Report of Geotechnical Exploration 2027 NGCC Geotechnical Investigation – E. W. Brown Generating Station Harrodsburg, Mercer County, Kentucky S&ME Project No. 22360136

PREPARED FOR:

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April 21, 2023

April 21, 2023

Louisville Gas and Electric and Kentucky Utilities Company
820 West Broadway
Louisville, Kentucky 40202

Attention: Mr. Jeff Heun, P.E.

Reference: **Report of Geotechnical Exploration**
2027 NGCC Geotechnical Investigation
E. W. Brown Generating Station
Harrodsburg, Mercer County, Kentucky
S&ME Project No. 22360136
LG&E/KU Contract No. 1124902

Dear Mr. Heun:

S&ME, Inc. (S&ME) has completed our geotechnical exploration for the planned 2027 NGCC Geotechnical Investigation – E. W. Brown Generating Station located in Harrodsburg, Mercer County, Kentucky. This exploration was performed in general accordance with S&ME, Inc. Proposal No. 22360136 dated November 4, 2022, which was authorized by LG&E KU Services Company (LG&E-KU) on November 22, 2022, with LG&E-KU Contract No. 1124902. The purpose of this exploration was to obtain preliminary geotechnical data at two sites within the existing E. W. Brown Generating Station (E. W. Brown) to support the construction of one new Natural Gas Combined Cycle (NGCC) unit and Battery Energy Storage System (BESS).

This report explains our understanding of the project, documents our findings, and presents our conclusions and geotechnical engineering recommendations.

Sincerely,

S&ME, Inc.

STATE OF KENTUCKY
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Report at a Glance

Key geotechnical findings based on our current understanding of the proposed project are presented below. These findings are presented as an overview and should not be used in place of the more detailed recommendations presented in the remainder of this report.

Category	Key Geotechnical Finding
Site Development Challenges	Specific geotechnical issues identified on this site that should be considered include: • Moderate to High plasticity clays. • Presence of pinnacled bedrock/likely karst. • Shallow bedrock. • Large fills required to achieve site grade.
Subsurface Conditions	Residual soils derived from weathering of rock (i.e., residuum). Predominately medium-stiff to very stiff, lean (CL) to fat (CH) clays. Transitions to decomposed limestone with depth. Top of Intermediate Geomaterial (IGM) ranges from none at some locations to 4.0 to 22.0 feet overlying top of limestone bedrock at 6.9 to 25.0 feet at the Unit 1-2 site. Top of limestone bedrock varies from 2.5 feet to 25 feet at the Unit 1-2 site and 2.2 feet to 19.7 feet at the Webb Farm site. Groundwater, where encountered, at the end of augering ranged from 5.5 feet to 26.2 feet below existing grade.
Seismic Considerations	Generally, SPT N-values indicated Site Class C with the exception of B-3 (soft soils encountered between 8.0 and 17.0 feet) and B-8 (embankment fill).
Foundation Type	Combination of mat/shallow foundations and drilled shafts/micropiles
Slab Support	Slab-on-grade construction may require additional drainage and subgrade preparation due to moderate to high plasticity site soils.
Use of Site Soil as Fill	Site soils are suitable for use as structural fill. More clayey soils with Unified Soil Classifications of CH should be restricted to depths of 3 ft or more below final grade. Moisture conditioning will likely be needed to achieve proper compaction. Chemical stabilization may also be needed.
Construction Dewatering	Construction dewatering may be required for local perched water and surface water infiltration.
Previous Development Impacts	The Unit 1-2 site is currently developed, and includes existing structures, embankments, utilities, and a septic field. The previous structures at Webb Farm were removed, however remnants such as septic fields, uncompacted fill, foundations, etc. may be encountered and require remediation during site grading.

1.0 Introduction

S&ME, Inc. (S&ME) has completed our geotechnical exploration for the planned 2027 NGCC Geotechnical Investigation – E. W. Brown Generating Station located in Harrodsburg, Mercer County, Kentucky. This exploration was performed in general accordance with S&ME, Inc. Proposal No. 22360136 dated November 4, 2022, which was authorized by LG&E KU Services Company (LG&E-KU) on November 22, 2022, with LG&E-KU Contract No. 1124902. The purpose of this exploration was to obtain preliminary geotechnical data at two sites within the existing E. W. Brown Generating Station (E. W. Brown) to support the construction of one new Natural Gas Combined Cycle (NGCC) unit and Battery Energy Storage System (BESS).

This report explains our understanding of the project, documents our findings, and presents our conclusions and geotechnical engineering recommendations.

2.0 Project Information

Initial information for this project was provided via an email RFP by Mr. Paul Meyer with LG&E-KU on October 19, 2022, and through Zycus. The provided information consisted of a bid package, submittal documentation, and example contract. A list of these documents is below.

- 2027 NGCC Geotech Exhibits.pdf including an Exhibit SOW and Technical Specification providing loading information, specifications for sampling and testing, and Site Plans with boring locations and grading for EW Brown -Unit 1-2, EW Brown – Webb Farm, and Mill Creek.
- 2027 NGCC Geotechnical Investigation Contract.docx including a draft Services Authorization dated June 14, 2021.

The following bid forms were also provided for upload to Zycus during the bid process.

- Attachment CE – Bidder Commentary and Exceptions
- Attachment PA – Proposal Authorization
- Attachment RFC – Request for Clarification

In addition to the provided bid information, S&ME took part in a pre-bid conference between LG&E-KU and potential bidders via phone on October 24, 2022. A project kick-off meeting to discuss the approved project scope, boring layouts, potential utility conflicts, and schedule was conducted via Zoom on November 18, 2022. Additional information was provided by Mr. Dan Sorg (LG&E-KU) revising plans within the Webb Farm area for a Battery Energy Storage System (BESS). Loading information provided by LG&E-KU for the BESS area is included in Table 2.2 on page 7.

Based on our review of the provided information, we understand LG&E-KU has identified the Unit 1-2 site for the planned NGCC unit and the Webb Farm site as a location for the planned BESS. LG&E-KU Identified eleven (11) borings at each site to support preliminary geotechnical recommendations for the structures and fills. Table 2.1,

on the following page, summarizes the as-drilled locations at or near the locations provided by LG&E. Latitude and longitude represent as-drilled locations, NAD83 Kentucky State Plane North.

Prior to mobilization of drilling equipment, and at the request of LG&E-KU, S&ME walked the three sites with LG&E-KU Project engineering personnel on November 21, 2022, to confirm access, identify site conditions that may delay drilling, identify potential utility conflicts (i.e., moving a boring away from a marked gas line), and marking boring locations for utility clearance and hydrovacuum excavations. Boring Locations are also presented in Appendix II. Note: borings with a "B" represent Unit 1-2 locations and "WB" represent Webb Farm locations.

Table 2.1 – Boring Location summary

Boring Location	Surface Elevation (ft)	Latitude	Longitude
B-01	870	37.788808	-84.710752
B-02	874	37.789050	-84.710901
B-03	878	37.789346	-84.711176
B-04	880	37.789424	-84.711321
B-05	879	37.789488	-84.711761
B-06	881	37.789311	-84.711967
B-07	860	37.788493	-84.710019
B-08	853	37.788163	-84.709614
B-09	845	37.789507	-84.710224
B-10	844	37.789379	-84.710090
B-11	863	37.789912	-84.711133
WB-01	895	37.795663	-84.716212
WB-02	897	37.795852	-84.716114
WB-03	892	37.796149	-84.715967
WB-04	886	37.796399	-84.715833
WB-05	884	37.796564	-84.715748
WB-06	900	37.795904	-84.715658
WB-07	865	37.797182	-84.716357
WB-08	859	37.797602	-84.716151
WB-09	861	37.796795	-84.716890
WB-10	863	37.796516	-84.717041
WB-11	884	37.792340	-84.717311

Table 2.2, below, summarizes the expected major structures and loading based on information provided by LG&E-KU with associated boring locations.

Table 2.2 – Structure Summary

Structure	Anticipated Soil Pressure (psf)	Anticipated Footprint (LxW, ft)	Associated Boring Location(s)	Expected Foundation System
Natural Gas Combine Cycle (Unit 1-2)				
Heat Recovery Steam Generator (HRSG) and Stack (180-feet height)	6000	210 x 50	B-1	Drilled Shafts / Micropiles
Single Shaft CT/ST/Generator	3500-5000	200 x 50-80	B-2	Drilled Shafts / Micropiles
Turbine Building	4000	185 x 100-150	B-3, B-4, B-5	Drilled Shafts / Micropiles
Gas Compressors	3000-4000	30 x 60	B-6	Drilled Shafts / Micropiles
Cooling Tower Basin	2500	250 x 120	B-7, B-8	Drilled Shafts / Micropiles
Demineralization Tank	3000	40' Diameter	B-9	Mat / Shallow Foundations
Fire/Service Water Tank	3000	50' Diameter	B-10	Mat / Shallow Foundations
GSU Transformer	3000	70 x 60	B-11	Mat / Shallow Foundations
Administration Control Building (PEMB)	3000	80 x 100	-	Mat / Shallow Foundations
Battery Energy Storage System (Webb Farm)				
Battery container	700	21.9 x 10	-	Mat / Shallow Foundations
Inverter	550	23.3 x 8.5	-	Mat / Shallow Foundations

Existing site elevations within the Unit 1-2 footprint range from approximately El. 844 to El. 881. Existing site elevations within the Webb Farm footprint range from approximately El. 859 to El. 900. Based on the provided boring layout, we understand up to 12 feet of fill placement will be required to achieve planned grade for Unit 1-2 near boring locations B-7 through B-11 near an elevation of El. 852. Preliminary grading, loading, or structure information has not been provided for the Webb Farm battery farm.

The following report sections provide foundation design parameters for the expected bearing conditions summarized in Table 2.2 above.

3.0 Regional Geology

According to *Geologic Map of the Wilmore Quadrangle, Central Kentucky*, dated 1970, the site is located in the Inner Bluegrass Region of Kentucky and underlain by Middle Ordovician aged Logana Member (WB-1 through WB-6) and Curdsville Member (B-1 through B-6, B-11, and WB-7 through WB-11) of the Lexington Limestone formation and Tyrone Limestone (B-7 through B-10) of the High Bridge Group.

- The Logana Member is described as fossiliferous, interbedded limestone and shale light olive gray to medium gray in color.
- Curdsville Limestone is described as medium to light gray bioclastic limestone that may contain shale, chert nodes, and fossils.
- Tyrone Limestone can be described as light gray to light olive gray containing specks or tubes or clear calcite or very light gray to light brownish gray containing calcareous dolomite.

Bedrock was encountered in each of our borings at depths ranging from 2.2 feet to 25.0 feet with elevations ranging from El. 829.5 to El. 891.8, excluding possible karst areas that extended approximately 10 to 13 feet beyond adjacent depths in locations B-8 and WB-11. Site geology encountered is consistent with the reported information for the area.

3.1 Karst

A review of online karst information for the site and vicinity through the Kentucky Geologic survey, including *Mapped Karst Groundwater Basins in the Harrodsburg 30 x 60 Minute Quadrangle*, indicates the site is underlain by bedrock with a high potential for karst development and have identified several known karst features, including springs and sinkholes, in similar bedrock formations within the immediate area. As mentioned previously, two boring locations encountered pinnacled bedrock during our investigation: B-8 and WB-11. Both borings were initially offset due to misaligned tools likely caused by uneven bedrock. B-8 encountered auger refusal at a depth of 35.5 feet and was then offset 3 feet north and redrilled to 22 feet before coring. WB-11 encountered auger refusal at 19.8 feet and was offset 5 feet east and redrilled to 10.7 feet before coring. These abrupt changes in bedrock surface may indicate pinnacled bedrock or the presence of karst features within the site footprint. Boring locations and details are presented in Appendix I and Appendix II.

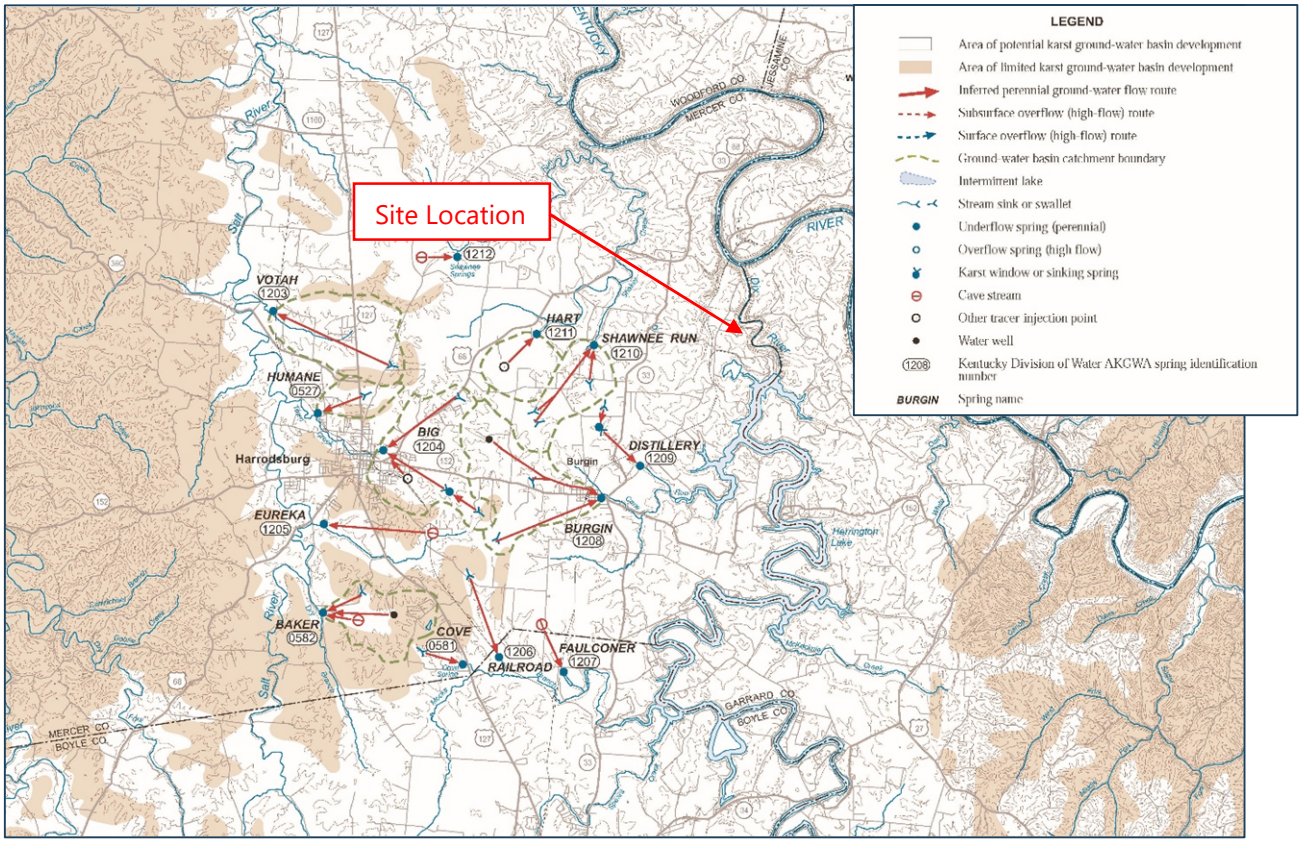


Figure 3.1 – Karst Mapping

3.2 Review of Regional Mining Activity (KMMIS)

Our review of the available mine mapping for the area (Kentucky Mine Mapping Information System, minemaps.ky.gov) and Mineral and Fuel Resources Map of Kentucky (uky.edu) indicated the following information:

- Coal mines, including surface and deep, are not located within the vicinity of the site.
- Mineral and limestone mines or quarries are present near the site, both active and abandoned.

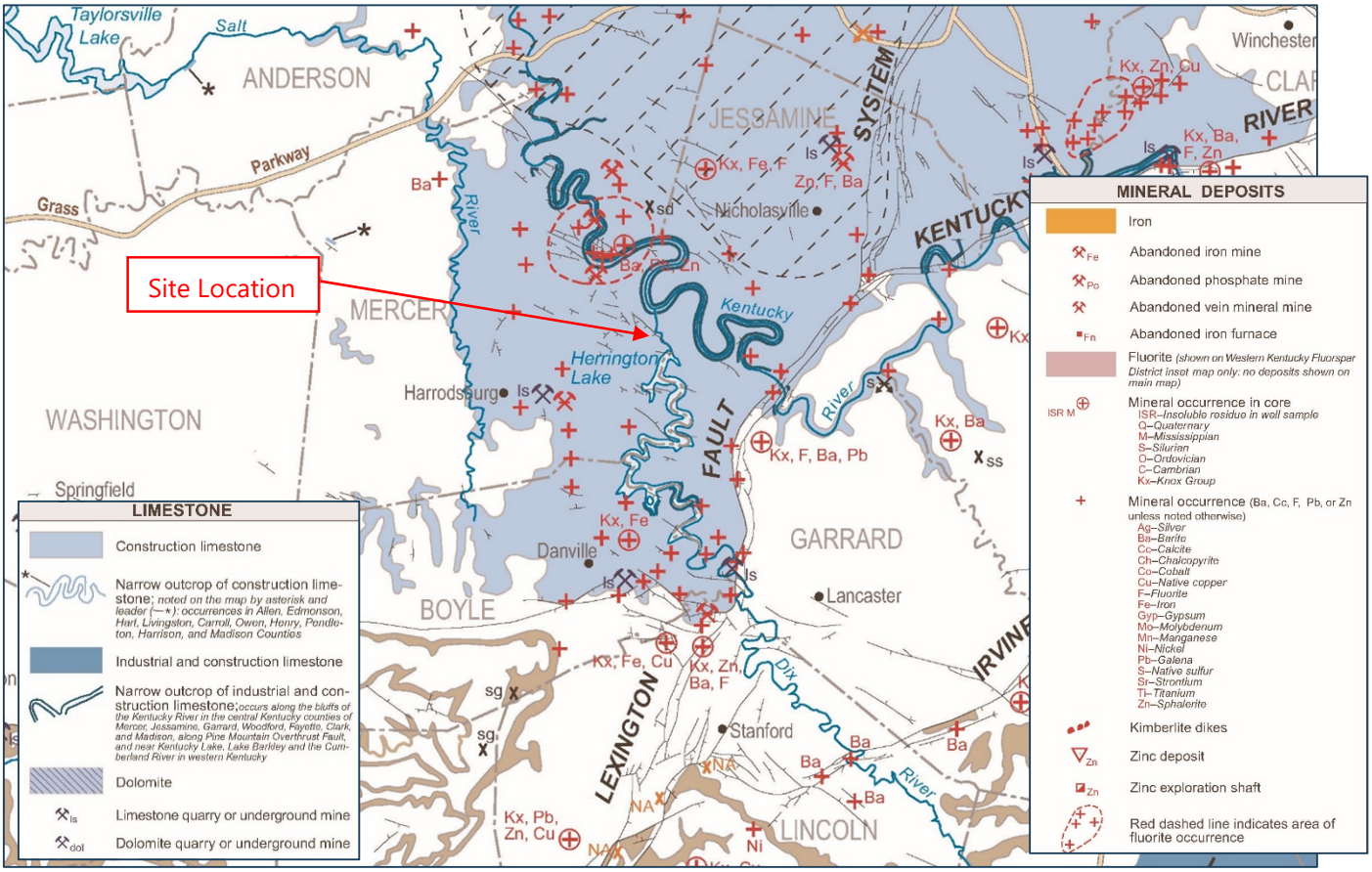


Figure 3.2 – Mineral Resources

3.3 Review of Flood Hazards

A review of the FEMA National Flood Hazard Layer Map (https://www.fema.gov/flood-maps/national-flood-hazard-layer) indicates that each of the borings are located in FEMA Zone X, areas subject to minimal flood hazards and outside the 500-year flood or protected from 100-year flood by levee.

4.0 Exploration and Testing

The procedures used by S&ME for field and laboratory sampling and testing are in general accordance with ASTM procedures and established engineering practice. Appendix II contains brief descriptions of the procedures used in this exploration.

4.1 Site Surface Conditions

The site conditions for both locations were generally grass covered areas adjacent to existing station structures (Unit 1-2) or farm structures (Webb Farm) that were removed prior to our investigation. Some locations were located within gravel areas (B-4, B-11, WB-6, and WB-11), adjacent to the coal pile (B-7), or atop an existing embankment (B-8). Site images presented in Appendix II depict the site conditions at the time of drilling.

Existing site elevations within the Unit 1-2 footprint range from approximately El. 844 to El. 881. Existing site elevations within the Webb Farm footprint generally ranged from approximately El. 859 to El. 900.

4.2 Field Exploration

A total of 22 soil test borings (labeled B-1 through B-11 and WB-1 through WB-11) were performed for this geotechnical exploration. Borings were located in the field using handheld GPS equipment. Boring offsets due to utilities or difficulty drilling are shown as-drilled in the tables and figures of this report.

The borings were performed using an all-terrain CME-50 and Deitrich D-50 drill rig using 3-1/4 inch hollow stem augers within the soil. Rock coring was performed with NQ-sized rock coring techniques through the hollow stem augers. Soil samples were obtained using a split-barrel sampler driven by an automatic hammer system in general accordance with ASTM D1586 (140-pound hammer falling 30-inches) and thin-walled undisturbed samples (Shelby Tubes) in general accordance with ASTM D1587. A general description of our field procedures, a test boring log legend, Boring Logs, photographs of our recovered rock cores, and a photo log of the existing site conditions are provided in Appendix II of this report.

Boring coordinates are summarized previously in Table 2.1. The approximate locations of the borings are shown on the Boring Location Plans (Figures 2A and 2B) in Appendix I. Boring elevations were estimated from available topographic information.

Each boring was advanced to auger refusal and a minimum of 10 feet of rock core was attempted. The borings were advanced through soil overburden generally consisting of residual Lean Clays (CL) and Fat Clays (CH). Auger refusal was encountered in each of our borings. The refusal depths ranged from 2.2 to 35.5 feet. A summary of the bedrock depths, auger refusal depths, rock core depths, and boring termination depths is presented in Table 4.1. A more detailed description of the soil and rock strata can be found in Section 5 and on the individual logs in Appendix II.

Table 4.1 – Auger Refusal Summary

Boring Location	Surface Elevation (ft)	IGM		Top of Rock		Auger Refusal Depth (ft)	Rock Core Depth (ft)
		Depth (ft)	Elevation (ft)	Depth (ft)	Elevation (ft)		
B-01	870.0	7.0	863.0	10.5	859.5	10.3	10.5 - 20.5
B-02	874.0	13.0	861.0	16.1	857.9	16.1	16.1 - 36.1
B-03	878.0	17.4	860.6	21.0	857.0	21.0	21.0 – 31.0
B-04	880.0	13.5	866.5	18.5	861.5	21.3	21.3 - 32.1
B-05	879.0	-	-	8.0	871.0	8.2	8.2 - 18.5
B-06	881.0	19.0	862.0	23.7	857.3	23.7	23.7 - 38.9
B-07	860.0	22.0	838.0	25.0	835.0	25.0	25.0 - 35.1
B-08 A	853.0	-	-	22.0	831.0	22.0	22.0 - 36.0
B-8 [1]	853.0	-	-	7.3	845.7	35.5	-
B-09	845.0	4.0	841.0	6.9	838.1	7.3	7.3 - 22.4
B-10	844.0	5.0	839.0	14.5	829.5	7.0	7.0 - 17.0
B-11	863.0	-	-	2.5	860.5	14.5	14.5 - 24.6
WB-01	895.0	-	-	5.4	889.6	2.2	2.2 - 17.6
WB-02	897.0	-	-	9.4	887.6	5.5	5.5 - 20.5
WB-03	892.0	-	-	7.2	884.8	10.0	10.0 - 18.8
WB-04	886.0	-	-	6.1	879.9	7.5	7.5 - 16.8
WB-05	884.0	-	-	6.4	877.6	6.2	6.2 - 16.2
WB-06	900.0	-	-	8.2	891.8	6.5	6.5 - 26.3
WB-07	865.0	-	-	4.4	860.6	9.0	9.9 - 18.7
WB-08	859.0	-	-	7.9	851.1	4.5	4.5 - 14.5
WB-09	861.0	-	-	5.8	855.2	8.2	8.2 - 18.2
WB-10	863.0	-	-	19.7	843.3	6.0	6.6 – 16.0
WB-11 A	884.0	-	-	10.7	873.3	10.7	10.7 - 21.1
WB-11 [1]	884.0	-	-	10.5	873.5	19.8	-

[1] Borings abandoned after auger refusal conditions due to misaligned coring equipment in pinnacled bedrock.

We measured the groundwater level in each boring upon completion, prior to backfilling the borehole with bentonite-grout. Observed groundwater levels at the time of our exploration are shown in the following section.

4.3 Groundwater

Groundwater and/or seepage was encountered in six (6) of the twenty-two (22) borings during the time of drilling or after soil drilling and prior to rock coring. Table 4.2 summarizes our groundwater findings at both sites.

Table 4.2 – Groundwater Summary

Boring No.	Depth During Drilling (ft)	Depth at Completion (ft)	24-hr Reading (ft)	Top of Boring Elevation (ft)	Water Elevation (ft)
B-01	Not encountered	Dry at completion prior to rock core	-	870.0	-
B-02	Not encountered	26.2	-	874.0	847.8
B-03	Not encountered	5.5	6.1	878.0	872.5
B-04	Not encountered	Dry at completion prior to rock core	-	880.0	-
B-05	Not encountered	7	9.2	879.0	872.0
B-06	16.4	9.6	6.0 [1]	881.0	871.4
B-07	Not encountered	Dry at completion prior to rock core	-	860.0	-
B-08 A	Not encountered	Dry at completion prior to rock core	-	853.0	-
B-09	Not encountered	5.8	-	845.0	839.2
B-10	Not encountered	Dry at completion prior to rock core	4.2 [2]	844.0	839.8
B-11	Not encountered	Dry at completion prior to rock core	-	863.0	-
WB-01	Not encountered	Dry at completion prior to rock core	-	895.0	-
WB-02	Not encountered	Dry at completion prior to rock core	-	897.0	-
WB-03	Not encountered	Dry at completion prior to rock core	-	892.0	-
WB-04	Not encountered	Dry at completion prior to rock core	-	886.0	-
WB-05	Not encountered	Dry at completion prior to rock core	-	884.0	-
WB-06	Not encountered	Dry at completion prior to rock core	-	900.0	-
WB-07	Not encountered	Dry at completion prior to rock core	-	865.0	-
WB-08	Not encountered	Dry at completion prior to rock core	-	859.0	-
WB-09	Not encountered	Dry at completion prior to rock core	-	861.0	-
WB-10	Not encountered	Dry at completion prior to rock core	-	863.0	-
WB-11 A	Not encountered	Dry at completion prior to rock core	-	884.0	-

Note:
1. Measured after rain event.
2. B-10 is located near to suspected septic field and may not represent actual groundwater conditions.
3. 24-hour readings influenced by introduction of coring fluid.

Seasonal and periodic variations in precipitation can also affect the observed water level conditions. Long-term static groundwater readings can be obtained with the installation and periodic monitoring of piezometers.

4.4 Laboratory Testing

4.4.1 Classification and Other

Soil and rock core samples collected during the field exploration were transferred to our soil laboratory, where a geotechnical engineer or geologist visually examined each sample to estimate the distribution of grain-sizes, plasticity, organic content, moisture condition, color, presence of lenses and seams and apparent geological origin. The soil samples were classified according to the Unified Soil Classification System (ASTM D2487). The results of the classifications, as well as the field test results, are presented on the individual Boring Logs in Appendix II. Similar soils were grouped into strata on the logs and summarized in Section 5.2.

Selected spilt-spoon and undisturbed samples were assigned laboratory testing including:

- Natural Moisture Content (ASTM D2216)
- Atterberg Limits and Hydrometer Analysis (ASTM D4318 and D422)
- Specific Gravity (ASTM D854 Method B)
- Unit Weight of Soil (ASTM D7263)
- Unconfined Compressive Strength of Cohesive Soils (ATSM D2166)
- Unconsolidated Undrained (UU) Triaxial Shear (ASTM D2850)
- Consolidated Undrained (CU) Triaxial Shear (ASTM D4767)
- Modified Moisture-Density (ASTM D1557)
- CBR (ASTM D1883)
- Consolidation Testing (ASTM D2435)
- Uniaxial Compressive Strength of Rock (ASTM D7012, Method C)
- pH (AASHTO T 289)
- Sulfate (SW9056A)
- Chloride (SW9056A)
- Oxidation Reduction Potential (ASTM G200-9)
- Miller Box Electrical Resistivity (ASTM G57)

The laboratory testing results are summarized in Tables III-1, III-2, and the Summary of Laboratory Test Data in Appendix III. Individual data sheets are also available in Appendix III.

4.4.2 Resistivity, pH, and Chemical Testing

One (1) representative soil specimen (boring B-4) was selected for chemical testing, including for soluble sulfates, sulfides, chloride ion, oxidation reduction (redox) potential. Chemical testing has been summarized in Table III-3 and Table III-4 in Appendix III along with individual chemical testing results. Data presented in this section is considered informational only. Interpretation and evaluation of these data are beyond our scope. S&ME recommends consulting with a qualified corrosion engineer.

The test results for resistivity, pH and chemical analysis are included in the Summary of Laboratory Test Data and on data sheets in Appendix III. Appendix III also contains an excerpt from the Ductile Iron Pipe Research Association (DIPRA), which is often used to help evaluate the corrosion potential for underground metal pipes,

(Figure III-1), ACI 318-11 Requirements for Concrete Exposed to Sulfates (Figure III-2), and the American Concrete Institute (ACI) 318 Table 19.3.1.1 – Exposure Categories and Classes (Figure III-3). These figures are provided for reference only.

4.1 Field Resistivity Testing

On December 1, 2022, we performed field soil resistivity testing at the requested locations in general accordance with ASTM G57 "*Standard Test Method for Field Measurement of Soil Resistivity using the Wenner Probe Four-Electrode Method*" using an Advanced Geosciences Incorporated, Inc. (AGI) R8 SuperSting™ resistivity meter, which is calibrated annually by the manufacturer.

The soil resistivity testing consisted of two (2) perpendicular linear arrays using a Wenner configuration at each test location, as shown in Figure 2A (ER-2) and Figure 2B (ER-1) in Appendix I. The ER-1 test arrays were generally oriented east-west and south-north (Lines A and B, respectively), and the ER-2 test arrays were oriented southwest-northeast and northwest-southeast (Lines A and B, respectively). Both soil resistivity tests used an electrode ("a") spacing of 2.5, 5, 10, 15, 20, and 30 feet to determine the resistivity at increasing depths. The eighteen-inch stainless steel electrodes used for the surveys were inserted 4 to 12 inches into the ground, and soil conditions were noted at the survey location.

The results of the soil resistivity survey are provided in Appendix II as *"22360136_EW Brown_Resistivity Data Sheet_ER-1"* and *"22360136_EW Brown_Resistivity Data Sheet_ER-2,"* which present the "a" spacing (feet and cm), electrode depth (inches), and associated calculated resistance (ohms), apparent resistivity (ohm/cm and ohm/ft), injected current (mA), and standard deviation.

4.1.1 Geophysical Methodology Limitations

Regardless of the thoroughness of a geophysical survey, there is always a possibility that actual conditions may not match the interpretations. The results should be considered accurate only to the degree implied by the methods used and the method's limitations and data coverage. The geophysical method used for this survey also has inherent limitations. Buried site metallic features (e.g., utilities, etc.) and overhead transmission lines can produce excessive noise and/or false responses in resistivity data.

5.0 Subsurface Conditions

The following is a brief and general description of subsurface conditions encountered in the borings. Detailed information is provided on the individual Boring Logs included in Appendix II. Fence diagrams are also included in Appendix II.

5.1 Surface Materials

The boring locations were either located in grassy areas or gravel covered laydown areas. Each boring within Unit 1-2 and Webb Farm encountered topsoil ranging in thickness from 2 inches to 6 inches, with the exception of borings B-4, B-7, B-11, and WB-6.

5.2 Residual Soils Deposits (Groups 'A' through 'C')

Underlying the surficial topsoil or crushed stone in each of our borings, residual soils from the weathering of limestone bedrock were encountered and consisted of Lean Clay (CL), Fat Clay (CH), and decomposed limestone. These three (3) classifications are presented below as Groups 'A' through 'C' for clarity.

5.2.1 Strata A – Lean Clays (CL)

Lean Clays (CL) with varying amounts of limestone fragments were the most predominant soils encountered in the borings. These soils were encountered in all the borings from below the surficial materials and extended to depths ranging from 6 feet to 30 feet. These clays were varying shades of reddish to yellow brown or gray in color. Standard Penetration Test (SPT) N-values recorded typically ranged from 3 blows per foot (bpf) to over 50 bpf, indicating a soft to hard consistency. Generally, CL soils encountered ranged from stiff to very stiff. Laboratory testing indicated these clays have moderate plasticity with liquid limits ranging from 42 percent to 44 percent. Natural moisture contents ranged from 18.3 percent to 21.1 percent.

5.2.2 Strata B – Fat Clays (CH)

Fat Clays (CH) were encountered in each boring, with the exception of B-1, B-3, B-5, B-7, B-8, WB-1, and WB-2, extending to depths ranging from 4.0 to 19.7 feet. These clays were observed to vary in color from red brown to dark red brown. Recorded SPT N-values ranging from 5 bpf to 25 bpf, indicated a medium stiff to very stiff consistency. Laboratory testing indicated these clays have a high plasticity with liquid limits ranging from 55 to 77 percent. Natural moisture contents ranged from 18.7 percent to 45.4 percent.

5.2.3 Strata C – Decomposed Limestone

Intermediate Geomaterial (IGM) consisting of decomposed limestone was identified in Unit 1-2 area borings, generally ranging from 3 feet to 5 feet in thickness above limestone bedrock. These materials were described as tan, light brown to brown, and yellow brown and typically stiff to hard in consistency.

5.3 Bedrock

Bedrock consisting predominantly of limestone was encountered in each boring at depths ranging from 2.2 feet to 25.0 feet with elevations ranging from El. 829.5 to El. 891.8, excluding possible karst or pinnacled areas that extended approximately 10 to 13 feet beyond adjacent depths in locations B-8 and WB-11. The limestone encountered was previously identified as belonging to one of three formations: Logana and Curdsville Members of Lexington Limestone or Tyrone Limestone of the High Bridge Group. A summary of encountered bedrock depths and elevations is presented in Table 4.1 and a laboratory data summary is presented in Table III-2 in Appendix III. Table 5.1 presents a summary of rock coring data. More information about bedrock and bedrock laboratory results can be found in the boring logs in Appendix II and laboratory results in Appendix III.

Table 5.1 – Rock Core Summary

Boring No.	Sample	Depth (ft)	Elevation (ft)	Core Length (ft)	Recovery (%)	RQD (%)	Rock type	Uniaxial Compressive Strength (psi)
B-01	RC-1	10.5	859.5	1	83	42	Limestone	-
B-01	RC-2	11.5	858.5	5	100	79	Limestone	-
B-01	RC-3	16.5	853.5	4	100	86	Limestone	-
B-02	RC-1	16.1	857.9	5	100	38	Limestone	-
B-02	RC-2	21.1	852.9	10	46	28	Limestone	-
B-02	RC-3	31.1	842.9	5	100	60	Limestone	-
B-03	RC-1	21.0	857	5	96	74	Limestone	-
B-03	RC-2	26.0	852	5	100	66	Limestone	-
B-04	RC-1	21.3	858.7	4.6	98	80	Limestone	-
B-04	RC-2	25.9	854.1	5	100	96	Limestone	-
B-04	RC-3	30.9	849.1	1.16	100	100	Limestone	-
B-05	RC-1	8.2	870.8	3.7	97	78	Limestone	-
B-05	RC-2	11.9	867.1	5	100	90	Limestone	13,108
B-05	RC-3	16.9	862.1	1.6	100	100	Limestone	-
B-06	RC-1	23.7	857.3	2.7	96	67	Limestone	-
B-06	RC-2	26.4	854.6	5	100	34	Limestone	-
B-06	RC-3	31.4	849.6	2.5	100	96	Limestone	-
B-06	RC-4	33.9	847.1	5	100	74	Limestone	-
B-07	RC-1	25.0	835	1.8	97	74	Limestone	-
B-07	RC-2	26.8	833.2	5	100	98	Limestone	-
B-07	RC-3	31.8	828.2	3.3	95	95	Limestone	-
B-08 A	RC-1	22.0	831.0	4	83	13	Limestone	-
B-08 A	RC-2	26.0	827.0	5	97	90	Limestone	-
B-08 A	RC-3	31.0	822.0	5	100	76	Limestone	-
B-09	RC-1	7.4	837.6	5	90	34	Limestone	-
B-09	RC-2	12.4	832.6	5	100	68	Limestone	-
B-09	RC-3	17.4	827.6	5	100	78	Limestone	-
B-10	RC-1	7.0	837.0	5	96	72	Limestone	-
B-10	RC-2	12.0	832.0	5	100	94	Limestone	-

Boring No.	Sample	Depth (ft)	Elevation (ft)	Core Length (ft)	Recovery (%)	RQD (%)	Rock type	Uniaxial Compressive Strength (psi)
B-11	RC-1	14.5	848.5	1.5	100	100	Limestone	-
B-11	RC-2	16.0	847.0	5	100	97	Limestone	9,332
B-11	RC-3	21.0	842.0	3.58	100	91	Limestone	-
WB-01	RC-1	2.6	892.4	5	82	42	Limestone	-
WB-01	RC-2	7.6	887.4	5	64	36	Limestone	-
WB-01	RC-3	12.6	882.4	5	100	94	Limestone	-
WB-02	RC-1	5.5	891.5	10	82	39	Limestone	-
WB-02	RC-2	15.5	881.5	5	100	84	Limestone	-
WB-03	RC-1	10.0	882.0	10	88	63	Limestone	10,986
WB-04	RC-1	7.3	878.7	10	90	59	Limestone	-
WB-05	RC-1	6.2	877.8	10	94	61	Limestone	-
WB-06	RC-1	6.5	893.5	5	62	14	Limestone	-
WB-06	RC-2	11.5	888.5	5	80	26	Limestone	-
WB-06	RC-3	16.5	883.5	4.8	100	50	Limestone	-
WB-06	RC-4	21.3	878.7	5.2	92	73	Limestone	-
WB-07	RC-1	9.0	856.0	10	97	64	Limestone	-
WB-08	RC-1	4.5	854.5	10	98	70	Limestone	-
WB-09	RC-1	8.2	852.8	8	99	91	Limestone	-
WB-09	RC-2	16.2	844.8	2	100	100	Limestone	-
WB-10	RC-1	6.0	857.0	10	95	79	Limestone	-
WB-11	RC-1	19.8	864.2	2.5	92	48	Limestone	-
WB-11 A	RC-1	10.7	873.3	5	98	76	Limestone	-
WB-11 A	RC-2	15.7	868.3	5	96	60	Limestone	-

6.0 Site Seismicity

6.1 Unit 1-2 Area

Based on the subsurface stratigraphy encountered at the project site between ground surface and estimated to 100 feet below existing grade, it is the opinion of S&ME that this site is best characterized by International Building Code Site Class C based on average N-values ($\bar{N}$) from each boring and shear wave velocities ($\bar{V}_s$)

determined by downhole seismic testing performed on boring B-4. However, locations B-3 and B-8 within Unit 1-2 are best characterized by Site Class D. Additionally, areas receiving planned fills, such as B-8 and east of B-10, should be reevaluated for site class after construction. Table 6.1 summarizes site coefficients and spectral response parameters for this site referencing ASCE 7 design code and considering Risk Category II.

Table 6.1 – Site Coefficients and Spectral Response Acceleration Parameters

Boring	Site Class	S_s	S_1	F_a	F_v	PGA_M	S_{DS}	S_{D1}
General Site	C	0.181g	0.094g	1.2	1.7	0.1	0.145g	0.107g
B-3 and B-8	D	0.181g	0.094g	1.6	2.4	0.134	0.193g	0.151g

6.2 Webb Farm Area

Based on the subsurface stratigraphy encountered at the project site between ground surface and estimated to 100 feet below existing grade, it is the opinion of S&ME that this site is best characterized by International Building Code Site Class C based on average N-values ($\bar{N}$) from each boring and shear wave velocities ($\bar{V}_s$) determined by downhole seismic testing performed on boring WB-3. Site Class B is only applicable to areas having less than 10 feet of soil/subgrade between bedrock and foundations. Table 6.2 summarizes site coefficients and spectral response parameters for this site referencing ASCE 7 design code and considering Risk Category II.

Table 6.2 – Site Coefficients and Spectral Response Acceleration Parameters

Boring	Site Class	S_s	S_1	F_a	F_v	PGA_M	S_{DS}	S_{D1}
Shallow bedrock (< 10 feet)	B	0.181g	0.094	1	1	.084	0.121g	0.063g
General Site	C	0.181g	0.094g	1.2	1.7	0.1	0.145g	0.107g

6.3 Downhole Seismic Geophysical Services

On January 26, 2023, S&ME performed downhole seismic surveys within borings *B-04 (Units 1 & 2)* and *WB-03 (Webb Farm)* in general accordance with ASTM D7400 "*Standard Test Methods for Downhole Seismic Testing*" using a Geometrics seismograph and 14 Hz downhole triaxial geophone. Energy for the seismic survey was generated by a 16-pound sledgehammer striking opposing ends of a wooden plank for obtaining surface wave measurements and a metal plate for P-wave measurements. Seismic velocities were obtained to a depth of about 28 feet for *B-04* and 18 feet for *WB-03* using recorded depth intervals of 3 feet. Data analysis was conducted using the OYO Corporation's SeisImager™/SW software (*Pickwin™*) and the resulting shear wave velocity profiles for *B-04* and *WB-03* are presented in Appendix II.

6.3.1 Geophysical Limitations

Regardless of the thoroughness of a geophysical survey, there is always a possibility that actual conditions may not match the interpretations. The results should be considered accurate only to the degree implied by the method used and the method's limitations and data coverage. In addition, site activity (e.g., heavy traffic, etc.) and overhead powerlines can cause noise/interference in downhole seismic data sets.

7.0 Discussion and Recommendations

Based on the conditions encountered and the expected foundation types, S&ME has identified some areas of concern.

7.1 Construction Concerns

7.1.1 Possible Karst Areas

As mentioned in Section 3, the surrounding areas contain abundant natural karst features. Borings B-8 and WB-11 encountered significant variations in bedrock elevation within several feet of an offset boring, which could be evidence of a potential, and previously unknown, karst feature. Unknown karst features can cause catastrophic failures beneath buildings and structures. We recommend further exploration of potential construction footprints through the use of rock soundings/corings, geophysical methods (e.g., MASW or ERT), or both to assist in delineating potential karst hazards.

7.1.2 Large Fills and Cuts

Based on an approximated final grade near El. 852 and El. 845, we anticipate fills up to 12 feet will be required for the footprints of the cooling tower basin (B-7 and B-8), demineralization tank (B-9), fire/service water tank (B-10), and GSU transformers (B-11). Additionally, existing site grades for the heat recovery steam generator (B-1), single shaft CT/ST generator (B-2), turbine building (B-3, B-4, and B-5), and gas compressors (B-6) range from El. 870 to El. 881, with bedrock ranging from El. 857 to El. 871 and approximately 8 to 25 feet of soil overburden. To achieve the planned grade shown on the preliminary site plan, provided in the SOW, excavation efforts may include soil and rock excavation.

7.1.3 High Plasticity Clays

High plasticity, fat, clays (LL > 50) were encountered throughout the site. These soils are more susceptible to swelling and shrinking with changes in ground moisture as well as losing strength if exposed to construction traffic during wet weather. Typical site solutions include removal, capping, or chemical treatment.

7.2 Site Preparation

Unit 1-2 construction will require the relocation of existing transmission lines in the valley north of the coal pile area. Recommendations for the transmission lines were beyond the scope of this report.

7.2.1 Stripping

Initial site preparation should include stripping of topsoil, root balls, and other vegetation. Any unstable-near surface soils revealed during stripping may also require in place remediation or removal. Soft soils were not encountered in our borings; however, some stripping should be expected in areas of utilities.

7.2.2 Removal of Existing Structures

Existing structures and utilities are present at both the Unit 1-2 and Webb Farm areas. These structures include existing control buildings and cooling towers near Unit 1-2 and a previously demolished farmhouse and barn in the Webb Farm area. Any structures encountered during grading should be demolished and removed, including shallow foundations, and backfilled with engineered fill.

7.2.3 High Moisture Contents

Natural Moisture contents of the uppermost fat clay soils (soils ranging in depth between the surface and about 10 feet) were reported between about 18 percent and 40 percent for Unit 1-2 borings and between about 29 percent and 41 percent in the Webb Farm area, generally well above the lab reported optimum moisture content of 17.3 percent to 20.0 percent, respectively. Excess moisture in clayey soils can lead to poor site conditions (i.e., rutting, pumping, excavation difficulty, etc.) difficult fill placement and proper compaction, weakened bearing capacities, and excessive differential or total settlement.

7.2.4 High Plasticity Clays

Liquid limits ranging from 42 to 77 percent were encountered onsite. Chemical treatment of these soils may be necessary to prevent swelling and/or shrinking within the construction footprint and/or to achieve proper compaction.

7.2.5 Proofrolling/Subgrade Repair Methods

Following stripping, undercutting of any unstable surface soils, and/or necessary excavation to obtain the design subgrades, the exposed subgrade should be proofrolled with a heavily loaded tandem-axle dump truck or similar rubber-tired equipment under the observation of the Geotechnical Engineer. The proofrolling will help reveal the presence of unstable or otherwise unsuitable surface materials through pumping and rutting. Areas that are unstable should be undercut as recommended by the Geotechnical Engineer. Further evaluation with hand auger borings and/or backhoe excavated test pits could also be required if unexpected conditions are encountered or for areas not accessible to proofrolling equipment.

The exposed subgrade soil of both excavation and fill areas can deteriorate when exposed to construction activity and environmental changes such as freezing, erosion, softening from ponded rainwater, and rutting from construction equipment. We recommend the exposed subgrade surfaces that have deteriorated be properly repaired by one of the following methods:

- scarifying, aerating, and recompacting;

- over excavating and replacing with compacted suitable fill;
- using a geogrid on top of the subgrade in connection with granular base; or,
- using chemical stabilization techniques.

The determination of which of the four methods is appropriate for remediation of weak portions of the subgrade could be best determined by an S&ME representative witnessing a prooffroll.

