Density based on correction factor for Automatic hammer.

SAMPLE TYPE ☒ Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206)
% MOISTURE PERCENT NATURAL MOISTURE CONTENT
∇ GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING
▼ STABILIZED GROUNDWATER LEVEL

REC RECOVERY
RQD ROCK QUALITY DESIGNATION
UD UNDISTURBED
Qu POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH

LL: LIQUID LIMIT
PL: PLASTIC LIMIT
PI: PLASTICITY INDEX
M: NATURAL MOISTURE CONTENT
F: PERCENT PASSING NO. 200 SIEVE

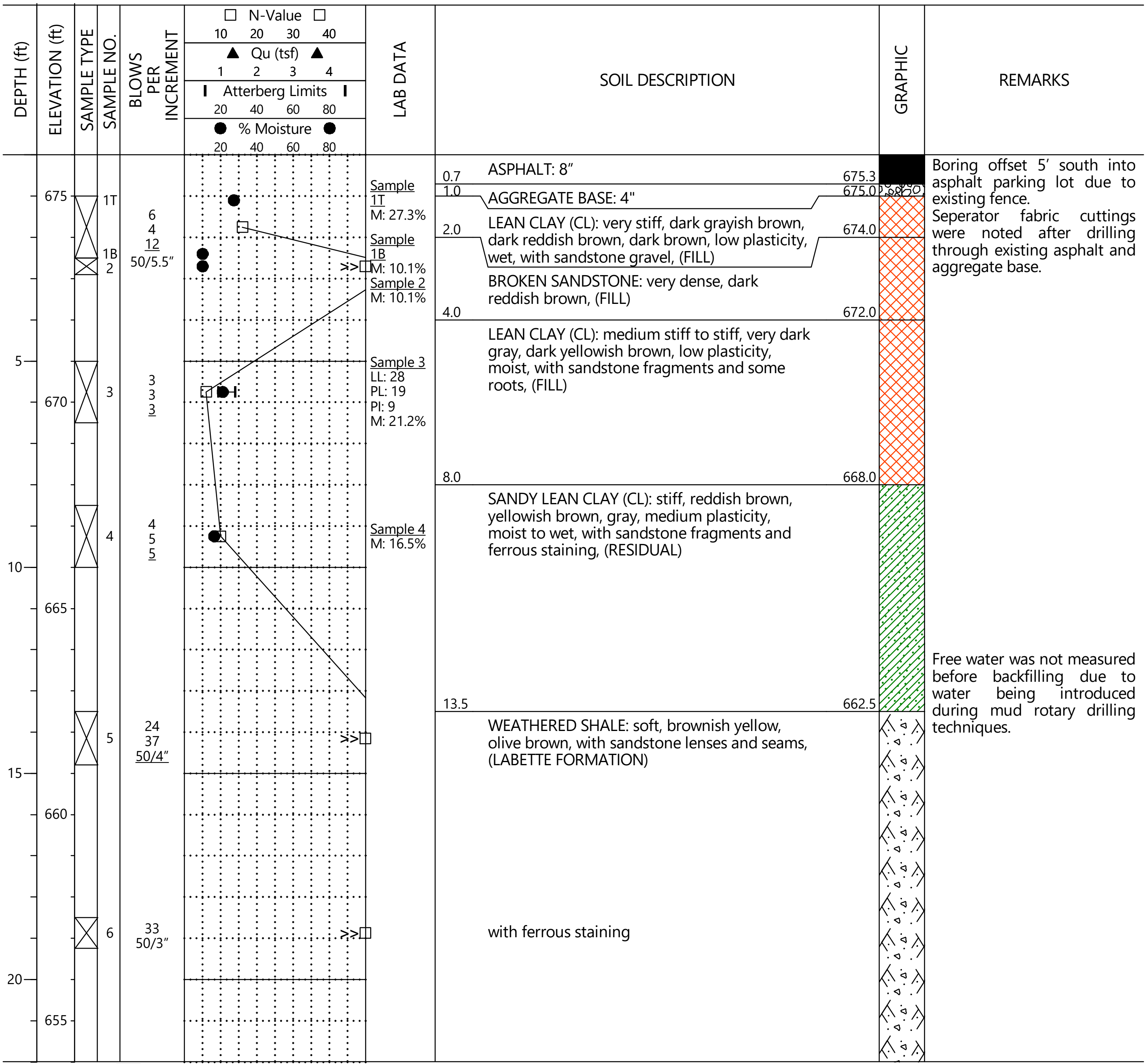
BUILDING & EARTH
Geotechnical, Environmental, and Materials Engineers

