ADDENDUM #1

A New Transylvania County EMS Base, Brevard, North Carolina

Addendum #1 **September 28, 2022**

This addendum supersedes all other addenda and forms a part of the bid documents and modifies the original project manual and drawings dated September 21, 2022.

Item #1: **Project Manual: Section "Appendix A"**

A. Replace Appendix "A" Geotechnical Exploration document date January 28, 2021 with attached Appendix "A" Geotechnical Exploration document date July 1, 2022.

Geotechnical Exploration Report
Transylvania County Emergency Services Base

Brevard, North Carolina

S&ME Project No. 22410052

PREPARED FOR:

Transylvania County
152 Public Safety Way
Brevard, North Carolina 28712

PREPARED BY:

S&ME, Inc.
44 Buck Shoals Road, Suite C-3
Arden, North Carolina 28704

July 1, 2022

July 1, 2022

Transylvania County
152 Public Safety Way
Brevard, North Carolina 28712

Attention: Mr. Larry Reece

Reference: **Geotechnical Exploration Report**
Transylvania County Emergency Services Base
Brevard, North Carolina
S&ME Project No. 22410052
NC PE Firm License No. F-0176

Dear Mr. Reece:

S&ME, Inc. (S&ME) is pleased to submit this Geotechnical Exploration Report for the referenced project. The exploration was performed in accordance with our Proposal No. 22410052 and Agreement for Services dated April 14, 2022. The purpose of the subsurface exploration was to help determine site subsurface conditions and to evaluate these conditions relative to site preparation, foundation design, and other geotechnical aspects of design and construction. This report presents a brief confirmation of our understanding of the project, the exploration results, and our geotechnical conclusions and recommendations regarding site grading and building and pavement support.

We appreciate the opportunity to provide the geotechnical engineering services for this project. Please contact us if you have questions regarding the information in this report, or when further services are needed.

Sincerely,

S&ME, Inc.

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Appendices

1.0 Project Information

Our understanding of the project is based upon the following:

- Email and telephone correspondence between Mr. Larry Reece with Transylvania County, Mr. Richard Worley, AIA, Michael Goforth, P.E. with High Country Engineering, and Mr. Matt McCurdy, P.E. with S&ME between April 8 and April 12, 2022;
- Our review of the *Schematic Site Plan* with proposed boring locations prepared by Mr. Richard Worley and sent via email on April 8, 2022;
- A site visit to locate the borings by Mr. Christian Moloney with S&ME on May 6, 2022;
- Our review of aerial imagery and property information from the Transylvania County GIS website and Google Earth^{TM};
- Project meetings using Microsoft Teams with Mr. Reece and Mr. David McNeill with Transylvania County, Mr. Worley, Mr. Goforth, Messrs. Ed Medlock, P.E. and Tim Dempsey, P.E. with Medlock and Associates Engineering, and Mr. McCurdy on June 15, 22, and 29, 2022; and
- Review of structural drawing sheets FP-1.5 and FP-6 dated 6-22-22 provided by Medlock and Associates and preliminary civil drawing sheets C-1and C-2 dated 5-3-22 provided by Mr. Goforth

Based on the information above, it is our understanding that construction of a new Emergency Services Base (EMS) has been proposed for a vacant parcel located at the corner of Morris Road and Ecusta Road in Brevard, North Carolina. Based on the provided drawings, we understand that the Emergency Services Base will be approximately 10,635 square feet consisting of an administrative area with six vehicle bays for emergency medical vehicles to the eastern side of the building. We anticipate the structure will be single-story with high bay ceilings in the truck bay areas. The provided structural drawings indicate the column and wall loads will be on the order of 5 to 22 kips and 1 to 9½ kips per lineal foot, respectively. We assume floor slab loads will range from about 100 to 250 pounds per square foot.

Based on the provided grading plan, earthwork is planned to involve the placement of approximately 4 to 5 feet of fill soils. The planned finished floor elevation of the proposed building is to be 2,120 feet and the parking lot and green space areas will slope gently away from the building. A stormwater wet pond is planned for the eastern portion of the site, adjacent to Ecusta Road.

2.0 Exploration and Testing

2.1 Field

The field exploration included visual site reconnaissance and boring layout by our staff professional along with the performance of ten soil test borings (labeled B-1 through B-10) in the approximate requested locations. Borings B-1 through B-8 were located in the proposed building and pavement areas, while borings B-9 and B-10 were located away from the building site at the proposed borrow pit location. The borings were drilled to depths ranging from 5 to 20 feet below the existing ground surface. Seven of the borings were located within the proposed building footprint, extending to depths of between 11.1 and 16.5 feet where auger refusal was encountered. Boring B-8 was located in the proposed asphalt pavement parking area. The boring locations were identified in the field by our staff professional using the provided site plans and using a handheld GPS unit. The boring locations are shown on Boring Location Plans (Figures 2 and 3 in the Appendix). Because precise survey techniques were not used, the indicated locations should be considered approximate.

The borings were drilled May 25, 2022 using a Mobile Drill B-57 track-mounted drill rig (with an automatic hammer) and advanced using hollow stem auger techniques. Split-spoon samples and Standard Penetration (SPT) values (N-values) were generally obtained at 2.5-foot intervals in the upper 10 feet, and at 5-foot intervals thereafter. After completion of drilling and attempting initial subsurface water depth measurements, boreholes were kept open overnight to allow water levels to stabilize somewhat for a final measurement. Following subsurface water measurements, the boreholes were backfilled with soil cuttings and mechanical hole plugs were installed in each hole to help reduce borehole settlement.

2.2 Laboratory Testing

Following completion of the field work, the split-spoon samples were transported to our laboratory where a Staff Professional visually and manually classified the soils in general accordance with the Unified Soil Classification System (USCS). The field testing and classification results are presented on the individual Boring Logs in Appendix II, along with a Test Boring Log Legend, and the Field Testing Procedures in Appendix IV. Selected samples were subjected to the following tests and performed in general accordance with the applicable standards:

- Natural Moisture Content (ASTM D2216)
- Plastic Index (D4318)
- Grain Size Analysis (D422)
- Standard Proctor D698

A Summary of Laboratory Test Data is in Section 3.3 and individual laboratory data sheets are attached in Appendix III.