7.3 Excavation

Excavation of near surface on-site soils will primarily consist of medium stiff to very stiff cohesive soils (Lean Clay – CL, Fat Clay – CH). Sloughing and caving should be anticipated when excavations extend into/through granular or weaker (i.e., very soft to soft) cohesive seams and layers. All excavations should be laid back or braced in accordance with the most recent OSHA excavation rules and regulations.

Excavation into IGM and/or rock may be required if determined by the final grading plans. If IGM/bedrock is encountered above planned final grade, the contractor should be prepared to break up and remove the IGM/rock, if necessary. Where IGM/bedrock may be shallower, it may be beneficial for the contractor to perform additional exploratory test pits to better verify the competency of the IGM/bedrock and the depth to which excavations can be performed using conventional methods. **It should be emphasized that a direct correlation should not be made between the performance of the drilling rig and the ability of construction equipment to excavate the IGM/bedrock at this site.** Depending on final design invert elevations, the contractor should be prepared to use other rock excavation techniques (i.e., hydraulic splitting, pneumatic, blasting, or other) should they become necessary.

7.3.1 Groundwater Considerations

Groundwater or seepage was encountered in borings B-2, B-3, B-5, B-6, and B-9 at the time of drilling at depths ranging between 5.5 feet and 16.4 feet. Based on the high moisture contents encountered in our borings and depending on the time of year for construction, it should be anticipated that a limited amount of groundwater seepage and/or surface water runoff may be encountered during excavations or soil augering. We anticipate groundwater, if encountered, will most likely be present at or near the bedrock interface. The presence of water in excavations, coupled with construction activity, will soften and weaken cohesive soils present at the bottom of the excavations, and these affected materials may cause settlement beneath a structure following backfilling. Therefore, the bottom of the excavations and shafts should be kept free of standing water, and any softened, weakened, or disturbed materials should be removed and replaced with select granular backfill or flowable fill.

If pumping from a system of sumps and pumps cannot sufficiently maintain the water level below plan bearing elevations, then more extensive dewatering techniques, such as wells or a well-point system may be necessary for dewatering.

S&ME recommends that construction dewatering and the release of pumped groundwater be performed in accordance with all applicable Federal, State, and Local requirements.

7.3.2 Excavation Regulations

All excavations, as a minimum, should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is solely responsible for site safety. This information is provided only as a service and under no circumstances should S&ME be assumed to be responsible for construction site safety.

The near surface clays (residual soils to bedrock) typically classify as Type A and B soils according to the OSHA guidelines, provided the soil is not subjected to vibration and remains dry. The soil slopes for short term excavations during construction for Type A soils can be cut to a maximum ¾H:1V (horizontal to vertical) to the existing ground surface. Type B soils can be cut to a maximum of 1H:1V (horizontal to vertical) to the existing ground surface. Flatter slopes are allowed, but the excavated slopes should not be steeper than the OSHA guidelines. As excavations are made, the competent person in charge of operations should evaluate the soils to determine the appropriate benching or shoring methods required per OSHA guidelines. Granular soils (e.g., sand and gravel) should be excavated/shored according to the OSHA guidelines.

7.3.3 Structural Fill Placement

Undercut areas and/or areas requiring structural fill, should be raised to the design subgrade elevation with materials with the following minimum requirements:

- Fill should be free of deleterious materials and rock fragments greater than 4 inches in diameter;
- Uniformly spread in 6- to 8-inch thick loose lifts;
- Clay soil used as fill should be compacted to at least 95 percent of the soil's maximum dry density, as determined by a laboratory Modified Proctor compaction test (ASTM D-1557). See Appendix III for our laboratory results;
- If a clean granular soil (sand) is used as fill, it may not be possible to determine a maximum unit weight using ASTM D-698. In this case, soils should be tested in accordance with ASTM D-4254, and a minimum relative density of 85% should be achieved or compaction should be controlled by test strips performed in the field at the time of placement;
- The moisture content should be controlled to within +/- 2 to 3 percent of optimum moisture content, depending on the moisture-density curve of the specific soil being placed.
- Fill placement should be monitored by a qualified Materials Technician working under the direction of the Geotechnical Engineer. In addition to this visual evaluation, the Technician should perform a sufficient amount of in-place field density tests to confirm that the required degree of compaction is being attained.
- Settlement plates may also be warranted due to the planned fill heights. The final determination of whether settlement plates and monitoring are needed should be determined after final grades are established. At that time, the final geotechnical exploration and design should include the number of settlement plates and locations, if warranted.

Based on the planned maximum slope of 3:1 (H:V) slope stability analyses have not been performed at this time.

7.3.4 Use of Excavated Soils as Fill

Based on the results of our exploration and laboratory testing, the on-site soils are typically adequate for use as structural soil fill. However, high plasticity soils (i.e., Fat Clay – CH) should be at least 3 feet below the planned surface or structural component or chemically stabilized. Additionally, in-situ moisture content of these soils was measured to typically be well above (> +3%) the optimum moisture content for compaction at the time the exploration was performed. The moisture content of these soils will fluctuate with prevailing weather conditions prior to and at the time of grading. If the soils are stockpiled, they should be protected from precipitation. Some moisture adjustment (wetting or drying) could be required to achieve the recommended degree of compaction at the time of placement. Table 7.1 below summarizes the results of bulk sample laboratory testing.

Table 7.1 – Summary of Bulk Sample Laboratory Testing

Boring	Sampled Depth (ft)	Soil Type	Modified Proctor Maximum Dry Density (pcf)	Optimum Moisture	Natural Moisture	Plasticity Index	CBR Value
B-4	5.0 to 10.0	FAT CLAY (CH)	112.8	17.3	27.7	54 [1]	4.6
WB-9	1.0 to 5.0	FAT CLAY with SAND (CH)	107.6	20.0	35.7	39	-

[1] Based on similar materials tested in B-10 from a depth of 3.0 to 5.0 feet.

Prior to use as fill, both natural soil and existing soil fill should be evaluated by the Geotechnical Engineer to assess the adequacy for use.

Soils containing organic matter should not be used in structural fill areas. Organic laden soils should be wasted off-site or placed in any nonstructural "green" areas.

7.3.5 Use of Off-Site Borrow Materials as Fill

Imported fill used for site grading should consist of a clean (free of organics and debris), low plasticity soil (Liquid Limit less than 50, Plasticity Index less than 15) with moist (total) unit weight of at least 100 pcf and be evaluated by a Geotechnical Engineer prior to use. Depending on subgrade stability and the amount of borrow material needed, crushed stone, such as DGA, could be required.

7.4 Foundation Recommendations

The following **preliminary** recommendations apply to both Unit 1-2 and Webb Farm areas for structures bearing on deep or shallow foundations.

7.4.1 Drilled Shafts

The tables attached in Appendix IV of this report present design parameters for axial capacity analyses and lateral (LPILE) analyses. These parameters are also applicable to micropiles and should be used by the structural engineer to determine the final depth of embedment coupled with the recommendations given in this report.

Drilled shafts will develop axial capacity from a combination of skin friction along the length of the pile and end bearing at the tip. The soil coefficients used in our axial capacity analyses were developed using published correlations relating soil skin friction and end bearing unit capacities to SPT N-values and to the laboratory strength results, and our experience with similar projects/foundations in similar geologic settings. The uplift capacity for shafts can be determined using the dead load of the deep foundation unit and the skin friction values along the sides of the foundation. The buoyant unit weight of concrete should be used below the groundwater levels as noted on each provided table.

Skin friction calculations are cumulative, generally neglecting the upper three (3) to four (4) feet. The provided net allowable bearing pressure and allowable skin friction values are based on a factor of safety of at least 3.0 and 2.0, respectively, with the understanding that load testing will not be performed. Structural capacity of drilled shafts should be evaluated by a structural engineer.

Drilled shaft design parameters were provided with the following considerations:

- Tip elevations for all drilled shaft foundations are expected to extend into underlying hard limestone bedrock of varying depth. See the Axial Capacity/LPILE Tables presented in Appendix IV of this report with recommended soil parameters.
- Lateral analyses will be performed by others using the geotechnical parameters provided in the attached Axial Capacity/LPILE Tables located in Appendix IV. These parameters may be used to perform analyses using the LPILE computer program. Some of the parameters may not be required, depending on the version of the program being used. Lateral capacity analyses for foundation elements were beyond the scope of our services and have not been conducted.

7.4.2 Micropile Foundations

Based on our experience in the area and understanding of the project, we anticipate micropiles extending into bedrock can be utilized for deep foundation support at the site. Micropiles are small (typically less than 12-inch) diameter, reinforced, low displacement grout-in-place piles. Typical installation of micropiles requires the installation and advancement of temporary, or permanent, casing and drilling tools through soil overburden to rock or through weaker soil strata to bearing depth. The casing is then tremie grouted and reinforced with a rebar cage or single large diameter steel bar to provide lateral support to the pile. The pile is then typically grouted under pressure and the casing is retracted forming a grout to ground bond zone, depending on the type and use of the micropile, the casing may be plunged into the grout zone for additional lateral reinforcement. Pile support is primarily achieved by the frictional grout to ground resistance along the uncased portion of the pile to the adjacent soil. Due to the installation method, tip resistance is typically a small percentage of the total load carrying capacity. Additionally, significantly more downward movement of the pile is required to mobilize the tip resistance

in comparison to the side shear resistance. As such, it is recommended that only the side shear resistance of the pile be used to estimate the required depth of the pile.

Micropile design parameters were provided with the following considerations:

- Micropile foundations for the planned structures should extend through the site fills, native lean to fat clays, and decomposed to highly weathered rock strata to bear within the hard underlying limestone bedrock. For the purpose of this report, side resistance between pile and newly placed soil fills (up to 12 feet below grade) has been reduced.
- S&ME performed analyses for the use of micropiles to support the planned NGCC structures in general accordance with the procedures and guidance provided in FHWA NHI-05-039 "Micropile Design and Construction" as published by the Federal Highway Administration (FHWA) in December 2005; however detailed loading information is not available. Our recommended axial resistances and lateral design parameters presented for these foundations are based on our laboratory evaluation of the on-site soils and our experience with similar projects/foundations in similar geologic settings. Appendix IV presents general design parameters for axial capacity analyses and lateral (LPILE) analyses, to be performed by others.
- Micropiles should also be spaced at least 3-diameters from the nearest adjacent micropile.
- We recommend micropiles be installed as Type A, tremie/gravity grouted piles, or Type B, pressure grouted piles. Casing may either be temporary or permanent based on the lateral design; however, pile design will be the responsibility of the pile contractor.

7.4.3 Shallow Foundation Support

Based on the preliminary estimates for soil pressures and footprints provided by LGE-KU and summarized in Table 2.2, S&ME anticipates structures bearing on shallow foundations (e.g., mat foundations) will have total settlements ranging from about 1-inch to over 6-inches within Unit 1-2 and less than 1-inch within Webb Farm. Therefore, we anticipate the final design for shallow foundations will be settlement-controlled within Unit 1-2.

7.4.4 Slabs-on-Grade

Slabs on grade should be evaluated individually based on dimensions of the planned floor area, expected deformation, and final grade elevation. Based on the soils encountered onsite, we recommend slabs on grade bear on a compacted granular aggregate overlying native, or newly placed and compacted, lean clays. Fat clays underlying slabs should be chemically stabilized.

7.4.5 Retaining Walls and Sub-Level Walls

Below-grade portions of proposed structures, or walls acting as retaining walls, should be designed to withstand lateral earth pressures, as well as hydrostatic pressures, which may develop behind the walls. If it is anticipated that the walls of the proposed structures will be fixed at both the top and bottom preventing significant lateral deflections or rotations from occurring, then an "at-rest" earth pressure condition exists. If the walls can deflect a distance of at least 0.1 percent of their height, then an "active" earth pressure condition may be assumed for

design purposes. The magnitude of lateral earth pressures varies based on soil type, permissible wall movement, and configuration of backfill.

Because cohesive soils and granular soils with significant clay content can cause high magnitudes of lateral loads due to creep and swelling pressures, it is recommended that these materials not be used to backfill against below-grade walls. It is recommended that a free-draining granular material such as dense-graded aggregate (DGA) or a coarse angular gravel such as No. 57 limestone, be used as backfill against below-grade walls. This granular zone should be drained so that hydrostatic pressures do not develop against the wall, otherwise, the wall should be designed for hydrostatic loading. Additionally, we recommend granular backfill be placed at a minimum in a wedge formed by the back of the wall and a line rising from the base of the wall at a maximum 60-degree angle from the horizontal. It is unknown at this time what material type will be used behind the below-grade walls. Design parameters for the various conditions are presented in Table 7.2 below.

Table 7.2 – Lateral Earth Pressure Coefficients

Material	Unit Weight (γ, pcf)	Effective Friction Angle (Φ')	Active (K_a)	At-Rest (K_o)	Passive (K_p)
Fat Clays [1]	115 to 120	29°	0.35	0.59	2.89
Compacted No. 57 Stone	125	40°	0.22	0.36	4.60

[1] Use of fat clays is not recommended as backfill for retaining or below-grade walls.

It is likely temporary shoring will be needed for below-grade excavations especially where excavations are adjacent to and potentially extend below existing adjacent structures. The design of temporary shoring is beyond the scope of our work.

8.0 Limitations of Report

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty, either express or implied, is made.

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction.

conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

S&ME should be retained to perform a final geotechnical exploration and to review the final plans and specifications to confirm that earthwork and other recommendations are properly interpreted and implemented.

For more information on the use and limitations of this report, please read the Geoprofessional Business Association (GBA) document that follows this page.

Important Information About Your
Geotechnical Engineering Report

Variations in subsurface conditions can be a principal cause of construction delays, cost overruns and claims. The following information is provided to assist you in understanding and managing the risk of these variations.

Geotechnical Findings Are Professional Opinions

Geotechnical engineers cannot specify material properties as other design engineers do. Geotechnical material properties have a far broader range on a given site than any manufactured construction material, and some geotechnical material properties may change over time because of exposure to air and water, or human activity.

Site exploration identifies subsurface conditions at the time of exploration and only at the points where subsurface tests are performed or samples obtained. Geotechnical engineers review field and laboratory data and then apply their judgment to render professional opinions about site subsurface conditions. Their recommendations rely upon these professional opinions. Variations in the vertical and lateral extent of subsurface materials may be encountered during construction that significantly impact construction schedules, methods and material volumes. While higher levels of subsurface exploration can mitigate the risk of encountering unanticipated subsurface conditions, no level of subsurface exploration can eliminate this risk.

Geotechnical Findings Are Professional Opinions

Professional geotechnical engineering judgment is required to develop a geotechnical exploration scope to obtain information necessary to support design and construction. A number of unique project factors are considered in developing the scope of geotechnical services, such as the exploration objective; the location, type, size and weight of the proposed structure; proposed site grades and improvements; the construction schedule and sequence; and the site geology.

Geotechnical engineers apply their experience with construction methods, subsurface conditions and exploration methods to develop the exploration scope. The scope of each exploration is unique based on available project and site information. Incomplete project information or constraints on the scope of exploration increases the risk of variations in subsurface conditions not being identified and addressed in the geotechnical report.

Services Are Performed for Specific Projects

Because the scope of each geotechnical exploration is unique, each geotechnical report is unique. Subsurface conditions are explored and recommendations are made for a specific project.

Subsurface information and recommendations may not be adequate for other uses. Changes in a proposed structure location, foundation loads, grades, schedule, etc. may require additional geotechnical exploration, analyses, and consultation. The geotechnical engineer should be consulted to determine if additional services are required in response to changes in proposed construction, location, loads, grades, schedule, etc.

Geo-Environmental Issues

The equipment, techniques, and personnel used to perform a geo-environmental study differ significantly from those used for a geotechnical exploration. Indications of environmental contamination may be encountered incidental to performance of a geotechnical exploration but go unrecognized. Determination of the presence, type or extent of environmental contamination is beyond the scope of a geotechnical exploration.

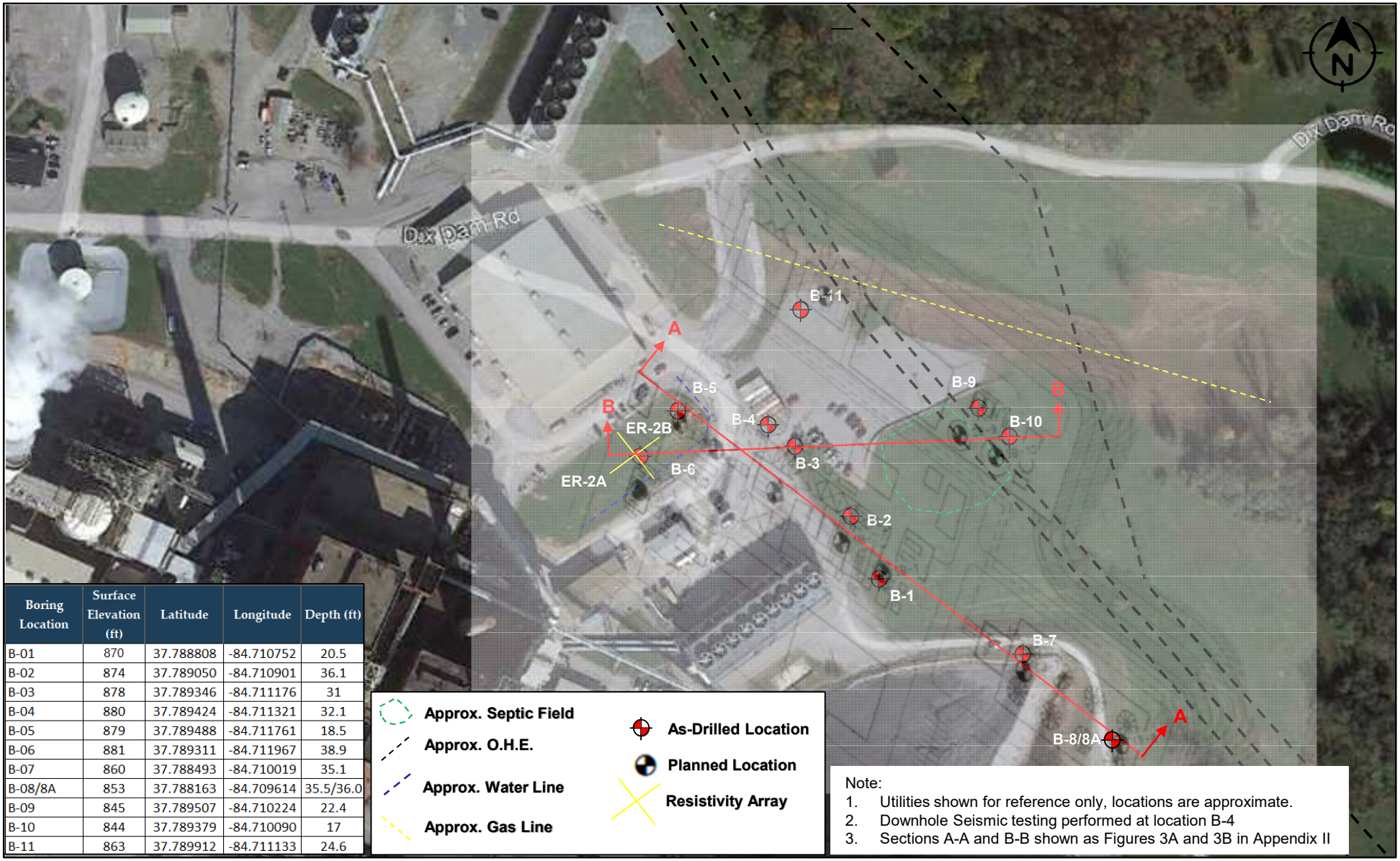
Geotechnical Recommendations Are Not Final

Recommendations are developed based on the geotechnical engineer's understanding of the proposed construction and professional opinion of site subsurface conditions. Observations and tests must be performed during construction to confirm subsurface conditions exposed by construction excavations are consistent with those assumed in development of recommendations. It is advisable to retain the geotechnical engineer that performed the exploration and developed the geotechnical recommendations to conduct tests and observations during construction. This may reduce the risk that variations in subsurface conditions will not be addressed as recommended in the geotechnical report.

Appendices

Appendix I – Project Location Map / Boring - Seismic Location Plan

	Site Location Plan	SCALE: As Shown	FIGURE NO. 1
	E.W. Brown Generating Station Harrodsburg, Kentucky	DATE: 4/6/2023 PROJECT NUMBER 22360136	



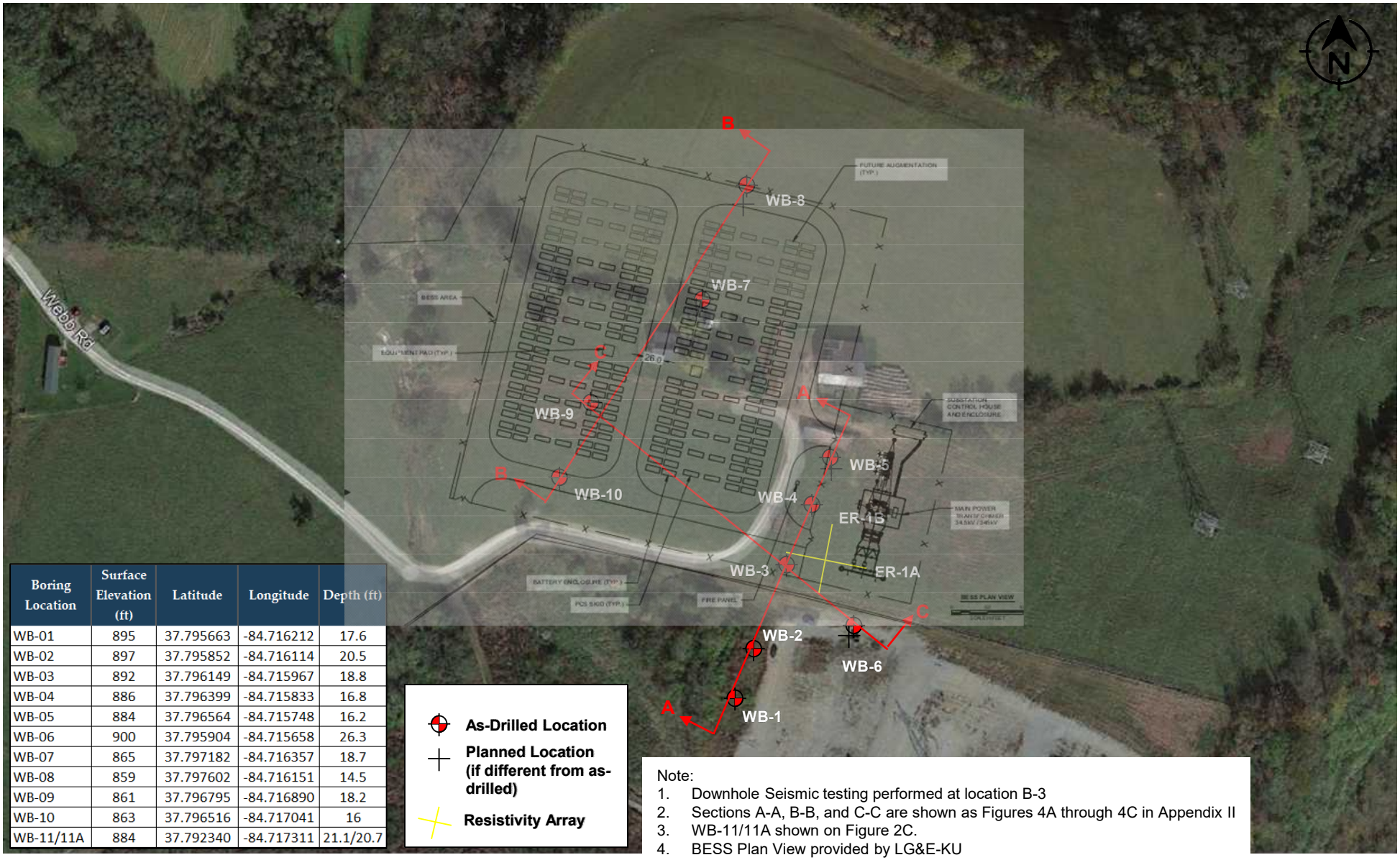
Boring Location	Surface Elevation (ft)	Latitude	Longitude	Depth (ft)
B-01	870	37.788808	-84.710752	20.5
B-02	874	37.789050	-84.710901	36.1
B-03	878	37.789346	-84.711176	31
B-04	880	37.789424	-84.711321	32.1
B-05	879	37.789488	-84.711761	18.5
B-06	881	37.789311	-84.711967	38.9
B-07	860	37.788493	-84.710019	35.1
B-08/8A	853	37.788163	-84.709614	35.5/36.0
B-09	845	37.789507	-84.710224	22.4
B-10	844	37.789379	-84.710090	17
B-11	863	37.789912	-84.711133	24.6

Note:
1. Utilities shown for reference only, locations are approximate.
2. Downhole Seismic testing performed at location B-4
3. Sections A-A and B-B shown as Figures 3A and 3B in Appendix II

Boring / Seismic Location Plan

E.W. Brown Generating Station – Units 1-2
Harrodsburg, Mercer County, Kentucky

SCALE:	FIGURE NO.
As Shown	2A
DATE:	
4/20/2023	
PROJECT NUMBER	
22360136	



Boring Location	Surface Elevation (ft)	Latitude	Longitude	Depth (ft)
WB-01	895	37.795663	-84.716212	17.6
WB-02	897	37.795852	-84.716114	20.5
WB-03	892	37.796149	-84.715967	18.8
WB-04	886	37.796399	-84.715833	16.8
WB-05	884	37.796564	-84.715748	16.2
WB-06	900	37.795904	-84.715658	26.3
WB-07	865	37.797182	-84.716357	18.7
WB-08	859	37.797602	-84.716151	14.5
WB-09	861	37.796795	-84.716890	18.2
WB-10	863	37.796516	-84.717041	16
WB-11/11A	884	37.792340	-84.717311	21.1/20.7

Note:
1. Downhole Seismic testing performed at location B-3
2. Sections A-A, B-B, and C-C are shown as Figures 4A through 4C in Appendix II
3. WB-11/11A shown on Figure 2C.
4. BESS Plan View provided by LG&E-KU

Boring / Seismic Location Plan

E.W. Brown Generating Station – Webb Farm Area
Harrodsburg, Mercer County, Kentucky

SCALE:	FIGURE NO.
As Shown	2B
DATE:	
4/20/2023	
PROJECT NUMBER	
22360136	

Boring Location	Surface Elevation (ft)	Latitude	Longitude	Depth (ft)
WB-01	895	37.795663	-84.716212	17.6
WB-02	897	37.795852	-84.716114	20.5
WB-03	892	37.796149	-84.715967	18.8
WB-04	886	37.796399	-84.715833	16.8
WB-05	884	37.796564	-84.715748	16.2
WB-06	900	37.795904	-84.715658	26.3
WB-07	865	37.797182	-84.716357	18.7
WB-08	859	37.797602	-84.716151	14.5
WB-09	861	37.796795	-84.716890	18.2
WB-10	863	37.796516	-84.717041	16
WB-11/11A	884	37.792340	-84.717311	21.1/20.7

Boring / Seismic Location Plan

E.W. Brown Generating Station – Webb Farm Area
Harrodsburg, Mercer County, Kentucky

SCALE:	FIGURE NO.
As Shown	2C
DATE:	
4/20/2023	
PROJECT NUMBER	
22360136	

Appendix II – Test Boring Log Legend / Boring Logs / Rock Core Photo Logs / Site Photos

TEST BORING LOG LEGEND

FINE AND COARSE GRAINED SOIL INFORMATION

COARSE GRAINED SOILS (SANDS AND GRAVELS)

N	Relative Density
0-4	Very Loose
5-10	Loose
11-30	Medium Dense
31-50	Dense
Over 50	Very Dense

FINE GRAINED SOILS (CLAYS AND SILTS)

N	Consistency
0-2	Very Soft
3-4	Soft
5-8	Medium Stiff
9-15	Stiff
16-30	Very Stiff
Over 30	Hard

PARTICLE SIZE

Boulders	Greater than 300 mm (12")
Cobbles	75 mm—300 mm (3-12")
Gravel	4.75 mm—75 mm (3/16-3")
Coarse Sand	2 mm—4.74 mm
Medium Sand	.425 mm—2 mm
Fine Sand	0.075 mm—0.425 mm
Silts and Clays	Less than 0.075 mm

The STANDARD PENETRATION TEST as defined by ASTM D 1586 is a method to obtain a disturbed soil sample for examination and testing and to obtain relative density and consistency information. A standard 1.4-inch I.D. / 2.0-inch O.D. split barrel sampler is driven three 6-inch increments with a 140 lb. hammer falling 30 inches. The hammer can either be of a trip, free-fall design, or actuated by a rope and cathead. The blow counts required to drive the sampler the final two 6-inch increments are added together and designated the N-value defined in the above tables.

ROCK PROPERTIES

RQD

Percent RQD	Quality
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

ROCK HARDNESS

Very Hard	Rock can be broken by heavy hammer blows.
Hard	Rock cannot be broken by thumb pressure, but can be broken by moderate hammer blows.
Moderately Hard	Small pieces can be broken off along sharp edges by considerable thumb pressure; can be broken with light hammer blows.
Soft	Rock is coherent but breaks very easily with thumb pressure at sharp edges and crumbles with firm hand pressure.
Very Soft	Rock disintegrates or easily compresses when touched; can be hard to very hard soil.

KEY

Undisturbed Sample

Standard Penetration Test Sample

Rock Core Sample

Core Diameter (I.D.)	Inches
BQ	1-7/16
NQ	1-7/8
HQ	2-1/2

$$\text{RQD} = \frac{\text{Sum of 4" and Longer Rock Pieces Recovered}}{\text{Length of Core Run}} \times 100$$

(Rock Quality Designation)

$$\text{REC} = \frac{\text{Length of Rock Core Recovered}}{\text{Length of Core Run}} \times 100$$

(Recovery)

SOIL PROPERTY SYMBOLS

N	Standard Penetration, BPF
NMC	Natural Moisture Content, %
LL	Liquid Limit, %
PL	Plastic Limit, %
PI	Plasticity Index, %
PPV	Pocket Penetrometer Value, TSF
Qu	Unconfined Compressive Strength, TSF
Yd	Dry Unit Weight, PCF
F	Fines Content

PLATE 3

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: B-01
Sheet 1 of 1

DATE DRILLED: 12/06/2022	**ELEVATION:** 870 ft	**NOTES:** Unit 1-2 Area
DRILL RIG: Diedrich D-50 (ATC)	**DATUM:** NAVD88	
DRILLER: Tim Frost	**BORING DEPTH:** 20.5 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Nick Jones	**LATITUDE:** 37.788808 **LONGITUDE:** -84.710752
SAMPLING METHOD: RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0					TOPSOIL, 5 inches			870
0.4		Residuum			LEAN CLAY (CL), limestone fragments, Hydrovacuum Excavation (visual)			
5								865
7.0				SPT-1 (24 in)	IGM stiff to very hard, tan and light gray, highly weathered to decomposed limestone	1-3-5-9 N = 8	●	
10	Auger refusal at 10.3 feet			SPT-2 (12 in)		7-11-50/5" N = 50/5"	●	860
10.5		Curdsville Limestone		RC-1 REC-83% RQD-42%	LIMESTONE AND CHERT, light gray, very thinly bedded, fine, Highly fractured jointed, slightly weathered to moderately weathered, hard, Curdsville Limestone			
15				RC-2 REC-100% RQD-79%				855
16.5				RC-3 REC-100% RQD-86%	LIMESTONE AND SHALE, light gray and greenish gray, thinly bedded bedded, very fine, Highly fractured to Moderately fractured jointed, slightly weathered to unweathered, hard, Curdsville Limestone			
20								850
20.5					Borehole terminated at 20.5 feet			
25								845
30								840
35								835
40								830

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	12/06/2022		Not encountered
END OF DRILLING	▼	12/06/2022		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: B-02
Sheet 1 of 1

DATE DRILLED: 12/01/2022	**ELEVATION:** 874 ft	**NOTES:** Unit 1-2 Area
DRILL RIG: Diedrich D-50 (ATC)	**DATUM:** NAVD88	
DRILLER: Tim Frost	**BORING DEPTH:** 36.1 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Deron Zierer	**LATITUDE:** 37.789050 **LONGITUDE:** -84.710901
SAMPLING METHOD: SS, UD, RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0								874
				SPT-1 (6 in)	TOPSOIL, 5 inches	2-2-4		
	0.4	Fill		SPT-2 (10 in)	LEAN CLAY (CL), limestone fragments, medium stiff to very stiff, red brown, slightly moist, iron oxide staining	N = 6		
				UD-1		11-12-13		
5				REC-100%		N = 25		869
				SPT-3 (10 in)		4-6-6		
	6.5			SPT-4 (10 in)	FAT CLAY (CH), medium stiff to very stiff, light brown and red brown, mottled, moist	N = 12		
				SPT-5 (10 in)		6-8-8		
10		Residuum		SPT-6 (10 in)		N = 16		864
				SPT-7 (8 in)		2-3-4		
	13.0			SPT-8 (10 in)	IGM stiff to very hard, pale gray, fine to medium grained, relict structure, highly weathered to decomposed limestone	N = 7		
15				SPT-9 (10 in)		2-2-3		859
	Auger refusal at 16.1 feet			SPT-10 (5 in)	LIMESTONE, pale gray to light gray, very thinly bedded, slightly weathered, hard, Curdsville Limestone	N = 5		
	16.1			RC-1 REC-100% RQD-38%		6-5-6		
	17.8				LIMESTONE AND CHERT, light gray, thinly bedded, very fine grained, very close jointed, moderately weathered, hard, Curdsville Limestone	N = 11		
20	19.6					5-8-6		854
					LIMESTONE, pale gray to light gray, very thinly bedded, slightly weathered, hard, Curdsville Limestone	N = 14		
					clay filled void	10-12-14		
						N = 26		
		Curdsville Limestone				18-50/1"		
25	24.3 ▽			RC-2 REC-46% RQD-28%		N = 50/1"		849
					LIMESTONE AND CALCAREOUS SHALE, pale gray to light gray, very thinly bedded, slightly weathered to unweathered, hard, Shale partings throughout, Curdsville Limestone			
30								844
				RC-3 REC-100% RQD-60%				
35								839
	36.1				Borehole terminated at 36.1 feet			
40								834

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	12/01/2022		Not encountered
END OF DRILLING	▼	12/01/2022	26.2	Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: B-03

Sheet 1 of 1

DATE DRILLED: 11/30/2022
ELEVATION: 878 ft
NOTES: Unit 1-2 Area
DRILL RIG: Diedrich D-50 (ATC)
DATUM: NAVD88
DRILLER: Tim Frost
BORING DEPTH: 31.0 ft
HAMMER TYPE: Auto Hammer (140 lb)
CLOSURE: Cuttings and Grout
DRILLING METHOD: HSA, NQ
LOGGED BY: Deron Zierer
LATITUDE: 37.789346 **LONGITUDE:** -84.711176
SAMPLING METHOD: UD, SS, RC
PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane Kentucky North FIPS 1601 Feet

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0				SPT-1 (11 in)	TOPSOIL, 3 inches	2-3-5 N = 8	878
0.3		Fill		SPT-2 (10 in)	LEAN CLAY (CL), limestone fragments, medium stiff to very stiff, light red brown, slightly moist, iron oxide staining	7-9-10 N = 19	
				UD-1 REC-100%			
5				SPT-3 (10 in)		3-5-8 N = 13	873
				SPT-4 (8 in)		6-7-9 N = 16	
8.0		Residuum		SPT-5 (11 in)	LEAN CLAY (CL), soft to medium stiff, light brown and red brown, mottled, moist	2-2-3 N = 5	
10				SPT-6 (11 in)		1-2-2 N = 4	868
				SPT-7 (11 in)		2-2-3 N = 5	
15				SPT-8 (8 in)		2-2-2 N = 4	863
17.4				SPT-9 (6 in)	IGM very stiff to very hard, pale gray, fine to medium grained, relict structure, highly weathered to decomposed limestone	3-3-3 N = 6	
20				SPT-10 (6 in)		3-2-1 N = 3	858
21.0	Auger refusal at 21.0 feet	Curdsville Limestone		UD-2 REC-82%	LIMESTONE, pale gray to light gray, very thinly bedded, slightly weathered to unweathered, hard, Some shale partings throughout, Curdsville Limestone	9-10-13 N = 23	
				SPT-11 (10 in)		12-13-16 N = 29	
25				SPT-12 (8 in)		13-50/1" N = 50/1"	853
				SPT-13 (5 in)	*Water stained vertical fracture*		
30				RC-1 REC-96% RQD-74%			848
31.0				RC-2 REC-100% RQD-66%	Borehole terminated at 31.0 feet		
35							843
40							838

STANDARD PENETRATION TEST DATA
△ % Fines
○ NMC
⊢ PL---LL
20 40 60 80 100

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/30/2022		Not encountered
END OF DRILLING	▼	11/30/2022	5.5	Dry at completion of soil augering.
AFTER DRILLING	▼	12/01/2022	6.1	
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

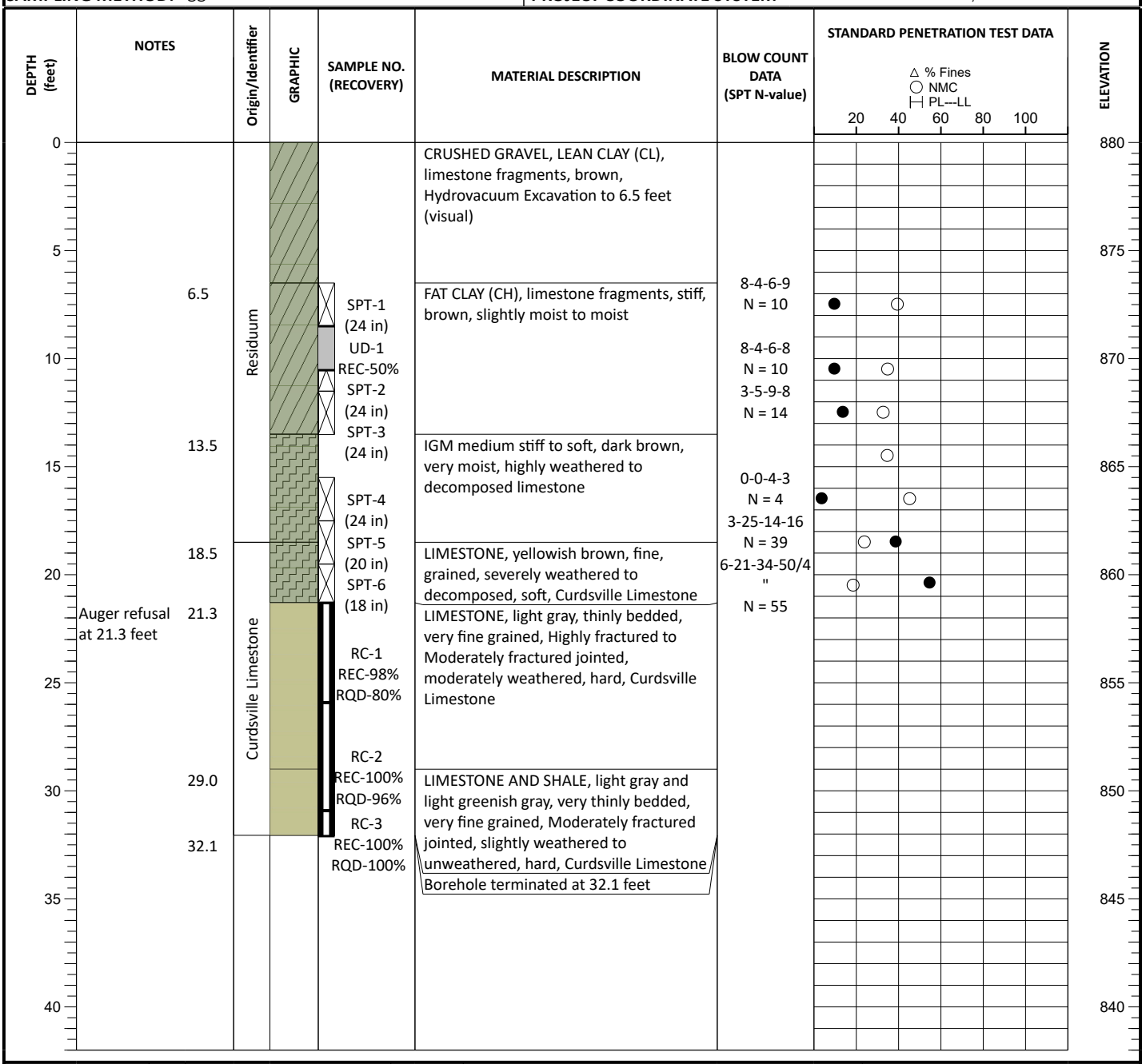
GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: B-04

Sheet 1 of 1

DATE DRILLED: 12/05/2022	**ELEVATION:** 880 ft	**NOTES:** Unit 1-2 Area
DRILL RIG: Diedrich D-50 (ATC)	**DATUM:** NAVD88	
DRILLER: Tim Frost	**BORING DEPTH:** 32.1 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Nick Jones	**LATITUDE:** 37.789424 **LONGITUDE:** -84.711321
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	12/05/2022		Not encountered
END OF DRILLING	▼	12/05/2022		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: B-05

Sheet 1 of 1

DATE DRILLED: 11/30/2022	**ELEVATION:** 879 ft	**NOTES:** Unit 1-2 Area
DRILL RIG: Diedrich D-50 (ATC)	**DATUM:** NAVD88	
DRILLER: Tim Frost	**BORING DEPTH:** 18.5 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Deron Zierer	**LATITUDE:** 37.789488 **LONGITUDE:** -84.711761
SAMPLING METHOD: SS, RC, UD	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0								879
	0.2	Residuum		SPT-1 (9 in)	TOPSOIL, 2 inches	1-3-5		
				SPT-2 (12 in)	LEAN CLAY (CL), medium stiff to very stiff, light brown and red brown, mottled, slightly moist	N = 8		
				UD-1		6-9-9		
				REC-100%		N = 18		
5	[UU = 7.18 ksf]			SPT-3 (10 in)		5-8-14		874
						N = 22		
						6-7-7		
						N = 14		
	8.0			SPT-4 (10 in)	LIMESTONE, weathered, no sample obtained., Curdsville Limestone	50/2"		
	Auger refusal at 8.2 feet 8.2	Curdsville Limestone		SPT-5 (1 in)	LIMESTONE AND CALCAREOUS SHALE, pale gray to dark gray, very thinly bedded, hard, Vuggy, fossiliferous, crystalline calcite in vugs, Curdsville Limestone	N = 50/2"		
10				RC-1				869
				REC-97%				
				RQD-78%				
	[Unconfined Compressive Strength = 13,108 psi]			RC-2				
15				REC-100%				864
				RQD-90%				
				RC-3				
	18.5			REC-100%	Borehole terminated at 18.5 feet			
20				RQD-100%				859
25								854
30								849
35								844
40								839

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/30/2022		Not encountered
END OF DRILLING	▼	11/30/2022	7.0	Dry at completion of soil augering.
AFTER DRILLING	▼	12/01/2022	9.2	
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: B-06

Sheet 1 of 1

DATE DRILLED: 11/29/2022	**ELEVATION:** 881 ft	**NOTES:** Unit 1-2 Area
DRILL RIG: Diedrich D-50 (ATC)	**DATUM:** NAVD88	
DRILLER: Tim Frost	**BORING DEPTH:** 38.9 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Deron Zierer	**LATITUDE:** 37.789311 **LONGITUDE:** -84.711967
SAMPLING METHOD: SS, UD, RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0				SPT-1 (10 in)	TOPSOIL, 3 inches	1-5-4		881
0.3				SPT-2 (11 in)	LEAN CLAY WITH SAND (CL), limestone fragments, stiff to hard, light red brown, slightly moist, iron oxide staining	N = 9		
				UD-1		5-9-10		
	[QU = 7.2 ksf]			REC-58%		N = 19		
5				SPT-3 (11 in)		6-7-7		876
				SPT-4 (11 in)		N = 14		
				SPT-5 (12 in)		12-14-17		
9.0				SPT-6 (11 in)		N = 31		
10	Hole Cave at 10.1 feet	Residuum		SPT-7 (10 in)	LEAN CLAY (CL), stiff to very stiff, light brown and red brown, mottled, slightly moist	4-5-5		871
				SPT-8 (10 in)		N = 10		
				UD-2		4-5-9		
				REC-100%		N = 14		
14.0				SPT-9 (12 in)	SANDY FAT CLAY (CH), ferrous nodules, medium stiff to stiff, dark brown and red brown, mottled, very moist	11-9-10		
15	[UU = 1.58 ksf]			SPT-10 (12 in)		N = 19		866
				SPT-11 (10 in)		4-8-3		
19.0				SPT-12 (10 in)	IGM very stiff to very hard, pale gray, fine to medium grained, relict structure, highly weathered to decomposed limestone	N = 11		
20				SPT-13 (5 in)		5-9-6		861
				SPT-14		N = 15		
				RC-1		2-3-2		
				REC-96%		N = 5		
				RQD-67%		1-8-16		
				RC-2		N = 24		
				REC-100%		16-20-30		
				RQD-34%		N = 50		
23.7	Auger refusal at 23.7 feet			RC-3		8-10-50/3"		
25				REC-100%		N = 50/3"		856
25.2				RQD-96%	LIMESTONE AND CALCAREOUS SHALE, pale gray to dark gray, very thinly bedded, moderately weathered, hard, Curdsville Limestone *vertical joint, water stained*	50/1"		
				RC-4		N = 50/1"		
				REC-100%				
				RQD-74%				
30		Curdsville Limestone			LIMESTONE AND CALCAREOUS SHALE, pale gray to dark gray, very thinly bedded, moderately weathered to slightly weathered, hard, Curdsville Limestone			851
35								846
38.9					Borehole terminated at 38.9 feet			
40								841

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	11/29/2022	16.4	
END OF DRILLING	▼	11/29/2022		Dry at completion of soil augering.
AFTER DRILLING	▼	11/29/2022	9.6	Measured after introduction of coring fluid.
AFTER DRILLING	▼	11/30/2022	6.0	Measured after rain event overnight.