LOG OF BORING
Designation: GP-04
Sheet 1 of 2

1403 South 70th East Avenue
Tulsa, OK 74112
Office: (918) 439-9005

PROJECT NAME: Catoosa CDC Golf Netting Poles
PROJECT NUMBER: TU250174
DRILLING METHOD: Hollow Stem Auger/Mud Rotary Drilling
EQUIPMENT USED: Diedrich D-50
HAMMER TYPE: Automatic
BORING LOCATION: Pole Location #18

LOCATION: Catoosa, OK
DATE DRILLED: 8/11/25
WEATHER: Partly cloudy
ELEVATION: 676
DRILL CREW: Building & Earth
LOGGED BY: J. Swyden



Depth (ft)	Elevation (ft)	Sample Type	Sample No.	Blows per Increment	Lab Data	Soil Description	Remarks
0.7	675.3					ASPHALT: 8"	Boring offset 5' south into asphalt parking lot due to existing fence. Seperator fabric cuttings were noted after drilling through existing asphalt and aggregate base.
1.0	675.0					AGGREGATE BASE: 4"	
2.0	674.0	☒	1T	6 4 12	Sample 1T M: 27.3%	LEAN CLAY (CL): very stiff, dark grayish brown, dark reddish brown, dark brown, low plasticity, wet, with sandstone gravel, (FILL)	
			1B		Sample 1B M: 10.1%		
4.0	672.0	☒	2	50/5.5"	Sample 2 M: 10.1%	BROKEN SANDSTONE: very dense, dark reddish brown, (FILL)	
8.0	668.0	☒	3	3 3 3	Sample 3 LL: 28 PL: 19 PI: 9 M: 21.2%	LEAN CLAY (CL): medium stiff to stiff, very dark gray, dark yellowish brown, low plasticity, moist, with sandstone fragments and some roots, (FILL)	
13.5	662.5	☒	4	4 5 5	Sample 4 M: 16.5%	SANDY LEAN CLAY (CL): stiff, reddish brown, yellowish brown, gray, medium plasticity, moist to wet, with sandstone fragments and ferrous staining, (RESIDUAL)	Free water was not measured before backfilling due to water being introduced during mud rotary drilling techniques.
		☒	5	24 37 50/4"		WEATHERED SHALE: soft, brownish yellow, olive brown, with sandstone lenses and seams, (LABETTE FORMATION)	
		☒	6	33 50/3"		with ferrous staining	