3.0 Site and Subsurface Conditions

3.1 Site Conditions

The proposed EMS site is mostly flat, sloping gently downward 4 feet from west to east based upon topographic information obtained Topographic Survey prepared by Carolina Mountain Surveying, dated May 22, 2022. The property is a 2.182-acre lot with two outbuildings located on the western portion of the site. Morris Road borders the property to the south, a wooded vacant lot is located along the eastern boundary, the Transylvania County Habitat for Humanity ReStore building is located to the north, and Ecusta Road bounds the property to the east. The ground surface consists mainly of a grassed field with a few scattered areas of brush near the perimeter of the site. The western portion of the site has 2 out buildings and the ground around them is covered with a mixture of mulch and gravel. There is a creek located across Ecusta Road, approximately 100 feet from the eastern property. The site is in an apparent geologic floodplain.

The proposed fill soil borrow pit is located approximately ¼ of a mile from the proposed building location near the intersection of Corrections Loop and Public Safety Way. The property where the borrow pit is to be located slopes downward from west to east from approximately 2,218 feet atop the hill to 2,150 along the eastern property boundary. The site consists of a grassed field with isolated wooded areas throughout. Based on the information provided to us, we understand that the borrow pit is to be located at the top of the hill in a grassed field.

3.2 Area Geology

The site is located within the Brevard Fault Zone at the contact of the Piedmont physiographic province of North Carolina and the Blue Ridge, an area underlain by ancient igneous and metamorphic rocks. The soils encountered in this area are the residual product of in-place physical and chemical weathering of the rock presently underlying the site. In areas not altered by erosion or disturbed by the activities of man, the typical residual soil profile typically consists of clayey soils near the surface, where soil weathering is more advanced, underlain by sandy silts and silty sands.

The boundary between soil and rock is not sharply defined. This transitional zone, termed "partially weathered rock," is normally found overlying parent bedrock. Partially weathered rock is defined, for engineering purposes, as residual material with standard penetration resistance values of at least 50 blows per 6 inches. Weathering is facilitated by fractures, joints, and the presence of less resistant rock types. Consequently, the profile of the partially weathered rock (as well as hard rock) is quite irregular and erratic, even over relatively short horizontal distances. Also, it is not unusual to find lenses and boulders of hard rock and zones of partially weathered rock within the soil mantle, well above the general bedrock level.

The natural geological profile of portions of the site have been modified/disturbed by past grading activities that have resulted in disturbance of soils and the placement of fill. Disturbed and fill soils can vary in composition and consistency, and the engineering characteristics of these soils can be difficult to predict. Fill can be comprised of a variety of soil types and can also contain debris from building demolition, organics, topsoil, trash, etc. The engineering properties of fill depend primarily on its composition, density, and moisture content. Based on the samples obtained, it does not appear that the fill was monitored by an engineering firm and documented for compaction and moisture characteristics.

Typically, the upper soils along streams, creeks, rivers, drainage features, and in geologic floodplain areas are water-deposited materials (termed alluvium) that have been eroded and washed down from higher ground. These alluvial soils are usually wet, soft, and compressible, having never been consolidated by pressures in excess of their present overburden. Alluvial materials can vary from silts and clays to sand, gravel, cobbles, and boulders, and can contain organic debris.

3.3 Subsurface Conditions

The following is a brief and general description of subsurface conditions encountered at the site. More information is provided on the individual Boring Logs located in the Appendix.

3.3.1 *Surface Materials*

All of the borings with the exception of B-8 encountered a layer of topsoil ranging between 2 and 5 inches thick. Boring B-8 initially encountered an 8-inch aggregate base likely from a previous pavement. Surface material thicknesses and types may vary from those encountered in the borings and the organic layer of topsoil could be thicker than shown on the boring logs.

3.3.2 *Existing Fill*

Beneath the topsoil in borings B-9 and B-10 at the proposed borrow area, existing fill soils were encountered to depths of 5.5 feet and 3 feet below the ground surface, respectively. The fill materials consisted of sandy lean clay (USCS symbol CL) with traces mica and varying amounts of roots and wood fragments. Based on visual observation of the split-spoon samples, the moisture content observed in the sampled fill was noted to be very moist in boring B-9 and moist in boring B-10, indicating that the soils were wetter than the estimated standard Proctor optimum moisture contents. Standard penetration resistance values (N-values) in the existing fill ranged between 2 and 5 blows per foot (bpf), indicating a very low degree of compaction. Based on the wetness of the fill, the lower N-values, and the topsoil, roots, and wood fragments encountered, it appears the fill was not placed with regard for compaction or structural support and is considered undocumented. Unless the organics are separated and the fill is dried, it does not appear suitable for reuse as structural fill.

3.3.3 *Alluvium*

Alluvial soils (deposited by water) were encountered beneath the topsoil in borings B-1 through B-8 and extended to depths ranging between 5 and 13.4 feet below the existing ground surface. Borings B-1, B-2, B-3, B-5, B-6, B-7, encountered auger refusal in the alluvial soils or at the bottom of the alluvial soil layer. Boring B-8 was terminated at its planned depth of 5 feet in the alluvium.

The sampled alluvium was generally described as moist to wet and consisted of lean clay with sand (CL), silty sand (SM), and well-graded gravel with silt and sand (GW-GM). Varying amounts of roots, mica, sand, clay, and rounded rock pieces were observed in the alluvium. N-values ranged from weight-of-hammer (denoted as 0 on the logs; meaning just the weight of the drilling tools pushed the sampler through the soils) to 37 bpf. It should be noted that the higher N-values may have been artificially inflated due to the presence of rocky materials in the alluvial layer. The N-values indicate a very soft to firm consistency in the fine-grained soils (clays) and a very loose to dense relative density in the coarse-grained soils (sands) and gravels.