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

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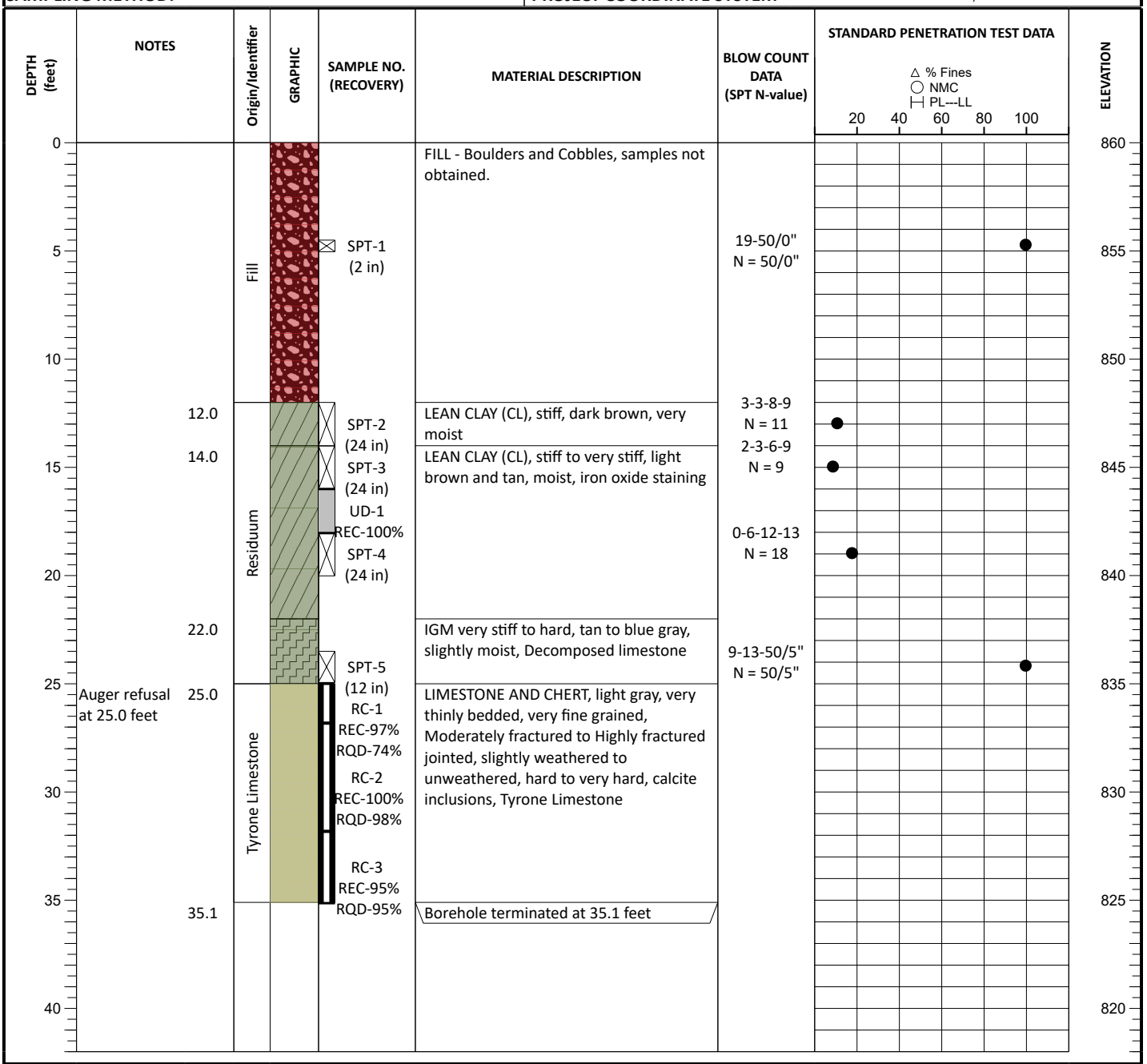
PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: B-07
Sheet 1 of 1

DATE DRILLED: 12/06/2022	**ELEVATION:** 860 ft
DRILL RIG: Diedrich D-50 (ATC)	**DATUM:** NAVD88
DRILLER: Tim Frost	**BORING DEPTH:** 35.1 ft
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Nick Jones
SAMPLING METHOD:	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet

NOTES: Unit 1-2 Area

LATITUDE: 37.788493 **LONGITUDE:** -84.710019



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	12/06/2022		Not encountered
END OF DRILLING	▼	12/06/2022		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

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PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: B-08
Sheet 1 of 1

DATE DRILLED: 12/08/2022	**ELEVATION:** 853 ft	**NOTES:** Unit 1-2 Area
DRILL RIG: Diedrich D-50 (ATC)	**DATUM:** NAVD88	
DRILLER: Tim Frost	**BORING DEPTH:** 35.5 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Nick Jones	**LATITUDE:** 37.788163 **LONGITUDE:** -84.709614
SAMPLING METHOD:	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0					TOPSOIL , 6 INCHES			853
	0.5				LEAN CLAY (CL), Hydrovacuum Excavation to 6 feet (visual)			
5								848
	6.0	Fill		SPT-1 (3 in)	LEAN CLAY (CL), very soft, light brown to gray, moist to very moist	0-0-1-1 N = 1	●	
	8.0			SPT-2 (7 in)	LEAN CLAY (CL), stiff, brown, very moist to moist	2-3-8-8 N = 11	●	
10				SPT-3 (10 in)		4-6-7-9 N = 13	●	843
	13.0	Residuum		SPT-4 (11 in)	LEAN CLAY (CL), stiff, brown, moist	4-5-7-10 N = 12	●	
				SPT-5 (7 in)		3-6-7-6 N = 13	●	
15				SPT-6 (14 in)		3-5-6-5 N = 11	●	838
	18.0	Fill		SPT-7 (17 in)	LEAN CLAY (CL), soft to very soft, brown, moist to very moist	2-2-2-4 N = 4	●	
20								833
				SPT-8 (10 in)		0-0-3-4 N = 3	●	
25								828
	27.0	Residuum		SPT-9 (7 in)	LEAN CLAY (CL), stiff, brown, very moist	5-9-4-2 N = 13	●	
30	30.0				Boulders and Cobbles			823
35								818
	Auger refusal at 35.5 feet 35.5				Borehole terminated at 35.5 feet			
40								813

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	12/08/2022		Not encountered
END OF DRILLING	▼	12/08/2022		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

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PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
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BORING LOG: B-08 A
Sheet 1 of 1

DATE DRILLED: 12/08/2022	**ELEVATION:** 853 ft	**NOTES:** Unit 1-2 Area
DRILL RIG: Diedrich D-50 (ATC)	**DATUM:** NAVD88	
DRILLER: Tim Frost	**BORING DEPTH:** 36.0 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Nick Jones	**LATITUDE:** 37.788163 **LONGITUDE:** -84.709614
SAMPLING METHOD:	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0					(Offset) Blank drilling, no samples obtained.			853
5		Fill						848
10								843
13.0								
15								838
20								833
22.0	Auger refusal at 22.0 feet	Tyrone Limestone		RC-1 REC-83% RQD-12% RC-2 REC-97% RQD-90% RC-3 REC-100% RQD-76%	LIMESTONE AND SHALE, light gray and light greenish gray, very thinly bedded, very fine grained, Intensely fractured to Moderately fractured jointed, moderately weathered to unweathered, hard, Tyrone Limestone			828
25								
30								823
35								818
36.0					Borehole terminated at 36.0 feet			
40								813

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	12/08/2022		Not encountered
END OF DRILLING	▼	12/08/2022		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
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PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
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BORING LOG: B-09
Sheet 1 of 1

DATE DRILLED: 12/02/2022	**ELEVATION:** 845 ft	**NOTES:** Unit 1-2 Area
DRILL RIG: Diedrich D-50 (ATC)	**DATUM:** NAVD88	
DRILLER: Tim Frost	**BORING DEPTH:** 22.4 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Deron Zierer	**LATITUDE:** 37.789507 **LONGITUDE:** -84.710224
SAMPLING METHOD: UD, SS, RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0								845
	0.2	Residuum		SPT-1 (14 in)	TOPSOIL, 2 inches	1-2-2-2 N = 4	●	
				SPT-2 (13 in)	LEAN CLAY (CL), soft to stiff, light brown and red brown, mottled, slightly moist	2-5-5-6 N = 10	●	
5	4.0			UD-1 REC-60%	IGM very hard, light blue and light brown, mottled, slightly moist	8-5-50/5" N = 50/5"	●	840
				SPT-3 (10 in)				
	7.3	Tyrone Limestone			LIMESTONE, weathered, no sample obtained, Tyrone Limestone			
	7.4				LIMESTONE, pale gray to light gray, very thinly bedded, slightly weathered, hard, Tyrone Limestone			
10	9.6			RC-1 REC-90% RQD-34%				835
	12.4				LIMESTONE AND CHERT, pale gray to light gray, very thinly interbedded, moderately weathered, hard, Tyrone Limestone			
15				RC-2 REC-100% RQD-68%				830
					LIMESTONE AND CALCAREOUS SHALE, pale gray to light gray, very thinly bedded, slightly weathered to unweathered, hard, Shale partings throughout, chert nodules throughout, Tyrone Limestone			
20				RC-3 REC-100% RQD-78%				825
	Auger refusal at 22.4 feet	22.4			Borehole terminated at 22.4 feet			
25								820
30								815
35								810
40								805

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	12/02/2022		Not encountered
END OF DRILLING	▼	12/02/2022	5.8	Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

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PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
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BORING LOG: B-10
Sheet 1 of 1

DATE DRILLED: 12/01/2022	**ELEVATION:** 844 ft	**NOTES:** Unit 1-2 Area
DRILL RIG: Diedrich D-50 (ATC)	**DATUM:** NAVD88	
DRILLER: Tim Frost	**BORING DEPTH:** 17.0 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Deron Zierer	**LATITUDE:** 37.789379 **LONGITUDE:** -84.710090
SAMPLING METHOD: UD, SS, RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0							844
	0.2	Residuum		SPT-1 (6 in)	TOPSOIL, 2 inches	3-4-5	
				SPT-2 (8 in)	FAT CLAY (CH), stiff, light brown and red brown, mottled, slightly moist	N = 9	
				UD-1		7-7-5	
						N = 12	
5	5.0			REC-50% SPT-3 (8 in)	IGM medium stiff to hard, light blue and light brown, mottled, slightly moist	1-3-3 N = 6	839
	Auger refusal at 7.0 feet					50/5" N = 50/5"	
	6.9	Tyrone Limestone		SPT-4 (4 in)	LIMESTONE, weathered, no sample obtained, Tyrone Limestone		
	7.0						
	8.0			RC-1	LIMESTONE, pale gray to light gray, very thinly bedded, unweathered, hard, Tyrone Limestone		
10	9.2			REC-96% RQD-72%			834
					LIMESTONE, pale gray to light gray, very thinly bedded, moderately weathered, hard, Tyrone Limestone		
				RC-2 REC-100% RQD-94%	LIMESTONE AND CALCAREOUS SHALE, pale gray to light gray, very thinly bedded, slightly weathered to unweathered, hard, Shale partings throughout, chert nodules throughout, Tyrone Limestone		
15							829
	17.0				Borehole terminated at 17.0 feet		
20							824
25							819
30							814
35							809
40							804

STANDARD PENETRATION TEST DATA
△ % Fines
○ NMC
⊢ PL---LL
20 40 60 80 100

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	12/01/2022		Not encountered
END OF DRILLING	▼			
AFTER DRILLING	▼	12/02/2022	4.2	
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

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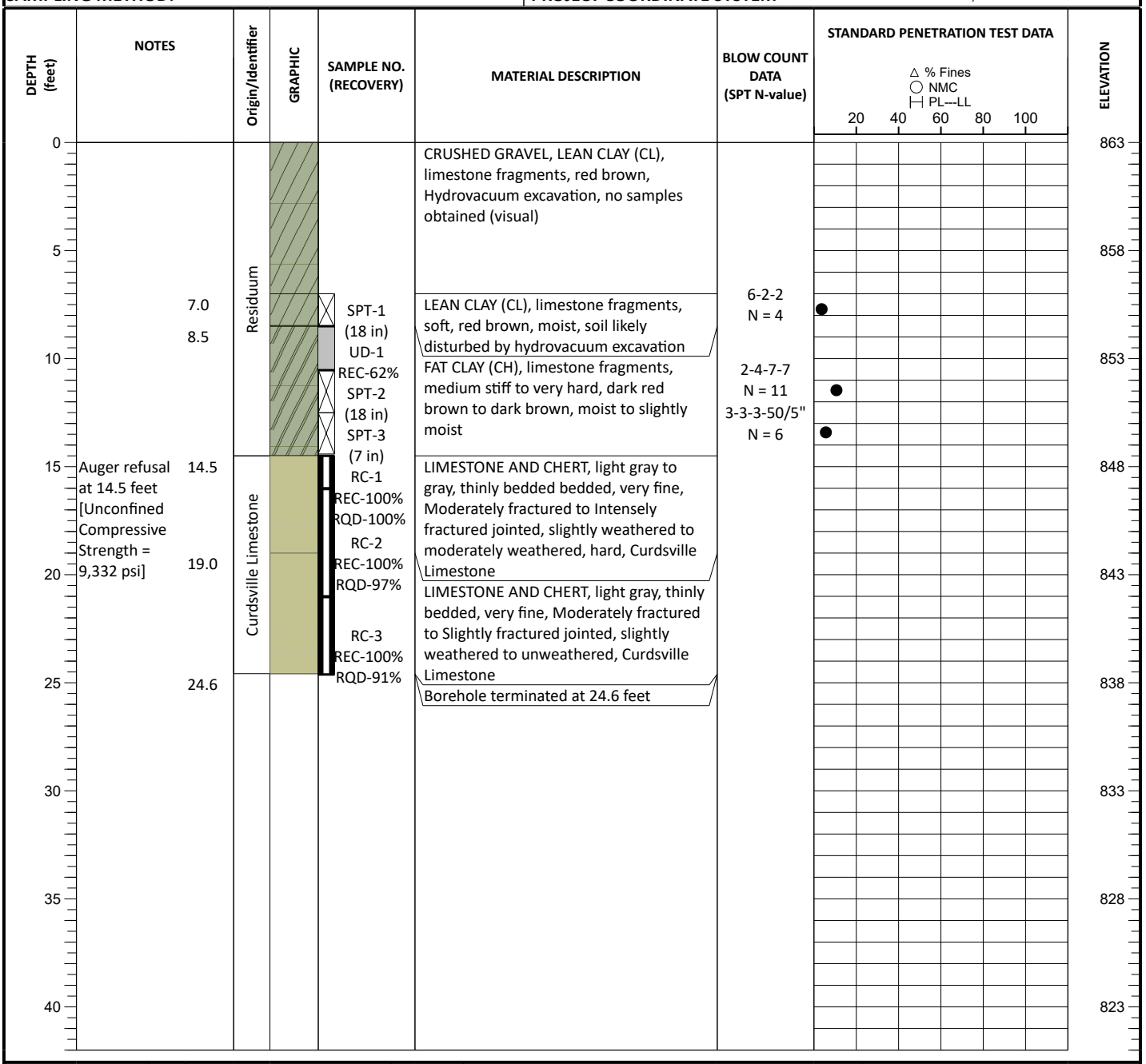
PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: B-11
Sheet 1 of 1

DATE DRILLED: 12/05/2022	**ELEVATION:** 863 ft
DRILL RIG: Diedrich D-50 (ATC)	**DATUM:** NAVD88
DRILLER: Tim Frost	**BORING DEPTH:** 24.6 ft
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings and Grout
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Nick Jones
SAMPLING METHOD:	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet

NOTES: Unit 1-2 Area

LATITUDE: 37.789912 **LONGITUDE:** -84.711133



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	12/05/2022		Not encountered
END OF DRILLING	▼	12/05/2022		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
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PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: WB-01

Sheet 1 of 1

DATE DRILLED: 01/17/2023	**ELEVATION:** 895 ft	**NOTES:** Webb Farm Area
DRILL RIG: D-50	**DATUM:** NAVD88	
DRILLER: Martin Minie	**BORING DEPTH:** 17.6 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Asad Khan/ Deron Zierer	**LATITUDE:** 37.795663 **LONGITUDE:** -84.716212
SAMPLING METHOD: SS, RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0								895
0.2		Residuum		SPT-1 (13 in)	TOPSOIL, 2 inches	2-3-4-11		
					LEAN CLAY (CL), trace chert, medium stiff, dark brown to, moist	N = 7		
	Auger refusal at 2.2 feet					PPV= 2.0		
2.5				SPT-2 (2 in)				
2.6					LIMESTONE, weathered, no sample obtained, Logana Member	3-50/1"		
5				RC-1 REC-82% RQD-42%	LIMESTONE, light gray to light brown, very thinly bedded, moderately weathered, hard, clay seams throughout, water staining present throughout, Logana Member	N = 50/1" PPV= 2.2		890
10		Logana Member		RC-2 REC-64% RQD-36%				885
13.6					LIMESTONE, light gray to gray, very thinly bedded, slightly weathered to unweathered, hard, Shale partings throughout, Logana Member			
15				RC-3 REC-100% RQD-94%				880
17.6					Borehole terminated at 17.6 feet			
20								875
25								870
30								865
35								860
40								855

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/17/2023		Not encountered
END OF DRILLING	▼	01/17/2023		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

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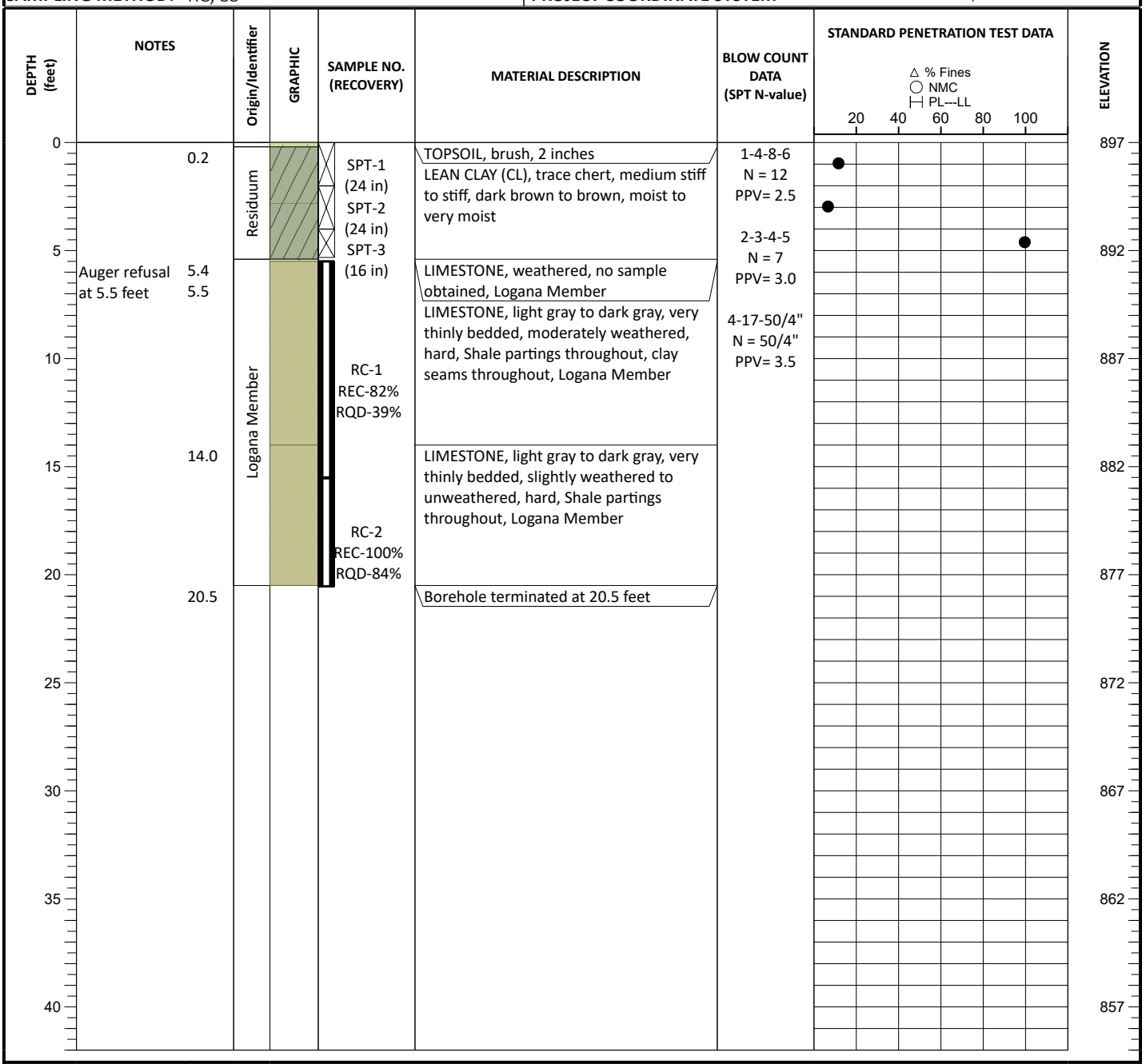
PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: WB-02
Sheet 1 of 1

DATE DRILLED: 01/17/2023	**ELEVATION:** 897 ft	**NOTES:** Webb Farm Area
DRILL RIG: D-50	**DATUM:** NAVD88	
DRILLER: Martin Minie	**BORING DEPTH:** 20.5 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Asad Khan/ Deron Zierer	**LATITUDE:** 37.795852 **LONGITUDE:** -84.716114
SAMPLING METHOD: RC, SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/17/2023		Not encountered
END OF DRILLING	▼	01/17/2023		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
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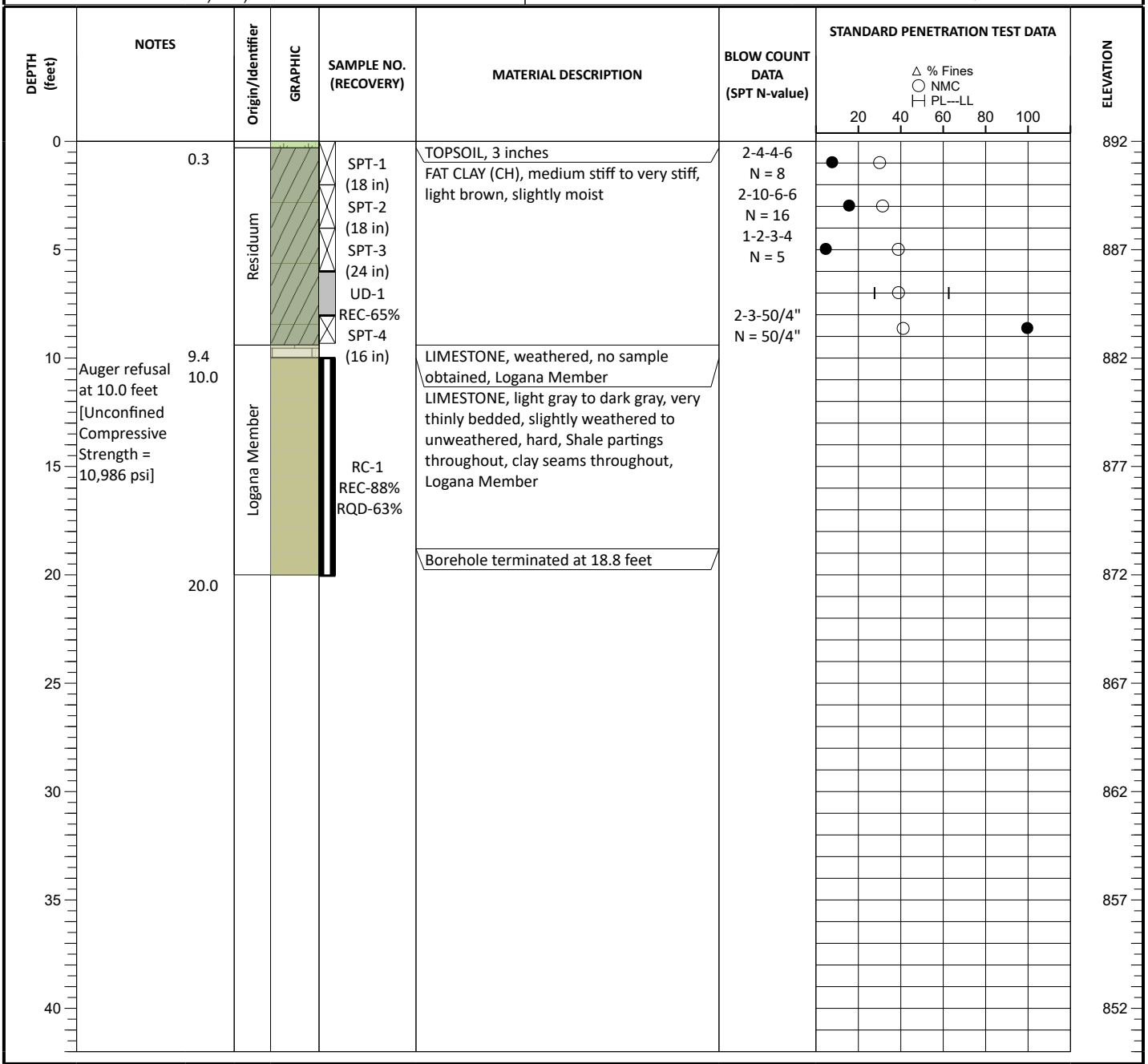
PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: WB-03

Sheet 1 of 1

DATE DRILLED: 01/17/2023	**ELEVATION:** 892 ft	**NOTES:** Webb Farm Area
DRILL RIG: D-50	**DATUM:** NAVD88	
DRILLER: Jake Slone	**BORING DEPTH:** 18.8 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Asad Khan/ Deron Zierer	**LATITUDE:** 37.796149 **LONGITUDE:** -84.715967
SAMPLING METHOD: SS, UD, RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/17/2023		Not encountered
END OF DRILLING	▼	01/17/2023		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: WB-04
Sheet 1 of 1

DATE DRILLED: 01/17/2023	**ELEVATION:** 886 ft	**NOTES:** Webb Farm Area
DRILL RIG: D-50	**DATUM:** NAVD88	
DRILLER: Jake Slone	**BORING DEPTH:** 17.3 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Asad Khan/ Deron Zierer	**LATITUDE:** 37.796399 **LONGITUDE:** -84.715833
SAMPLING METHOD: SS, RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0								886
					TOPSOIL, 3 inches			
	0.3	Residuum		SPT-1 (16 in)	FAT CLAY (CH), some limestone fragments, soft to stiff, brown to tan, mottled, slightly moist	3-4-50/4" N = 50/4"	●	
				SPT-2 (12 in)		45-2-2-4 N = 4	●	
5				SPT-3 (24 in)		3-6-8-10 N = 14	●	881
	7.2			SPT-4 (4 in)	LIMESTONE, weathered, no sample obtained, Logana Member	50/4" N = 50/4"	●	
	Auger refusal at 7.5 feet 7.3	Logana Member		RC-2 REC-90% RQD-59%	LIMESTONE, light gray to dark gray, very thinly bedded, slightly weathered to unweathered, hard, Shale partings throughout, clay seams throughout, Logana Member			
10								876
15								871
	17.3				Borehole terminated at 17.3 feet			
20								866
25								861
30								856
35								851
40								846

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/17/2023		Not encountered
END OF DRILLING	▼	01/17/2023		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: WB-05
Sheet 1 of 1

DATE DRILLED: 01/17/2023	**ELEVATION:** 884 ft	**NOTES:** Webb Farm Area
DRILL RIG: D-50	**DATUM:** NAVD88	
DRILLER: Jake Slone	**BORING DEPTH:** 16.2 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Asad Khan/ Deron Zierer	**LATITUDE:** 37.796564 **LONGITUDE:** -84.715748
SAMPLING METHOD: SS, RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0								884
					TOPSOIL, 4 inches			
	0.3	Residuum		SPT-1 (24 in)	FAT CLAY (CH), trace chert, medium stiff to stiff, dark brown to light brown, moist, Silty	1-3-5-6 N = 8	●	
				SPT-2 (24 in)		2-4-6-7 N = 10	●	
5				SPT-3 (13 in)		3-5-50/1" N = 50/1"	●	879
	Auger refusal at 6.2 feet 6.1				LIMESTONE, weathered, no sample obtained, Logana Member			
	6.2	Logana Member		RC-1 REC-94% RQD-61%	LIMESTONE, light gray to light brown, very thinly bedded, slightly weathered to unweathered, hard, clay seams throughout increasing in frequency towards bottom of run, water staining present throughout, vuggy, Logana Member			
10								874
15								869
	16.2				Borehole terminated at 16.2 feet			
20								864
25								859
30								854
35								849
40								844

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/17/2023		Not encountered
END OF DRILLING	▼	01/17/2023		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

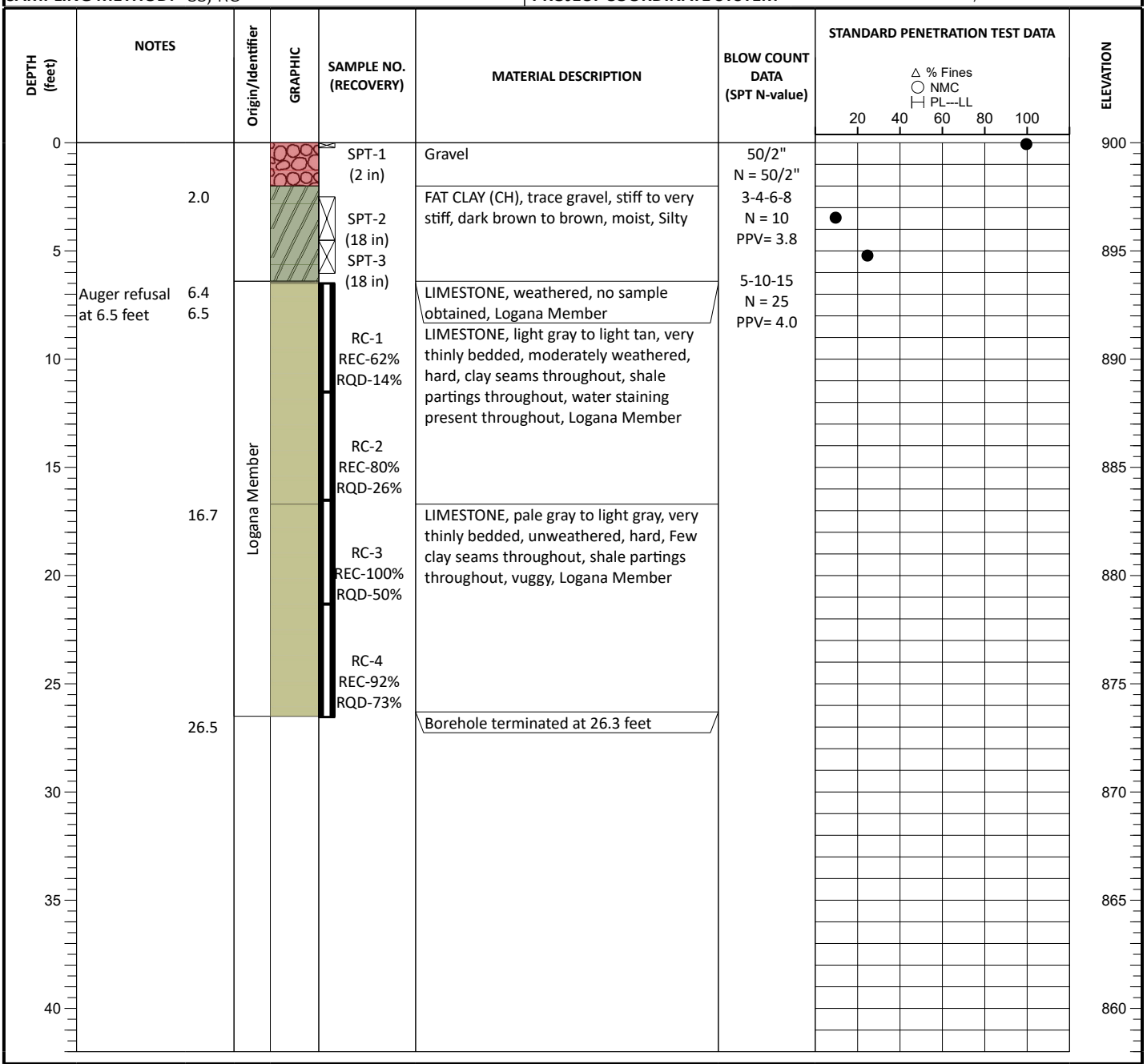
Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: WB-06
Sheet 1 of 1

DATE DRILLED: 01/17/2023	**ELEVATION:** 900 ft	**NOTES:** Webb Farm Area
DRILL RIG: D-50	**DATUM:** NAVD88	
DRILLER: Martin Minie	**BORING DEPTH:** 26.3 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Asad Khan/ Deron Zierer	**LATITUDE:** 37.795904 **LONGITUDE:** -84.715658
SAMPLING METHOD: SS, RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/17/2023		Not encountered.
END OF DRILLING	▼	01/17/2023		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

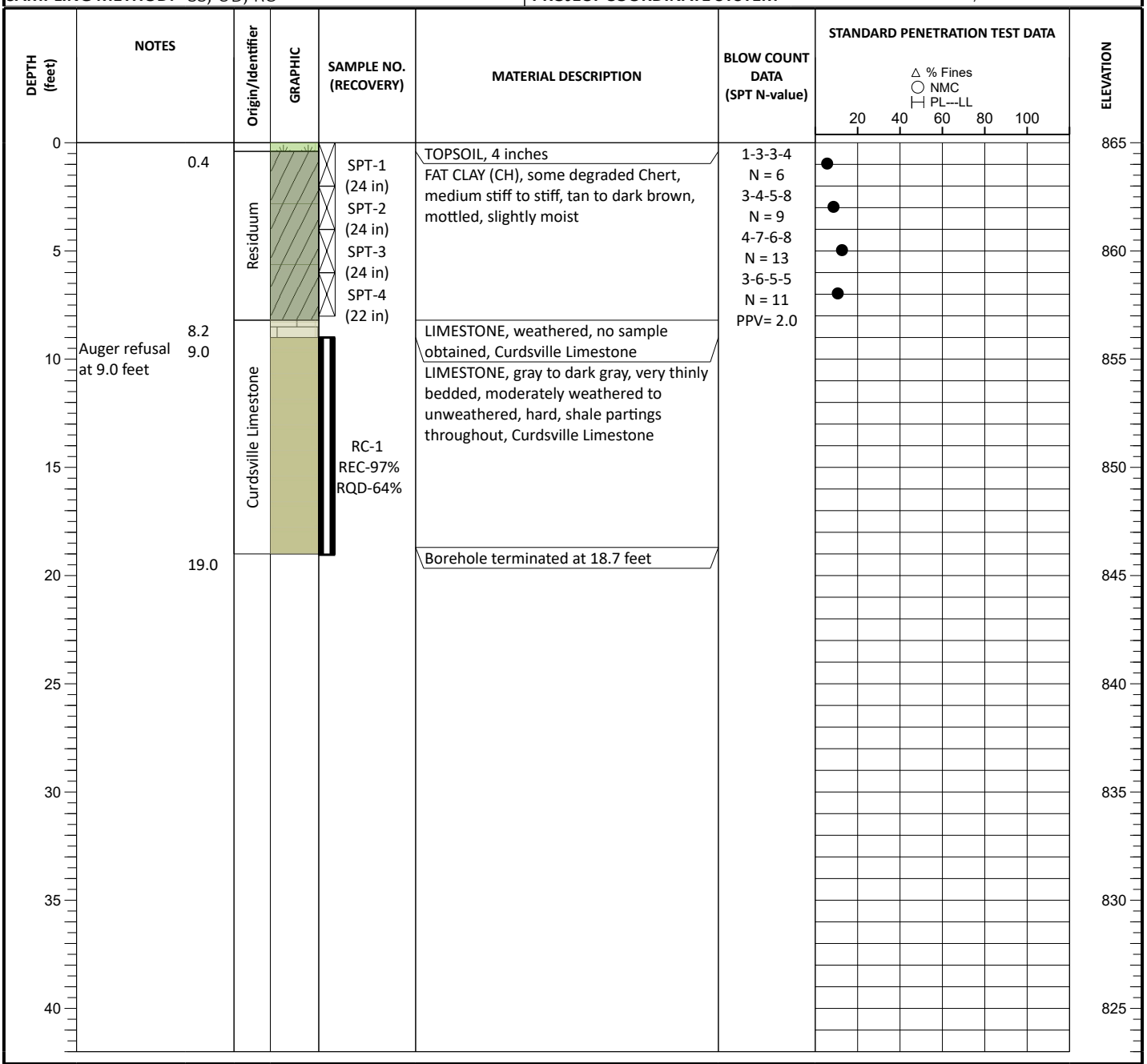
GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: WB-07

Sheet 1 of 1

DATE DRILLED: 01/18/2023	**ELEVATION:** 865 ft	**NOTES:** Webb Farm Area
DRILL RIG: D-50	**DATUM:** NAVD88	
DRILLER: Jake Slone	**BORING DEPTH:** 18.7 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Asad Khan/ Deron Zierer	**LATITUDE:** 37.797182 **LONGITUDE:** -84.716357
SAMPLING METHOD: SS, UD, RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/18/2023		Not encountered
END OF DRILLING	▼	01/18/2023		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: WB-08
Sheet 1 of 1

DATE DRILLED: 01/16/2023	**ELEVATION:** 859 ft	**NOTES:** Webb Farm Area
DRILL RIG: D-50	**DATUM:** NAVD88	
DRILLER: Jake Slone	**BORING DEPTH:** 14.5 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Asad Khan/ Deron Zierer	**LATITUDE:** 37.797602 **LONGITUDE:** -84.716151
SAMPLING METHOD: SS, CORE	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0		Residuum		SPT-1 (22 in)	FAT CLAY (CH), stiff, brown and gray, slightly moist, Some chert	3-6-6-5 N = 12		859
				SPT-2 (4 in)		5-7-50/4" N = 50/4"		
5	Auger refusal at 4.5 feet	Curdsville Limestone			LIMESTONE, weathered, no sample obtained, Curdsville Limestone			854
	4.4							
	4.5				LIMESTONE, light gray to gray, very thinly bedded, slightly weathered, hard, Clay seams throughout, Curdsville Limestone			
	8.5			RC-1 REC-98% RQD-70%	LIMESTONE, light gray to gray, very thinly bedded, unweathered, hard, Shale partings throughout, Curdsville Limestone			
10								849
15	14.5				Borehole terminated at 14.5 feet			844
20								839
25								834
30								829
35								824
40								819

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/16/2023		Not encountered
END OF DRILLING	▼	01/16/2023		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: WB-09
Sheet 1 of 1

DATE DRILLED: 01/18/2023	**ELEVATION:** 861 ft	**NOTES:** Webb Farm Area
DRILL RIG: D-50	**DATUM:** NAVD88	
DRILLER: Jake Slone	**BORING DEPTH:** 18.2 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Asad Khan/ Deron Zierer	**LATITUDE:** 37.796795 **LONGITUDE:** -84.716890
SAMPLING METHOD: SS, RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0					TOPSOIL, 6 inches			861
0.5		Residuum		SPT-1 (24 in)	FAT CLAY WITH SAND (CH), medium stiff to stiff, brown, moist, Some chert	1-3-5-5 N = 8		
				SPT-2 (24 in)		5-5-9-9 N = 14		
5				SPT-3 (22 in)		4-5-5-6 N = 10 PPV= 2.2		856
				SPT-4 (22 in)				
7.9	Auger refusal at 8.2 feet				LIMESTONE, weathered, no sample obtained, Curdsville Limestone	3-4-5-50/4" N = 9 PPV= 1.5		
8.2		Curdsville Limestone			LIMESTONE, light gray to dark gray, very thinly bedded, unweathered, hard, Shale partings throughout, Curdsville Limestone			
10				RC-1 REC-99% RQD-91%				851
15								846
16.0					SHALE, very dark gray, thinly bedded, moderately weathered, hard, Water stained, Curdsville Limestone			
17.1				RC-2 REC-100% RQD-100%	LIMESTONE AND SHALE, light gray to dark gray, thinly interbedded, slightly weathered to unweathered, hard, Curdsville Limestone			
18.2					Borehole terminated at 18.2 feet			
20								841
25								836
30								831
35								826
40								821

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/18/2023		Not encountered
END OF DRILLING	▼	01/18/2023		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: WB-10

Sheet 1 of 1

DATE DRILLED: 01/18/2023	**ELEVATION:** 863 ft	**NOTES:** Webb Farm Area
DRILL RIG: D-50	**DATUM:** NAVD88	
DRILLER: Jake Slone	**BORING DEPTH:** 16.0 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Asad Khan/ Deron Zierer	**LATITUDE:** 37.796516 **LONGITUDE:** -84.717041
SAMPLING METHOD: RC, SS, UD	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0								863
				SPT-1 (24 in)	TOPSOIL, 2 inches	1-2-4-8		
	0.2	Residuum		UD-1 REC-100%	FAT CLAY (CH), trace chert, medium stiff to stiff, dark brown, moist, Silty	N = 6 PPV= 2.8	●	
5				SPT-2 (19 in)		3-5-6-50/2" N = 11 PPV= 3.2	●	858
	Auger refusal at 6.0 feet 5.8 6.0				LIMESTONE, weathered, no sample obtained, Curdsville Limestone			
		Curdsville Limestone		RC-1 REC-95% RQD-79%	LIMESTONE, light gray to gray, very thinly bedded, unweathered, hard, Shale partings throughout, Curdsville Limestone			
10								853
15								848
	16.0				Borehole terminated at 16.0 feet			
20								843
25								838
30								833
35								828
40								823

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/18/2023		Not encountered
END OF DRILLING	▼	01/18/2023		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: WB-11

Sheet 1 of 1

DATE DRILLED: 01/18/2023	**ELEVATION:** 884 ft	**NOTES:** Webb Farm Area
DRILL RIG: D-50	**DATUM:** NAVD88	
DRILLER: Martin Minie	**BORING DEPTH:** 21.1 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings and Grout	
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Asad Khan/ Deron Zierer	**LATITUDE:** 37.792340 **LONGITUDE:** -84.717311
SAMPLING METHOD: SS, UD, RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0								884
	0.2			SPT-1 (19 in)	Topsoil	2-12-8-8		
		Residuum		SPT-2 (24 in)	LEAN CLAY (CL), stiff to very stiff, dark brown and brown, mottled, slightly moist, Some silt	N = 20 3-4-7-8		
				SPT-3 (24 in)		N = 11 4-6-7-7		
5				SPT-4 (23 in)		N = 13 4-7-10-9		879
				SPT-5 (24 in)		N = 17 3-6-6-7		
				SPT-6 (24 in)		N = 12 3-4-5-5		
10				UD-1 REC-100%		N = 9		874
	13.0			SPT-7 (24 in)	FAT CLAY (CH), medium stiff to stiff, tan to brown, mottled, moist	2-3-3-5 N = 6		
				SPT-8 (24 in)		2-3-3-3 N = 6		
15				SPT-9 (20 in)		2-3-4 N = 7		869
	19.7	Curdsville Limestone		RC-1 REC-92% RQD-48%	LIMESTONE, hard, weathered, no sample obtained, Curdsville Limestone			
20	Auger refusal at 19.8 feet 19.8				LIMESTONE, light gray, very thinly bedded, unweathered, hard, Curdsville Limestone			864
	22.3				Borehole terminated at 21.1 feet			
25								859
30								854
35								849
40								844

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	01/18/2023		Not encountered
END OF DRILLING	▼	01/18/2023		Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

PROJECT: 2027 NGCC Geotechnical Investigation
KU - E.W. Brown Generating Station
S&ME Project No. 22360136 - Unit 1-2 / Webb Farm

BORING LOG: WB-11 A
Sheet 1 of 1

DATE DRILLED: 01/18/2023	**ELEVATION:** 884 ft
DRILL RIG: D-50	**DATUM:** NAVD88
DRILLER: Martin Minie	**BORING DEPTH:** 20.7 ft
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings and Grout
DRILLING METHOD: HSA, NQ	**LOGGED BY:** Asad Khan/ Deron Zierer
SAMPLING METHOD: RC	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Kentucky North FIPS 1601 Feet

NOTES: Webb Farm Area

LATITUDE: 37.792340 **LONGITUDE:** -84.717311

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA (△ % Fines, ○ NMC, ⊢ PL---LL; 20 40 60 80 100)	ELEVATION
0					(Offset) Blank drill, no samples obtained.			884
5								879
10	Auger refusal at 10.7 feet	Curdsville Limestone		RC-1 REC-98% RQD-76%	LIMESTONE, pale gray to gray, very thinly bedded, unweathered, hard, Clay seams throughout, Curdsville Limestone			874
15	14.5			RC-2 REC-96% RQD-60%	LIMESTONE, light gray to dark gray, very thinly bedded, hard, Shale partings throughout, Curdsville Limestone			869
20	20.7				Borehole terminated at 20.7 feet			864
25								859
30								854
35								849
40								844

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽			Not encountered
END OF DRILLING	▼			Dry at completion of soil augering.
AFTER DRILLING	▼			
AFTER DRILLING	▼			

Vertical Accuracy: Estimated from topo map (Rounded 1 ft), Horizontal Accuracy: Handheld GPS (1 ft)

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf), AR = Auger Refusal

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	10.5	to	11.5	1	83	42
RC-2	11.5	to	16.5	5	100	79
RC-3	16.5	to	20.5	4	100	86

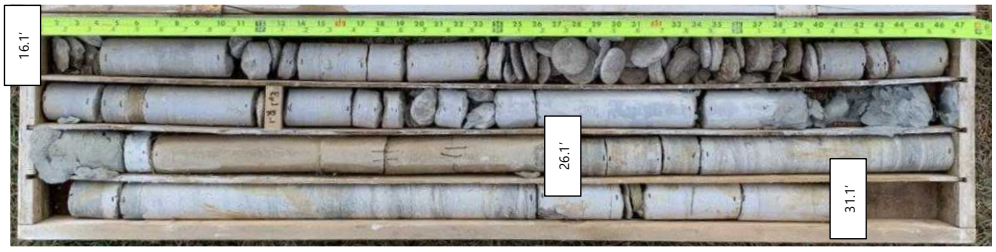
Date: 12/21/2022

Photographer: N. Jones

10.5'

1		
	Location / Orientation	B-1 (10.5 ft – 20.5 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	16.1	to	21.1	5	100	38
RC-2	21.1	to	31.1	10	46	28