SAMPLE TYPE ☒ Split Spoon

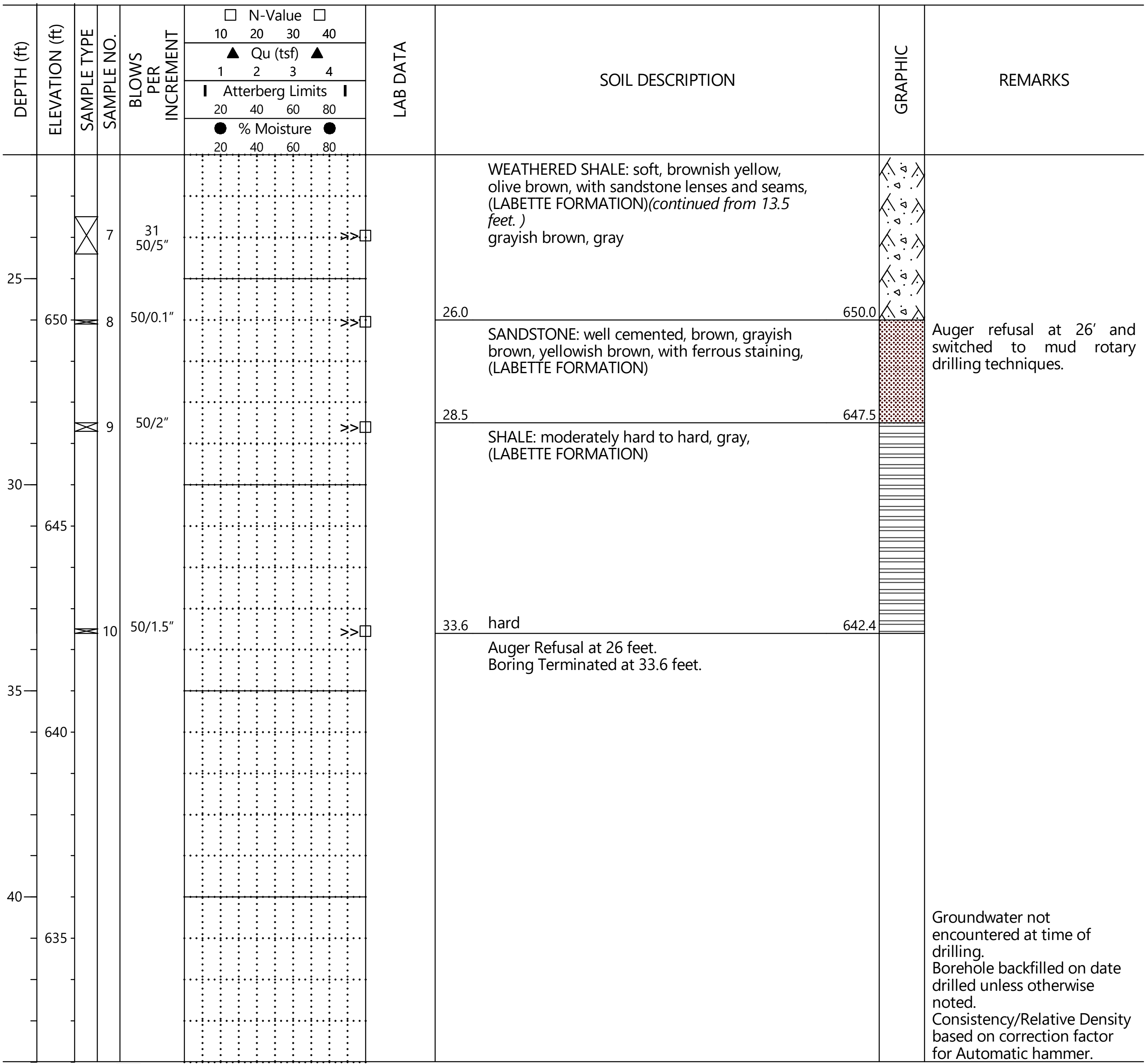
N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY	**LL:** LIQUID LIMIT	**M:** NATURAL MOISTURE CONTENT
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	**RQD**	ROCK QUALITY DESIGNATION	**PL:** PLASTIC LIMIT	**F:** PERCENT PASSING NO. 200 SIEVE
▽	GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING	**UD**	UNDISTURBED	**PI:** PLASTICITY INDEX	
▼	STABILIZED GROUNDWATER LEVEL	**Qu**	POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH		

BUILDING & EARTH
Geotechnical, Environmental, and Materials Engineers

LOG OF BORING
Designation: GP-04
Sheet 2 of 2

1403 South 70th East Avenue
Tulsa, OK 74112
Office: (918) 439-9005

PROJECT NAME:	Catoosa CDC Golf Netting Poles	LOCATION:	Catoosa, OK
PROJECT NUMBER:	TU250174	DATE DRILLED:	8/11/25
DRILLING METHOD:	Hollow Stem Auger/Mud Rotary Drilling	WEATHER:	Partly cloudy
EQUIPMENT USED:	Diedrich D-50	ELEVATION:	676
HAMMER TYPE:	Automatic	DRILL CREW:	Building & Earth
BORING LOCATION:	Pole Location #18	LOGGED BY:	J. Swyden



DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	N-Value	LAB DATA	SOIL DESCRIPTION	REMARKS
		☒	7	31 50/5"	>>☐		WEATHERED SHALE: soft, brownish yellow, olive brown, with sandstone lenses and seams, (LABETTE FORMATION)*(continued from 13.5 feet.)* grayish brown, gray	
26.0	650.0	☒	8	50/0.1"	>>☐		SANDSTONE: well cemented, brown, grayish brown, yellowish brown, with ferrous staining, (LABETTE FORMATION)	Auger refusal at 26′ and switched to mud rotary drilling techniques.
28.5	647.5	☒	9	50/2"	>>☐		SHALE: moderately hard to hard, gray, (LABETTE FORMATION)	
		☒	10	50/1.5"	>>☐		hard	
33.6	642.4						Auger Refusal at 26 feet. Boring Terminated at 33.6 feet.	

Groundwater not encountered at time of drilling.
Borehole backfilled on date drilled unless otherwise noted.
Consistency/Relative Density based on correction factor for Automatic hammer.

SAMPLE TYPE ☒ Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY	**LL:** LIQUID LIMIT	**M:** NATURAL MOISTURE CONTENT
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LABORATORY TEST PROCEDURES

A brief description of the laboratory tests performed is provided in the following sections.

DESCRIPTION OF SOILS (VISUAL-MANUAL PROCEDURE) (ASTM D2488)

The soil samples were visually examined by our engineer and soil descriptions were provided. Representative samples were then selected and tested in accordance with the aforementioned laboratory-testing program to determine soil classifications and engineering properties. This data was used to correlate our visual descriptions with the Unified Soil Classification System (USCS).

NATURAL MOISTURE CONTENT (ASTM D2216)

Natural moisture contents (M%) were determined on selected samples. The natural moisture content is the ratio, expressed as a percentage, of the weight of water in a given amount of soil to the weight of solid particles.

ATTERBERG LIMITS (ASTM D4318)

The Atterberg Limits test was performed to evaluate the soil's plasticity characteristics. The soil Plasticity Index (PI) is representative of this characteristic and is bracketed by the Liquid Limit (LL) and the Plastic Limit (PL). The Liquid Limit is the moisture content at which the soil will flow as a heavy viscous fluid. The Plastic Limit is the moisture content at which the soil is between "plastic" and the semi-solid stage. The Plasticity Index (PI = LL - PL) is a frequently used indicator for a soil's potential for volume change. Typically, a soil's potential for volume change increases with higher plasticity indices.

MATERIAL FINER THAN NO. 200 SIEVE BY WASHING (ASTM D1140)

Grain-size tests were performed to determine the partial soil particle size distribution. The amount of material finer than the openings on the No. 200 sieve (0.075 mm) was determined by washing soil over the No. 200 sieve. The results of wash #200 tests are presented on the boring logs included in this report and in the table of laboratory test results.

LABORATORY TEST RESULTS

The results of the laboratory testing are presented in the following tables.

BORING NO.	DEPTH	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	% PASSING #200 SIEVE	CLASSIFICATION
GP-01	0.5 - 2.0	18.8					
GP-01	2.5 - 4.0	19.1	33	16	17	84	CL
GP-01	5.0 - 6.5	19.3					
GP-01	8.5 - 8.8	10.0					
GP-02	0.5 - 2.0	22.2	34	18	16		
GP-02	2.5 - 4.0	21.4					
GP-02	5.0 - 6.5	17.4					
GP-02	8.5 - 10.0	16.7					
GP-03	0.5 - 2.0	16.1					
GP-03	2.5 - 4.0	18.9					
GP-03	5.0 - 6.5	17.1					
GP-03	8.5 - 10.0	11.5					
GP-04	1.1	27.3					
GP-04	2.4	10.1					
GP-04	2.5 - 2.9	10.1					
GP-04	5.0 - 6.5	21.2	28	19	9		
GP-04	8.5 - 10.0	16.5					

TABLE L-1: General Soil Classification Test Results

Soils with a Liquid Limit (LL) greater than 50 and Plasticity Index (PI) greater than 25 usually exhibit significant volume change with varying moisture content and are considered to be highly plastic

(1) Indicates visual classification. WR indicates weathered rock.

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.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of 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.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GBC GEOTECHNICAL BUSINESS COUNCIL
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