3.3.4 *Residuum*

Residual soils were encountered beneath the alluvial soils in boring B-4 and beneath the existing fill in borings B-9 and B-10. The sampled residuum consisted of loose to medium dense silty sands (SM) and stiff sandy silts (ML). The residual soils contained traces of mica, small rocks, and rock fragments. N-values in the sampled residuum ranged between 10 and 22 bpf. Borings B-9 and B-10 were terminated in residual soils at the planned depth of 20 feet.

3.3.5 *Auger Refusal Materials*

Auger refusal was encountered in borings B-1 through B-7 at depths ranging between 11.1 and 16.5 feet below the existing ground surface. Refusal is a designation applied to any material having a resistance in excess of the penetrating capacity of the drilling equipment. Auger refusal materials may consist of boulders, cobbles, massive rock, rock in pinnacle form, or a thin lens of hard rock. Coring is typically required to determine the composition of the refusal material, and this was beyond our scope of services. Although no residual material was sampled from 6 of the borings prior to reaching refusal, the driller attempted an additional split-spoon sample at the refusal depth in 5 of these borings. The N-value obtained was 50 blows for 0 inches of penetration.

3.3.6 *Subsurface Water*

Subsurface water levels from the time of boring (TOB) and on the following day (approximately 24 hours) are summarized in the table below. It should be noted that subsurface water levels will fluctuate during the year and from year to year due to seasonal and climatic changes, construction activity, and other factors, and may be at different depths in the future. The following table summarizes the water levels observed at each boring.

Table 3-1 – Table of Subsurface Water Levels

Boring	Water Level at TOB (ft)	Water Level at ~24 Hours (ft)
B-1	4.2	3.8
B-2	4.3	3.8
B-3	5.7	4.2
B-4	3.2	3.2
B-5	3.0	2.9
B-6	4.8	3.8
B-7	2.7	2.7
B-8	3.6	2.1
B-9	Not Encountered	Not Encountered
B-10	Not Encountered	Not Encountered

3.3.7 *Laboratory Testing*

Atterberg limits tests, grain size analysis, natural moisture contents, and standard Proctor tests were performed on selected site samples, and the results are summarized below. A Summary of Laboratory Test Data is in the table below and individual laboratory data sheets are attached in Appendix III.

Table 3-2 – Summary of Laboratory Results

Boring Number	Depth (ft)	Moisture (%)	% Passing #200	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
B-2	3.5-5.0	25.9	--	48	26	22	--	--
B-3	3.5-5.0	38.1	--	--	--	--	--	--
B-5	1.0-2.5	35.5	--	--	--	--	--	--
B-9	6.0-7.5	19.9	--	--	--	--	--	--
B-9	18.5-20.0	21.5	--	--	--	--	--	--
B-10	3.5-5.0	23.3	--	--	--	--	--	--
B-10	8.5-10.0	20.6	--	--	--	--	--	--
B-10	13.5-15.0	23.2	--	--	--	--	--	--
B-10	10.0-15.0	18.4	63.2	44	33	11	104.4	20.1

4.0 Conclusions and Recommendations

The following conclusions and recommendations presented herein are based on information and assumptions concerning structural loads, existing grades and final site grades, our understanding of the proposed project, findings of the subsurface exploration, geotechnical engineering evaluations of encountered subsurface conditions, and experience with similar projects. When reviewing this information, please keep in mind subsurface conditions vary erratically in this geologic area. This is particularly true with previously placed fill, alluvial soils, and groundwater levels. The development and construction team must understand our recommendations are based on the premise that our personnel will be on-site to observe and document site work, including site preparation, proofrolling, undercutting, fill placement, and to perform density testing of fills. Proper site preparation and maintenance is very important in helping to providing time- and cost-efficient construction. Our field observations and tests are a vital component in improving the performance and efficiency of the site work.

4.1 General Discussion

The boring data indicates that near-surface soils generally consist of very low to low consistency alluvial soils throughout the proposed building site. The sampled alluvium extended to depths up to 13.4 feet deep, where auger refusal was encountered in boring B-6. Subsurface water was shallow, with depths ranging between 2.1 to 4.2 feet below the ground surface at the end of the day of drilling. We note some of the subsurface water levels could actually be higher than indicated by the borings when allowed to stabilize in open excavations. The shallow subsurface water will impact site preparation and excavation, and dewatering will likely be required, especially during any undercutting and installation of utilities.

It is our opinion that the site can be developed for support of the proposed building and pavements; however, special measures will be required. The alluvial soils are typically under-consolidated and will settle excessively and non-uniformly under new loads; therefore, we would expect settlement-related issues for structures and pavements built without remedial site work or special foundations. The most positive approach would be to undercut all of the alluvial soil; however, this is not practical due to the depth of the alluvium and the shallow subsurface water. Deep foundations such as driven or augered piles would also be a low risk approach to building support, but this would be expensive and probably cost-prohibitive for this lightly loaded structure.

During project meetings with the design team and owner, the following two lower cost remedial work plans were discussed in detail for support of the building:

1. Partial undercutting and placement of at least 5 feet of new fill under the building.
2. Ground improvement such as compacted aggregate piers.

4.1.1 *Partial Undercutting*

One remedial approach evaluated is to undercut the alluvial soils encountered in the building areas (and raise grades) so that at least 5 feet of new structural fill can be placed to support the building. The undercutting would need to extend at least 7 feet beyond building lines. Also, the initial subgrade after stripping and/or undercutting would likely require stabilization with a geotextile fabric and 12 to 24 inches of crushed stone (depending on actual conditions and weather at the time of construction). Dewatering could also be required in some areas. The new well-compacted fill would act as a stable mass (or mat/raft) under the building and reduce differential settlement.