Date: 12/21/2022

Photographer: N. Jones

2		
	Location / Orientation	B-2, box 1 of 2
	Remarks	Box 1 of 2

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-3	31.1	to	36.1	5	100	60

Date: 12/21/2022

Photographer: N. Jones

3	**Location / Orientation**	B-2 (31.1 ft – 36.1 ft)
	Remarks	Box 2 of 2

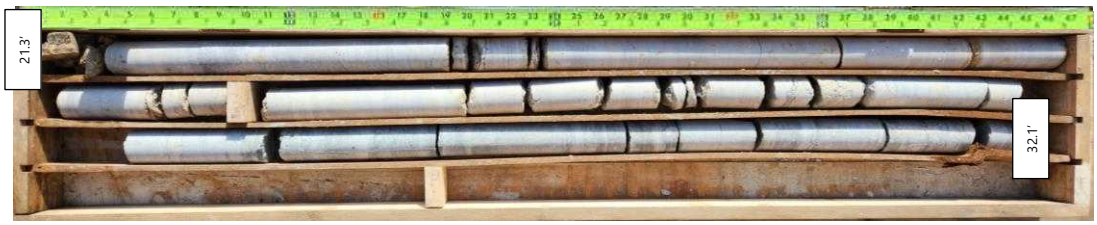
Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	21	to	26	5	96	74
RC-2	26	to	31	5	100	66

Date: 12/21/2022

Photographer: N. Jones

4	**Location / Orientation**	B-3 (21.0 ft – 31.0 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	21.3	to	25.9	4.6	98	80
RC-2	25.9	to	30.9	5	100	96
RC-3	30.9	to	32.06	1.16	100	100

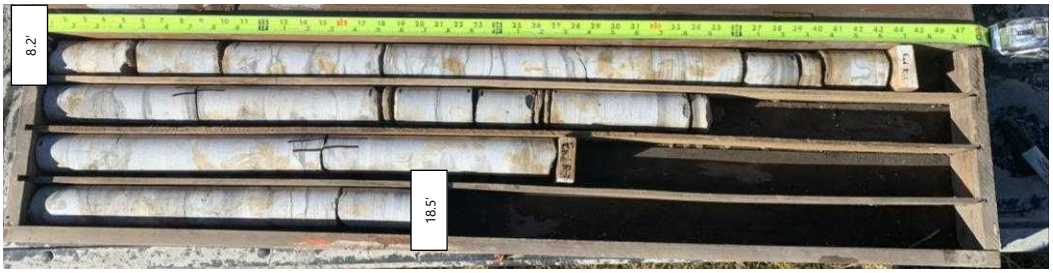


Date 12/21/2022

Photographer: N. Jones

5	Location / Orientation	B-4 (21.3 ft – 32.1 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	8.2	to	11.9	3.7	97	78
RC-2	11.9	to	16.9	5	100	90
RC-3	16.9	to	18.5	1.6	100	100



Date: 12/21/2022

Photographer: N. Jones

6	Location / Orientation	B-5 (8.2 ft – 18.5 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	23.7	to	26.4	2.7	96	67
RC-2	26.4	to	31.4	5	100	34
RC-3	31.4	to	33.9	2.5	100	96
RC-4	33.9	to	38.9	5	100	74

Date: 12/21/2022

Photographer: N. Jones

7	**Location / Orientation**	B-6 (23.7 ft – 38.9 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	25	to	26.8	1.8	97	74
RC-2	26.8	to	31.8	5	100	98
RC-3	31.8	to	35.1	3.3	95	95

Date: 12/21/2022

Photographer: N. Jones

8	**Location / Orientation**	B-7 (25.0 ft – 35.1 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	22	to	26	4	83	13
RC-2	26	to	31	5	97	90
RC-3	31	to	36	5	100	76

Date: 12/21/2022

Photographer: N. Jones

9	Location / Orientation	B-8A (22.0 ft – 36.0 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	7.4	to	12.4	5	90	34
RC-2	12.4	to	17.4	5	100	68
RC-3	17.4	to	22.4	5	100	78

Date: 12/21/2022

Photographer: N. Jones

10	Location / Orientation	B-9 (7.4 ft – 22.4 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	7	to	12	5	96	72
RC-2	12	to	17	5	100	94

Date: 12/21/2022

Photographer: N. Jones

11	Location / Orientation	B-10 (7.0 ft – 17.0 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	14.5	to	16	1.5	100	100
RC-2	16	to	21	5	100	97
RC-3	21	to	24.58	3.58	100	91

Date: 12/21/2022

Photographer: N. Jones

12	Location / Orientation	B-11 (14.5 ft – 24.6 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	2.6	to	7.6	5	82	42
RC-2	7.6	to	12.6	5	64	36
RC-3	12.6	to	17.6	5	100	94

Date: 1/31/2023

Photographer: D. Zierer GIT

13	Location / Orientation	WB-1 (2.6 ft – 17.6 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	5.5	to	15.5	10	82	39
RC-2	15.5	to	20.5	5	100	84

Date: 1/31/2023

Photographer: D. Zierer GIT

14	Location / Orientation	WB-2 (5.5 ft – 20.5 ft)
	Remarks	Box 1 of 1

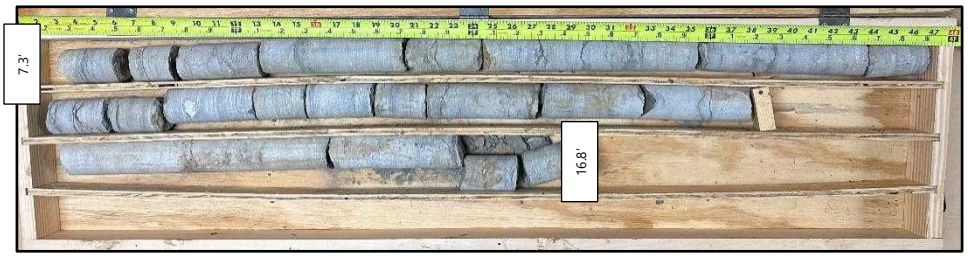
Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	10	to	20	10	88	63

Date: 1/31/2023

Photographer: D. Zierer GIT

15	Location / Orientation	WB-3 (10.0 ft – 20.0 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	7.3	to	17.3	10	90	59



Date: 1/31/2023

Photographer: D. Zierer GIT

16	Location / Orientation	WB-4 (7.3 ft – 16.8 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	6.2	to	16.2	10	94	61

Date: 1/31/2023

Photographer: D. Zierer GIT

17	Location / Orientation	WB-5 (6.2 ft – 16.2 ft)
	Remarks	Box 1 of 1

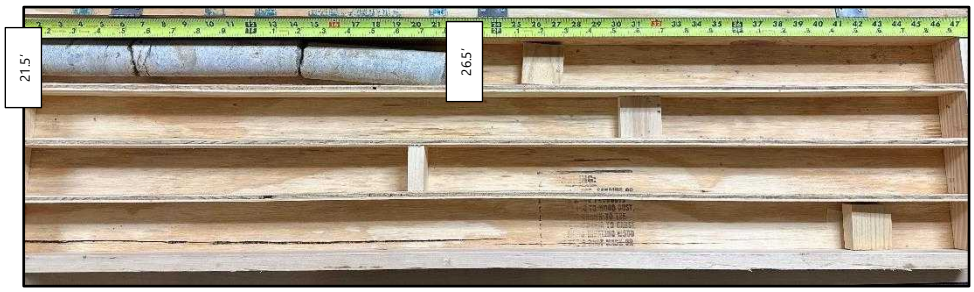
Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	6.5	to	11.5	5	62	14
RC-2	11.5	to	16.5	5	80	26
RC-3	16.5	to	21.3	4.8	100	50
RC-4	21.3	to	26.5	5.2	92	73

Date: 1/31/2023

Photographer: D. Zierer GIT

18	Location / Orientation	WB-6 (6.5 ft – 26.5 ft)
	Remarks	Box 1 of 2

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-4	21.3	to	26.5	5.2	92	73

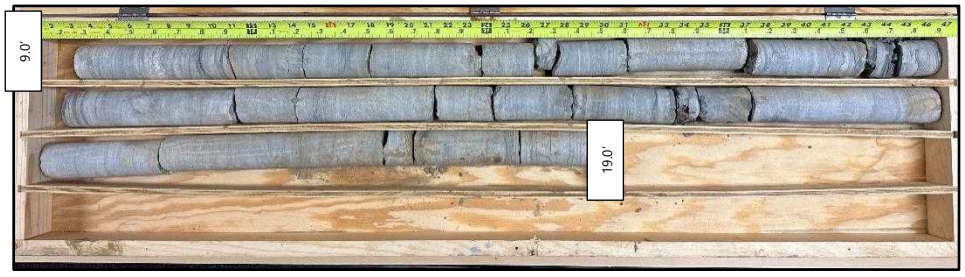


Date: 1/31/2023

Photographer: D. Zierer GIT

19	Location / Orientation	WB-6 (21.5 ft – 26.5 ft)
	Remarks	Box 2 of 2

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	9	to	19	10	97	64



Date: 1/31/2023

Photographer: D. Zierer GIT

20	Location / Orientation	WB-7 (9.0 ft – 19.0 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	4.5	to	14.5	10	98	70

Date: 1/31/2023

Photographer: D. Zierer GIT

21	Location / Orientation	WB-8 (4.5 ft – 19.5 ft)
	Remarks	Box 1 of 1

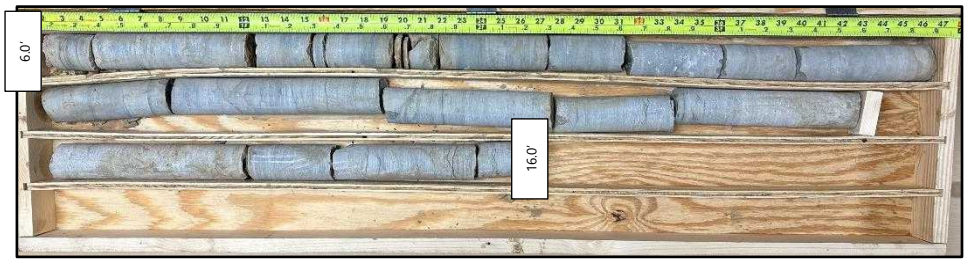
Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	8.2	to	16.2	8	99	91
RC-2	16.2	to	18.2	2	100	100

Date: 1/31/2023

Photographer: D. Zierer GIT

22	Location / Orientation	WB-9 (8.2 ft – 18.2 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	6	to	16	10	95	79



Date: 1/31/2023

Photographer: D. Zierer GIT

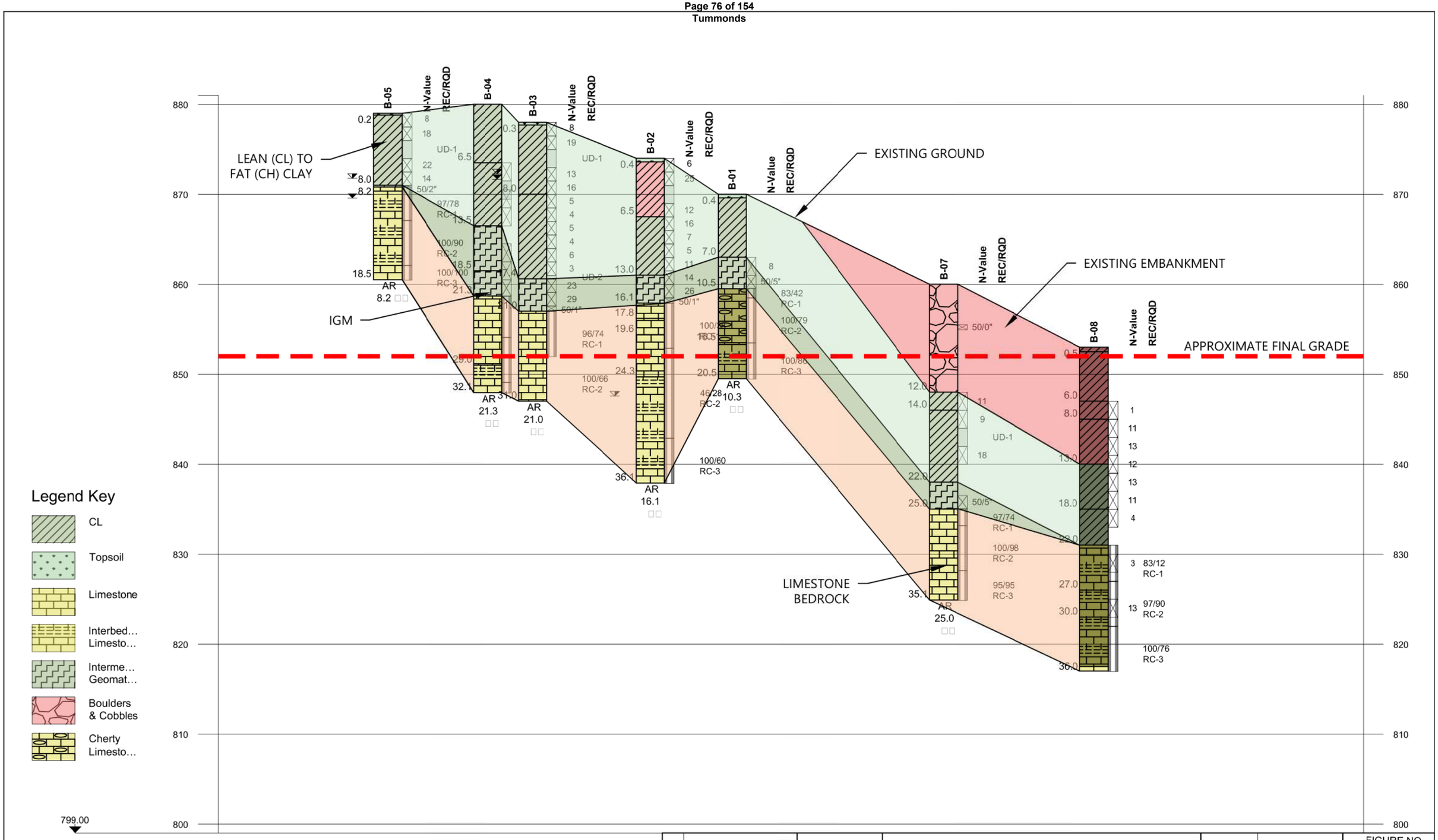
23	Location / Orientation	WB-10 (6.0 ft – 16.0 ft)
	Remarks	Box 1 of 1

Run	Depth (ft)			Length (ft)	Recovery (%)	RQD (%)
RC-1	10.7	to	15.7	5	98	76
RC-2	15.7	to	20.7	5	96	60

Date: 1/31/2023

Photographer: D. Zierer GIT

24	Location / Orientation	WB-11 SA (19.8 ft – 20.7 ft)
	Remarks	Box 1 of 1



The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgement. The actual subsurface concitions will vary between boring locations.

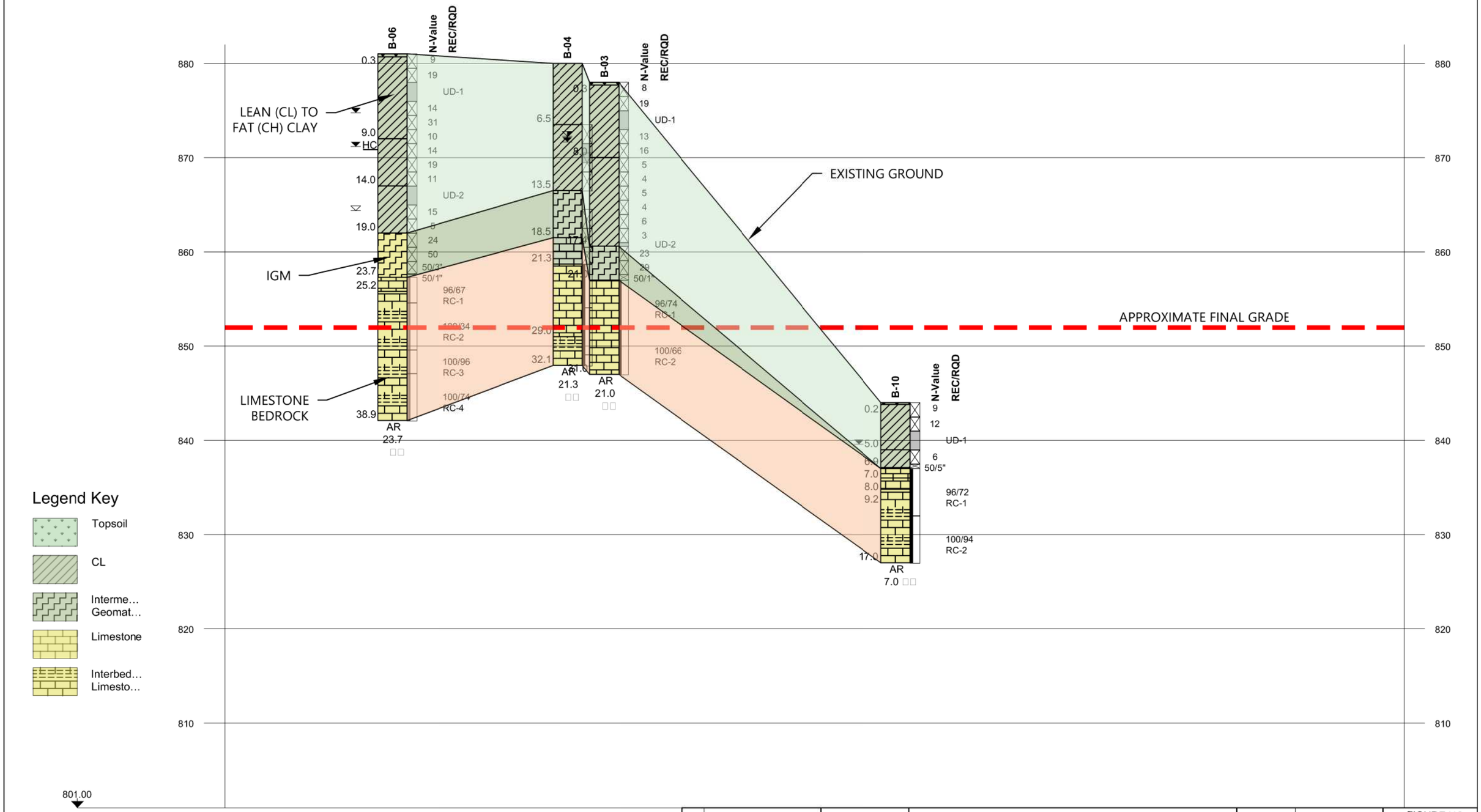
▽	AT TIME OF DRILLING
▼	END OF DRILLING
▼	AFTER DRILLING

Section A-A

2027 NGCC Geotechnical Investigation
KU -E.W. Brown Generating Station

SCALE:	1:1200
DATE:	Mar 09, 2023
PROJECT NUMBER:	22360136 -Unit 1-2 / Webb Farm

FIGURE NO
3A



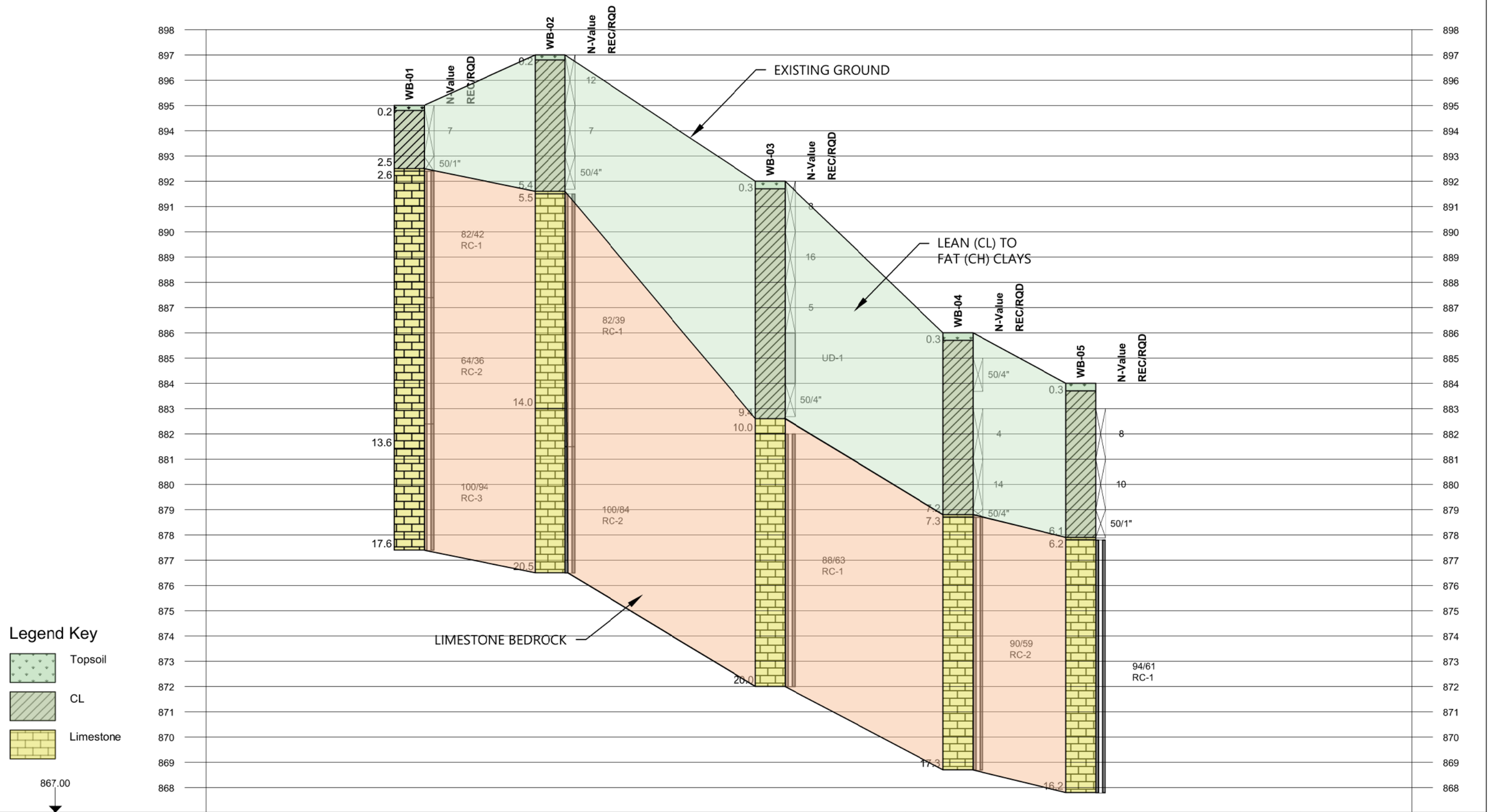
The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgement. The actual subsurface concitions will vary between boring locations.

Section B-B

2027 NGCC Geotechnical Investigation
KU -E.W. Brown Generating Station

SCALE:	1:1200
DATE:	Mar 09, 2023
PROJECT NUMBER:	22360136 -Unit 1-2 / Webb Farm

FIGURE NO
3B



The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgement. The actual subsurface concitions will vary between boring locations.

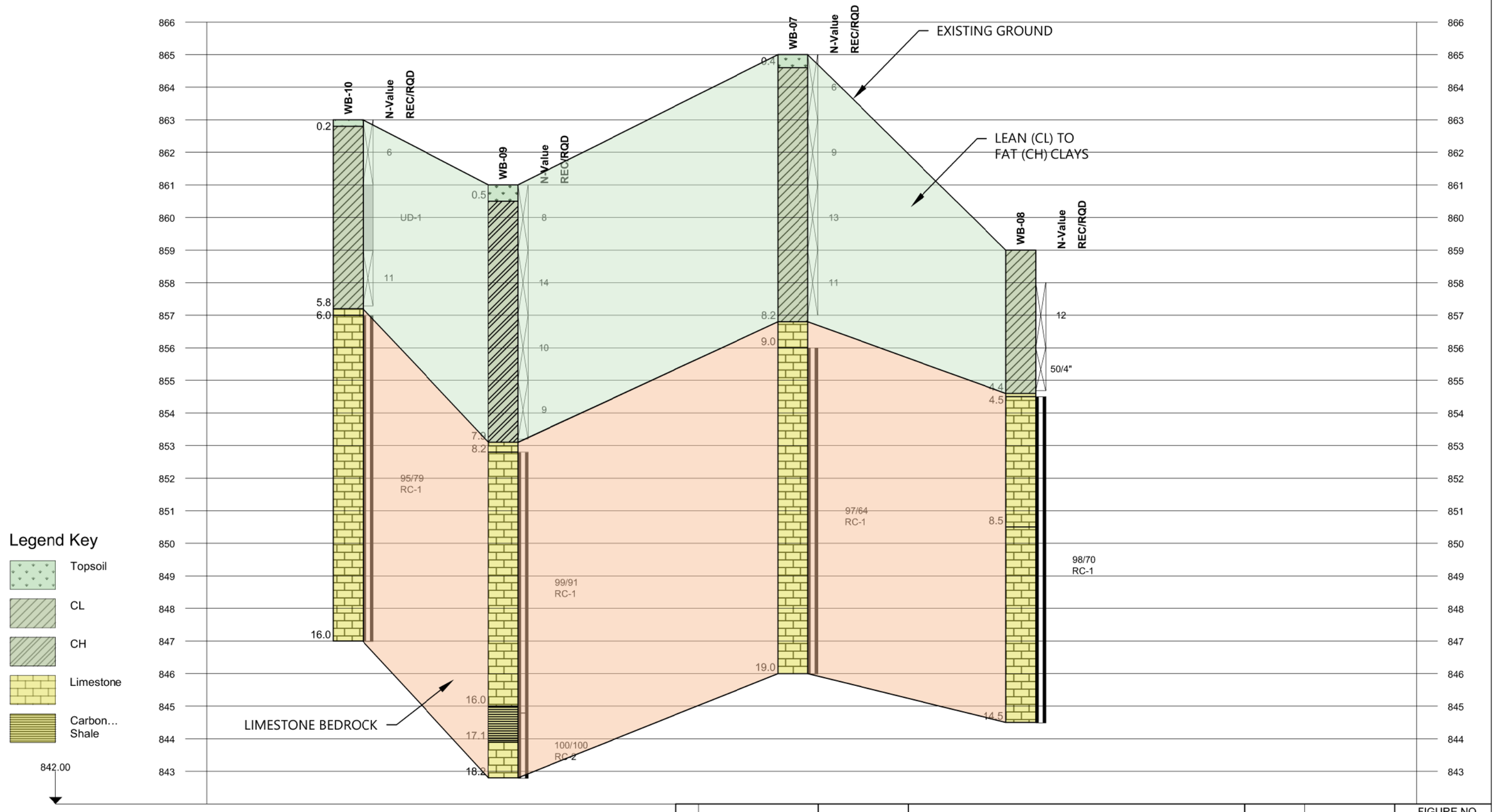
▽	AT TIME OF DRILLING
▼	END OF DRILLING
▼	AFTER DRILLING

Section A-A

2027 NGCC Geotechnical Investigation
KU -E.W. Brown Generating Station

SCALE:	1:600
DATE:	Mar 15, 2023
PROJECT NUMBER:	22360136 -Unit 1-2 / Webb Farm

FIGURE NO.
4A



The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgement. The actual subsurface concitions will vary between boring locations.

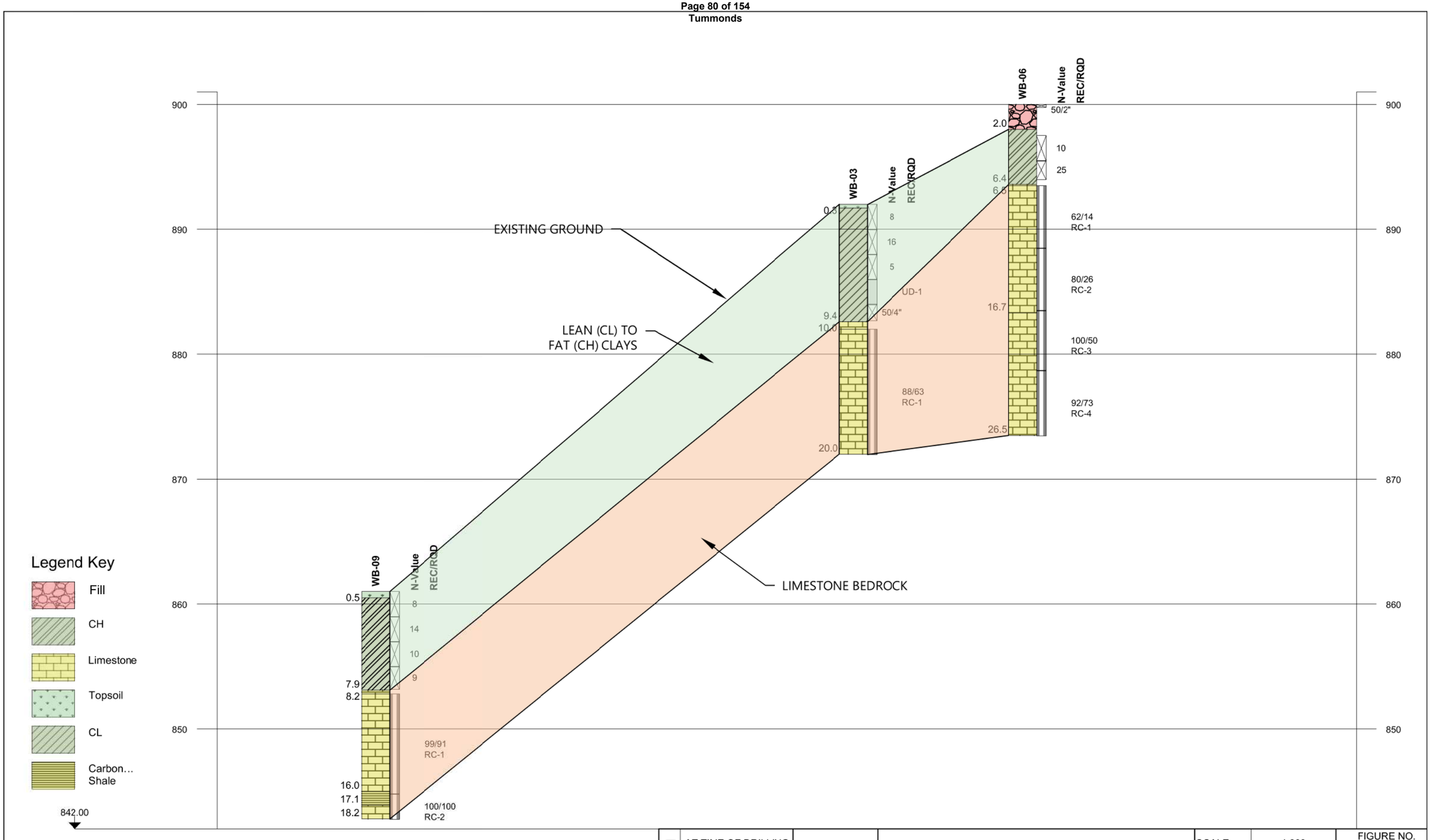
▽	AT TIME OF DRILLING
▼	END OF DRILLING
▼	AFTER DRILLING

Section B-B

2027 NGCC Geotechnical Investigation
KU -E.W. Brown Generating Station

SCALE:	1:800
DATE:	Mar 15, 2023
PROJECT NUMBER:	22360136 -Unit 1-2 / Webb Farm

FIGURE NO.
4B



The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgement. The actual subsurface concitions will vary between boring locations.

▽	AT TIME OF DRILLING
▼	END OF DRILLING
▼	AFTER DRILLING

Section C-C

2027 NGCC Geotechnical Investigation
KU -E.W. Brown Generating Station

SCALE:	1:800
DATE:	Mar 15, 2023
PROJECT NUMBER:	22360136 -Unit 1-2 / Webb Farm

FIGURE NO.
4C

E.W. Brown Unit 1-2
2027 NGCC Geotechnical Investigation – Site Photos
Harrodsburg, Mercer County, Kentucky
S&ME Project No. 22360136

Date: 12/2/2022

Photographer: Nick Jones

1	**Location / Orientation**	Area around B-1, looking southeast.
	Remarks	

Date: 12/2/2022

Photographer: Nick Jones

2	**Location / Orientation**	B-3 toward B-11, looking north.
	Remarks	

E.W. Brown Unit 1-2
2027 NGCC Geotechnical Investigation – Site Photos
Harrodsburg, Mercer County, Kentucky
S&ME Project No. 22360136

Date: 12/2/2022

Photographer: Nick Jones

3	**Location / Orientation**	Area near B-6, looking southwest.
	Remarks	

Date: 12/2/2022

Photographer: Nick Jones

4	**Location / Orientation**	Rock outcropping below embankment near B-8, looking southeast.
	Remarks	

Date: 12/2/2022

Photographer: Nick Jones

5	**Location / Orientation**	S&ME drilling B-8, looking south.
	Remarks	

Date: 12/2/2022

Photographer: Nick Jones

6	**Location / Orientation**	B-9 and B-10, looking north.
	Remarks	

E.W. Brown Unit 1-2
2027 NGCC Geotechnical Investigation – Site Photos
Harrodsburg, Mercer County, Kentucky
S&ME Project No. 22360136

Date: 12/2/2022

Photographer: Nick Jones

7	**Location / Orientation**	Overhead lines near B-9 and B-10, looking southeast.
	Remarks	B-9 and B-10 offset north due to OHE and septic fields.

Date: 12/2/2022

Photographer: Nick Jones

8	**Location / Orientation**	Existing overhead lines in area of fill, looking north
	Remarks	

E.W. Brown Unit 1-2
2027 NGCC Geotechnical Investigation – Site Photos
Harrodsburg, Mercer County, Kentucky
S&ME Project No. 22360136

Date: 12/2/2022

Photographer: Nick Jones

9	**Location / Orientation**	Parking area near B-11, looking north.
	Remarks	

E.W. Brown Webb Farm
2027 NGCC Geotechnical Investigation – Site Photos
Harrodsburg, Mercer County, Kentucky
S&ME Project No. 22360136

Date: 1/17/2023

Photographer: Asad Khan

1	**Location / Orientation**	Area near B-6, looking east.
	Remarks	

Date: 1/17/2023

Photographer: Asad Khan

2	**Location / Orientation**	Downhole Seismic Casing at WB-03
	Remarks	

E.W. Brown Webb Farm
2027 NGCC Geotechnical Investigation – Site Photos
Harrodsburg, Mercer County, Kentucky
S&ME Project No. 22360136

Date: 1/17/2023

Photographer: Asad Khan

3	**Location / Orientation**	General site (after demo), looking northwest.
	Remarks	

Date: 1/17/2023

Photographer: Asad Khan

4	**Location / Orientation**	Near WB-8, looking west.
	Remarks	

E.W. Brown Webb Farm
2027 NGCC Geotechnical Investigation – Site Photos
Harrodsburg, Mercer County, Kentucky
S&ME Project No. 22360136

Date: 1/17/2023

Photographer: Asad Khan

5	**Location / Orientation**	WB-1, looking South (Photo A)
	Remarks	

Date: 1/17/2023

Photographer: Asad Khan

6	**Location / Orientation**	WB-1, looking South (Photo B)
	Remarks	Click here.

Date: 1/17/2023

Photographer: Asad Khan

7	**Location / Orientation**	WB-2, looking north.
	Remarks	

Date: 1/17/2023

Photographer: Asad Khan

8	**Location / Orientation**	WB-9, looking north.
	Remarks	

E.W. Brown Webb Farm
2027 NGCC Geotechnical Investigation – Site Photos
Harrodsburg, Mercer County, Kentucky
S&ME Project No. 22360136

Date: 1/17/2023

Photographer: Asad Khan

9	**Location / Orientation**	WB-10, looking east.
	Remarks	

Soil Resistivity Data Sheet
Wenner Four-Electrode Method

Project: KU LG&E 2027 NGCC EW Brown **Project #:** 22360136

Project Location: Harrodsburg, KY **Station #:** ER-2 Line-A (NW-SE)

Date: 12/1/2022 **Time:** 10:45 AM

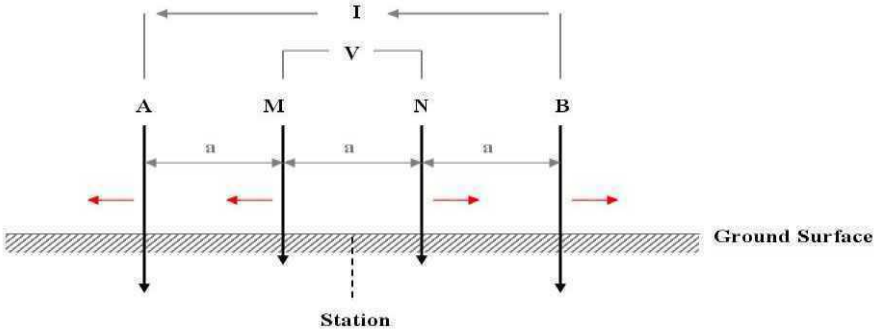
Weather & Temperature: 32°F, Sunny

Soil Conditions: Clay

Performed By (Name of Tester) Adam Gostic

Additional Notes: Units 1-2

$\rho = 2\pi \cdot a \cdot R$



"a" Spacing (feet)	"a" Spacing (centimeters)	Electrode Depth (Inches)	Resistance (Ω)	ρ Apparent Resistivity (Ω·cm)	ρ Apparent Resistivity (Ω·ft)	Injected Current (mA)	Standard Deviation (%)
2.5	76.20	4	16.750	8019.56	263.11	51.09	0.00%
5	152.40	6	8.140	7794.54	255.73	52.83	0.00%
10	304.80	12	2.441	4674.81	153.37	795.70	0.00%
15	457.20	12	1.462	4199.86	137.79	788.50	0.00%
20	609.60	12	1.093	4186.45	137.35	756.00	0.00%
30	914.40	12	0.748	4296.38	140.96	780.40	0.00%

Soil Resistivity Data Sheet
Wenner Four-Electrode Method

Project: KU LG&E 2027 NGCC EW Brown **Project #:** 22360136

Project Location: Harrodsburg, KY **Station #:** ER-2 Line-B (NE-SW)

Date: 12/1/2022 **Time:** 11:05 AM

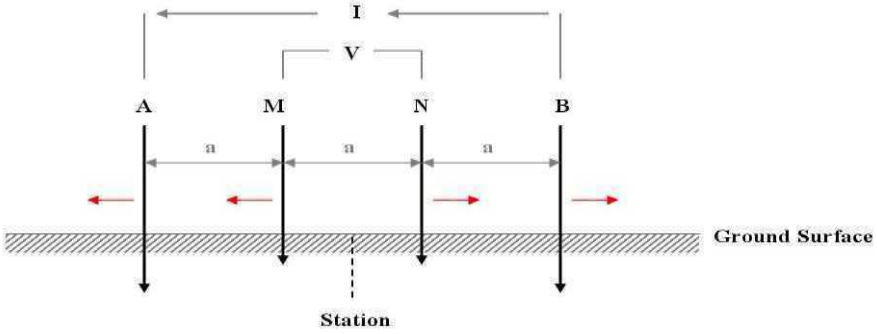
Weather & Temperature: 35°F, Sunny

Soil Conditions: Clay

Performed By (Name of Tester) Adam Gostic

Additional Notes: Units 1-2

$\rho = 2\pi \cdot a \cdot R$



"a" Spacing (feet)	"a" Spacing (centimeters)	Electrode Depth (Inches)	Resistance (Ω)	ρ Apparent Resistivity (Ω·cm)	ρ Apparent Resistivity (Ω·ft)	Injected Current (mA)	Standard Deviation (%)
2.5	76.20	4	16.840	8062.65	264.52	47.79	0.00%
5	152.40	6	7.356	7043.81	231.10	45.87	0.00%
10	304.80	12	2.706	5182.31	170.02	765.80	0.00%
15	457.20	12	1.556	4469.89	146.65	713.30	0.00%
20	609.60	12	1.244	4764.82	156.33	732.10	0.00%
30	914.40	12	0.874	5022.02	164.76	788.60	0.00%

Soil Resistivity Data Sheet
Wenner Four-Electrode Method

Project: KU 2027 NGCC EW Brown **Project #:** 22360136

Project Location: Harrodsburg, KY **Station #:** ER-1 Line-A (E-W)

Date: 12/1/2022 **Time:** 1:00 PM

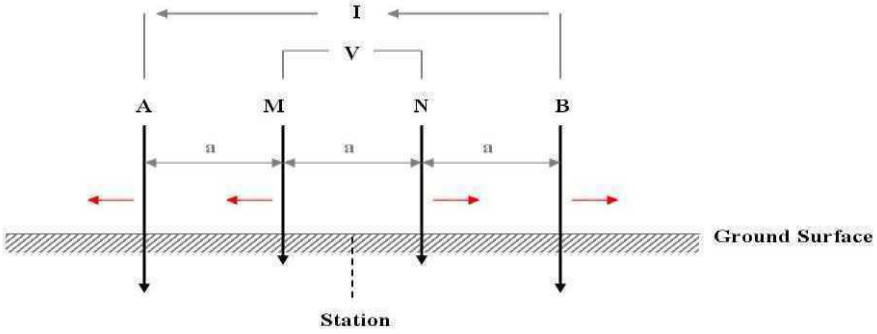
Weather & Temperature: 34°F, Sunny

Soil Conditions: Clay

Performed By (Name of Tester) Adam Gostic

Additional Notes: Webb Farm

$\rho = 2\pi \cdot a \cdot R$



"a" Spacing (feet)	"a" Spacing (centimeters)	Electrode Depth (Inches)	Resistance (Ω)	ρ Apparent Resistivity (Ω·cm)	ρ Apparent Resistivity (Ω·ft)	Injected Current (mA)	Standard Deviation (%)
2.5	76.20	4	26.950	12903.12	423.33	21.33	0.00%
5	152.40	6	9.108	8721.45	286.14	213.20	0.00%
10	304.80	12	6.149	11776.07	386.35	488.90	0.00%
15	457.20	12	5.057	14527.14	476.61	616.90	0.00%
20	609.60	12	4.155	15914.64	522.13	424.40	0.00%
30	914.40	12	2.751	15805.48	518.55	501.20	0.00%

Soil Resistivity Data Sheet
Wenner Four-Electrode Method

Project: KU 2027 NGCC EW Brown **Project #:** 22360136

Project Location: Harrodsburg, KY **Station #:** ER-1 Line-B (N-S)

Date: 12/1/2022 **Time:** 1:20 PM

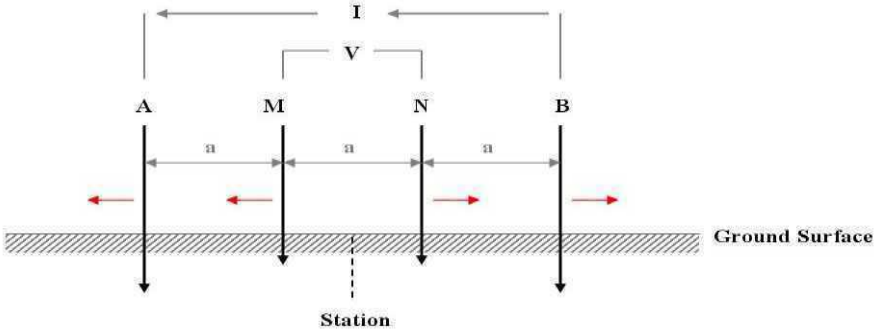
Weather & Temperature: 34°F, Sunny

Soil Conditions: Clay

Performed By (Name of Tester) Adam Gostic

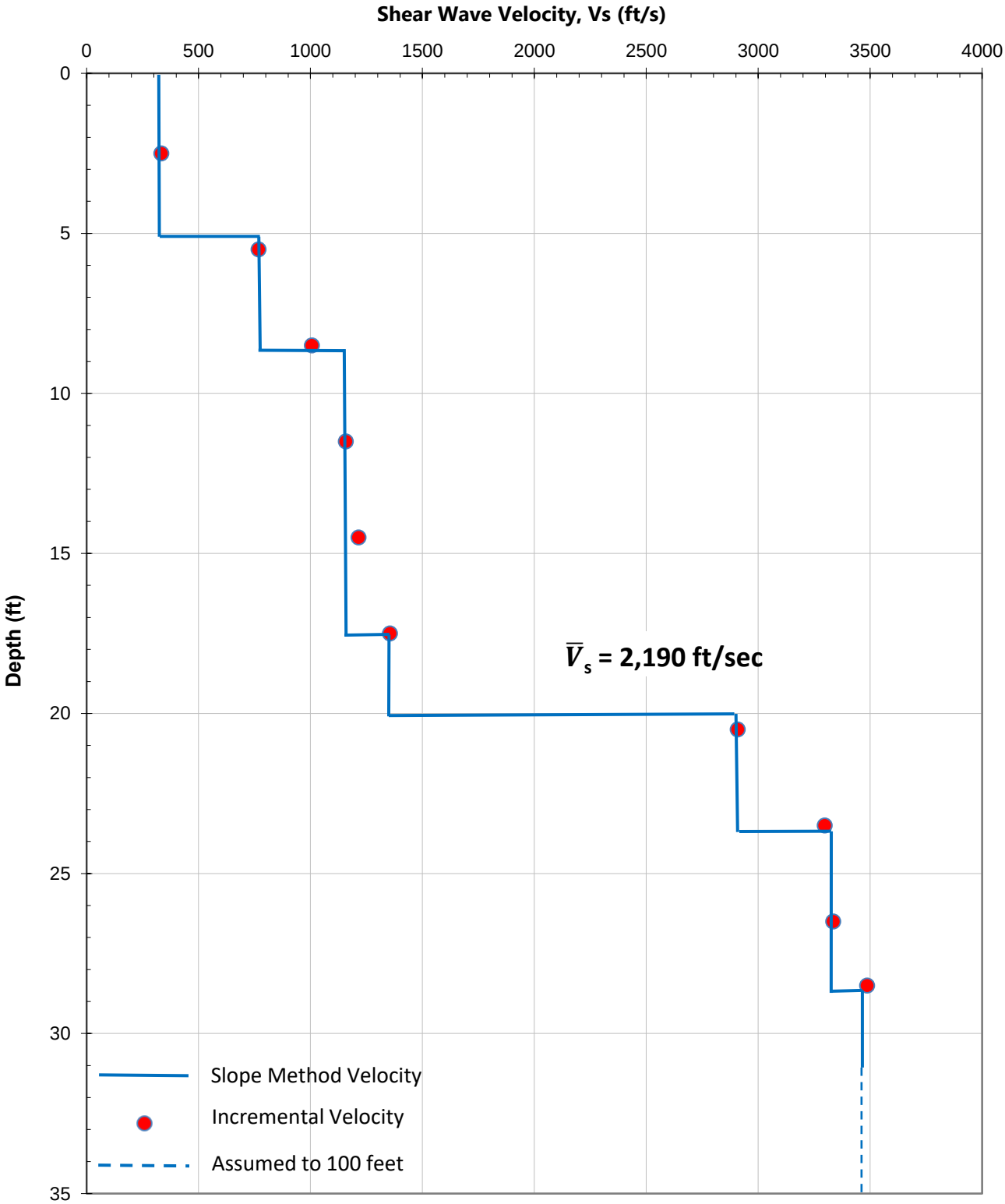
Additional Notes: Webb Farm

$\rho = 2\pi \cdot a \cdot R$

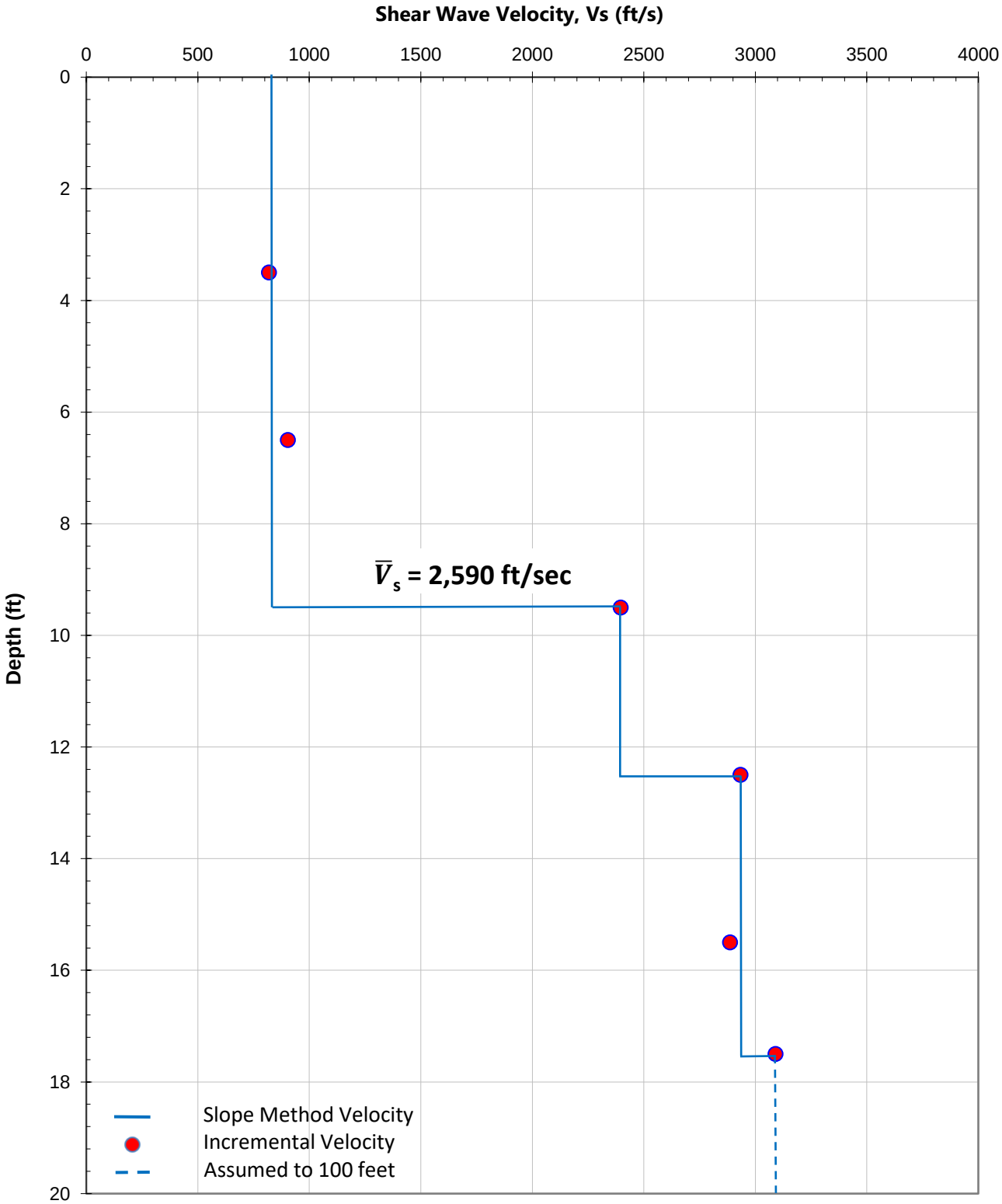


"a" Spacing (feet)	"a" Spacing (centimeters)	Electrode Depth (Inches)	Resistance (Ω)	ρ Apparent Resistivity (Ω·cm)	ρ Apparent Resistivity (Ω·ft)	Injected Current (mA)	Standard Deviation (%)
2.5	76.20	4	20.670	9896.38	324.68	20.64	0.00%
5	152.40	6	9.700	9288.33	304.74	242.80	0.00%
10	304.80	12	5.457	10450.81	342.87	410.40	0.00%
15	457.20	12	4.111	11809.58	387.45	648.00	0.00%
20	609.60	12	3.756	14386.38	471.99	650.30	0.00%
30	914.40	12	2.756	15834.21	519.49	381.20	0.00%

Shear Wave Velocity Profile B-04
KU E.W. Brown - Unit 1-2
Burgin, Mercer County, Kentucky
S&ME Project Number: 22360136



Shear Wave Velocity Profile WB-03
KU E.W. Brown - Webb Farm
Burgin, Mercer County, Kentucky
S&ME Project Number: 22360136



Summary of Field Procedures

Boring and Sampling

Soil Test Boring with Hollow-Stem Auger

Soil sampling and penetration testing were performed in general accordance with ASTM D1586, *Standard Test Method for Penetration Test and Split Barrel Sampling of Soils*. Borings were made by mechanically twisting a continuous steel hollow stem auger into the soil. At regular intervals, soil samples were obtained with a standard 1.4-inch I. D., 2-inch O. D., split barrel sampler. The sampler was first seated six inches to penetrate any loose cuttings, then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler through the two final six inch increments was recorded as the penetration resistance (SPT N) value. The N-value, when properly interpreted by qualified professional staff, is an index of the soil strength and foundation support capability.