This approach was performed for the adjacent Habitat for Humanity ReStore building and from outside the building appears to be performing satisfactorily (however, Mr. Reese informed us there are some small cracks in the floor slab). In our experience, this approach has also been successful on other similar sites in western North Carolina, although a small risk of excessive settlement must be accepted by the owner due to the remaining alluvial soils which will not be undercut or treated. If this remedial approach is selected for building support and performed as outlined in this report, shallow spread footings could be used to support the proposed building and a design bearing pressure of up to 1,500 psf could be used in design to size column and wall footings. A thicker and more heavily reinforced slab would be used to reduce the chance of cracking according to Mr. Medlock.

4.1.2 *Ground Improvement – Compacted Aggregate Piers*

An alternative to undercutting and stabilization in the building area would be to utilize ground improvement with aggregate piers. Aggregate piers were used to support the adjacent Ecusta Road/Sylvan Sports Warehouse. The aggregate piers generally have a 24- to 30-inch diameter and can be constructed to the required depth below the alluvium to support the building footings and the slab. If this approach is selected for the building area, higher bearing pressures are sometimes available. The actual bearing pressure would be determined by the design-build specialty contractor.

We discussed feasibility of this approach and preliminary budgeting with Mr. Tripp Ford, P.E. with Wurster Betterground. Mr. Ford indicated the site conditions and proposed project are a good candidate for aggregate piers. Aggregate piers could be placed prior to fill placement or after the fill is in place. Mr. Ford indicated they would prefer to install the piers after the fill is in place so they have a stable working platform. Otherwise, the subgrade would need to be stabilized with crushed stone so their equipment does not get mired down in the soft alluvial soils. He informed us that, with aggregate piers under the slab as well as under the footings, an initial thickened soil bridging lift could probably be used over the soft subgrade soils rather than crushed stone stabilization. This will need to be evaluated in the field at the time of construction. Using aggregate piers under the slab will also help to reduce differential settlement across the slab.

In the design team and owner meeting on June 29, 2022, it was agreed that the aggregate pier approach was more favorable to reduce risk of excessive settlement, and reduce increased earthwork costs associated with undercutting, stabilization, and dewatering. Therefore, the remainder of the report is tailored for building support with aggregate piers under the footings and slab.

4.1.3 Pavement Areas

Pavement areas will likely need to be stabilized with geotextiles and/or crushed stone before structural fill is placed to achieve design grades. Some undercutting of the alluvial soil could also be required. If more than about 3 feet of fill will be placed, an initial thickened soil bridging lift could be considered to stabilize the soft subgrade in some areas. This is discussed in more detail in later sections of the report.

The following sections of this report discuss the site preparation, earthwork, foundations, and pavements in more detail.

4.2 Site Preparation

4.2.1 Stripping

Site preparation should begin with stripping of all unsuitable surface materials to at least 10 feet outside the building limits and 3 feet outside pavement areas, where practical. This would include surface vegetation, organic-laden topsoil, trees, bushes and shrubs, large root systems, and remnants of previous construction.

Utility lines may be present throughout the site. For lines that lie within the footprint of the proposed building, we suggest they be relocated 10 feet beyond building lines and their trenches cleaned and properly backfilled. Our experience indicates that the backfill soils for existing utility lines could be poorly compacted. If any utility lines will remain below “green” areas or proposed pavement areas, we suggest that the trench backfill material be carefully evaluated to ensure suitability.

4.2.2 Subgrade Evaluations / Proofrolling

At multiple stages during grading (following stripping, excavation to the design subgrade levels, and after any necessary undercutting), the exposed subgrade should be thoroughly proofrolled with a heavily loaded, tandem-axle dump truck or similar rubber-tired equipment under the observation of a Geotechnical Engineer or his/her representative, where practical. Proofrolling will help reveal the presence of unstable or otherwise unsuitable surface materials and may help densify the exposed subgrade for subsequent structural fill placement and building and pavement support. Areas that are unstable should be undercut or stabilized in place as recommended by the Geotechnical Professional. Because of the alluvial soils on site, proofrolling is very important at this site. However, some areas will likely be too soft and wet to proofroll and will need to be evaluated by observation of test pits, hand auger borings, and/or probing with a small-diameter steel rod.

4.2.3 *Remedial Site Work – Undercutting and Stabilization*

Recommendations for remedial site work within the building and pavement areas are discussed in the following three sections. Any undercutting should extend to at least 7 feet beyond building lines and 3 feet beyond the pavement areas, where applicable. All undercutting should be closely observed by the Geotechnical Engineer or their representative to help confirm the extent and removal of unsuitable materials. We recommend several backhoe-excavated test pits be made by the contractor at the beginning of earthwork (or sooner during the planning phase) in the presence of our representative to observe the character and composition of the fill and alluvial material and subsurface water levels. Additional recommendations can be made in the field when needed.

4.2.3.1 Building and Floor Slab

As previously mentioned, low consistency alluvial soils were encountered in the building area to depths of up to 13.4 feet below the existing ground surface. Unless aggregate piers are used for foundation support, the alluvial soils within the building area should be partially undercut where necessary so that at least 5 feet of new fill can be placed beneath the floor slab. After undercutting, the subgrade in most areas will likely be too soft to begin earthwork without placing a stabilization layer. The stabilization layer could consist of about 1 to 2 feet of crushed stone and possibly a geotextile fabric and/or geogrid for separation or additional support. The actual stabilization layer should be determined in the field based on conditions encountered during the remedial work and jointly selected by the geotechnical engineer and the contractor. Also, the contractor should be prepared to control groundwater during the remedial work if it is higher than the undercut excavations.

If aggregate piers are used in the building area as expected, including the slab, the subgrade stabilization measures can likely be reduced. For one reason, heavy fabrics or geogrids and crushed stone can cause difficulty during installation of aggregate piers and this should be avoided. Also, since the slab will be supported by the aggregate piers, a thickened initial lift of soil with a low degree of compaction can be placed over the initial subgrade to achieve stability. If needed, about ½ to 1 foot of ABC stone could be used in problematic subgrade areas, without causing issues with installation of aggregate piers.