Bulk Samples

At selected locations and depths, representative bulk samples of the soils were obtained by randomly taking shovel loads from the cuttings or spoil brought to the surface, until a sample of 30 to 50 pounds was obtained. The sample was placed in a cloth or plastic sack marked with appropriate descriptive information. Samples were protected from freezing at all times.

Undisturbed (UD) Sampling

Split spoon or split barrel sampling provide samples suitable for visual examination and classification tests but not sufficiently intact for quantitative laboratory testing. To provide samples for quantitative tests, relatively undisturbed samples were obtained by pushing sections of 3-inch O.D., 16-guage, steel tubing (Shelby tube) into the soil at the desired sampling intervals. The procedures used generally followed those described in ASTM D1587, *Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils*. Each tube, together with the encased soil, was carefully removed from the ground and the length of the recovered soil measured. Locations and depths of undisturbed samples were recorded on each field test boring record.

Refusal to Drilling

Refusal to the soil drilling methods used at this site may result from encountering hard cemented soil, soft weathered rock, coarse gravel, cobbles or boulders, thin rock seams, or the upper surface of sound continuous rock. Core drilling would be required to determine the character and continuity of materials below refusal of the soil auger in natural soils. Where fills are present, refusal to drilling may also result from encountering buried debris, building materials, or objects. Backhoe test pits would be required to expose and identify buried materials below refusal levels in filled areas.

Rock Core Drilling in Cased Borehole

In selected borings where refusal to the drilling tools had been encountered, steel casing was set in the hole to the refusal depth to keep the hole from caving. Materials below refusal level were then cored using a

diamond studded bit fastened to the end of hollow double tube core barrel, in general accordance with the procedures described in ASTM D2113, *Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation*. In this case an NX size core barrel was used to produce cylindrical cores, 1-7/8 inches in diameter. Core rod RPM and advance rate were closely monitored to prevent plugging the bit or core blockage or damage. A circulating media was used to flush cuttings during the coring process. In this case the circulating media used was water without additives. Circulating water was released on the surface after completion of coring.

Installation of Temporary PVC Casing (Observation Well)

Water level readings taken during boring operations do not provide information on long term fluctuations of the water table. In several of the borings, a temporary observation well will be constructed by inserting PVC casing to the indicated depth. A slotted PVC well screen will be attached to the bottom of the PVC pipe to allow subsurface water to enter the well. Soil will be mounded around the observation wells at the ground surface to prevent surface runoff from entering the borehole.

Borehole Closure

Following collection of relevant geotechnical data, boreholes were backfilled with a mixture of cement-bentonite grout and soil cuttings.

Preservation and Transporting of Soil Samples with Control of Field Moisture

Procedures for preserving soil samples obtained in the field and transportation of samples to the laboratory generally followed those given in ASTM D4220, *Standard Practice for Preserving and Transporting Soil Samples* for Group B samples as defined in Section 4. Group B samples are those samples not suspected of being contaminated and for which only water content and classification, proctor, relative density, or profile logging will be performed. Group B samples also include bulk samples that are intended to be remolded in the laboratory for compaction, swell pressure, percent swell, consolidation, permeability, CBR, or shear testing. Representative samples of the cuttings or split spoon samples, or representative bulk samples, were placed in suitably identified, sealed glass jars or plastic containers and transported to the laboratory. Sample identification numbers on the containers corresponded to sample numbers recorded on field boring records or test pit records. Thin-walled tube samples were sealed at the ends with paraffin and capped with plastic end caps.

Preservation and Transporting of Intact Soil Samples

Procedures for preserving certain selected soil samples obtained in the field and transportation of those samples to the laboratory generally followed procedures given in ASTM D4220, *Standard Practice for Preserving and Transporting Soil Samples* for Group C samples as defined in Section 4. Group C samples are intact, naturally formed or field fabricated, samples for density determination, swell pressure, percent swell, permeability testing or shear testing with or without stress-strain plots or volume change measurement, including dynamic and cyclic testing. Representative thin walled tube samples were protected against vibration or shock, or extreme heat or cold, during transport to the laboratory. Sample identification numbers on the containers corresponded to sample numbers recorded on field boring records or test pit records. Thin-walled tube samples were sealed at the ends with paraffin and capped with plastic end caps. Samples

were transported in the upright position in containers providing complete encasement in cushioning or insulation for individual samples.

Preservation and Transport of Rock Core Requiring Routine Care

Procedures for preserving recovered rock core specimens followed those given for routine care of non-sensitive, non-fragile samples for which only general visual examination will be performed. Steps for routine care are described in ASTM D5079, *Standard Practices for Preserving and Transporting Rock Core Samples*, section 7.5.1. Rock cored in 5 to 10 foot runs were placed in sleeves or channels in specially constructed wood or cardboard core boxes. Empty portions of sleeves or channels were packed with wood or paper to prevent slippage of the core during transport. Boxes were transported flat and secured to prevent sliding or vibration. A preliminary field log of each core indicating recovery and general visual description was prepared prior to packing of the core.

♦ Field Tests of Earth Materials

The subsurface conditions encountered during drilling were reported on a field test boring record by the chief driller. The record contains information about the drilling method, samples attempted and sample recovery, indications of materials in the borings such as coarse gravel, cobbles, etc., and indications of materials encountered between sample intervals. Representative soil samples were placed in glass jars and transported to the laboratory along with the field boring records. Recovered samples not expended in laboratory tests are commonly retained in our laboratory for 60 days following completion of drilling. Field boring records are retained at our office.

Measurement of Static Water Levels

Water level readings were made in the open boreholes immediately after completing drilling and withdrawal of the tools. Where feasible, measurements were repeated after an elapsed period of 24 hours to gauge the stabilized water level. Procedures for measurement of liquid levels in open boreholes are described in ASTM D4750, *Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)*. A calibrated cable with electrical wire encased, equipped with a weighted sensing tip at one end and an electric meter at the other, was slowly lowered into each borehole until the liquid surface was penetrated by the weighted end. Contact with the water closed an electric circuit and was recorded by the meter. The depth reading on the cable was then recorded relative to a reference point on the surface. Measurements made by this method were then repeated until approximately consistent values were obtained.

Downhole Shear Wave Velocity Test (Geophone)

Shear wave velocity measurements were performed using downhole methods in general accordance with ASTM D7400, *Standard Test Methods for Downhole Seismic Testing*. For downhole surveys, a triaxial geophone is lowered in the hole and coupled to the borehole sidewall. At various depths, generally every 3 to 5 feet, the horizontal geophone records a pair of opposite polarity horizontally polarized vertical shear wave generated at the surface of the borehole. The shear wave is typically generated at the surface by hitting opposite ends of a plank coupled to the ground surface and a vertical geophone used to record compression. Corrections for the source offset are typically made, however corrections for verticality are not required.

Field Resistivity Testing

Apparent resistivity of the soil was measured at selected locations in the field by measuring the voltage potential between four equally spaced, in-line direct current electrodes in the Wenner Electrode Arrangement as described in ASTM D6431, *Standard Guide for Using the Direct Current Resistivity Method for Subsurface Investigation*. Using the measured voltages, resistivity was estimated using the approach described in *A Method of Measuring Earth Resistivity*, U. S. Bureau of Standards Bulletin No. 258, by Dr. F. Wenner, in which the average resistivity of the soil to a depth of "A" is given by:

r = 191.5 x AE/I, where:

r = Average resistivity of soil, ohm-cm
A = Distance between electrodes, cm
E = Measured Voltage, Volts
I = Current, Amperes

Appendix III – Laboratory Testing Summaries and Data Sheets

Table III-1 – Laboratory Data Summary (Soil)

Boring	Depth (ft)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Classification	Undrained Shear Strength (psf)
B-5	3.0 to 5.0	44	24	20	Lean Clay (CL)	3,600
B-6	3.0 to 5.0	42	21	21	Lean Clay (CL)	3,600
B-6	14.0 to 16.0	55	20	35	Fat Clay (CH)	790
B-10	3.0 to 5.0	77	23	54	Fat Clay (CH)	-
WB-3	6.0 to 8.0	63	28	35	Fat Clay (CH)	-
WB-9	2.0 to 4.0	67	28	39	Fat Clay (CH)	-

Table III-2 – Laboratory Data Summary (Rock)

Boring	Sample ID	Depth (ft)	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Uniaxial Compressive Strength (psi)
B-5	RC-2	11.9	0.1	164.5	13,108
B-11	RC-2	15.2	0.6	165.1	9,332
WB-3	RC-1	12.1	-	-	10,986

Table III-3 – Corrosion Series Laboratory Test Results Summary (Soil)

Boring	Sample ID	Sample Depth (ft)	pH	Electrical Resistivity (ohm-cm)	Redox Potential (mV)	Sulfate (mg/kg)	Sulfide (mg/kg)	Chloride (mg/kg)
B-4	ST-1	10.0 to 12.0	9.4	1,500	100 to 120	4100	BRL[1]	BRL[2]

Note:
1. BRL = below reporting limit. Reporting limit is 60.6 mg/kg.
2. Reporting limit is 150 mg/kg.

Table III-4 – Concrete Exposure Classes

Boring	Sample	Depth (ft)	Freezing and Thawing (F)	Sulfate (S)	In Contact with Water (W)	Corrosion Protection of Reinforcement (C)
B-4	ST-1	10.0 to 12.0	F0	S2	W0	C1

Soil Test Evaluation for Ductile Iron Pipe

(10-Point System)*

Soil Characteristics	*Points*
Resistivity (ohm-cm)**	
<1,500	10
≥1,500-1,800	8
>1,800-2,100	5
>2,100-2,500	2
>2,500-3,000	1
>3,000	0
pH	
0-2	5
2-4	3
4-6.5	0
6.5-7.5	0***
7.5-8.5	0
>8.5	3
Redox potential	
>+100 mv	0
+50 to +100 mv	3.5
0 to +50 mv	4
Negative	5
Sulfides	
Positive	3.5
Trace	2
Negative	0
Moisture	
Poor drainage, continuously wet	2
Fair drainage, generally moist	1
Good drainage, generally dry	0

*Ten points–corrosive to Ductile Iron pipe. Protection is indicated.

**Based on water-saturated soil box. This method is designed to obtain the lowest–and most accurate–resistivity reading.

***If sulfides are present and low (<100 mv) or negative redox-potential results are obtained, 3 points should be given for this range.

Note: DIPRA recommends that the soil sample used in the 10-point evaluation be taken at pipe depth rather than at the surface. Soil corrosivity readings can vary substantially from the surface to pipe depth.

Figure III-1 – Soil Test Evaluation for Ductile Iron Pipe Table

ACI 318-11 Requirements for Concrete Exposed to Sulfates

Exposure Class (Concrete in contact with soluble sulfates in soil/sea water)	Max. w/cm	Minimum f'_c, psi	ASTM C150 Cementitious Type	ASTM C1012 expansion
S0 – Low sulfates*	N/A	2500	NA	
S1 - Moderate sulfates*	0.50	4000	Type II	0.10% at 6 m
S2 - Severe sulfates*	0.45	4500	Type V	0.05% at 6 m or 0.10% at 12 m
S3 – Very severe sulfates*	0.45	4500	Type V+pozzolan or slag	0.10% at 18 m

*Sulfate concentration is provided in ACI 318-11

Figure III-2 – ACI 318 Requirements for Concrete Exposed to Sulfates

Category	Class	Condition	
Freezing and thawing (F)	F0	Concrete not exposed to freezing-and-thawing cycles	
	F1	Concrete exposed to freezing-and-thawing cycles with limited exposure to water	
	F2	Concrete exposed to freezing-and-thawing cycles with frequent exposure to water	
	F3	Concrete exposed to freezing-and-thawing cycles with frequent exposure to water and exposure to deicing chemicals	
Sulfate (S)		Water-soluble sulfate (SO_4^{2-}) in soil, percent by mass[1]	Dissolved sulfate (SO_4^{2-}) in water, ppm[2]
	S0	$SO_4^{2-} < 0.10$	$SO_4^{2-} < 150$
	S1	$0.10 \le SO_4^{2-} < 0.20$	$150 \le SO_4^{2-} < 1500$ or seawater
	S2	$0.20 \le SO_4^{2-} \le 2.00$	$1500 \le SO_4^{2-} \le 10{,}000$
	S3	$SO_4^{2-} > 2.00$	$SO_4^{2-} > 10{,}000$
In contact with water (W)	W0	Concrete dry in service Concrete in contact with water and low permeability is not required	
	W1	Concrete in contact with water and low permeability is required	
Corrosion protection of reinforcement (C)	C0	Concrete dry or protected from moisture	
	C1	Concrete exposed to moisture but not to an external source of chlorides	
	C2	Concrete exposed to moisture and an external source of chlorides from deicing chemicals, salt, brackish water, seawater, or spray from these sources	

[1]Percent sulfate by mass in soil shall be determined by ASTM C1580.

[2]Concentration of dissolved sulfates in water, in ppm, shall be determined by ASTM D516 or ASTM D4130.

Figure III-3 – ACI 318 Table 19.3.1.1 Exposure Categories and Classes

Form No. TR-2310LEX-SUM1
Revision No. : 0a
Revision Date. : 11/15/20

Lab Summary

S&ME, Inc - Lexington 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project No.: 22360136 Report Date: 01/03/23

Project Name: 2027 NGCC - EW Brown

Client Name: LG&E-KU

Client Address: 820 West Broadway, Louisville, KY

BORING NO.	SAMPLE DEPTH, FT.	SAMPLE TYPE	USCS	NATURAL MOISTURE CONTENT,%	ATT. LIMITS L.L.	P.L.	P. I.	APPROX % RET.ON #40	MAX DRY DENSITY, PCF @ OPT MC % (STD. PROCTOR)	WET UNIT WEIGHT, PCF	DRY UNIT WEIGHT, PCF	APPROX ROCK UNCONFINED COMPRESSIVE STRENGTH, PSI	SOIL UNCONFINED COMPRESSIVE STRENGTH, PSF	% FINER THAN NO. 200	INTER-POLATED AT 95% CBR, %
B-4	6.5-8.5	1, SS		39.6											
B-4	9.5-11.5	2, SS		35.0											
B-4	11.5-13.5	3, SS		32.9											
B-4	13.5-15.5	4, SS		34.8											
B-4	15.5-17.5	5, SS		45.4											
B-4	17.5-19.5	6, SS		24.0											
B-4	19.5-21.5	7, SS		18.7											
B-4	5.0-10	1, BK		27.7					112.8 @ 17.3						4.6
B-5	3-5.0	1, UD	CL	18.3	44	24	20	10		122.4	103.5			85.2	
B-6	3-5.0	1, UD	CL	21.1	42	21	21	10		126.0	104.0		7,205	83.4	
B-6	14-16.0	2, UD	CH	33.8	55	20	35	10		113.3	84.7			60.8	
B-10	3-5.0	1, UD	CH	30.8	77	23	54	<5		112.9	86.3			91.3	

Notes:

Jacob Folsom — *Technical Responsibility*

Jacob Folsom

Lab Services Manager — *Position*

01/10/23 — *Date*

Form No. TR-2310LEX-SUM1
Revision No. : 0a
Revision Date. : 11/15/20

Lab Summary

S&ME, Inc - Lexington 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project No.: 22360136 Report Date: 02/10/23

Project Name: 2027 NGCC - Mill Creek and Brown

Client Name: LG&E-KU

Client Address: 820 West Broadway, Louisville, KY

BORING NO.	SAMPLE DEPTH, FT.	SAMPLE NO/TYPE	USCS	NATURAL MOISTURE CONTENT,%	ATT. LIMITS L.L.	ATT. LIMITS P.L.	ATT. LIMITS P. I.	APPROX % RET.ON #40	MAX DRY DENSITY, PCF @ OPT MC % (STD. PROCTOR)	WET UNIT WEIGHT, PCF	DRY UNIT WEIGHT, PCF	APPROX ROCK UNCONFINED COMPRESSIVE STRENGTH, PSI	SOIL UNCONFINED COMPRESSIVE STRENGTH, PSF	% FINER THAN NO. 200	INTER-POLATED AT 95% CBR, %
WB-3	0-2.0	1, SS		30.2											
WB-3	2.0-4.0	2, SS		31.6											
WB-3	4.0-6.0	3, SS		39.0											
WB-3	6.0-8.0	4, UD	CH	39.1	63	28	35	5		116.3	83.6			78.4	
WB-3	8.0-10.0	5, SS		41.3											
WB-3	10.0-20.0	6, NX										10,986			
WB-9	2.0-4.0	2, SS	CH	29	67	28	39	10		116.7	90.7			83	
WB-9	1.0-5	1, BK		35.7					107.6 @ 20.0						

Notes:

Joe LaMothe
Technical Responsibility

Senior Engineering Technician
Position

02/10/23
Date

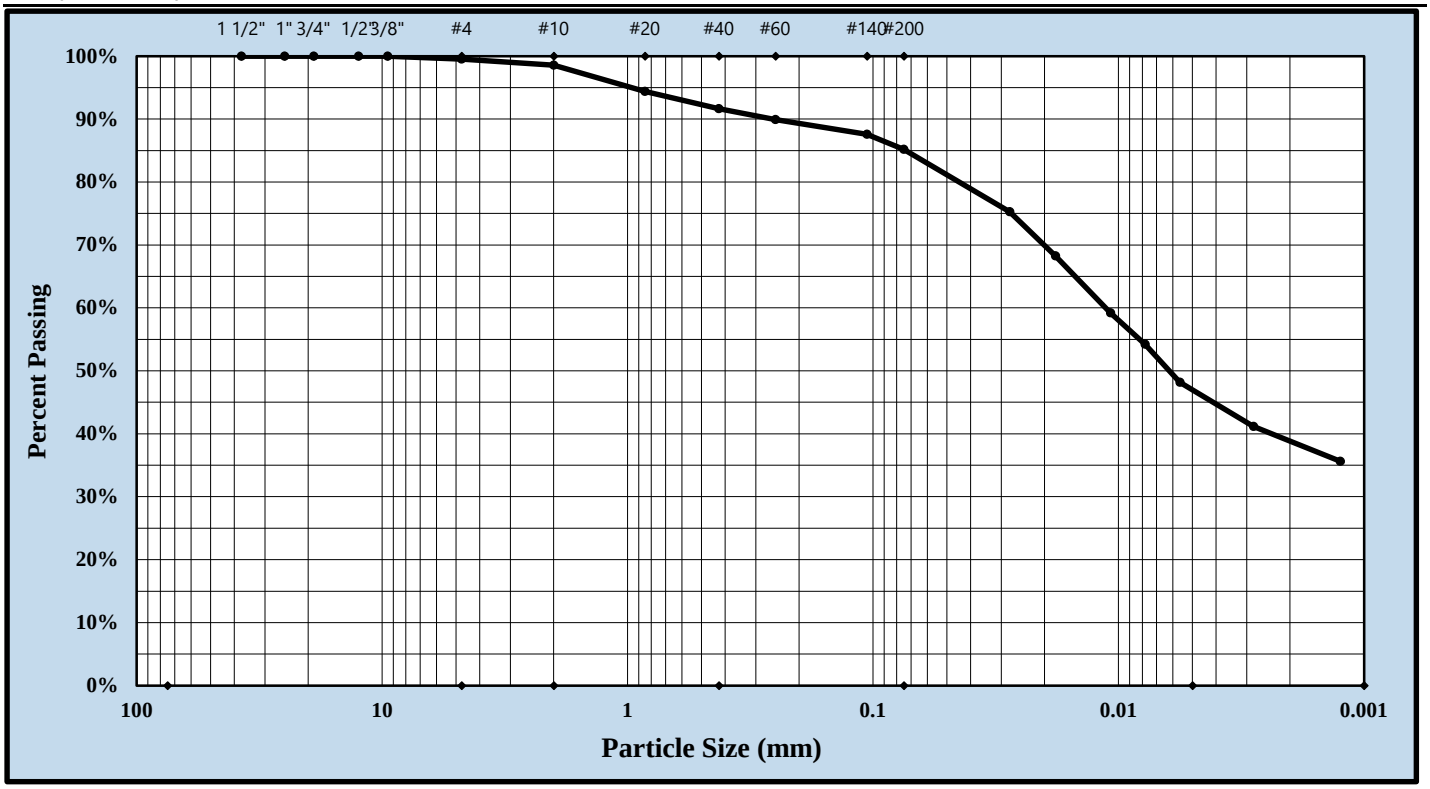
Form No. TR-D422-2
Revision No. 2LEXd
Revision Date: 06/21/22

PARTICLE SIZE ANALYSIS OF SOIL

ASTM D422

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	22360136	Report Date:	1/3/23
Project Name:	2027 NGCC - EW Brown	Test Date(s):	12/22/22
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY		
Type:	UD	Sample Date:	11/21/22
Location:	B-5	Depth (ft.):	3.0 - 5.0
Sample Description:	LEAN CLAY (CL), brown		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt Size	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay Size	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Nom. Maximum Particle Size:	#4	Gravel:	0.5%	Silt Size:	38.2%
Silt & Clay (% Passing #200):	85.2%	Total Sand:	14.3%	Clay Size:	47.0%
Assumed Relative Density:	2.650	Moisture Content:	24.9%		
Liquid Limit:	44	Plastic Limit:	24	Plastic Index:	20
Coarse Sand:	1.0%	Medium Sand:	6.9%	Fine Sand:	6.5%

Description of Sand and Gravel — Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus A — Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References / Comments / Deviations:

Jacob Folsom	Jacob Folsom	Lab Services Manager	1/10/2023
Technical Responsibility	*Signature*	*Position*	*Date*

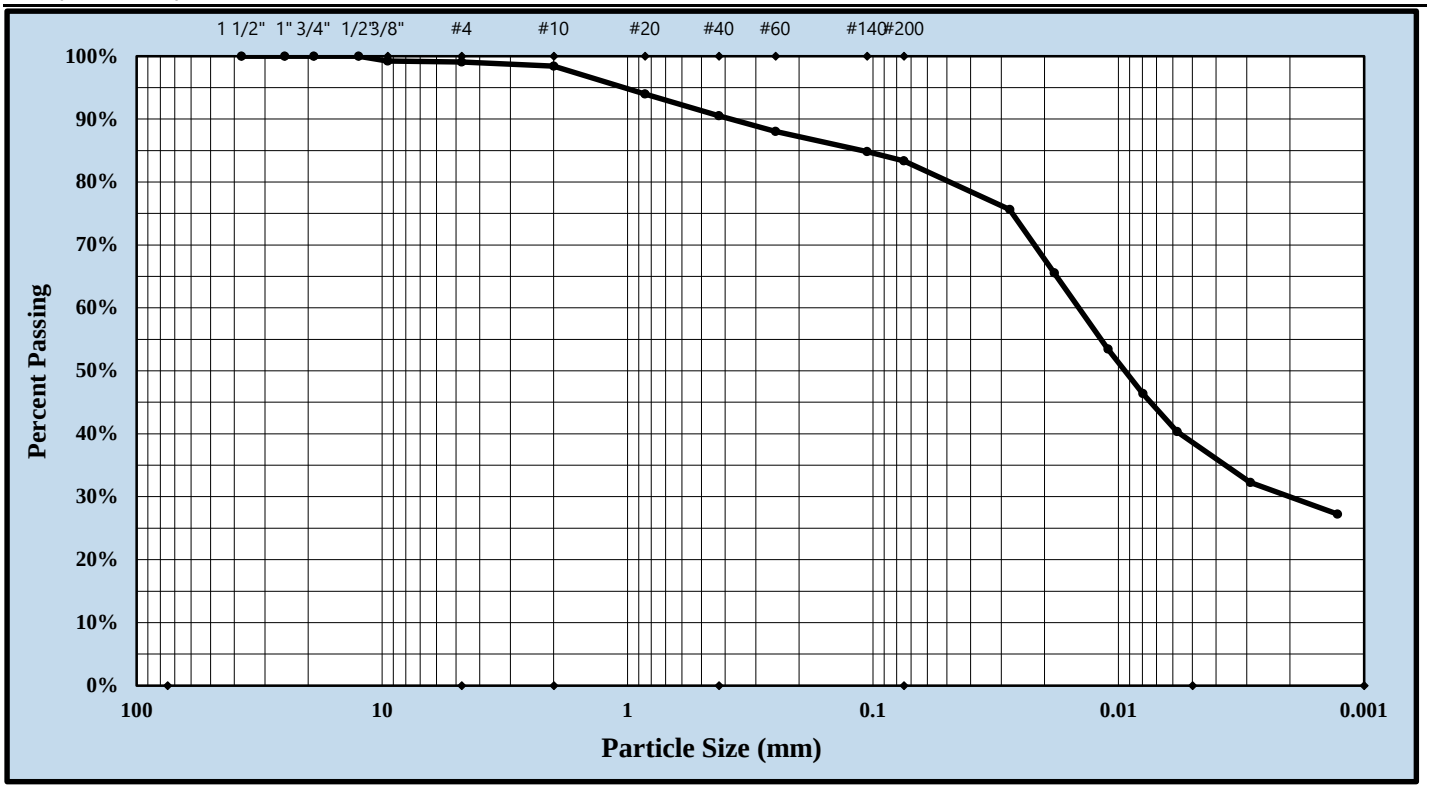
Form No. TR-D422-2
Revision No. 2LEXd
Revision Date: 06/21/22

PARTICLE SIZE ANALYSIS OF SOIL

ASTM D422

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	22360136	Report Date:	1/3/23
Project Name:	2027 NGCC - EW Brown	Test Date(s):	12/22/22
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY		
Type:	UD	Sample Date:	11/21/22
Location:	B-6	Depth (ft.):	3.0 - 5.0
Sample Description:	LEAN CLAY WITH SAND (CL), brown		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt Size	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay Size	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Nom. Maximum Particle Size:	#4	Gravel:	0.9%	Silt Size:	44.7%
Silt & Clay (% Passing #200):	83.4%	Total Sand:	15.7%	Clay Size:	38.6%
Assumed Relative Density:	2.650	Moisture Content:	21.2%		
Liquid Limit:	42	Plastic Limit:	21	Plastic Index:	21
Coarse Sand:	0.7%	Medium Sand:	7.9%	Fine Sand:	7.2%

Description of Sand and Gravel	Rounded ☐	Angular ☒	Hard & Durable ☒	Soft ☐	Weathered & Friable ☐		
Mechanical Stirring Apparatus A	Dispersion Period:	1 min.	Dispersing Agent:	Sodium Hexametaphosphate:	40 g./ Liter		

References / Comments / Deviations:

Jacob Folsom	Jacob Folsom	Lab Services Manager	1/10/2023
Technical Responsibility	*Signature*	*Position*	*Date*

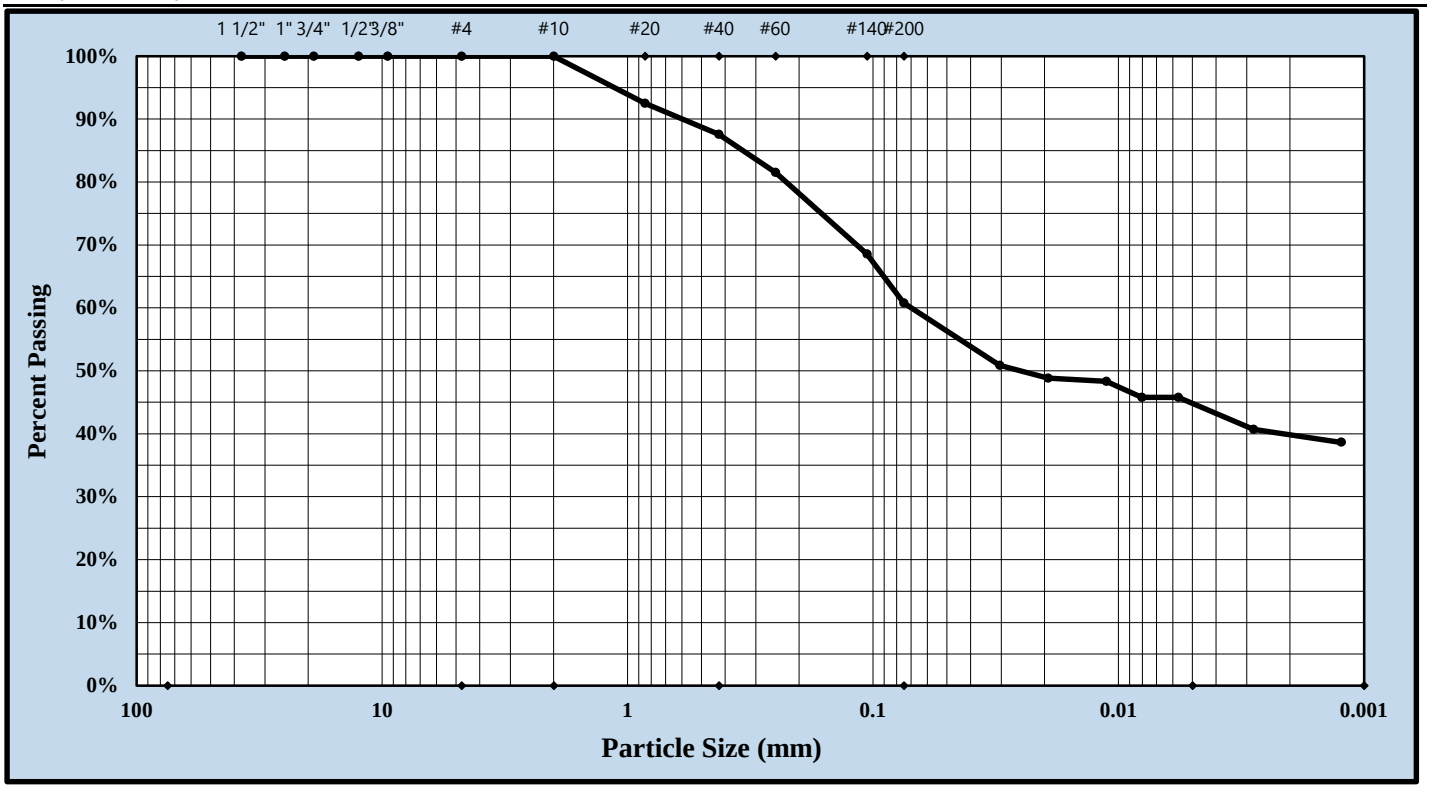
Form No. TR-D422-2
Revision No. 2LEXd
Revision Date: 06/21/22

PARTICLE SIZE ANALYSIS OF SOIL

ASTM D422

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	22360136	Report Date:	1/3/23
Project Name:	2027 NGCC - EW Brown	Test Date(s):	12/22/22
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY		
Type:	UD	Sample Date:	11/21/22
Location:	B-6	Depth (ft.):	14.0 - 16.0
Sample Description:	SANDY FAT CLAY (CH), mottled red brown and brown		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt Size	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay Size	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Nom. Maximum Particle Size:	#10	Gravel:	0.0%	Silt Size:	15.9%
Silt & Clay (% Passing #200):	60.8%	Total Sand:	39.2%	Clay Size:	44.8%
Assumed Relative Density:	2.650	Moisture Content:	37.0%		
Liquid Limit:	55	Plastic Limit:	20	Plastic Index:	35
Coarse Sand:	0.0%	Medium Sand:	12.4%	Fine Sand:	26.8%

Description of Sand and Gravel — Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus A — Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References / Comments / Deviations:

Jacob Folsom	Jacob Folsom	Lab Services Manager	1/10/2023
Technical Responsibility	*Signature*	*Position*	*Date*

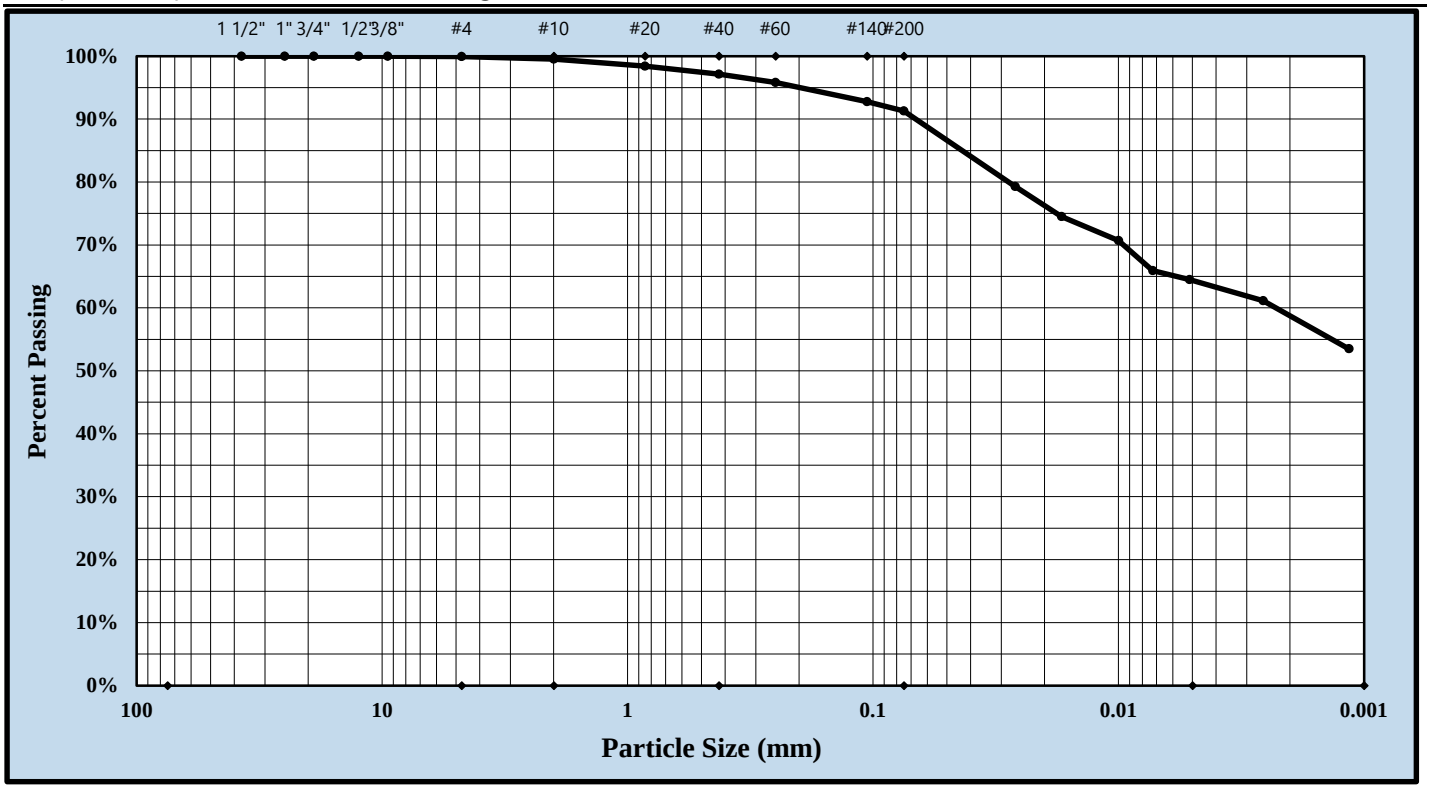
Form No. TR-D422-2
Revision No. 2LEXd
Revision Date: 06/21/22

PARTICLE SIZE ANALYSIS OF SOIL

ASTM D422

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	22360136	Report Date:	1/3/23
Project Name:	2027 NGCC - EW Brown	Test Date(s):	12/22/22
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY		
Type:	UD	Sample Date:	11/21/22
Location:	B-10	Depth (ft.):	3.0 - 5.0
Sample Description:	FAT CLAY (CH), light brown		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt Size	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay Size	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Nom. Maximum Particle Size:	#10	Gravel:	0.0%	Silt Size:	26.9%
Silt & Clay (% Passing #200):	91.3%	Total Sand:	8.7%	Clay Size:	64.3%
Apparent Relative Density:	2.689	Moisture Content:	30.8%		
Liquid Limit:	77	Plastic Limit:	23	Plastic Index:	54
Coarse Sand:	0.4%	Medium Sand:	2.4%	Fine Sand:	5.9%

Description of Sand and Gravel	Rounded ☐	Angular ☒	Hard & Durable ☒	Soft ☐	Weathered & Friable ☐		
Mechanical Stirring Apparatus A	Dispersion Period:	1 min.	Dispersing Agent:	Sodium Hexametaphosphate:	40 g./ Liter		

References / Comments / Deviations:

Jacob Folsom	Jacob Folsom	Lab Services Manager	1/10/2023
Technical Responsibility	*Signature*	*Position*	*Date*

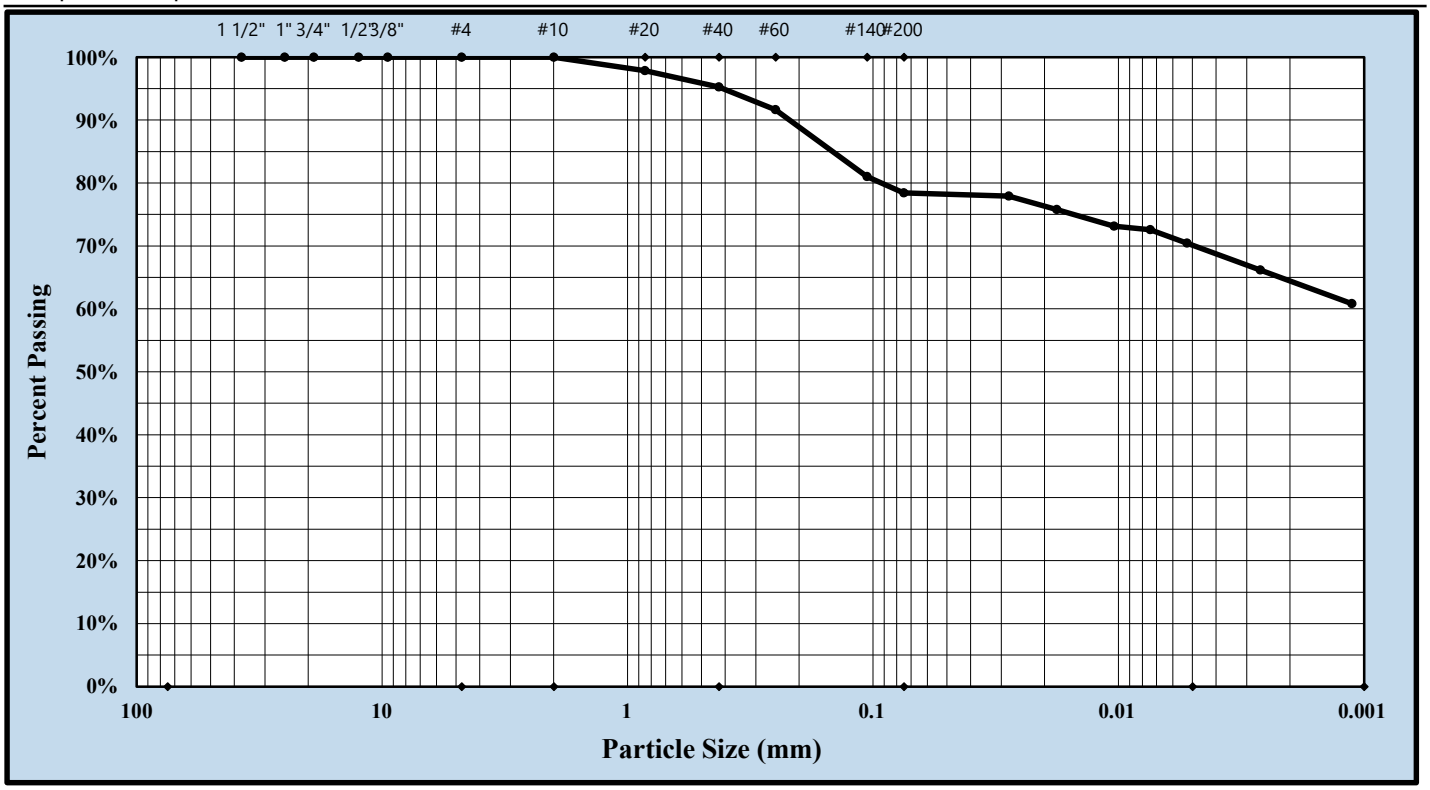
Form No. TR-D422-2
Revision No. 2LEXd
Revision Date: 06/21/22

PARTICLE SIZE ANALYSIS OF SOIL

ASTM D422

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	22360136	Report Date:	2/10/23
Project Name:	2027 NGCC - Mill Creek and Brown	Test Date(s):	2/6/23
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY		
Type:	UD	Sample Date:	11/23/22
Location:	WB-3	Depth (ft.):	6.0 - 8.0
Sample Description:	FAT CLAY WITH SAND (CH), brown		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt Size	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay Size	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Nom. Maximum Particle Size:	#10	Gravel:	0.0%	Silt Size:	8.3%
Silt & Clay (% Passing #200):	78.4%	Total Sand:	21.6%	Clay Size:	70.1%
Assumed Relative Density:	2.650	Moisture Content:	39.1%		
Liquid Limit:	63	Plastic Limit:	28	Plastic Index:	35
Coarse Sand:	0.0%	Medium Sand:	4.8%	Fine Sand:	16.8%

Description of Sand and Gravel — Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus A — Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References / Comments / Deviations:

Joe LaMothe — *Technical Responsibility*
_____ — *Signature*
Senior Engineering Technician — *Position*
2/10/2023 — *Date*

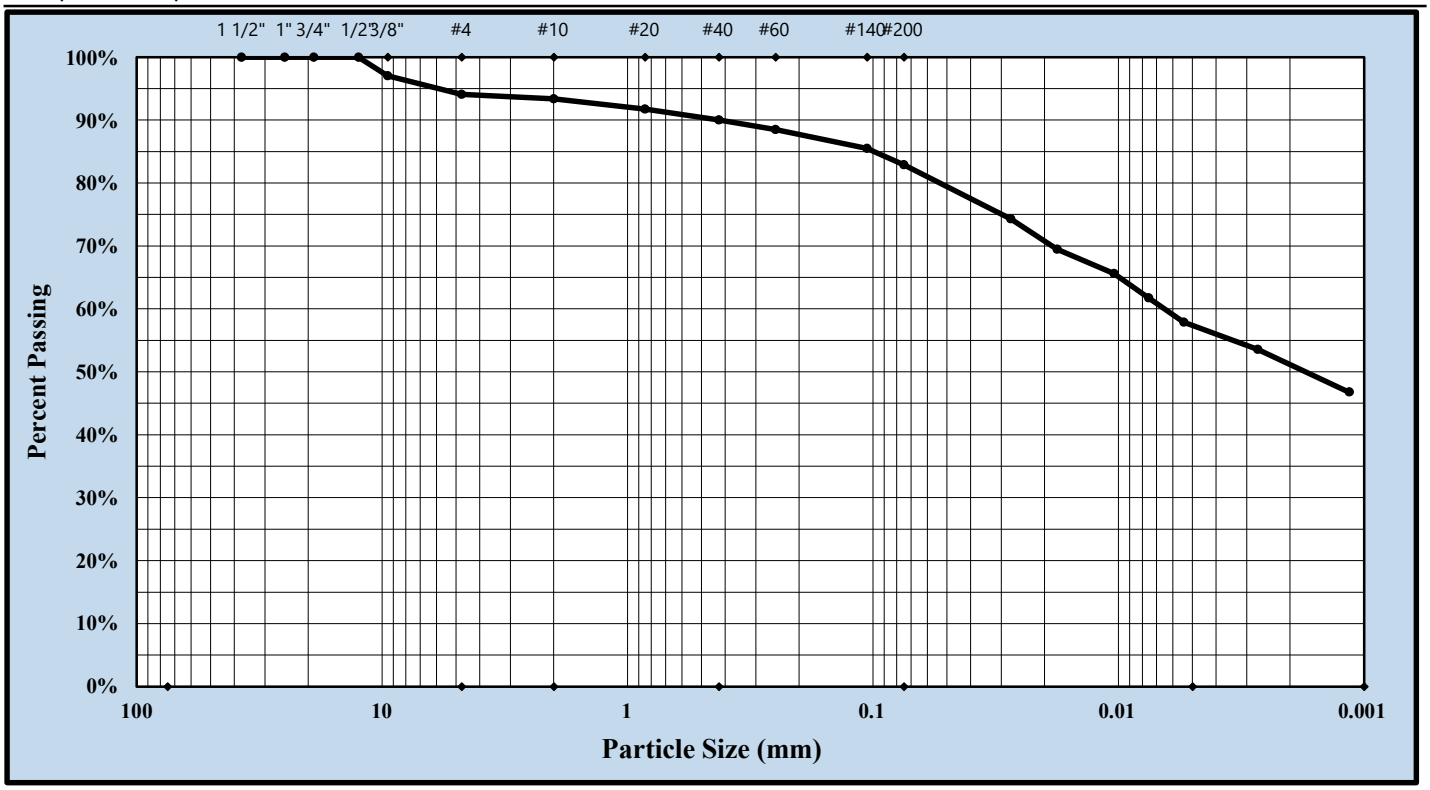
Form No. TR-D422-2
Revision No. 2LEXd
Revision Date: 06/21/22

PARTICLE SIZE ANALYSIS OF SOIL

ASTM D422

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	22360136	Report Date:	2/10/23
Project Name:	2027 NGCC - Mill Creek and Brown	Test Date(s):	2/6/23
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY		
Type:	SS	Sample Date:	11/23/22
Location:	WB-9	Depth (ft.):	2.0 - 4.0
Sample Description:	FAT CLAY WITH SAND (CH), brown		



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt Size	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and >2.00 mm (#10)	Clay Size	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Nom. Maximum Particle Size:	1/2"	Gravel:	6%	Silt Size:	25%
Silt & Clay (% Passing #200):	83%	Total Sand:	11%	Clay Size:	57%
Assumed Relative Density:	2.650	Moisture Content:	36%		
Liquid Limit:	67	Plastic Limit:	28	Plastic Index:	39
Coarse Sand:	1%	Medium Sand:	3%	Fine Sand:	7%

Description of Sand and Gravel: Rounded ☐ Angular ☒ Hard & Durable ☒ Soft ☐ Weathered & Friable ☐

Mechanical Stirring Apparatus A — Dispersion Period: 1 min. — Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References / Comments / Deviations: One 1", 28.05 g gravel excluded.

Specimen did not meet sample size requirement. All available material used.

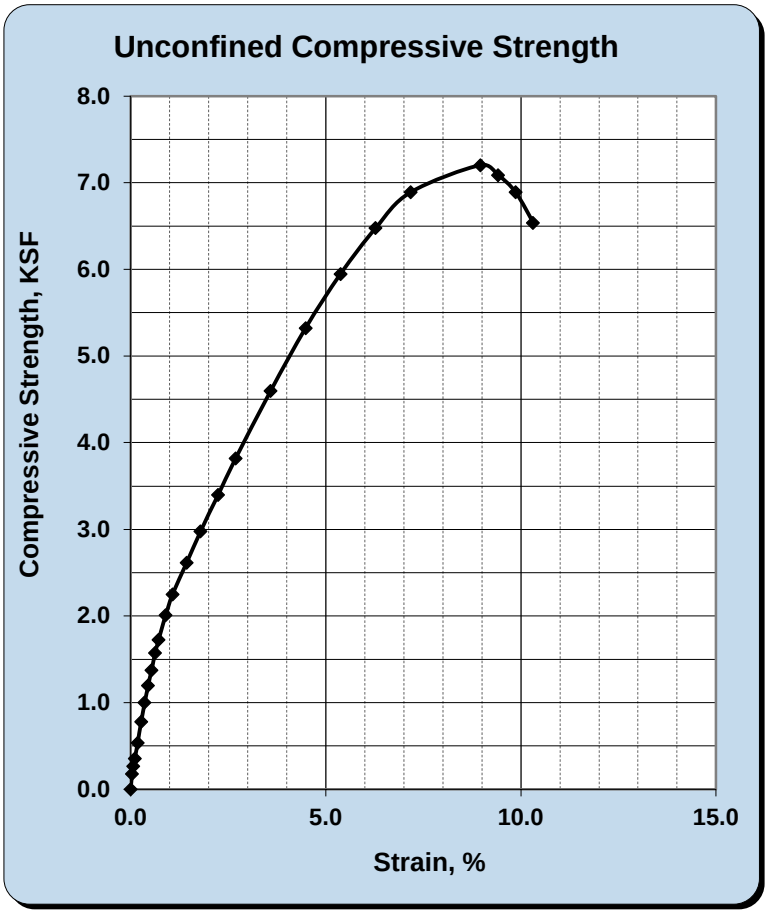
Joe LaMothe		Senior Engineering Technician	2/10/2023
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D2166-01-C
Revision No. : 1LEXb
Revision Date: 09/02/20

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS

ASTM D2166

S&ME, Inc. - Lexington:	2020 Liberty Road, Suite 105, Lexington, KY 40505		
Project No.:	22360136	Report Date:	1/3/2023
Project Name:	2027 NGCC - EW Brown	Test Date(s):	12/14/2022
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY		
Type:	UD	Sample Date:	11/21/2022
Location:	B-6	Depth (ft.):	3.6 - 4.1
Sample Description:	LEAN CLAY WITH SAND (CL), brown		



Failed Specimen

Type of Sample: Intact
Source of Moisture Sample: 3/4 Specimen

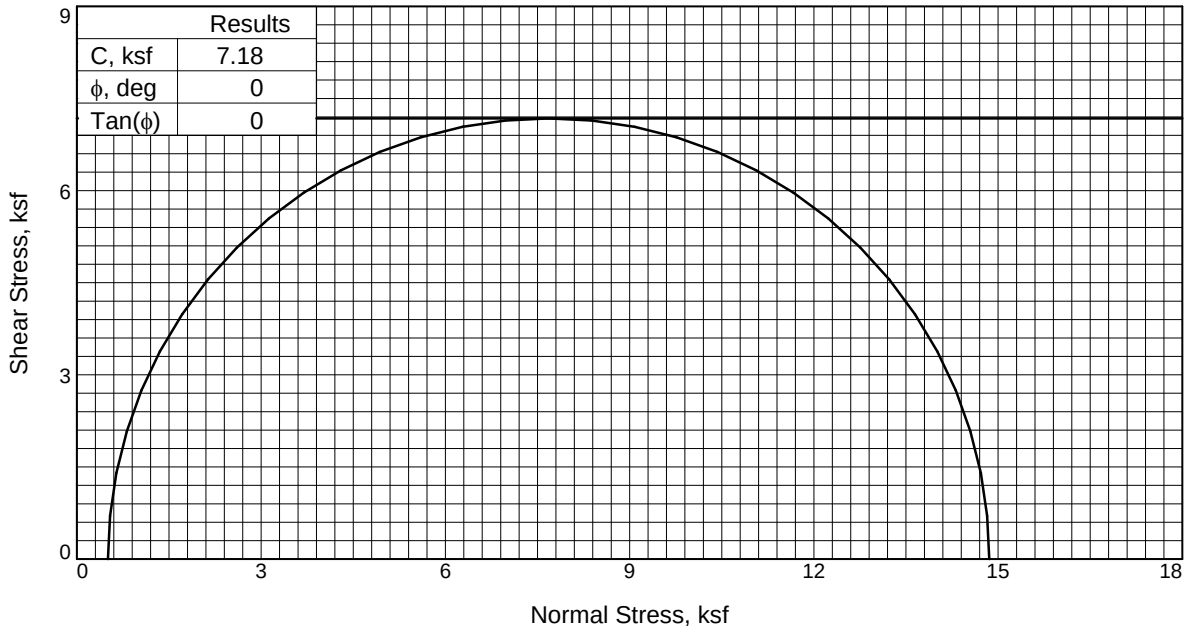
Liquid Limit: 42
Plasticity Index: 21
Height to Diameter Ratio: 1.9
Rate of Strain (%/min.): 1.1
Strain at Failure: 9%

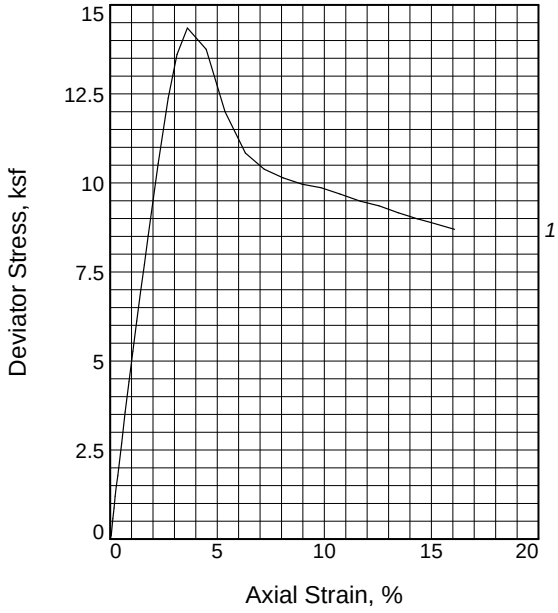
Initial Dry Unit Weight: 104.0 pcf
Initial Water Content: 21.2%
Unconfined Compressive Strength, q_u: **7.205** KSF
Undrained Shear Strength, s_u: **3.603** KSF

References / Comments / Deviations:

Jacob Folsom		Lab Services Manager	1/10/2023
Technical Responsibility	*Signature*	*Position*	*Date*

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.





Sample No.		1
Initial	Water Content, %	18.3
	Dry Density, pcf	103.5
	Saturation, %	81.0
	Void Ratio	0.5989
	Diameter, in.	2.868
	Height, in.	5.573
At Test	Water Content, %	24.9
	Dry Density, pcf	103.5
	Saturation, %	110.0
	Void Ratio	0.5989
	Diameter, in.	2.868
	Height, in.	5.573
Strain rate, %/min.		0.50
Back Pressure, psi		0.00
Cell Pressure, psi		3.50
Fail. Stress, ksf		14.4
Strain, %		3.6
Ult. Stress, ksf		8.9
Strain, %		15.0
σ_1 Failure, ksf		14.9
σ_3 Failure, ksf		0.5

Type of Test:
Unconsolidated Undrained
Sample Type: Intact
Description: LEAN CLAY (CL), brown

LL= 44 **PL=** 24 **PI=** 20
Assumed Specific Gravity= 2.65
Remarks: Failure criterion is peak deviator stress.

Client: LG&E-KU

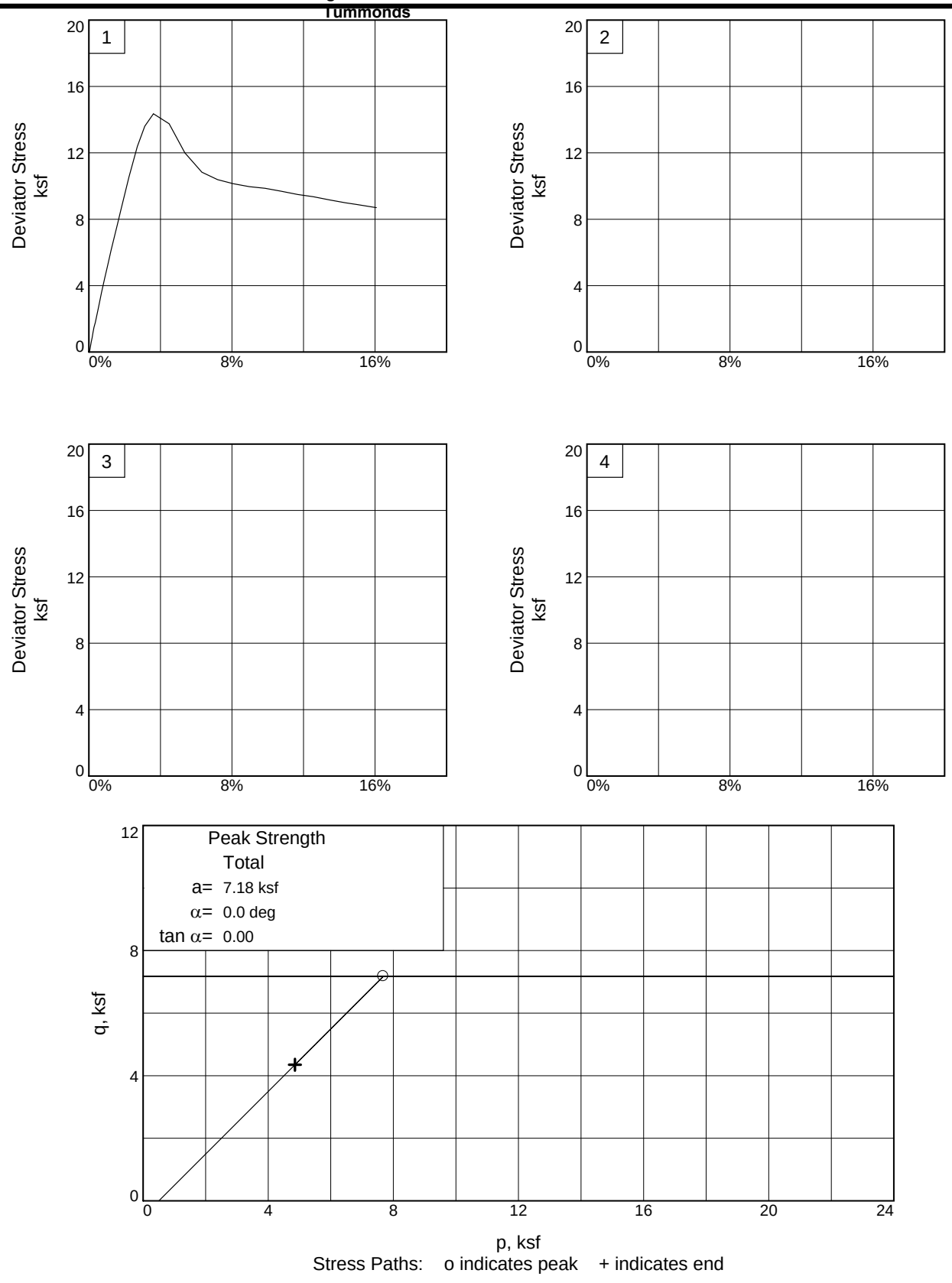
Project: 2027 NGCC - EW Brown

Source of Sample: B-5 **Depth:** 4.5 - 5.0
Sample Number: 1
Proj. No.: 22360136 **Date Sampled:** 11/23/22

TRIAXIAL SHEAR TEST REPORT
S&ME, Inc.
Lexington, Kentucky

Figure 1 of 2

Tested By: J. LaMothe **Checked By:** J. Folsom 01/04/2023



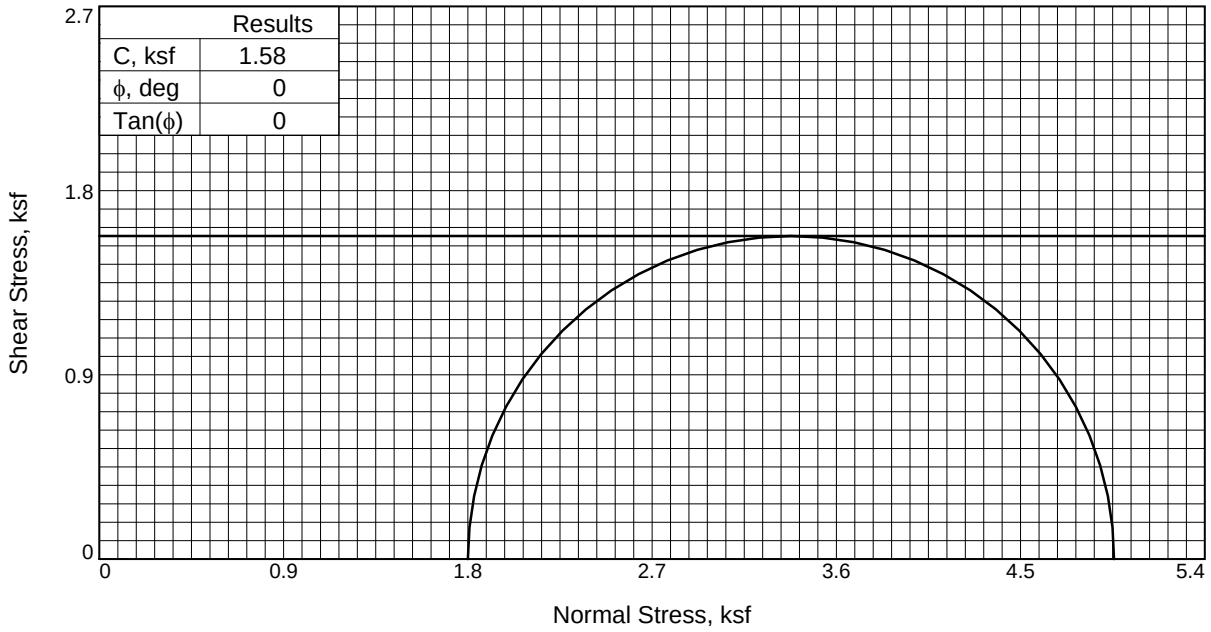
C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

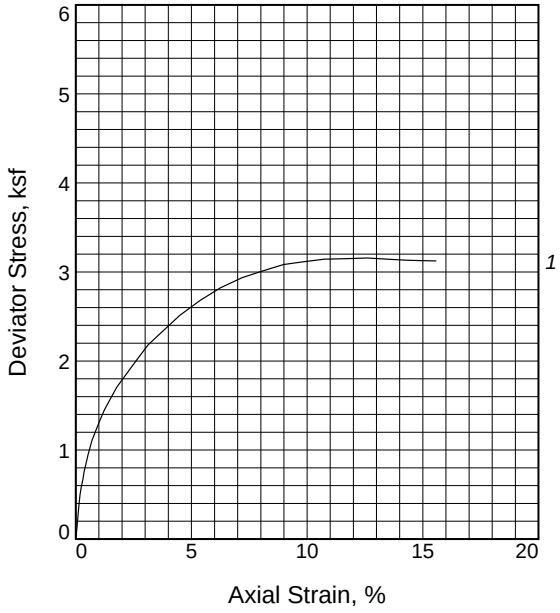
Client: LG&E-KU
Project: 2027 NGCC - EW Brown
Source of Sample: B-5 **Depth:** 45 - 5.0 **Sample Number:** 1
Project No.: 22360136 **Figure** 2 of 2

S&ME, Inc.

Tested By: J. LaMothe **Checked By:** J. Folsom 01/04/2023

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.





Sample No.		1
Initial	Water Content, %	33.8
	Dry Density, pcf	84.7
	Saturation, %	93.8
	Void Ratio	0.9540
	Diameter, in.	2.868
	Height, in.	5.569
At Test	Water Content, %	37.0
	Dry Density, pcf	84.7
	Saturation, %	102.8
	Void Ratio	0.9540
	Diameter, in.	2.868
	Height, in.	5.569
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		12.50
Fail. Stress, ksf		3.16
Strain, %		12.6
Ult. Stress, ksf		3.13
Strain, %		15.0
σ_1 Failure, ksf		4.96
σ_3 Failure, ksf		1.80

Type of Test:
Unconsolidated Undrained

Sample Type: Intact

Description: SANDY FAT CLAY (CH), mottled red brown and brown

LL= 55 **PL=** 20 **PI=** 35

Assumed Specific Gravity= 2.65

Remarks: Failure criterion is peak deviator stress.

Client: LG&E-KU

Project: 2027 NGCC - EW Brown

Source of Sample: B-6 **Depth:** 14.3 - 14.8

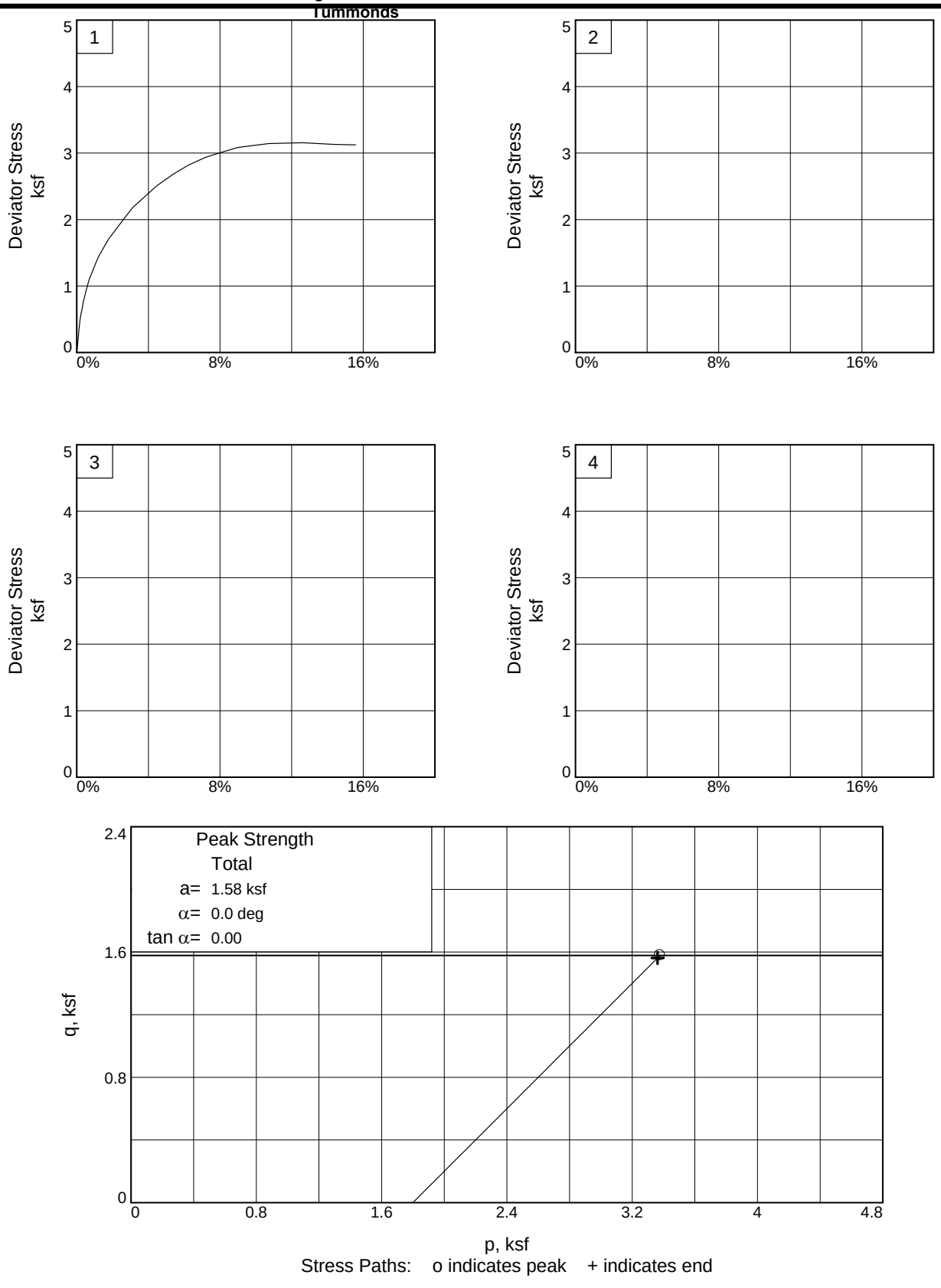
Sample Number: 2

Proj. No.: 22360136 **Date Sampled:** 11/23/22

TRIAXIAL SHEAR TEST REPORT
S&ME, Inc.
Lexington, Kentucky

Figure 1 of 2

Tested By: J. LaMothe **Checked By:** J. Folsom 01/04/2023



C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

Client: LG&E-KU
Project: 2027 NGCC - EW Brown
Source of Sample: B-6 **Depth:** 14.3 - 14.8 **Sample Number:** 2
Project No.: 22360136 **Figure** 2 of 2

S&ME, Inc.

Tested By: J. LaMothe **Checked By:** J. Folsom 01/04/2023

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

2/10/2023
2:54 PM

Date: 11/23/2022
Client: LG&E-KU
Project: 2027 NGCC - EW Brown
Project No.: 22360136
Location: WB-3
Depth: 6.4 - 6.9 **Sample Number:** 4
Description: FAT CLAY (CH), brown
Remarks: Failure criterion is peak deviator stress.
Type of Sample: Intact
Assumed Specific Gravity=2.816 **LL=**63 **PL=**28 **PI=**35
Test Method: ASTM D 4767 Method B (staged method triaxial test)

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	139.130			1077.860
Moisture content: Dry soil+tare, gms.	100.000			795.300
Moisture content: Tare, gms.	0.000			15.720
Moisture, %	39.1	39.6	38.8	36.2
Moist specimen weight, gms.	1069.61			
Diameter, in.	2.827	2.838	2.826	
Area, in.²	6.277	6.325	6.271	
Height, in.	5.580	5.572	5.562	
Net decrease in height, in.		0.008	0.010	
Net decrease in water volume, cc.			6.000	
Wet density, pcf	116.3	116.0	116.6	
Dry density, pcf	83.6	83.1	84.0	
Void ratio	1.1023	1.1155	1.0936	
Saturation, %	100.0	100.0	100.0	

Test Readings for Specimen No. 1

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Consolidation cell pressure = 65.40 psi (9.42 ksf)
Consolidation back pressure = 60.40 psi (8.70 ksf)
Consolidation effective confining stress = 0.72 ksf
Strain rate, %/min. = 0.02
Fail. Stress = 0.89 ksf **at reading no.** 13
Ult. Stress = 0.89 ksf **at reading no.** 13

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.0	0	0.0	0.00	0.66	0.66	1.00	60.80	0.66	0.00
1	0.0030	13.0	13	0.1	0.30	0.55	0.85	1.55	61.60	0.70	0.15
2	0.0070	20.0	20	0.1	0.46	0.49	0.95	1.94	62.00	0.72	0.23
3	0.0100	23.0	23	0.2	0.53	0.45	0.97	2.18	62.30	0.71	0.26
4	0.0130	26.0	26	0.2	0.60	0.42	1.01	2.43	62.50	0.72	0.30
5	0.0160	28.0	28	0.3	0.64	0.40	1.04	2.59	62.60	0.72	0.32
6	0.0200	30.0	30	0.4	0.69	0.39	1.08	2.77	62.70	0.73	0.34
7	0.0230	32.0	32	0.4	0.73	0.37	1.11	2.95	62.80	0.74	0.37
8	0.0260	33.0	33	0.5	0.75	0.36	1.11	3.10	62.90	0.74	0.38
9	0.0300	33.0	33	0.5	0.75	0.36	1.11	3.09	62.90	0.74	0.38
10	0.0330	35.0	35	0.6	0.80	0.35	1.14	3.31	63.00	0.75	0.40
11	0.0390	37.0	37	0.7	0.84	0.33	1.17	3.55	63.10	0.75	0.42
12	0.0460	38.0	38	0.8	0.87	0.33	1.20	3.61	63.10	0.76	0.43
13	0.0500	39.0	39	0.9	0.89	0.33	1.22	3.68	63.10	0.77	0.44

Parameters for Specimen No. 2

Specimen Parameter	Initial	Cum. for Test	Consolidated	Final
Moisture content: Moist soil+tare, gms.	139.130			1077.860
Moisture content: Dry soil+tare, gms.	100.000			795.300
Moisture content: Tare, gms.	0.000			15.720
Moisture, %	39.1		37.9	36.2
Moist specimen weight, gms.	1069.61			
Diameter, in.	2.827		2.818	
Area, in.²	6.277		6.237	
Height, in.	5.580		5.519	
Net decrease in height, in.		0.068	-0.007	
Net decrease in water volume, cc.			7.500	
Wet density, pcf	116.3		117.3	
Dry density, pcf	83.6		85.1	
Void ratio	1.1023		1.0661	
Saturation, %	100.0		100.0	

Test Readings for Specimen No. 2

Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Consolidation cell pressure = 71.30 psi (10.27 ksf)
Consolidation back pressure = 61.30 psi (8.83 ksf)
Consolidation effective confining stress = 1.44 ksf
Strain rate, %/min. = 0.02
Fail. Stress = 1.41 ksf **at reading no.** 11
Ult. Stress = 1.41 ksf **at reading no.** 11

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.0	0	0.0	0.00	1.37	1.37	1.00	61.80	1.37	0.00
1	0.0030	19.0	19	0.1	0.44	1.17	1.60	1.38	63.20	1.39	0.22
2	0.0070	30.0	30	0.1	0.69	1.04	1.73	1.67	64.10	1.38	0.35
3	0.0100	37.0	37	0.2	0.85	0.94	1.79	1.91	64.80	1.36	0.43
4	0.0130	41.0	41	0.2	0.94	0.86	1.81	2.09	65.30	1.34	0.47

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
5	0.0160	45.0	45	0.3	1.04	0.81	1.84	2.28	65.70	1.32	0.52
6	0.0200	48.0	48	0.4	1.10	0.76	1.87	2.45	66.00	1.32	0.55
7	0.0300	53.0	53	0.5	1.22	0.68	1.89	2.80	66.60	1.29	0.61
8	0.0390	56.0	56	0.7	1.28	0.63	1.92	3.03	66.90	1.28	0.64
9	0.0490	58.0	58	0.9	1.33	0.59	1.92	3.25	67.20	1.25	0.66
10	0.0590	60.0	60	1.1	1.37	0.58	1.95	3.38	67.30	1.26	0.69
11	0.0710	62.0	62	1.3	1.41	0.56	1.97	3.52	67.40	1.27	0.71

Parameters for Specimen No. 3

Specimen Parameter	Initial	Cum. for Test	Consolidated	Final
Moisture content: Moist soil+tare, gms.	139.130			1077.860
Moisture content: Dry soil+tare, gms.	100.000			795.300
Moisture content: Tare, gms.	0.000			15.720
Moisture, %	39.1		36.2	36.2
Moist specimen weight, gms.	1069.61			
Diameter, in.	2.827		2.805	
Area, in.²	6.277		6.180	
Height, in.	5.580		5.447	
Net decrease in height, in.		0.132	0.001	
Net decrease in water volume, cc.			12.400	
Wet density, pcf	116.3		118.5	
Dry density, pcf	83.6		87.0	
Void ratio	1.1023		1.0207	
Saturation, %	100.0		100.0	

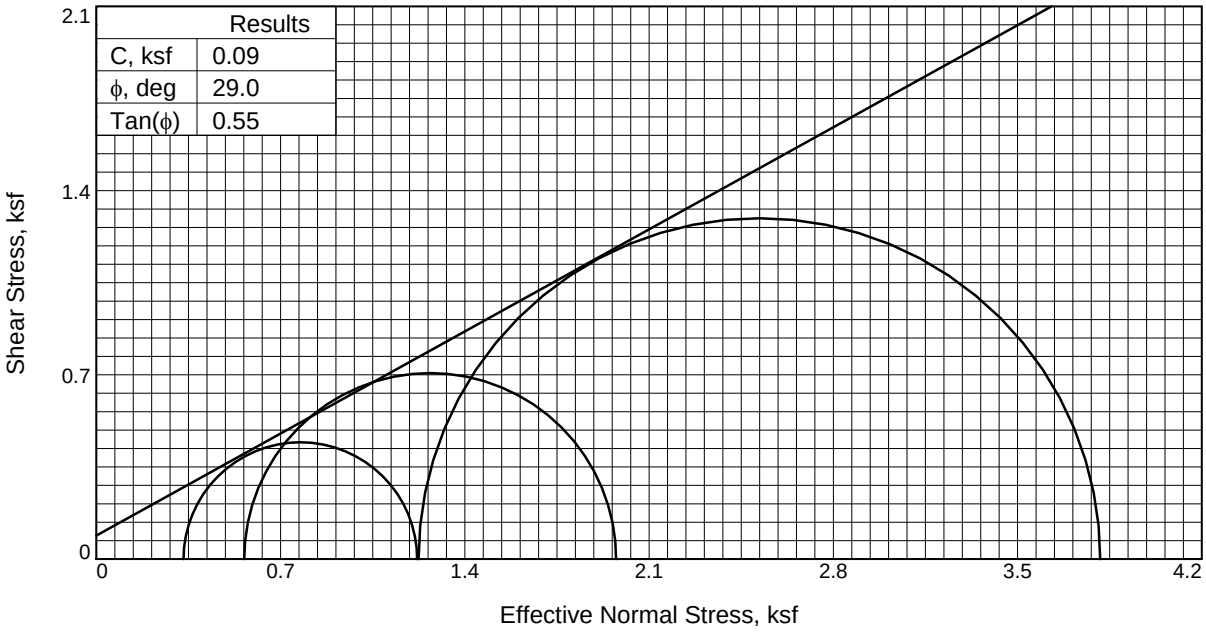
Test Readings for Specimen No. 3

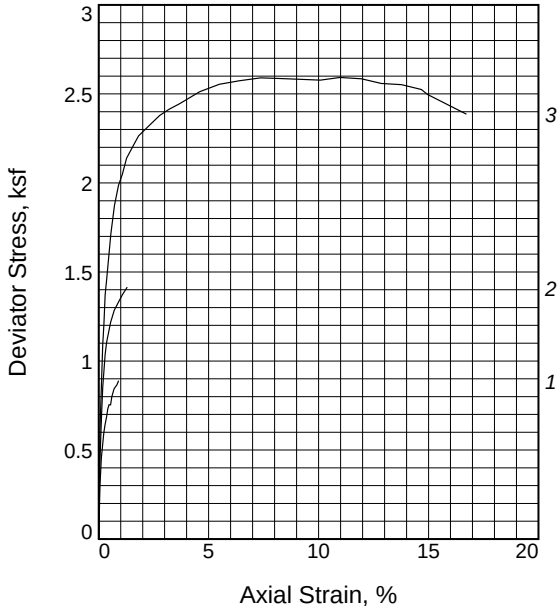
Membrane modulus = 0.124105 kN/cm²
Membrane thickness = 0.02 cm
Consolidation cell pressure = 81.30 psi (11.71 ksf)
Consolidation back pressure = 61.30 psi (8.83 ksf)
Consolidation effective confining stress = 2.88 ksf
Strain rate, %/min. = 0.02
Fail. Stress = 2.59 ksf **at reading no.** 22
Ult. Stress = 2.50 ksf **at reading no.** 31

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.0	0	0.0	0.00	2.74	2.74	1.00	62.30	2.74	0.00
1	0.0030	26.0	26	0.1	0.61	2.45	3.05	1.25	64.30	2.75	0.30
2	0.0070	38.0	38	0.1	0.88	2.29	3.17	1.39	65.40	2.73	0.44
3	0.0100	47.0	47	0.2	1.09	2.15	3.24	1.51	66.40	2.69	0.55
4	0.0130	52.0	52	0.2	1.21	2.06	3.27	1.59	67.00	2.66	0.60
5	0.0160	59.0	59	0.3	1.37	1.94	3.31	1.71	67.80	2.63	0.69
6	0.0200	63.0	63	0.4	1.46	1.86	3.32	1.79	68.40	2.59	0.73
7	0.0300	74.0	74	0.6	1.71	1.66	3.37	2.04	69.80	2.51	0.86
8	0.0390	81.0	81	0.7	1.87	1.51	3.39	2.24	70.80	2.45	0.94
9	0.0490	86.0	86	0.9	1.99	1.43	3.41	2.39	71.40	2.42	0.99
10	0.0590	89.0	89	1.1	2.05	1.37	3.42	2.50	71.80	2.39	1.03
11	0.0690	93.0	93	1.3	2.14	1.30	3.44	2.65	72.30	2.37	1.07

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
12	0.0790	95.0	95	1.5	2.18	1.25	3.43	2.74	72.60	2.34	1.09
13	0.0890	97.0	97	1.6	2.22	1.24	3.46	2.80	72.70	2.35	1.11
14	0.0990	99.0	99	1.8	2.26	1.21	3.47	2.87	72.90	2.34	1.13
15	0.1250	102.0	102	2.3	2.32	1.20	3.52	2.94	73.00	2.36	1.16
16	0.1510	105.0	105	2.8	2.38	1.15	3.53	3.06	73.30	2.34	1.19
17	0.1740	107.0	107	3.2	2.41	1.15	3.57	3.10	73.30	2.36	1.21
18	0.2010	109.0	109	3.7	2.45	1.14	3.58	3.15	73.40	2.36	1.22
19	0.2500	113.0	113	4.6	2.51	1.15	3.66	3.18	73.30	2.41	1.26
20	0.2990	116.0	116	5.5	2.55	1.17	3.72	3.19	73.20	2.44	1.28
21	0.3480	118.0	118	6.4	2.57	1.20	3.77	3.15	73.00	2.48	1.29
22	0.4010	120.0	120	7.4	2.59	1.22	3.81	3.12	72.80	2.52	1.30
23	0.4500	121.0	121	8.3	2.59	1.27	3.85	3.04	72.50	2.56	1.29
24	0.5000	122.0	122	9.2	2.58	1.30	3.88	2.99	72.30	2.59	1.29
25	0.5490	123.0	123	10.1	2.58	1.34	3.92	2.92	72.00	2.63	1.29
26	0.5980	125.0	125	11.0	2.59	1.37	3.96	2.90	71.80	2.66	1.30
27	0.6510	126.0	126	12.0	2.58	1.41	4.00	2.83	71.50	2.70	1.29
28	0.7000	126.0	126	12.9	2.56	1.44	4.00	2.78	71.30	2.72	1.28
29	0.7500	127.0	127	13.8	2.55	1.47	4.02	2.74	71.10	2.74	1.28
30	0.7990	127.0	127	14.7	2.53	1.50	4.02	2.69	70.90	2.76	1.26
31	0.8150	126.0	126	15.0	2.50	1.51	4.01	2.65	70.80	2.76	1.25
32	0.9100	123.0	123	16.7	2.39	1.58	3.97	2.51	70.30	2.78	1.19





Sample No.		1	2	3
Initial	Water Content, %	39.1	39.1	39.1
	Dry Density, pcf	83.6	83.6	83.6
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.1023	1.1023	1.1023
	Diameter, in.	2.827	2.827	2.827
	Height, in.	5.580	5.580	5.580
At Test	Water Content, %	38.8	37.9	36.2
	Dry Density, pcf	84.0	85.1	87.0
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.0936	1.0661	1.0207
	Diameter, in.	2.826	2.818	2.805
	Height, in.	5.562	5.519	5.447
Strain rate, %/min.		0.02	0.02	0.02
Eff. Cell Pressure, psi		5.00	10.00	20.00
Fail. Stress, ksf		0.89	1.41	2.59
Excess Pore Pr., ksf		0.39	0.88	1.66
Strain, %		0.9	1.3	7.4
Ult. Stress, ksf		0.89	1.41	2.50
Excess Pore Pr., ksf		0.39	0.88	1.37
Strain, %		0.9	1.3	15.0
$\bar{\sigma}_1$ Failure, ksf		1.22	1.97	3.81
$\bar{\sigma}_3$ Failure, ksf		0.33	0.56	1.22

Type of Test:
CU with Pore Pressures

Sample Type: Intact

Description: FAT CLAY (CH), brown

LL= 63 **PL=** 28 **PI=** 35

Assumed Specific Gravity= 2.816

Remarks: Failure criterion is peak deviator stress.

Client: LG&E-KU

Project: 2027 NGCC - EW Brown

Source of Sample: WB-3 **Depth:** 6.4 - 6.9

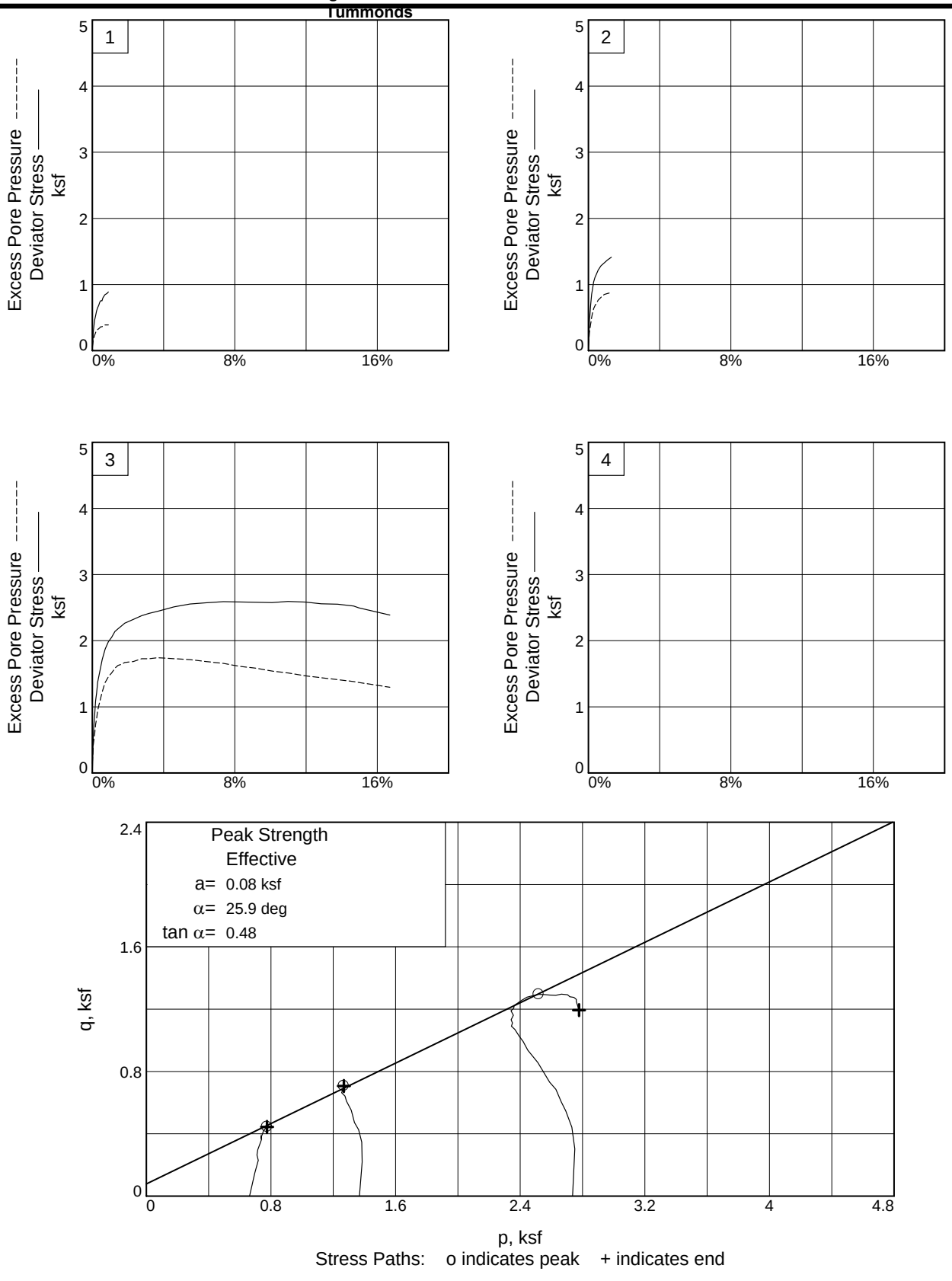
Sample Number: 4

Proj. No.: 22360136 **Date Sampled:** 11/23/2022

TRIAXIAL SHEAR TEST REPORT
S&ME, Inc.
Lexington, Kentucky

Figure 1 of 2

Tested By: J. LaMothe **Checked By:** J. Folsom 02/10/2023



Client: LG&E-KU
Project: 2027 NGCC - EW Brown
Source of Sample: WB-3 **Depth:** 6.4 - 6.9 **Sample Number:** 4
Project No.: 22360136 **Figure** 2 of 2

S&ME, Inc.

C & phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.