4.2.3.2 Pavement Areas

The need and extent of stabilization/undercutting in pavement areas will be based on evaluation in the field at the time of construction. We expect the soils in the pavement areas will be unstable after stripping and during proofrolling, and will need to be stabilized with crushed stone (approximately 1 to 2 feet), and possibly geotextile fabric and/or geogrid, prior to initiating fill placement or construction of the pavements. In favorable weather (hot and dry) the remedial measures may be reduced, but during wet weather the remedial measures will likely be increased.

If more than about 3 feet of fill will be placed in the light duty pavement areas, consideration could be given to placing an initial thickened soil bridging lift for stabilization instead of crushed stone. In heavy duty areas, at least 4 or 5 feet of new fill would be needed for a bridge lift. The bridge lift would consist of a single lift of structural fill soil at a relatively low moisture content, placed about 2 +/- feet thick and tracked in with a light bulldozer. Subsequent lifts of fill would be compacted in normal thin lifts compacted with sheepsfoot equipment, but heavy rubber-tired equipment should be kept off the area until it is sufficiently stable. The primary consideration for pavement areas is that a stable subgrade be achieved.

The use of a bridge lift should be discussed with the owner and contractor further before being implemented. Because the thickened lift is not well compacted, future buildings should not be placed over the bridge lift unless remedial work or special foundations are used.

4.2.3.3 Stabilization Materials

We suggest the bidding contractors be required to provide unit rates for potential stabilization materials for comparison and so the rates are established prior to awarding a contract. The following is a list of the items we anticipate could be recommended in areas requiring stabilization:

- Railroad ballast crushed stone,
- No. 57 crushed stone,
- NCDOT Aggregate Base Course (ABC stone),
- Woven fabric - Mirafi HP570 or equivalent,
- Non-woven fabric – Mirafi 140 N or equivalent, and
- Geogrid – Tensar BX-1200 or equivalent.

4.3 Site Drainage

Grading activities for typically result in areas of soil subgrade being exposed for extended periods with little to no topographic relief to drain surface water runoff. It is important the grading contractor protect the exposed soils from becoming wet or saturated during inclement weather. Positive site drainage should be maintained during all operations, including the initial stripping of the site, undercutting and backfilling, after excavation to subgrade levels, and after fill placement is complete. This may include surface ditches around the perimeter, internal ditching and in some cases French drains. Failure to provide positive site drainage can result in extensive and costly repairs to the exposed subgrade, as well as construction delays.

4.4 Excavation Considerations

The boring data indicate probable excavations during mass grading and installation of utilities will likely extend through very low to low consistency alluvium throughout the building site. At the borrow pit area, excavations will extend through existing fill and residual soils. We expect the soil materials can be excavated with conventional excavation equipment. That is, mass excavation can be accomplished by front-end loaders, large tracked excavators, and bulldozers. Excavation for shallow foundations and utility trenches can typically be accomplished with a rubber-tired or tracked excavator.

Auger refusal was encountered in each of the borings within the building footprint (as shallow as about 11 feet below existing grades) but this is not within anticipated excavation depths. However, there is always a possibility that rock, boulders, partially weathered rock and very dense soils will be encountered in areas intermediate of the borings or in unexplored areas, and difficult excavation, including blasting, can be required. This is because rock in a weathered, boulder, and massive form varies very erratically in depth and location in this geologic region.

All excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation safety standards. We note the Contractor is solely responsible for site safety.

This information is provided only as a service and under no circumstances should we be assumed to be responsible for construction site safety.

4.4.1 *Subsurface Water*

Subsurface water was encountered as shallow as about 2 feet below the surface at the EMS site. Depending on actual final grades, the depth of utility trenches, and undercutting depths, subsurface water will likely be encountered. In utility trenches that encounter subsurface water, at least 6 to 12 inches of No. 57 crushed stone bedding is normally required, and the trenches may also need to be backfilled up to the water line with No. 57 stone. If water is encountered during installation of utilities and/or undercutting, it can typically be controlled by pumping from sump pits until initial crushed stone backfill is in place. It is also possible that gravity-flowing French drains could be needed to permanently lower the water levels if they impact the final grades. If the bedding stone below the utility pipes is wrapped in non-woven filter fabric, it can often be used as a French drain to help lower the water across the site. A pipe would need to be installed from the bedding stone into a downstream manhole to provide an outlet for the water.

4.5 Fill Placement and Compaction

After excavation and undercutting, areas requiring fill placement should be raised to their design subgrade configuration with soil free of deleterious materials. The new fill should have a maximum particle size of 4 inches or less, plasticity index less than 25, and standard Proctor maximum dry density of at least 90 pounds per cubic foot (pcf). The fill should be uniformly spread in 6- to 8-inch thick loose lifts and be compacted to at least 95 percent of the soil's maximum dry density, as determined by a laboratory standard Proctor compaction test (ASTM D698). Since pavement and floor slab support characteristics generally improve with an increase in density, we recommend the upper 1 foot of fill in slab and pavement areas be compacted to a slightly higher degree (98 percent). The moisture content should be controlled at plus to minus 3 percent of optimum; however, a slight increase in optimum moisture could be allowable if the minimum compacted density is achieved and subgrade is stable.

Fill placement should be monitored by a qualified Materials Technician working under the direction of the Geotechnical Engineer. In addition to this evaluation, the Technician should perform a sufficient amount of in-place field density tests to confirm the required degree of compaction is being attained. We recommend that field density tests, including one-point Proctor verification tests, be performed on the fill as it is being placed at a frequency of 1 test per 2,500 square feet per lift in the building and pavement areas and 1 test per lift per 100 linear feet in utility trenches.

4.5.1 *Use of On-Site Excavated Soils as Fill (Borings B-1 through B-8)*

The majority of the soils sampled during this exploration appear to not be suitable for reuse in a well-compacted fill to support buildings and pavements. The majority of the sampled soils were wet of their optimum moisture contents and the upper part of the alluvial soils are clays with a relatively high plasticity and contain organics. Drying will be difficult or not reasonably possible unless the weather is hot and dry, and organics would need to be removed. For these reasons, most excavated materials will require being wasted in non-structural areas or hauled off-site.