Tested By: J. LaMothe **Checked By:** J. Folsom 02/10/2023

Form No. TR-D698-2
Revision No. 1LEXe
Revision Date: 02/12/21

MOISTURE - DENSITY REPORT

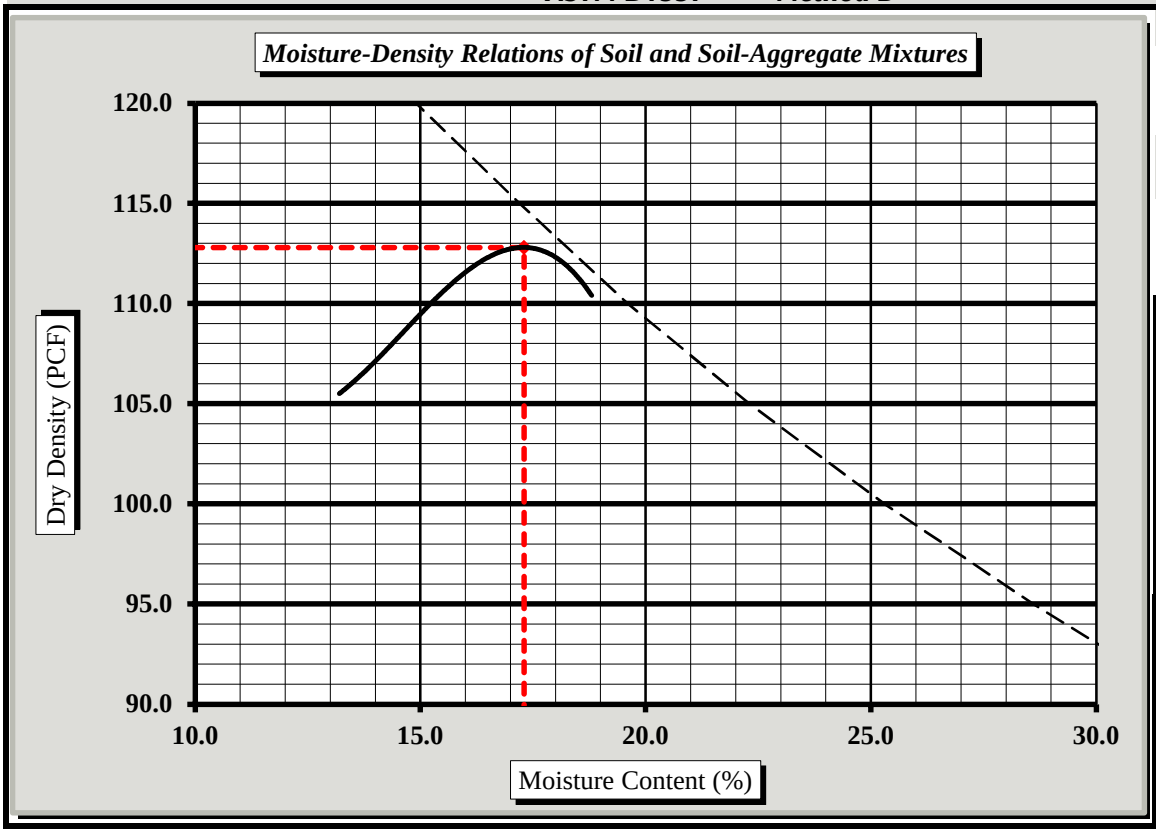
Quality Assurance ASTM D1557 Method B

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	22360136	Report Date:	01/03/23
Project Name:	2027 NGCC - EW Brown	Test Date(s):	12/21/22
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY		
	Sample No.: 1	Sample Date:	11/21/22
Location:	B-4	Depth (ft.):	5.0 - 10.0
Sample Description:	FAT CLAY (visual-manual), brown		

Maximum Dry Density 112.8 PCF. Optimum Moisture Content 17.3%

ASTM D1557 - - Method B



Soil Properties

As Received Moisture Content	27.7%
Specific Gravity Soil:*	2.700
Liquid Limit	ND
Plastic Limit	ND
Plastic Index	ND

% Passing	
3/4"	ND
3/8"	99%
#4	ND
#10	ND
#40	ND
#60	ND
#200	ND

Oversize Fraction	
Bulk Gravity	ND
% Moisture	ND
% Oversize	1%
MDD	NA
Opt. MC	NA

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☐ 3/8 inch Sieve ☒ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: NA = Not Applicable; ND = Not Determined. *Specific gravity of soil assumed.
Percent retained on separating sieve estimated from Proctor sample separation operations.

Jacob Folsom	Jacob Folsom	Lab Services Manager	1/10/2023
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D698-2
Revision No. 1LEXe
Revision Date: 02/12/21

MOISTURE - DENSITY REPORT

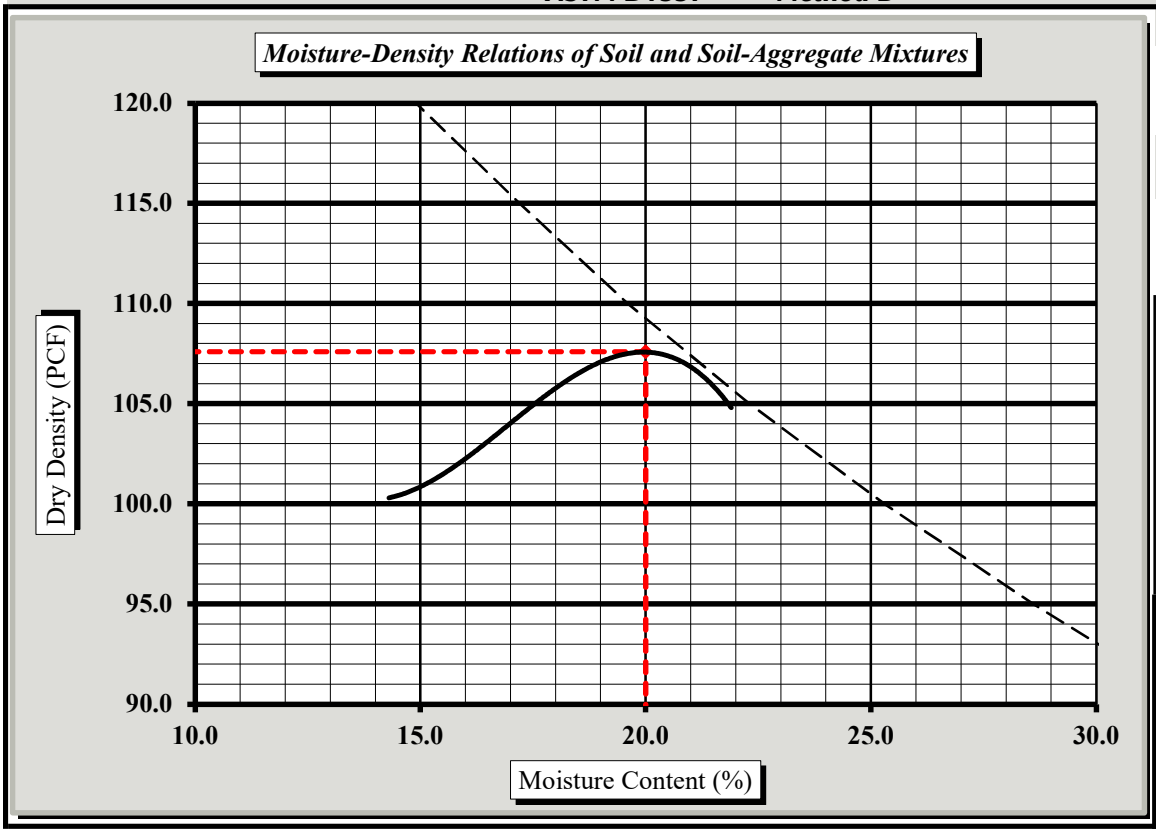
Quality Assurance ASTM D1557 Method B

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	22360136	Report Date:	02/10/23
Project Name:	2027 NGCC - Mill Creek and Brown	Test Date(s):	02/03/23
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY		
	Sample No.: 1	Sample Date:	11/23/22
Location:	WB-9	Depth (ft.):	1.0 - 5.0
Sample Description:	FAT CLAY WITH SAND (CH), brown		

Maximum Dry Density 107.6 PCF. Optimum Moisture Content 20.0%

ASTM D1557 - - Method B



Soil Properties

As Received Moisture Content	35.7%
Specific Gravity Soil:*	2.700
Liquid Limit	67
Plastic Limit	28
Plastic Index	39

% Passing	
3/4"	100%
3/8"	97%
#4	94%
#10	93%
#40	90%
#60	89%
#200	82.9%

Oversize Fraction	
Bulk Gravity	ND
% Moisture	ND
% Oversize	3%
MDD	NA
Opt. MC	NA

Moisture-Density Curve Displayed: Fine Fraction ☒ Corrected for Oversize Fraction (ASTM D 4718) ☐

Sieve Size used to separate the Oversize Fraction: #4 Sieve ☐ 3/8 inch Sieve ☒ 3/4 inch Sieve ☐

Mechanical Rammer ☒ Manual Rammer ☐ Moist Preparation ☐ Dry Preparation ☒

References / Comments / Deviations: NA = Not Applicable; ND = Not Determined. *Specific gravity of soil assumed.

Joe LaMothe		Senior Engineering Technician	2/10/2023
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D1883-T193-1
Revision No. 2 LEXc
Revision Date: 09/02/20

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

ASTM D 1883

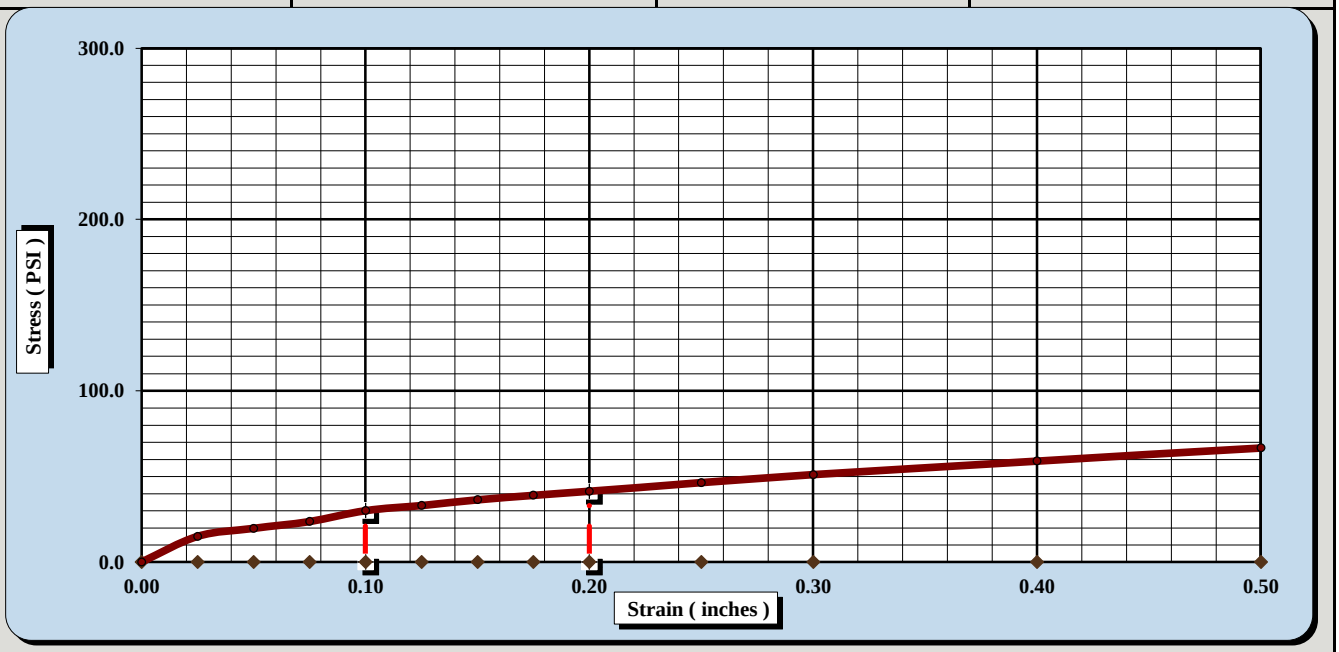
S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	22360136	Report Date:	01/03/23
Project Name:	2027 NGCC - EW Brown	Test Date(s)	12/23/22
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY		
Type:	Bulk	Sample #: 1	Sample Date: 11/21/22
Location:	B-4	Depth (ft.):	5.0 - 10.0
Sample Description:	FAT CLAY (visual-manual), brown		

ASTM D 698 *Method B* Maximum Dry Density: 112.8 PCF Optimum Moisture Content: 17.3%

Compaction Test performed on grading complying with CBR spec. % Retained on the 3/4" sieve: 0.0%

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 3.0	CBR at 0.2 in. 2.8	CBR at 0.1 in. 3.0	CBR at 0.2 in. 2.8



CBR Sample Preparation:

The entire gradation was used and compacted in a 6" CBR mold in accordance with ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	20		
Initial Dry Density (PCF)	99.4	Final Dry Density (PCF)	79.1
Moisture Content of the Compacted Specimen	16.3%	Moisture Content (top 1" after soaking)	25.4%
Percent Compaction	88.1%	Percent Swell	2.8%

Soak Time: 96 Surcharge Weight: 10.0 Surcharge Wt. per sq. Ft.: 50.9

Liquid Limit: ND Plastic Index: ND

Notes/Deviations/References:

Jacob Folsom		Lab Services Manager	1/10/2023
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D1883-T193-1
Revision No. 2 LEXc
Revision Date: 09/02/20

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

ASTM D 1883

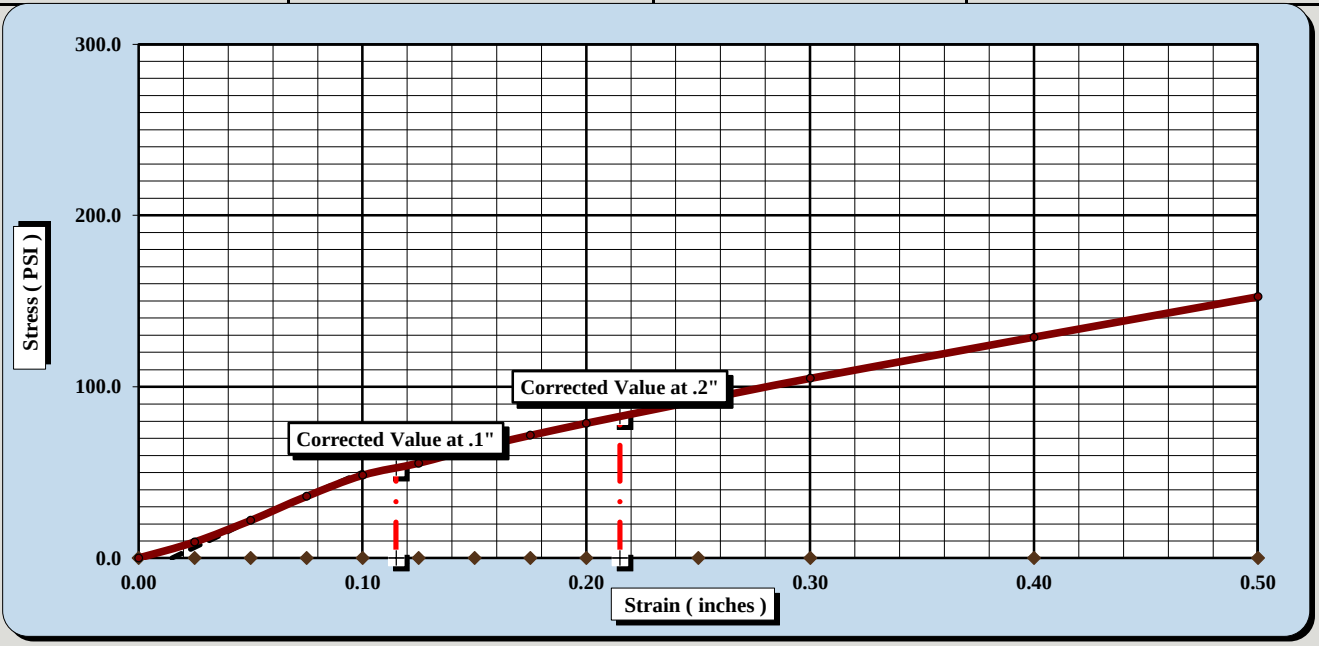
S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	22360136	Report Date:	01/03/23
Project Name:	2027 NGCC - EW Brown	Test Date(s)	12/23/22
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY		
Type:	Bulk	Sample #: 1	Sample Date: 11/21/22
Location:	B-4	Depth (ft.):	5.0 - 10.0
Sample Description:	FAT CLAY (visual-manual), brown		

ASTM D 698 *Method B* Maximum Dry Density: 112.8 PCF Optimum Moisture Content: 17.3%

Compaction Test performed on grading complying with CBR spec. % Retained on the 3/4" sieve: 0.0%

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in. 4.8	CBR at 0.2 in. 5.2	CBR at 0.1 in. 5.3	CBR at 0.2 in. 5.5



CBR Sample Preparation:

The entire gradation was used and compacted in a 6" CBR mold in accordance with ASTM D1883, Section 6.1.1

Before Soaking		*After Soaking*	
Compactive Effort (Blows per Layer)	56		
Initial Dry Density (PCF)	111.8	Final Dry Density (PCF)	107.6
Moisture Content of the Compacted Specimen	15.7%	Moisture Content (top 1" after soaking)	22.6%
Percent Compaction	99.1%	Percent Swell	3.6%

Soak Time: 96 Surcharge Weight 10.0 Surcharge Wt. per sq. Ft. 50.9

Liquid Limit ND Plastic Index ND

Notes/Deviations/References:

Jacob Folsom — *Technical Responsibility*
_____ — *Signature*
Lab Services Manager — *Position*
1/10/2023 — *Date*

Form No. TR-D1883-T193-1
Revision No. 2 LEXc
Revision Date: 09/02/20

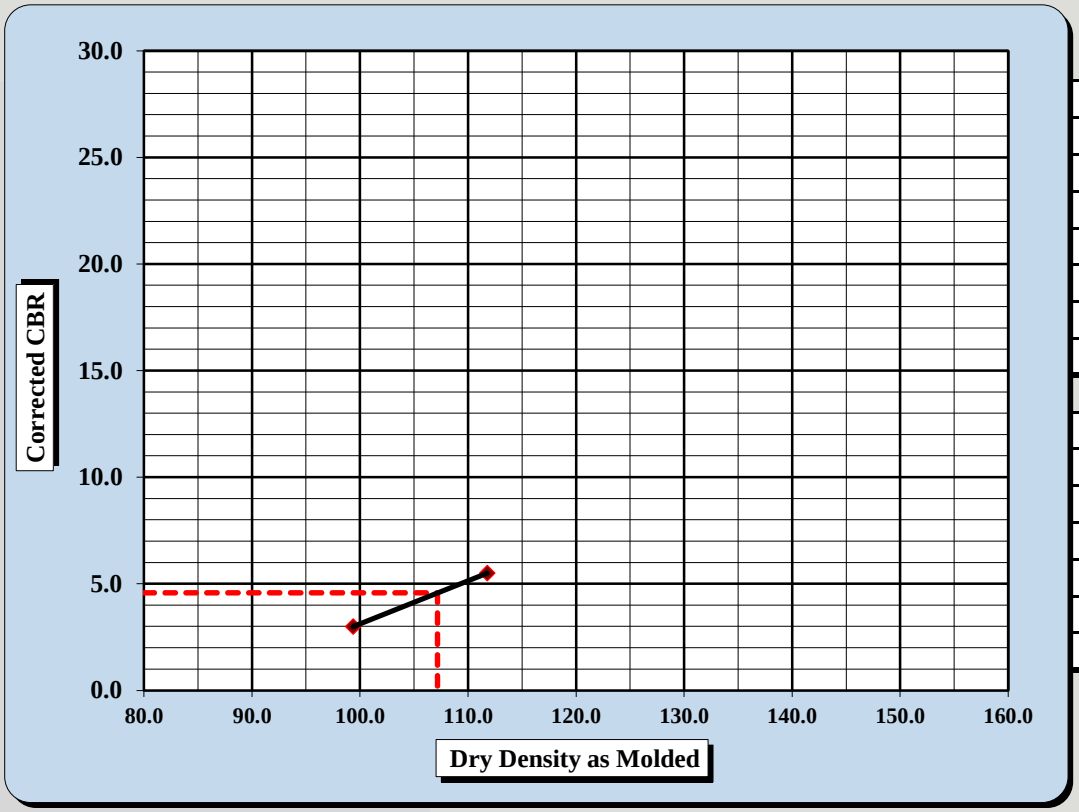
CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL

ASTM D 1883

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	22360136			Report Date:	01/03/23
Project Name:	2027 NGCC - EW Brown			Test Date(s)	12/23/22
Client Name:	LG&E-KU				
Client Address:	820 West Broadway, Louisville, KY				
Type:	Bulk	Sample #:	1	Sample Date:	11/21/22
Location:	B-4			Depth (ft.):	5.0 - 10.0
Sample Description:	FAT CLAY (visual-manual), brown				

Dry Unit Weight vs. Corrected CBR Values



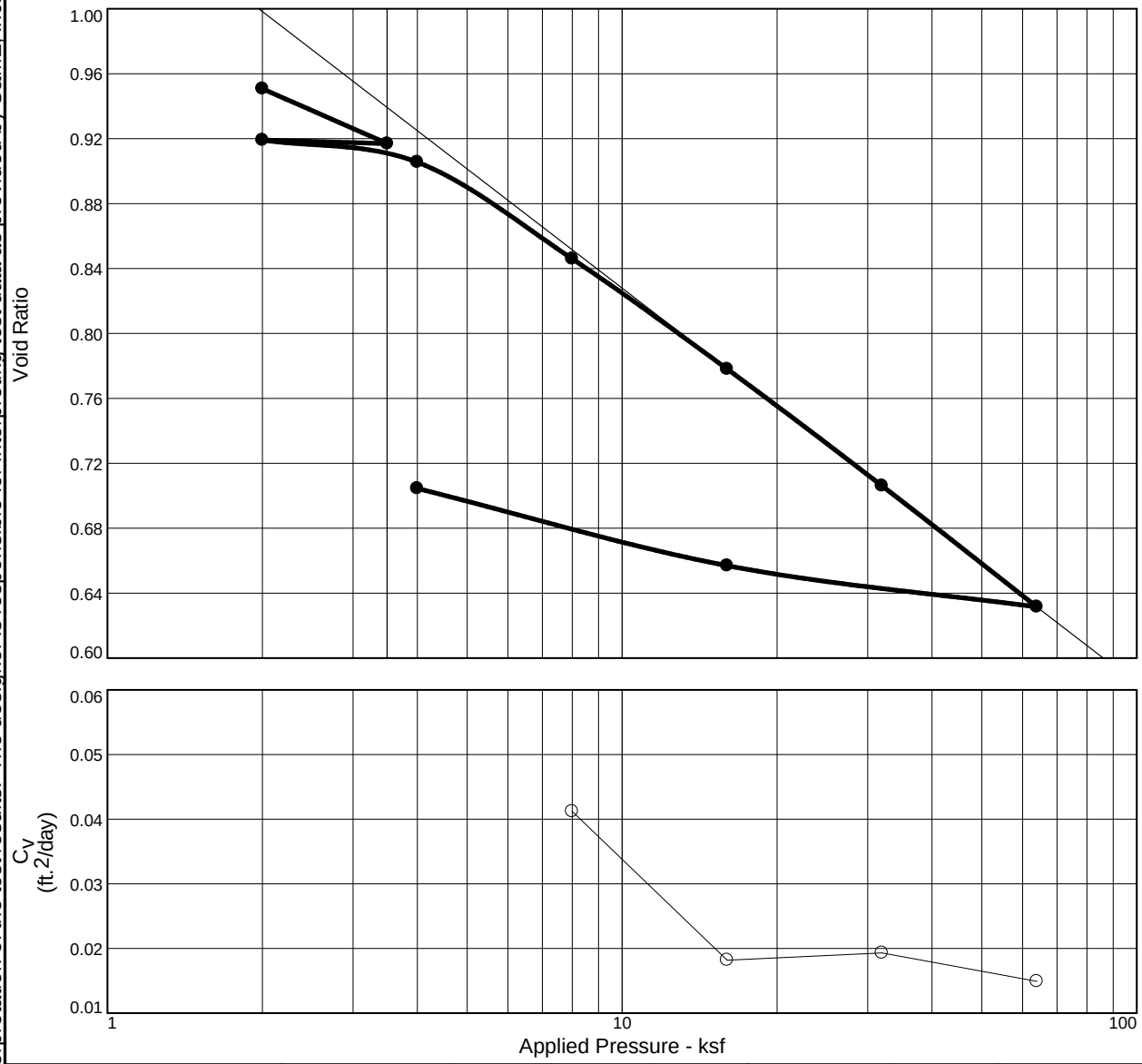
Series 1	
Dry Wt. PCF	CBR
99.4	3.0
111.8	5.5

Series 2: Design CBR	
80	4.6
107.2	4.6
107.2	0

Notes / Deviations / References: Interpolated CBR Value for 95% compaction: **4.6**

Jacob Folsom		Lab Services Manager	1/10/2023
Technical Responsibility	*Signature*	*Position*	*Date*

ASTM D2435 CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (ksf)	C_c	Initial Void Ratio
Saturation	Moisture							
87.5 %	30.8 %	86.3	77	54	2.689	4.9	0.24	0.945

MATERIAL DESCRIPTION	USCS	AASHTO
FAT CLAY (CH), light brown	CH	A-7-6

Project No. 22360136 **Client:** LG&E-KU

Project: 2027 NGCC - EW Brown

Source of Sample: B-10 **Depth:** 3.8 **Sample Number:** 1

S&ME, Inc.

Lexington, Kentucky

Remarks:
Inundated in the seating load.
1 ksf needed to control swell.

Figure 1

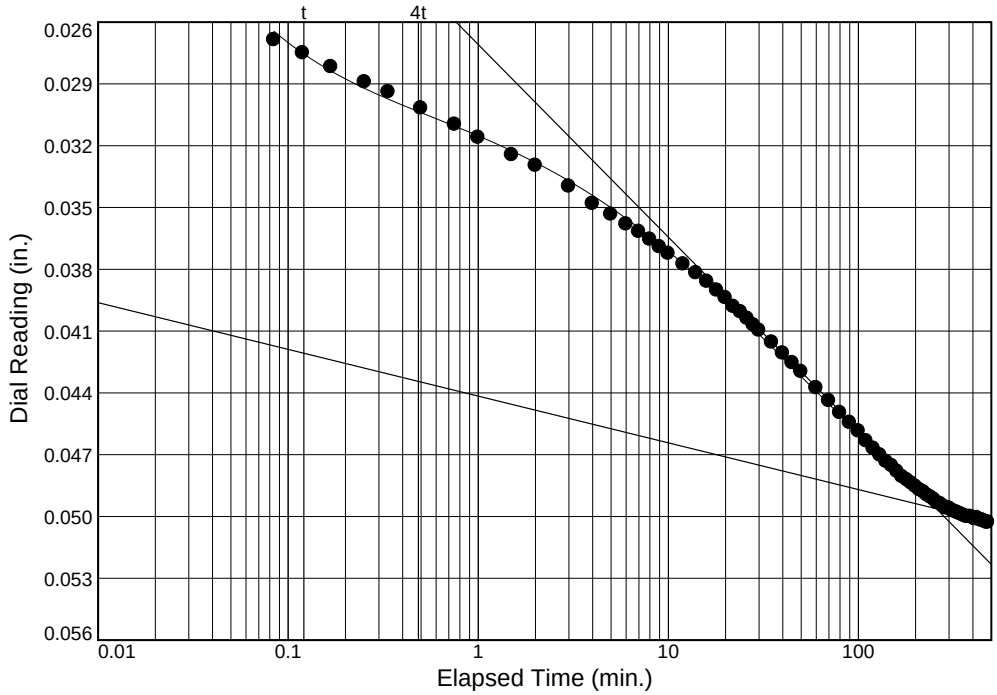
Cc, Pc, etc are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME, Inc.

Tested By: J. LaMothe **Checked By:** J. Folsom 01/04/2023

Dial Reading vs. Time

Project No.: 22360136
Project: 2027 NGCC - EW Brown

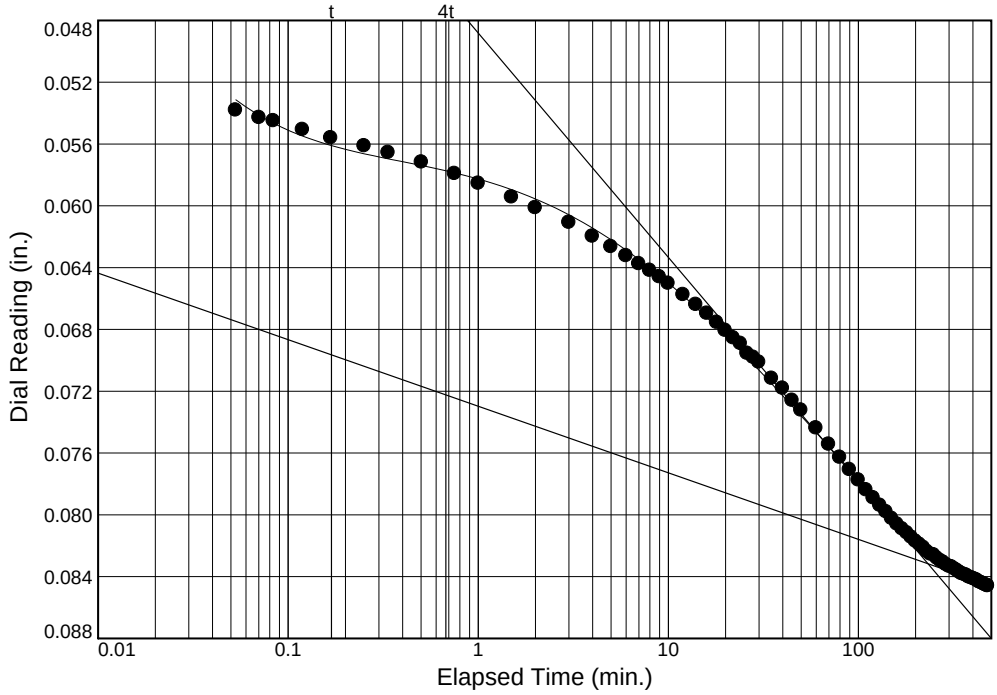
Source of Sample: B-10 Depth: 3.8 Sample Number: 1



Load No.= 5
Load= 8.00 ksf
D_0 = 0.0248
D_{50} = 0.0372
D_{100} = 0.0496
T_{50} = 10.21 min.

C_v @ T_{50}
0.041 ft.^{2}/day

C_α = 0.005



Load No.= 6
Load= 16.00 ksf
D_0 = 0.0545
D_{50} = 0.0688
D_{100} = 0.0832
T_{50} = 21.57 min.

C_v @ T_{50}
0.018 ft.^{2}/day

C_α = 0.009

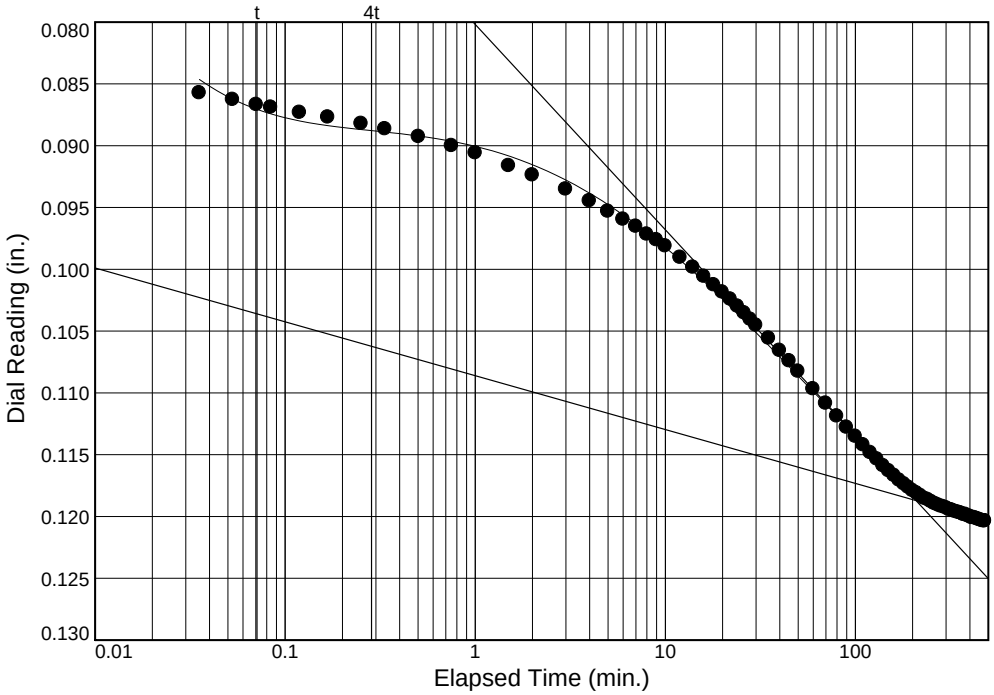
Figure 2

S&ME, Inc.

Dial Reading vs. Time

Project No.: 22360136
Project: 2027 NGCC - EW Brown

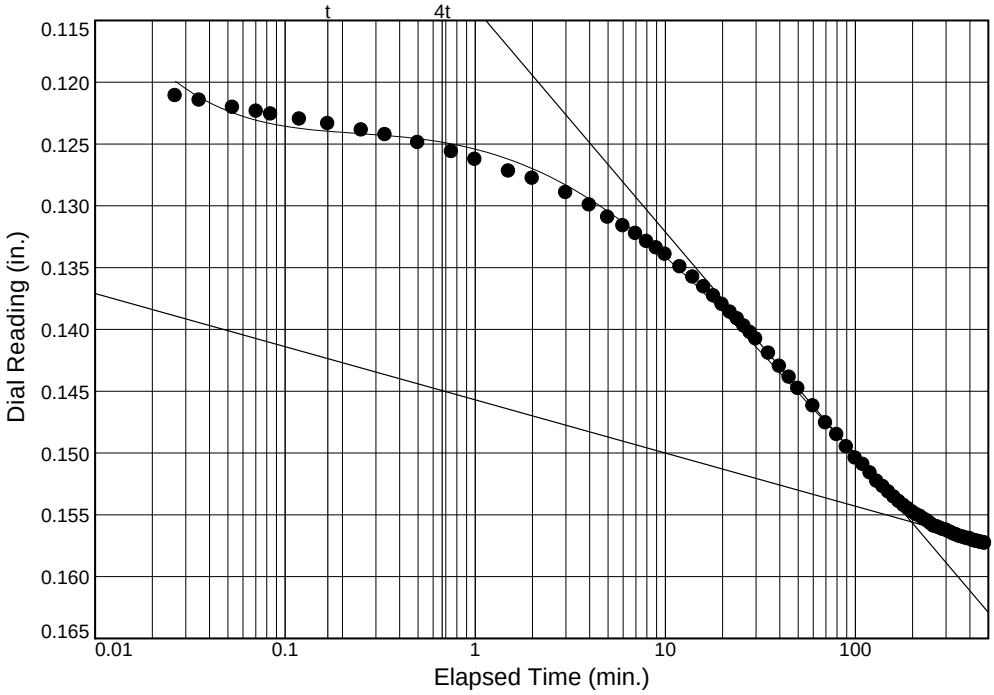
Source of Sample: B-10 Depth: 3.8 Sample Number: 1



Load No.= 7
Load= 32.00 ksf
D_0 = 0.0853
D_{50} = 0.1020
D_{100} = 0.1187
T_{50} = 18.84 min.

C_v @ T_{50}
0.019 ft.^{2}/day

C_α = 0.009



Load No.= 8
Load= 64.00 ksf
D_0 = 0.1231
D_{50} = 0.1393
D_{100} = 0.1556
T_{50} = 22.32 min.

C_v @ T_{50}
0.015 ft.^{2}/day

C_α = 0.009

Figure 3

Form No: TR-2310LEX-G57-T289-R
Revision No. 0
Revision Date: 04/16/21

LEAST ELECTRICAL RESISTIVTY AND pH FOR CORROSION

Electrical resistivity by Wenner 4-Pin

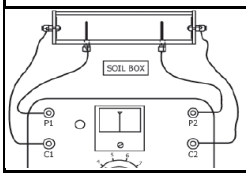
Quality Assurance ASTM G57, AASHTO T 289

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project #:	**22360136**	Report Date:	01/19/23
Project Name:	2027 NGCC	Test Date(s):	01/16/23
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY		
		Sample Date:	11/21-23/22

Boring/Location	Depth (ft.)	pH	Least Electrical Resistivity, Ω-cm	Water content for ER measurement
B-4	11.5-13.5	9.4	1,500	80.9%

Electrical Resistivity Method



A voltage is impressed between the outer electrodes, and the voltage drop between the inner electrodes is measured using a voltmeter.

RESISTIVITY, ρ, Ω*cm = (R) * A / a

a, inner electrode spacing, cm : 7.2

A, cross sectional area perpendicualr to flow, cm^2: 7.2

Notes / Deviations / References:

Jacob Folsom — *Technical Responsibility*
_____ — *Signature*
Lab Services Manager — *Position*
1/23/2023 — *Date*

Form No. TR-D7012C-01
Revision No. 0
Devision Date: 06/25/15

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

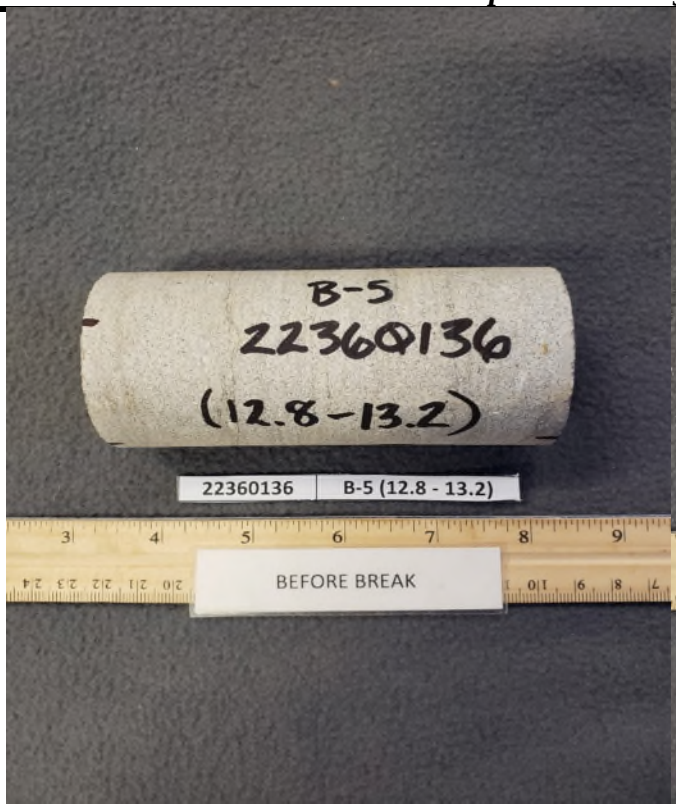
Project No.:	22360136	Report Date:	01/19/23
Project Name:	2027 NGCC - EW Brown	Test Date(s):	01/18/23
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY	Received Date:	12/23/22
Location:	B-5	Depth/Elev., ft:	12.8 - 13.2
Sample Description:	Grey Limestone		

Angle of load relative to lithology: Approximately perpendicular

Test Results

Moisture Content ***0.1*** **%** ***Dry Unit Weight*** ***164.5*** **pcf**

Compressive Strength ***13,108*** **psi**



Strain rate: 0.015 in/min.

Notes / Deviations / References:

J. Folsom	Jacob Folsom	Lab Services Manager	1/23/2023
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D7012C-01
Revision No. 0
Devision Date: 06/25/15

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project Name: 2027 NGCC - EW Brown Location: B-5 Depth, feet: 12.8 - 13.2

Summary of Specimen Tolerances

Length/diameter target:	**MET**	Perpendicularity target:	**MET**
Side straightness target:	**MET**	Planeness target:	**MET**
Parallelism target:	**MET**		

*ASTM D4543-08 Standard Practice for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerance, Section 1.2 - "Rock is a complex engineering material that can vary greatly as a function of lithology, stress history, weathering, moisture content, chemistry, and other natural geologic processes. As such, it is not always possible to obtain or prepare rock core specimens that satisfy the desirable tolerances given in this practice. Most commonly, this situation presents itself with weaker, more porous, and poorly cemented rock types and rock types containing significant or weak (or both) structural features. For these and other rock types which are difficult to prepare, all reasonable efforts shall be made to prepare a specimen in accordance with this practice and for the intended test procedure. However, when it has been determined by trial that this is not possible, the rock specimen will be prepared to the closest tolerance practicable and be considered the best effort and report it as such. If allowable or necessary for the intended test, capping the ends of the specimen as discussed in ASTM D7012 is permitted."

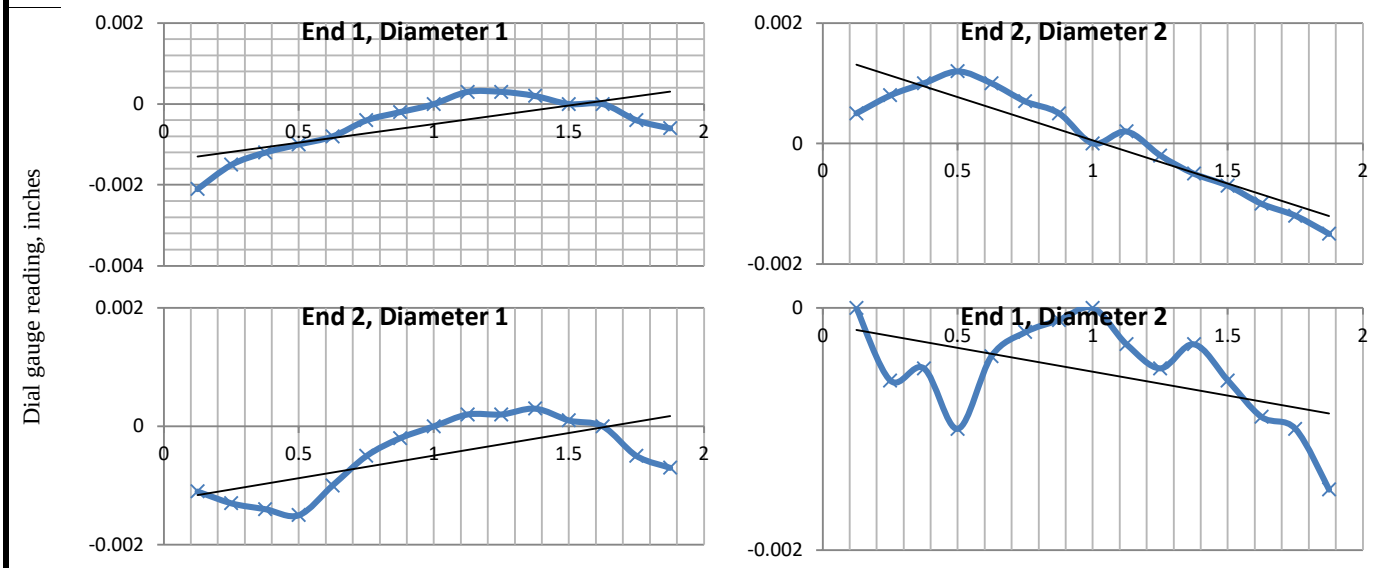
Length to Diameter Ratio

Length, inches: 4.38 Diameter, inches: 1.978
Ratio: 2.22 length to 1 diameter
Target tolerance: L:D ratio between 2 to 1 and 2.5 to 1

Side Straightness

Maximum gap between side of core and reference plate, inches: < .02
Target tolerance: Maximum gap less than .02 inches

Planeness



Distance along diameter, inches

Maximum point-line deviation, inches: < .001
Target Tolerance: No individually measured point should deviate from the best fit line by more than .001 inches.

Parallelism

Slope difference, Diameter 1, degrees: 0.01
Slope difference, Diameter 2, degrees: 0.06
Target Tolerance: Difference between slopes on each end less than 0.25º

Perpendicularity

Slope of End 1, Diameter 1, degrees: 0.05
Slope of End 2, Diameter 1, degrees: 0.04
Slope of End 1, Diameter 2, degrees: -0.02
Slope of End 2, Diameter 2, degrees: -0.08
Target Tolerance: Each diameter perpendicular to the long axis to within 0.25º

Test Information

Strain rate, in/min: 0.015
OR
Stress rate, lbs/sec:
Time to failure, min: 4.52
Temperature: room temperature

Form No. TR-D7012C-01
Revision No. 0
Devision Date: 06/25/15

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

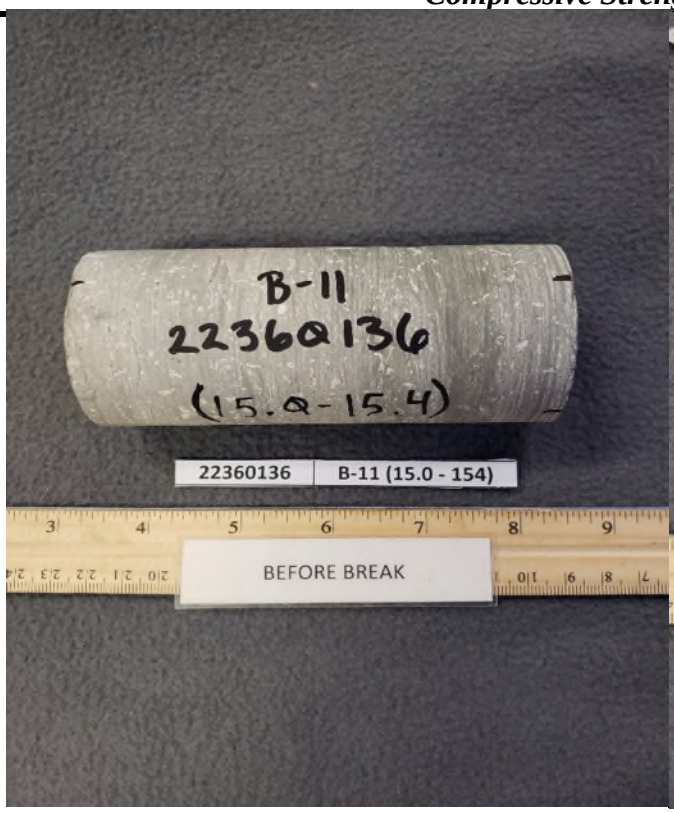
Project No.:	22360136	Report Date:	01/19/23
Project Name:	2027 NGCC - EW Brown	Test Date(s):	01/18/23
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY	Received Date:	12/23/22
Location:	B-11	Depth/Elev., ft:	15.0 - 15.4
Sample Description:	Grey Limestone		

Angle of load relative to lithology: Approximately perpendicular

Test Results

Moisture Content ***0.6*** **%** ***Dry Unit Weight*** ***165.1*** **pcf**

Compressive Strength ***9,332*** **psi**



Strain rate: 0.015 in/min.

Notes / Deviations / References:

J. Folsom	Jacob Folsom	Lab Services Manager	1/23/2023
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D7012C-01
Revision No. 0
Devision Date: 06/25/15

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project Name: 2027 NGCC - EW Brown | Location: B-11 | Depth, feet: 15.0 - 15.4

Summary of Specimen Tolerances

Length/diameter target:	**MET**	Perpendicularity target:	**MET**
Side straightness target:	**MET**	Planeness target:	**MET**
Parallelism target:	**MET**		

*ASTM D4543-08 Standard Practice for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerance, Section 1.2 - "Rock is a complex engineering material that can vary greatly as a function of lithology, stress history, weathering, moisture content, chemistry, and other natural geologic processes. As such, it is not always possible to obtain or prepare rock core specimens that satisfy the desirable tolerances given in this practice. Most commonly, this situation presents itself with weaker, more porous, and poorly cemented rock types and rock types containing significant or weak (or both) structural features. For these and other rock types which are difficult to prepare, all reasonable efforts shall be made to prepare a specimen in accordance with this practice and for the intended test procedure. However, when it has been determined by trial that this is not possible, the rock specimen will be prepared to the closest tolerance practicable and be considered the best effort and report it as such. If allowable or necessary for the intended test, capping the ends of the specimen as discussed in ASTM D7012 is permitted."

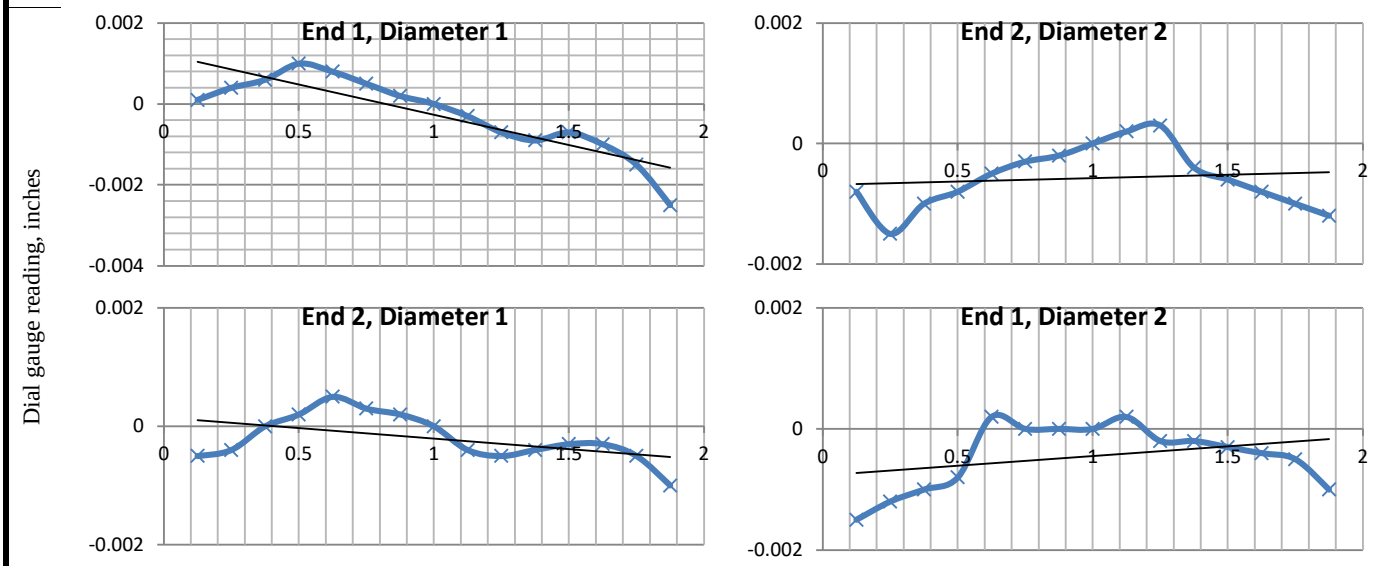
Length to Diameter Ratio

Length, inches: 4.58 | Diameter, inches: 1.980
Ratio: 2.31 length to 1 diameter
Target tolerance: L:D ratio between 2 to 1 and 2.5 to 1

Side Straightness

Maximum gap between side of core and reference plate, inches: < .02
Target tolerance: Maximum gap less than .02 inches

Planeness



Distance along diameter, inches

Maximum point-line deviation, inches: < .001
Target Tolerance: No individually measured point should deviate from the best fit line by more than .001 inches.

Perpendicularity

Slope of End 1, Diameter 1, degrees:	-0.09
Slope of End 2, Diameter 1, degrees:	-0.02
Slope of End 1, Diameter 2, degrees:	0.02
Slope of End 2, Diameter 2, degrees:	0.01

Target Tolerance: Each diameter perpendicular to the long axis to within 0.25º

Parallelism

Slope difference, Diameter 1, degrees:	0.07
Slope difference, Diameter 2, degrees:	0.01

Target Tolerance: Difference between slopes on each end less than 0.25º

Test Information

Strain rate, in/min:	0.015
OR	
Stress rate, lbs/sec:	
Time to failure, min:	3.1
Temperature:	room temperature

Form No. TR-D7012C-01
Revision No. 0
Devision Date: 06/25/15

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

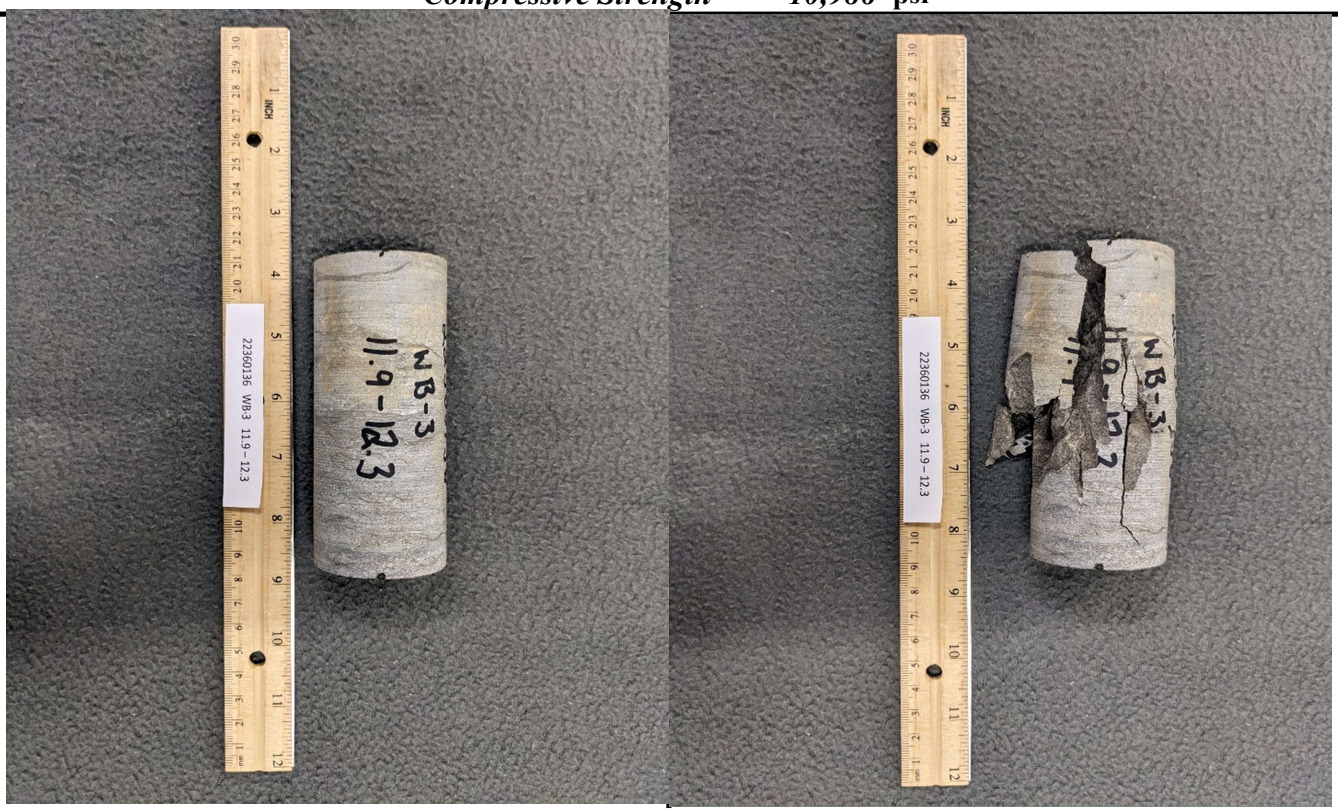
S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project No.:	22360136	Report Date:	02/10/23
Project Name:	2027 NGCC - Mill Creek and Brown	Test Date(s):	02/10/23
Client Name:	LG&E-KU		
Client Address:	820 West Broadway, Louisville, KY	Received Date:	01/26/23
Location:	WB-3	Depth/Elev., ft:	11.9-12.3
Sample Description:	Gray Limestone		

Angle of load relative to lithology: Approximately perpendicular

Test Results

Compressive Strength ***10,986*** **psi**



Strain rate: 0.015 in/min.

Notes / Deviations / References:

J. LaMothe		Senior Engineering Technician	2/10/2023
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D7012C-01
Revision No. 0
Devision Date: 06/25/15

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

S&ME, Inc. - Lexington: 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project Name: 2027 NGCC - Mill Creek and Brown Location: WB-3 Depth, feet: 11.9-12.3

Summary of Specimen Tolerances

Length/diameter target:	**MET**	Perpendicularity target:	**MET**
Side straightness target:	**MET**	Planeness target:	**MET**
Parallelism target:	**MET**		

*ASTM D4543-08 Standard Practice for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerance, Section 1.2 - "Rock is a complex engineering material that can vary greatly as a function of lithology, stress history, weathering, moisture content, chemistry, and other natural geologic processes. As such, it is not always possible to obtain or prepare rock core specimens that satisfy the desirable tolerances given in this practice. Most commonly, this situation presents itself with weaker, more porous, and poorly cemented rock types and rock types containing significant or weak (or both) structural features. For these and other rock types which are difficult to prepare, all reasonable efforts shall be made to prepare a specimen in accordance with this practice and for the intended test procedure. However, when it has been determined by trial that this is not possible, the rock specimen will be prepared to the closest tolerance practicable and be considered the best effort and report it as such. If allowable or necessary for the intended test, capping the ends of the specimen as discussed in ASTM D7012 is permitted."

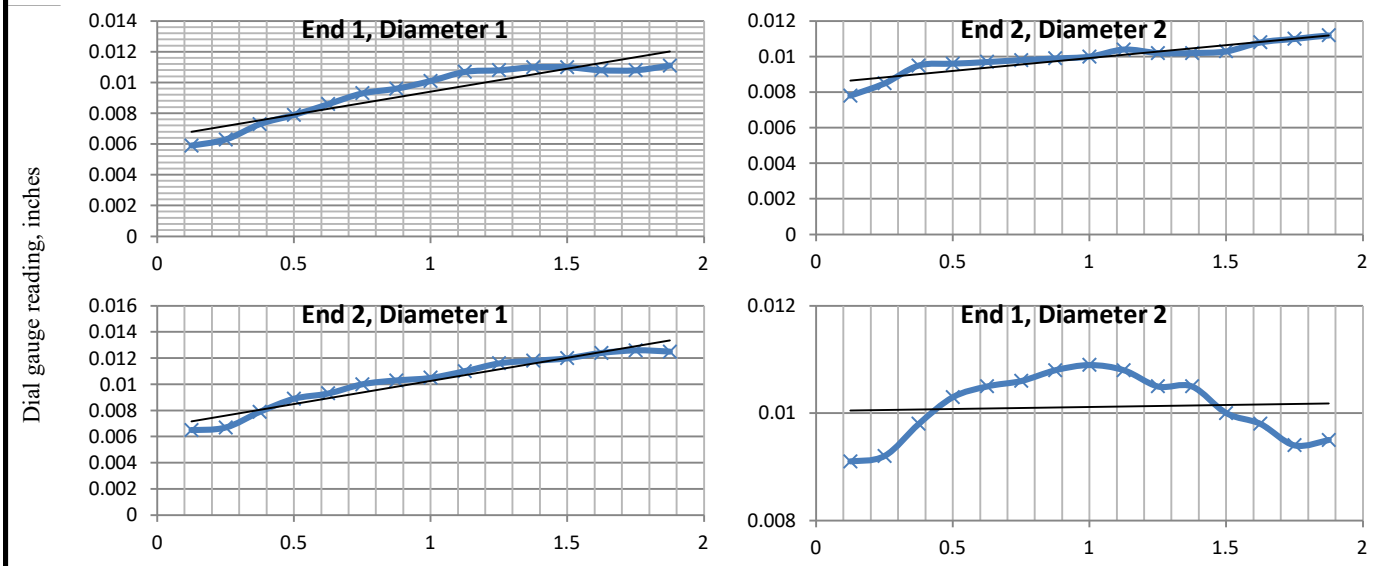
Length to Diameter Ratio

Length, inches: 4.66 Diameter, inches: 1.867
Ratio: 2.50 length to 1 diameter
Target tolerance: L:D ratio between 2 to 1 and 2.5 to 1

Side Straightness

Maximum gap between side of core and reference plate, inches: < .02
Target tolerance: Maximum gap less than .02 inches

Planeness



Distance along diameter, inches

Maximum point-line deviation, inches: < .001
Target Tolerance: No individually measured point should deviate from the best fit line by more than .001 inches.

Perpendicularity

Slope of End 1, Diameter 1, degrees:	0.17
Slope of End 2, Diameter 1, degrees:	0.20
Slope of End 1, Diameter 2, degrees:	0.00
Slope of End 2, Diameter 2, degrees:	0.08

Target Tolerance: Each diameter perpendicular to the long axis to within 0.25º

Parallelism

Slope difference, Diameter 1, degrees:	0.03
Slope difference, Diameter 2, degrees:	0.08

Target Tolerance: Difference between slopes on each end less than 0.25º

Test Information

Strain rate, in/min:	0.015
OR	
Stress rate, lbs/sec:	
Time to failure, min:	3.02
Temperature:	room temperature

AES

ANALYTICAL ENVIRONMENTAL SERVICES, INC.

January 23, 2023

Jacob Folsom
S&ME, Inc.

2020 Liberty Rd.
Lexington KY 40505

RE: CEC/NGCC

Dear Jacob Folsom: Order No: 2301F21

Analytical Environmental Services, Inc. received 7 samples on January 13, 2023 3:11 pm for the analyses presented in following report.

"No problems were encountered during the analyses except as noted in the Case Narrative or by qualifiers in the report or QC Summary. Additionally, all results for the associated Quality Control samples were within EPA and/or AES established limits.
AES's accreditations are as follows:
-NELAP/State of Florida Laboratory ID E87582 for analysis of Non-Potable Water, Solid & Chemical Materials, Air & Emissions Volatile Organics, and Drinking Water Microbiology & Metals, effective 07/01/22-06/30/23.
State of Georgia, Department of Natural Resources ID #800 for analysis of Drinking Water Metals, effective through 06/30/23 and Total Coliforms/ E. coli, effective 04/20/20-04/24/23.
-AIHA-LAP, LLC Laboratory ID: 100671 for Industrial Hygiene samples (Metals and PCM Asbestos), Environmental Lead (Paint, Soil, Dust Wipes, Air), and Environmental Microbiology (Fungal) Direct Examination, effective until 11/01/23.
These results relate only to the items tested as received. This report may only be reproduced in full.

If you have any questions regarding these test results, please feel free to call.

Sincerely,

Eben D. Buchanan, Jr.

Eben Buchanan

Project Manager

ANALYTICAL ENVIRONMENTAL SERVICES, INC.
3080 Presidential Drive Atlanta, GA 30340-3704
Phone: (770) 457-8177 / Toll-Free: (800) 972-4889 / Fax: (770) 457-8188

CHAIN OF CUSTODY

Work Order: 230|F21

Date: 01/11/2023 Page 1 of 1

COMPANY:	ADDRESS:
S&ME	2020 Liberty Road Lexington, KY 40505
PHONE: 859 293-5518	EMAIL: jfolsom@smeinc.com
SAMPLED BY:	SIGNATURE:

#	SAMPLE ID	SAMPLED: DATE	SAMPLED: TIME	GRAB	COMPOSITE	MATRIX (see codes)	Sulfates	Chloride Ions	Oxygen Reduction	Sulfides	REMARKS	Number of Containers
							PRESERVATION (see codes)					
							NA	NA	NA	NA		
1	CEC B-1 3.5-5	10/25/22					✔	✔	✔	✔		1
2	CEC B-2 3-5	10/25/22					✔	✔	✔	✔		1
3	CEC B-3 6-10	10/25/22			✔		✔	✔	✔	✔		1
4	CEC B-4 composite	10/25/22			✔		✔	✔	✔	✔		1
5												
6	NGCC B-4 10-12	11/23/22					✔	✔	✔	✔		1
7	NGCC MCB-5 12-14	11/23/22					✔	✔	✔	✔		1
8	NGCC MCB-5 43.5-45	11/23/22					✔	✔	✔	✔		1
9												
10												
11												
12												
13												
14												

Visit our website www.aesatlanta.com for downloadable COCs and to log in to your AESAccess account.

RELINQUISHED BY:	DATE/TIME:	RECEIVED BY:	DATE/TIME:
1.		1. MyJu 1/13/23 1511	
2.		2.	
3.		3.	

SPECIAL INSTRUCTIONS/COMMENTS:

SHIPMENT METHOD
OUT: / / VIA:
IN: / / VIA:
client (FedEx) UPS US mail courier
other: _____

PROJECT INFORMATION
PROJECT NAME: CEC/NGCC
PROJECT #:
SITE ADDRESS:
SEND REPORT TO: Jacob Folsom
INVOICE TO (IF DIFFERENT FROM ABOVE):
QUOTE #:_____ PO#:_____

RECEIPT
Total # of Containers

Turnaround Time (TAT) Request
- [x] Standard
- [ ] 2 Business Day Rush
- [ ] Next Business Day Rush
- [ ] Same-Day Rush **(auth req.)**
- [ ] Other _____

STATE PROGRAM (if any): _____
E-mail? ☐ Fax? ☐
DATA PACKAGE: I ○ II ○ III ○ IV ○

Submission of samples to the laboratory constitutes acceptance of AES's Terms & Conditions. Client assumes sole responsibility for damage or loss of samples before we accept them. Samples received after 3PM or on Saturday are considered as received the following business day. If no TAT is marked on COC, AES will proceed with standard TAT. Samples are disposed of 30 days after completion of report unless other arrangements are made.

7.11.18_CO

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water ST=Stormwater WW = Waste Water W = Water (Blanks) DW = Drinking Water (Blanks) O = Other (specify)

Preservative Codes: H+I = Hydrochloric acid + ice I = Ice only N = Nitric acid S+I = Sulfuric acid + ice S/M+I = Sodium Bisulfate/Methanol + ice O = Other (specify) NA = None

White Copy - Original; Yellow Copy - Client

Analytical Environmental Services, Inc **Date:** 23-Jan-23

Client:	S&ME, Inc.	**Client Sample ID:**	NGCC B-4 10-12
Project Name:	CEC/NGCC	**Collection Date:**	11/23/2022
Lab ID:	2301F21-005	**Matrix:**	Solid

Analyses	Result	Reporting Limit	Qual	Units	BatchID	Dilution Factor	Date Analyzed	Analyst
Sulfide by SW9030B/9034					**(SW9030B)**			
Sulfide	BRL	60.6	H	mg/Kg-dry	349766	1	01/19/2023 16:15	AA
Oxidation/Reduction Potential by ASTM G200-9								
Oxidation-Reduction Potential	110	1.0	H	mV	R506536	1	01/18/2023 14:22	AH
Oxidation-Reduction Potential	100	1.0	H	mV	R506536	1	01/18/2023 14:22	AH
Oxidation-Reduction Potential	120	1.0	H	mV	R506536	1	01/18/2023 14:22	AH
ION SCAN SW9056A					**(SW9056A)**			
Chloride	BRL	150	H	mg/Kg-dry	349744	10	01/19/2023 17:42	BI
Sulfate	4100	150	H	mg/Kg-dry	349744	10	01/19/2023 17:42	BI
PERCENT MOISTURE D2216								
Percent Moisture	36.5	0		wt%	R506205	1	01/15/2023 00:00	JW

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated (value above quantitation range)
BRL	Below reporting limit	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	Narr	See case narrative
N	Analyte not NELAC certified	F	Analyzed in the lab which is a deviation from the method
B	Analyte detected in the associated method blank	<	Less than Result value
>	Greater than Result value	J	Estimated value detected below Reporting Limit

Summary of Laboratory Procedures

Recovered disturbed and undisturbed samples and the drillers' field logs were transported to the laboratory where they were examined by the geotechnical engineer. Selected samples representative of certain groups of soils were subjected to simple classification tests by hand or other simple means.

Recovered disturbed and undisturbed samples and the drillers' field logs were transported to the laboratory where they were examined by the geotechnical engineer. Selected samples representative of certain groups of soils were subjected to simple classification tests by hand or other simple means. Other samples were tested in the laboratory to determine their strength or consolidation properties.

♦ Laboratory Tests of Soil

Examination of Split Spoon Soil Samples

Soil and rock samples and field boring records were reviewed in the laboratory by the geotechnical engineer. Soils were classified in general accordance with the visual-manual method described in ASTM D 2488, *Standard Practice for Description and Identification of Soils (Visual-Manual Method)*. The geotechnical engineer also prepared the final boring records enclosed with this report.

Extrusion and Examination of Group C Undisturbed Samples

Undisturbed samples were stored in the vertical position in the laboratory. Samples were extruded from the thin-walled sampler, using a specially constructed extruder, in the same direction of travel as the sample entered the tube during sampling. In certain cases it was necessary to cut the tube into short sections to facilitate removal of the soil without compressing or disturbing the sample. Specimens were trimmed using a wire saw or steel straightedge. Where removal of pebbles or crumbling resulting from trimming caused voids on the surface of the specimens selected for quantitative laboratory testing, they were filled with remolded soil obtained from the trimmed portion of the sample.

Moisture Content Testing of Soil Samples by Oven Drying

Moisture content was determined in general conformance with the methods outlined in ASTM D2216, "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil or Rock by Mass." This method is limited in scope to Group B, C, or D samples of earth materials which do not contain appreciable amounts of organic material, soluble solids such as salt or reactive solids such as cement. This method is also limited to samples which do not contain contamination.

A representative portion of the soil was divided from the sample using one of the methods described in Section 9 of ASTM D2216. The split portion was then placed in a drying oven and heated to approximately 110 degrees C overnight or until a constant mass was achieved after repetitive weighing. The moisture content of the soil was then computed as the mass of water removed from the sample by drying, divided by the mass of the sample dry, times 100 percent. No attempt was made to exclude any particular particle size from the portion split from the sample.

Liquid and Plastic Limits Testing

Atterberg limits of the soils was determined generally following the methods described by ASTM D4318, *Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils*. Albert Atterberg originally defined "limits of consistency" of fine grained soils in terms of their relative ease of deformation at various moisture contents. In current engineering usage, the liquid limit of a soil is defined as the moisture content, in percent, marking the upper limit of viscous flow and the boundary with a semi-liquid state. The plastic limit defines the lower limit of plastic behavior, above which a soil behaves plastically below which it retains its shape upon drying. The plasticity index (PI) is the range of water content over which a soil behaves plastically. Numerically, the PI is the difference between liquid limit and plastic limit values.

Representative portions of fine grained Group A, B, C, or D samples were prepared using the wet method described in Section 10.1 of ASTM D4318. The liquid limit of each sample was determined using the multipoint method (Method A) described in Section 11. The liquid limit is by definition the moisture content where 25 drops of a hand operated liquid limit device are required to close a standard width groove cut in a soil sample placed in the device. After each test, the moisture content of the sample was adjusted and the sample replaced in the device. The test was repeated to provide a minimum of three widely spaced combinations of N versus moisture content. When plotted on semilog paper, the liquid limit moisture content was determined by straight line interpolation between the data points at N equals 25 blows.

The plastic limit was determined using the procedure described in Section 17 of ASTM D4318. A selected portion of the soil used in the liquid limit test was kneaded and rolled by hand until it could no longer be rolled to a 3.2 mm thread on a glass plate. This procedure was repeated until at least 6 grams of material was accumulated, at which point the moisture content was determined using the methods described in ASTM D2216.

Grain Size Analysis of Samples

The distribution of particle sizes greater than 75 µm was determined in general accordance with the procedures described by ASTM D421, *Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants*, and D422, *Standard Test Method for Particle Size Analysis of Soils*. During preparation samples were divided into two portions. The material coarser than the No. 30 U.S. sieve size fraction was dry sieved through a nest of standard sieves as described in Article 6. Material passing the No. 30 sieve was independently passed through a nest of sieves down to the No. 200 size.

Grain Size Analysis of Samples with Hydrometer

The distribution of particle sizes was determined in general accordance with the procedures described by ASTM D421, *Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants*, and D422, *Standard Test Method for Particle Size Analysis of Soils*. During preparation samples were divided into two portions. The material coarser than the No. 10 U.S. sieve size fraction was dry sieved through a nest of standard sieves as described in Article 6. Material passing the No. 10 sieve was soaked in demineralized water and a dispersing agent, then the soil-water slurry placed in a glass sedimentation chamber and the specific gravity of the slurry recorded at various time intervals. The grain size distribution was calculated from the time rate of sedimentation of the various size particles. After the final hydrometer reading was obtained, the suspension was washed through the No. 200 sieve. The remaining material retained on the No. 200 sieve was oven dried, and then passed through a standard nest of sieves.

Percent Fines Determination of Samples

A selected specimen of soils was washed over a No. 200 sieve after being thoroughly mixed and dried. This test was conducted in general accordance with ASTM D1140, *Standard Test Method for Amount of Material Finer Than the No. 200 Sieve*. Method A, using water to wash the sample through the sieve without soaking the sample for a prescribed period of time, was used and the percentage by weight of material washing through the sieve was deemed the "percent fines" or percent clay and silt fraction.

Percent Organics (Organic Loss on Ignition)

The content of relatively undecayed or undecomposed vegetative matter in the soils is determined for representative samples of topsoil or stained subsoils using the procedures described by AASHTO T-267, *Determination of Organic Content in Soils by Loss on Ignition*. Representative samples of the minus No. 10 sieve size are dried at 105 C, then heated in a muffle furnace at 455 C for six hours. The resulting dry weight of the sample after ignition is then compared to the pre-ignition dry weight to estimate the organic content.

Compaction Tests of Soils Using Modified Effort

Soil placed as engineering fill is compacted to a dense state to obtain satisfactory engineering properties. Laboratory compaction tests provide the basis for determining the percent compaction and water content needed to achieve the required engineering properties, and for controlling construction to assure the required compaction and water contents are achieved. Test procedures generally followed those described by ASTM D1557, *Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 lbf/ft3)*.

The relationship between water content and the dry unit weight is determined for soils compacted in either 4 or 6 inch diameter molds with a 10 lbf rammer dropped from a height of 18 inches, producing a compactive effort of 56,000 lbf/ft3. ASTM D 1557 provides three alternative procedures depending on material gradation:

Method A (Shall be used if 20 percent or less by weight is retained on No. 4 sieve)

- All material passes No. 4 sieve size
- 4 inch diameter mold
- Soil in 5 layers with 25 blows per layer

Method B (Shall be used if 20 percent by weight is retained on the No. 4 sieve and 20 percent or less by weight is retained on the 3/8-inch sieve)

- All material passes 3/8 inch sieve
- 4 inch diameter mold
- Soil in 5 layers with 25 blows per layer

Method C (Shall be used if more than 20 percent by weight is retained on the 3/8-inch sieve and less than 30 percent is retained on the 3/4-inch sieve)

- All material passes ¾ inch sieve
- 6-inch diameter mold

- Soil in 5 layers with 56 blows per layer

Soil was compacted in the mold in five layers of approximately equal thickness, each compacted with either 25 or 56 blows of the rammer. After compaction of the sample in the mold, the resulting dry density and moisture content was determined and the procedure repeated. Separate soils were used for each sample point, adjusting the moisture content of the soil as described in Section 10.2 (Moist Preparation Method). The procedure was repeated for a sufficient number of water content values to allow the dry density vs. water content values to be plotted and the maximum dry density and optimum moisture content to be determined from the resulting curvilinear relationship.

Laboratory California Bearing Ratio Tests of Compacted Samples

This method is used to evaluate the potential strength of subgrade, subbase, and base course material, including recycled materials, for use in road and airfield pavements. Laboratory CBR tests were run in general accordance with the procedures laid out in ASTM D1883, *Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils*. Specimens were prepared in standard molds using three different levels of compactive effort within plus or minus 0.5 percent of the optimum moisture content value. While embedded in the compaction mold, each sample was inundated for a minimum period of 96 hours to achieve saturation. During inundation the specimen was surcharged by a weight approximating the anticipated weight of the pavement and base course layers. After removing the sample from the soaking bath, the soil was then sheared by jacking a piston having a cross sectional area of 3 square inches into the end surface of the specimen. The piston was jacked 0.5 inches into the specimen at a constant rate of 0.05 inches per minute.

The CBR is defined as the load required to penetrate a material to a predetermined depth, compared to the load required to penetrate a standard sample of crushed stone to the same depth. The CBR value was usually based on the load ratio for a penetration of 0.10 inches, after correcting the load-deflection curves for surface irregularities or upward concavity. However, where the calculated CBR for a penetration of 0.20 inches was greater than the result obtained for a penetration of 0.01 inches, the test was repeated by reversing the specimen and shearing the opposite end surface. Where the second test indicated a greater CBR at 0.20 inches penetration, the CBR for 0.20 inches penetration was used.

Soil pH Testing

Soil pH measures the activity of hydrogen ions in a water solution. The pH scale ranges from 0 (very acidic) to 14 (very alkaline or basic). Test methods follow those given by AASHTO T-289-91(2004), *Determining pH for Soil for Use in Corrosion Testing*.

Moist samples are sieved and pulverized as described in Section 6.2. A 30 mg sample is then suspended in distilled water for one hour. A pH meter is first standardized against a buffer solution of known pH, then the probe immersed in the suspended solution and the pH reading recorded. If the pH of the soil is below 4.5 the soil is reported as aggressive.

Soil Resistivity of Samples

This method is used to evaluate soil resistivity for the control of corrosion of buried structures, both for the estimation of expected corrosion rates and for the design of cathodic protection systems. Laboratory soil

resistivity tests were run in general accordance with the procedure laid out in ASTM G57, *Standard Test Method for Field Measurement of Soil Resistivity using the Wenner Four-Electrode Method*. Laboratory tests were performed using Section 7.2.

A soil sample representative of the area of interest was mixed thoroughly and brought to saturation by adding only a sufficient amount of distilled water to produce a slight amount of surface water. The sample was condition overnight allowing excess surface water to evaporate. The saturated stiff slurry sample was placed in the soil box in layers, eliminating air spaces as far as practicable. A voltage was impressed across the outer electrodes. The voltage drop across the inner electrodes was measured with both the current and voltage drop recorded, if a separate ammeter and voltmeter were used. Where a resistivity meter was used, the resistance was read directly. The saturated measurement will provide an approaching minimum resistivity.

Laboratory Sulfate Ion Content Test

External sulfate can occur when concrete is in contact with sulfate containing water e.g. seawater, swamp water, ground water or sewage water. The often massive formation of gypsum and ettringite formed during the external sulfate attack may cause concrete to crack and scale.

Water soluble sulfate ion content is determined using either Method A or B as described by AASHTO T-290-95(2003), *Determining Water-Soluble Sulfate Ion Content in Soil*. Soil specimens were first prepared by splitting and quartering representative portions from recovered samples as described in Section 7.2.

Method A, the Gravimetric Method, determines sulfate content by precipitation of barium sulfate from a heated solution of the soil and chemical reagents. Method B, the Turbidimetric Method, relies on a photoelectric colorimeter to determine the turbidity of a barium sulfate suspension after chemical reagents are added. Laboratory test data sheets will indicate the method used.

Laboratory Chloride Ion Content Test

Water soluble chloride ion content is determined using either Method A or B as described by AASHTO T-291-94(2004), *Determining Water-Soluble chloride Ion Content in Soil*. Soil specimens were first prepared by splitting and quartering representative portions from recovered samples as described in Section 7.2.

Method A, the Mohr Titration Method, determines chloride ion content using silver nitrate in a suspended solution of the soil and distilled water. A reaction between a potassium chromate indicator solution and the silver nitrate produces a red-silver chromate precipitate.

Method B utilizes a pH/mV meter with chloride ion selective electrodes. When inserted into the suspension the meter records the activity of the chloride ions. These readings are compared to a set of calibration curves to determine the ion content in mg/kg.

Consolidation Tests of Undisturbed Samples

The data from the consolidation test are used to estimate the magnitude and rate of both total and differential settlement of a structure or earthfill. In this test method a saturated soil specimen is restrained laterally by a steel mold and loaded axially with total stress increments. As the specimen consolidates, measurements are made of the change in specimen height and plotted vs. time to determine the relationship between the effective stress and void ratio or strain, and the time rate at which consolidation occurs.

Procedures for determining the magnitude and rate of consolidation of laterally restrained soil generally followed those described in ASTM D2435, *Standard Test Method for One-Dimensional Consolidation of Soils*. Undisturbed samples intended for use in consolidation testing were handled as Group C or D samples as described in ASTM D4220. Extruded samples were each trimmed to a disc 2.5 inches in diameter and 1.0 inches thick as described in Section 9. Each disc was confined in a stainless steel ring and sandwiched between two porous stone plates. After application of a seating load of 100 lb/ft2 to confine the specimen, the ring was placed in an oedometer and the sample immersed in water to full saturation.

Prepared specimens were loaded to the desired stress in accordance with one of the standard loading schedules ("A" or "B") described in Section 11.5 and indicated on the attached test reports, then unloaded in four equal decrements. Resulting deformation of the sample was measured using a micrometer dial gage.

Time deformation properties were plotted for each load increment using either the log time or square root of time methods described in Section 12.3 and the coefficient of consolidation Cv computed. Load deformation properties were plotted in terms of either void ratio at 100 percent consolidation for each loading increment vs. applied load or in terms of percentage strain (of initial sample height) vs. applied load plotted on log scale. The preconsolidation stress pc of the specimen was estimated from this plot using the Casagrande construction described in Section 12.4.6. The compression index Cc was estimated from the straight line portion of the semilog consolidation curve, above the preconsolidation stress.

UU or "Q" Triaxial Shear Tests of Undisturbed Samples

Shear tests were performed using the UU or "Q" test method described by ASTM D2850, *Standard Test Method for Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils*. This test is typically limited to fine-grained soils having a permeability slower than 10^{-3} cm/sec, which are preserved as Group C samples as defined in ASTM D4220. The UU test employs rapid application of both confining and axial stresses without permitting drainage of pore water. This condition simulates rapid loading of the soil during construction before sufficient time is allowed for the soil to consolidate. UU tests were performed on samples at their "as-received" moisture content, so that results may be applied to "construction conditions" in embankment stability analyses. The extruded sample was encased in a rubber membrane and sealed to the specimen base and cap with rubber O-rings to prevent drainage of the specimen. For this test UD samples were tested without trimming except for cutting the end surfaces plane and perpendicular to the longitudinal axis of the specimen.

The UU test is performed with the drain valve of the triaxial cell closed during all phases of the test and before the sample has a chance to consolidate (S<100 percent). The chamber was pressurized to the desired confining pressure and the sample allowed to stabilize at least 10 minutes before application of axial load. The sample was loaded axially by compressing the top platen into the sample at a constant rate of approximately one percent strain per minute. Deformation of the sample and the applied stress was recorded electronically using LVDT strain gauges. Failure of the specimens during the tests was defined as the maximum principal stress difference (deviator stress) attained at any point during the test, or as the deviator stress at 15 percent strain, whichever occurred first. Test output is attached in the Appendix and includes a plot of deviator stress vs. applied strain for various load increments, and Mohr Circle plots at various increments of confining stress.

CU or "R" Triaxial Shear Tests of Undisturbed Samples

Shear tests were performed using the CU or "R" test method described by ASTM D4767, *Standard Test Method for Consolidated-Undrained Triaxial Compression Test for Cohesive Soils*. This test is typically applicable to fine-grained soils preserved as Group C samples as defined in ASTM D4220. Samples tested using the R test method are isotropically consolidated and sheared in compression without drainage at a constant rate of axial deformation. The shear characteristics measured under undrained conditions are applicable to field conditions where soils that have been fully consolidated under one set of stresses are subjected to a change in stress without time for further consolidation to take place. Measured pore pressures induced by the change in stress can be used to compute effective stress shear strength, which may be applied to field conditions in which full drainage can occur or to conditions in which pore pressures induced by loading can be estimated.

R tests were performed on samples prepared as generally described in Section 6 of ASTM D4767. Each extruded sample was encased in a rubber membrane and sealed to the specimen base and cap with rubber O-rings to prevent drainage of the specimen. For this test UD samples were tested without trimming except for cutting the end surfaces plane and perpendicular to the longitudinal axis of the specimen. Samples were saturated by back pressuring the pore water in the specimen to drive the air in the void spaces into solution, after the system was saturated by applying a vacuum to the specimen and dry drainage system as described in section 8.2.

With the drainage valves of the triaxial cell closed, the cell pressure was increased while maintaining back pressure constant to confine the specimen. After the chamber was pressurized to the desired confining pressure the appropriate drainage ports were opened and the sample allowed to fully consolidate to equilibrium before application of axial load. The fully consolidated sample was then loaded axially by compressing the top platen into the sample at a constant rate of approximately one percent strain per minute, with the drainage ports again closed. Deformation of the sample and the applied stress was recorded electronically using LVDT strain gauges and induced pore pressures measured using a stiff electronic pressure transducer.

Failure of the specimens during the tests was defined as the point of maximum effective stress obliquity, the maximum stress difference (deviator stress) attained at any point during the test, or as the deviator stress at 15 percent strain, whichever occurred first. Test output is attached in the Appendix and includes a plot of deviator stress vs. applied strain for various load increments, induced pore pressure vs. applied strain, p'-q' diagram, and Mohr Circle plots at various increments of confining stress.

♦ Laboratory Tests of Rock

Examination of Rock Core Specimens

Rock core samples returned to the laboratory were examined by the geotechnical engineer or geologist and the percentage recovery and rock quality designation (RQD) estimated for each run. A core run is defined either as 1) a drill run defined by the length of the core barrel; 2) a change in formation or rock type could constitute the end of a core run; or 3) a core run can be a selected zone of concern. Core run lengths are indicated on the attached boring records.

The "recovery" is the ratio of the sample length recovered in the core barrel to the total length of the core run, expressed as a percent. Rock Quality Designation is described by ASTM D6032, *Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core*. The RQD is the percentage of the core run consisting of moderately hard or harder NX-sized rock core recovered in segments 4 inches long or longer. When properly interpreted by a qualified professional, the RQD value provides a basis for preliminary design decisions involving foundations or excavation in rock.

Only those pieces or rock formed by natural joints, bedding planes, shear zones, or cleavage planes that result in surfaces of separation were considered for RQD purposes. Pieces formed by breaks in the core due to drilling or handling were not considered. Pieces were considered intact when they appeared to have been bonded together prior to coring and broken surfaces consisted of fresh rock. Where a surface could not be determined as either a natural or mechanical break, it was considered a natural break.

Rock core specimens were classified based on the following characteristics:

Hardness	Description of Core
Soft Rock	May be broken with fingers
Moderately Soft	May be scratched by a nail, corners and edges may be broken with fingers
Moderately Hard	Light blow of hammer required to break sample
Hard Rock	Hard blow of hammer required to break sample
Very Hard	Rock core rings when struck by hammer

Continuity	Core Recovery in Percent
Incompetent	Less than 40 percent
Competent	40 – 70 percent
Fairly Continuous	70 – 90 percent
Continuous	90 – 100 percent

Rock Quality	Rock Quality Designation
Very Poor	0 - 25 percent
Poor	25 – 50 percent
Fair	50 – 75 percent
Good	75 – 90 percent
Excellent	90 – 100 percent

Weathering	Description
Fresh	Rock fresh, crystals bright, some joints may show slight staining
Very Slight	Joints stained, some joints may show thin clay coatings
Slight	Joints stained and rock discolored up to 1 inch from joint surfaces
Moderate	Significant discoloration and weathering effects
Moderately Severe	All rock except quartz discolored and stained
Severe	Rock severely discolored and stained, few intact pieces remain
Very Severe	Rock fabric remains but reduced in strength to strong soil

Detailed rock descriptions, percent recovery, RQD values and the core barrel or bit size used are shown on the appropriate boring records in the Appendix.

Unconfined Compressive Strength Tests of Intact Rock Core

The unconfined compressive strength of intact rock core specimens will be determined generally following the procedures described in ASTM D7012, *Standard Test Methods for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures*. Selected recovered samples of intact rock core representative of each run will be cut to length and the ends machined flat. Specimens will then be placed in a loading frame and axial load continuously applied until peak load and failure are obtained. Specimens selected for testing will meet shape and L/D proportions outlined in ASTM D4543, *Standard Practice for Preparing Rock Core Specimens and Determining Dimensional and Shape Tolerances*. The specimen minimum dimension should be at least six to ten times the maximum particle or mineral dimension, and the L/D ratio at least 2 to 2.5. Samples will be soaked prior to testing.

Appendix IV– LPILE Tables

KU - E.W. Brown Generating Station

Unit 1-2

Groundwater Encountered: Groundwater as shallow as 5.5 feet below existing ground.

Stratum Layer No.	Depth Below Existing Grade		LPILE Soil Type (p-y Curve)	Description	Total Unit Weight	ϕ	Undrained Shear Strength, s_u	Unconfined Compressive Strength, q_u	LPILE Design Parameters			Allowable End Bearing Pressure[2]	Allowable Skin Resistance (Soil to Concrete)		Allowable Skin Resistance (Soil to Steel)[5]	
	Top of Layer	Bottom of Layer							k	ε_{50}	RQD		Compression[3]	Uplift[4]	Compression[3]	Uplift[4]
	(ft)	(ft)			(pcf)	(deg)	(psf)	(psf) **(psi)**	(pci)		(%)	(psf)	(psf)	(psf)	(psf)	(psf)
1	0	3.0		Frost/Construction Disturbance	110	-	-	-	-	0.01	-	-	-	-	-	-
2[1]	3.0	12.0	Stiff Clay w/o water (Reese)	Anticipated FILL - Lean (CL) to Fat (CH) Clay	115	-	2,000	-	-	0.007	-	-	550	410	275	205
3[1]	3.0	22.0	Stiff Clay (Reese)	Native Lean (CL) to Fat (CH) Clays	115 (CH / 125 (CL)	-	790 - 3,590	1,580 - 7,180	-	0.01 - 0.005	-	-	135 - 1020	100 - 765	65 - 510	45 - 380
4[1]	7.0 - 19.0	10.0 - 22.0	Stiff Clay (Reese)	Weathered to Decomposed Limestone	125	-	4,000	-	-	0.004	-	-	550 - 1020	410 - 765	275 - 510	202 - 380
5[1]	8.0	24.0	Strong Rock (Vuggy Limestone)	Limestone and Chert, slightly to moderately weathered	165	-	-	**2500**[7]	-	0.00005	13 to 100	50,000	5985	4,485	4,485	3,365

Notes:

[1] When below the groundwater table, as in the case of flooding, use the effective unit weight, γ' = γ - 62.4 pcf and add hydrostatic water pressure

[2] FS = 3.0; Typically industry practice references a FS of 2.0 when load testing is performed and a FS between 2.5 and 3.0 without load testing. Additionally, drilled shafts/micropiles expected to penetrate into bedrock

[3] FS = 2.0 ; Typically industry practice references a FS on the order of 1.25 when load testing is performed and a FS of 2.0 or greater without load testing.

[4] Uplift taken as 75% of compression skin resistance.

[5] Applies to permanent steel casing.

[6] With or without free water depending on groundwater depth.

[7] LPILE limits Compressive strength to 2,500 psi for Vuggy Limestone. Actual strngths ranged from 9,300 to 13,100 psi

Webb Farm BESS

KU - E.W. Brown Generating Station

Groundwater Encountered: Groundwater not encountered

Stratum Layer No.	Depth Below Existing Grade		LPILE Soil Type (p-y Curve)	Description	Total Unit Weight	ϕ	Undrained Shear Strength, s_u	Unconfined Compressive Strength, q_u	LPILE Design Parameters			Allowable End Bearing Pressure[2]	Allowable Skin Resistance (Soil to Concrete)		Allowable Skin Resistance (Soil to Steel) [5]	
	Top of Layer	Bottom of Layer							k	ε_{50}	RQD		Compression[3]	Uplift[4]	Compression[3]	Uplift[4]
	(ft)	(ft)			(pcf)	(deg)	(psf)	(psf) **(psi)**	(pci)		(%)	(psf)	(psf)	(psf)	(psf)	(psf)
1	0	3.0		Frost/Construction Disturbance	110	-	-	-	-	0.01	-	-	-	-	-	-
2	2.0	11.0	Stiff Clay (Reese)	Native Lean (CL) to Fat (CH) Clays	115 (CH) / 125 (CL)	-	2,000 to 4,000	-	-	0.07 - 0.05	-	-	550 - 1020	410 - 765	275 - 510	205 - 380
3	2.0	26.0	Strong Rock (Vuggy Limestone)	Limestone and Chert, slightly to moderately weathered	165	-	-	**2500** [6]	-	0.00005	14 to 100	50,000	5985	4,485	4,485	3,365

Notes:

[1] When below the groundwater table, as in the case of flooding, use the effective unit weight, γ' = γ - 62.4 pcf and add hydrostatic water pressure

[2] FS = 3.0; Typically industry practice references a FS of 2.0 when load testing is performed and a FS between 2.5 and 3.0 without load testing. Additionally, drilled shafts/micropiles expected to penetrate into bedrock

[3] FS = 2.0 ; Typically industry practice references a FS on the order of 1.25 when load testing is performed and a FS of 2.0 or greater without load testing.

[4] Uplift taken as 75% of compression skin resistance.

[5] Applies to permanent steel casing.

[6] LPILE limits Compressive strength to 2,500 psi for Vuggy Limestone. Actual strngths ranged from 9,300 to 13,100 psi

[7] Allowable Skin Resistance is limited by the strength of concrete taken as f'_c = 4,000 psi for this project.