4.5.2 *Use of Off-Site Borrow Materials as Fill (Borings B-9 and B-10)*

We understand the area of borings B-9 and B-10 along Public Safety Way has been identified as a potential borrow source for the structural fill and trench backfill soils. Existing fill was encountered in these borings to depths of 3 and 5.5 feet below the ground surface, followed by residual soils common to the area. The existing fill soils generally consisted of sandy lean clay with significant amounts of topsoil, root, and wood debris. Due to the presence of these organic materials in the fill, we do not expect that any of the existing fill soils can be used for structural fill. We can observe the material during excavation to see if some of it is free of organics and can be reused. It should be anticipated that at least 5 feet of existing fill soils will need to be removed before soils suitable for structural fill are encountered.

Based on borings B-9 and B-10, it appears that the soils below the existing fill are generally suitable for reuse as structural fill. As with most earthwork projects, some wetting or drying could be required to achieve compaction. However, based on our moisture content tests and the standard proctor compaction test, the in-situ soil moistures appear to be reasonably close to the optimum moisture content. This will vary based on the weather at time of construction.

4.6 Excavated and Fill Slopes

We anticipate new fill slopes of up to about 5 feet in height may be required for development of this site. We are not aware of any excavated slopes. These low height slopes in well-compacted fill embankments should generally be stable at inclinations no steeper than 2H:1V (horizontal to vertical). To help reduce erosion, maintenance, and repair, and allow more convenient access for landscaping equipment, we advise all cut and fill slope inclinations be no steeper than 2.5H:1V to 3H:1V, if practical. All fill placed in embankments should be compacted to at least 95 percent of the standard Proctor maximum dry density.

Because of the type soils expected to be encountered in the excavated slopes and used for the fill embankments, erosion of the near surface soils tends to be a maintenance issue over time. Therefore, we advise the face of slopes and embankments be protected by establishing vegetation with the use of permanent erosion control mats as soon as practical after grading. North American Green has several products (such as EroNet Turf Reinforcement Mat P300 or P550) that can help reduce the amount of erosion.

We recommend the building be setback at least the height of the slope with a minimum of 10 feet from the crests of all slopes. If practical, we recommend new or existing utility lines be located away from the slopes or near their crests. Leaking utility lines and poorly-compacted trench backfills can lead to slope issues including failure.

4.7 Fill-Induced Settlement

Placement of new fill of up to 5 feet in thickness across the project site will induce settlement of the fill mass and the soft underlying site soils. We estimate the settlement will range from 1 to 3 inches and will be greatest in areas of the greatest fill thicknesses. Fill-induced settlement of the building pad should be allowed to occur prior to building foundation and slab construction. Settlement monitoring should be performed as described below to confirm settlements are substantially complete prior to building foundation and slab construction.

S&ME recommends placement of about 6 settlement pins across the building pad after the fill has been placed to final grade. Settlement pins may consist of 24-inch long pieces of reinforcing steel driven 20-inches into the compacted stone/soil subgrade. Settlement pins should be protected from disturbance. The elevation of the settlement pins should be surveyed every 2 to 3 days relative to an independent benchmark beyond the fill area. The settlement points should be estimated to the nearest 0.001 feet. While the accuracy of the third decimal place may be questionable, as surveying is commonly performed to the nearest 0.01 feet, it is useful to assist in determining if movement is completed. Measurements should be performed until interpretation of the survey data by the Geotechnical Engineer determines that settlement is substantially complete, and construction may proceed. We recommend budgeting on the order of 2 weeks for this settlement to occur.

4.8 Subgrade Repair and Improvement Methods

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 scarifying and recompacting immediately prior to further construction. If this must be performed during wet weather conditions, it would be worthwhile to consider undercutting the deteriorated soil and replacing it with compacted crushed stone.

4.9 Foundation and Floor Slab Recommendations

4.9.1 Conventional Spread Footings with Ground Improvement (Compacted Aggregate Piers)

Based on our project meetings and discussions with Wurster Betterground, we expect compacted aggregate piers (CAPs) will be utilized for building support. The design and installation of the ground improvement system is typically handled by a design-build specialty contractor. We expect a series of compacted aggregate piers could be installed to support the building. Often, these are installed beneath the footings only, but they can also be installed on a grid pattern to support the slab and reduce differential settlement across the entire structure.

A highly skilled specialty contractor with CAP experience should design and install the CAP elements in a grid pattern to support the building column and wall footings and the slab. We assume a performance criterion would be to limit total and differential settlement to ≤1 in. and ≤½ in., respectively. The actual design bearing pressure will be determined by the CAP spacing, size and depths as determined by the CAP contractor/designer.

CAPs are a method to replace a certain percentage of the low consistency soils with higher consistency elements that reduce total/differential settlement. CAP elements are generally 24 to 30 inches in diameter and installed to depths of 10 to 30 feet below the ground surface. (The entire soil column is typically not treated when using CAPs but may be on this site due to the auger refusal levels.) CAPs are installed using augers, vibratory probes or combination thereof, and can be top or bottom fed based on subsurface conditions. Based on the shallow water, we expect a bottom-feed method will be required.

A minimum of one full-scale compacted aggregate pier Modulus Load Test should be performed to verify CAP design assumptions. The load test provides a measure of the stiffness of the CAP element and will provide quality control guidelines for the CAP installation procedures. The Modulus Load Test should be performed in the areas of the site considered to be representative of the most critical soil condition.

The CAP installer's internal Quality Control program should include monitoring drill depths, total CAP element lengths, average lift thickness, installation procedures, aggregate quality and compaction energy. These items should be documented for each CAP element installed, to provide a complete installation report. The Geotechnical Engineer or his representative should review the CAP design, the CAP modulus test results, and execution of the installers Quality Control System during CAP construction.

4.9.2 Spread Footing Design and Construction

After ground improvement with CAPs, a design foundation bearing pressure of 2,000 psf or higher should be available, but this will need to be determined by the specialty contractor. We recommend wall footings have a minimum width of 18 inches and column footings have a minimum width of 24 inches. We also recommend a minimum footing embedment of 2 feet.

Individual foundation excavations require observation by S&ME prior to concrete placement. The surface of footings and aggregate piers should typically be tamped to recompact the surface after excavation. Exposure to the environment will cause the soils surrounding the piers to rapidly deteriorate. If surface water runoff collects in any excavation, it should be removed promptly by pumping to help prevent softening of foundation supporting soils. To further reduce the potential for deterioration of bearing soils, we recommend that foundation excavation, evaluation, and placement of concrete be conducted on the same day, if practical. If an excavation is to remain open overnight, or if rain is imminent, the footing subgrade should be lowered and a 3- to 4-inch thick mud mat of lean (2,000 psi) concrete placed in the bottom of the excavation to protect the bearing soils. This will help limit the potential for additional excavation of wet, softened soils which often results from footings exposed to inclement weather.

4.9.3 Floor Slab Support

We expect the floor slab will be supported by the soils and aggregate piers, provided the recommendations discussed in this report are followed and the final subgrades are evaluated to be satisfactorily stable by the Geotechnical Engineer. Typically for projects similar to this, we recommend using a 4- to 6-inch thick layer of crushed stone (NCDOT Aggregate Base Course) to separate the floor slab from the subgrade soils. This layer will provide a good capillary break, and if placed soon after completion of grading, will help protect the subgrade during construction and exposure to weather. If there are many utility stub-ups or other issues with using ABC stone, No. 57 stone could also be used. A modulus of subgrade reaction (k) of 120 pci is available for design of the floor slabs over the compacted stone and underlying aggregate piers.

A vapor retarder should be considered beneath the grade slabs to help prevent slab dampness due to the upward migration of soil moisture. The need for a vapor retarder will also be dependent upon the floor covering design and local and state building codes.

4.9.4 Seismic Conditions

The proposed structure should be designed to resist possible earthquake effects as determined in accordance with Section 1613 of the North Carolina Building Code (NCBC) 2018 Edition (2015 International Building Code with North Carolina Amendments). The NCBC assigns a Seismic Site Class based on the type and thickness of overburden soil materials. Site Class values range from Class A for hard bedrock to Class F for deep deposits of soft bearing strata. Based on the N-values obtained in the exploration and allowances in the North Carolina Building Code, a Seismic Site Class D should be used in design.

There are no active earthquake fault zones within close proximity to the general area and thus the site vicinity is not known to be subject to concerns of any major geologic hazards such as significant ground shaking, liquefaction, seismically induced slope failures, etc.

4.10 Cast-in Place (CIP) Concrete Retaining Wall Parameters

We anticipate some short below grade cast-in-place (CIP) walls could be incorporated in the project. CIP walls must be capable of resisting lateral earth pressures that will be imposed on them. Lateral earth pressures to be resisted by the walls will be partially dependent upon the wall type and method of construction. Assuming that the walls are relatively rigid and structurally braced against rotation, they should be designed for a condition approaching the "at-rest" lateral pressure. However, in the event the walls are free to deflect during backfilling, (about ½ to 1 inch for a 10-foot high wall) as for any exterior walls that are not restrained or rigidly braced, the "active" pressure conditions will be applicable for design. The following lateral earth pressure parameters are recommended for design. These parameters assume a level backfill, a frictionless wall, and no hydrostatic pressure.

Table 4-1 – CIP Retaining Wall Parameters

Lateral Earth Pressure Condition	Coefficient		Equivalent Fluid Pressure
At-Rest Condition	(K_o) =	0.53	64 psf/ft
Active Condition	(K_A) =	0.36	44 psf/ft
Passive Condition	(K_P) =	2.8	n/a
Unit Weight of Soil (Moist)	120 pcf		
Friction Factor for Foundations and Bearing Soils	0.35		

The recommended lateral earth pressure coefficients do not consider the development of hydrostatic pressure behind the earth retaining wall structures. As such, positive wall drainage must be provided for all earth retaining structures. These drainage systems can be constructed of open-graded washed stone isolated from the soil backfill with a geosynthetic filter fabric and drained by perforated pipe, or several wall drainage products are made specifically for this application. Lateral earth pressures arising from surcharge loading (such as from sloping backfill, or from slab/foundation stresses applied in the wall backfill zone) should be added to the above earth pressures to determine the total lateral pressure.

Backfill placed behind retaining walls should be compacted to a similar requirement previously recommended for structural fill. We caution that operating compaction equipment directly behind the retaining structures can create lateral earth pressures far in excess of those recommended for design. Therefore, bracing of the walls may be needed during backfilling.

4.11 Pavement Thicknesses and Recommendations

We understand the pavements will be used by emergency medical vehicles, light-duty passenger vehicles, delivery trucks, and garbage trucks (no fire trucks at this facility). Mr. Goforth informed us the current pavement designs consist of the following:

- For parking areas that receive only car traffic, a standard duty pavement section consisting of 2 inches of surface asphalt underlain by 8 inches of aggregate base course stone.
- For truck areas, a heavy duty pavement section with 4 inches of asphalt underlain by 8 inches of aggregate base course.
- For heavy duty concrete, a section with 6 inches of concrete underlain by 8 inches of aggregate base course.

S&ME was not provided traffic frequency or vehicle weight information for a detailed pavement design; however, based on our experience and assuming that a compacted, stable subgrade is developed at the time of construction, these thicknesses appear reasonable. The asphalt pavement should not be deficient by more than ¼ inch in any area. For the heavy duty asphalt section, per current NCDOT standards and compacted thickness requirements, the 4 inches of asphalt should consist of 2.5 inches of intermediate asphalt mix (I19.0B) and 1.5 inches of surface asphalt mix (S9.5B).

All materials and workmanship should meet the North Carolina Department of Transportation's Standard Specifications for Roads and Structures, latest edition. The aggregate base course should consist of Crushed Aggregate Base Course (Refer to NCDOT's Standard Specifications for Roads and Structures, Section 520). This base course should be compacted to at least 98 percent of the maximum dry density, as determined by the modified Proctor compaction test (ASTM D1557). To confirm that the base course has been uniformly compacted, in-place field density tests should be performed by a qualified Materials Technician and the area should be methodically proofrolled under his evaluation.

The condition of the subgrade is critical for the performance of the pavement. The soil subgrade should be proofrolled immediately prior to placement of base course stone. The stone subgrade should be proofrolled immediately prior to placement of asphalt. Unstable areas identified should be repaired as previously described. Sufficient testing and evaluation should be performed during pavement installation to confirm that the required thickness, density, and quality requirements of the specifications are followed.

The pavement subgrade should be sloped to allow rainwater to properly drain away. Areas adjacent to pavements (embankments, landscape islands, ditching, etc.) which can drain water (rainwater or irrigation) should be designed so that water does not stand on the pavement surface, pool behind curbing, or seep below the pavements. This may require the use of French drains or swales in some areas. Adequate drainage is very important for the long-term performance of the pavement.

4.12 Pre-Construction Meeting

Because of the subsurface conditions and grading measures required at this site, we strongly recommend that a pre-construction meeting be conducted with the Owner, Civil Engineer, Contractor, Grading Contractor, and a representative of our firm. During this meeting, the recommendations of this report can be discussed, and the most cost-efficient and practical methods can be determined based on input from all parties.

5.0 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. If 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.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants, or presence of any biological materials (mold, fungi, bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

S&ME should be retained to review the final plans and specifications to confirm that earthwork, foundation, and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork and foundation construction activities.

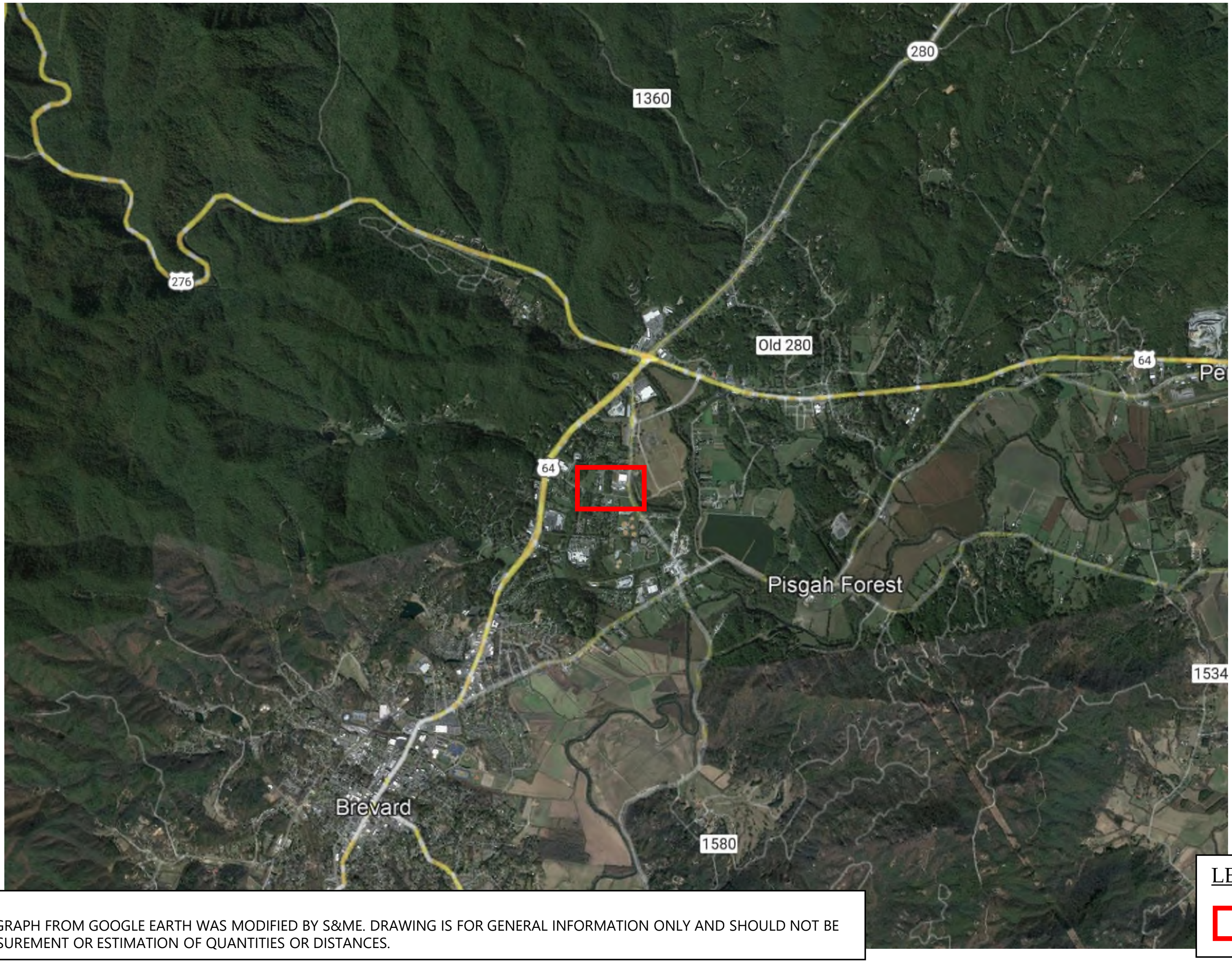
Appendices

Appendix I – Figures

Site Vicinity Map (Figure 1)

Boring Location Plan - EMS Base (Figure 2)

Boring Location Plan - Borrow Pit (Figure 3)



NOTE:
THE AERIAL PHOTOGRAPH FROM GOOGLE EARTH WAS MODIFIED BY S&ME. DRAWING IS FOR GENERAL INFORMATION ONLY AND SHOULD NOT BE USED FOR THE MEASUREMENT OR ESTIMATION OF QUANTITIES OR DISTANCES.

LEGEND

🟥 Site Area

SITE VICINITY PLAN

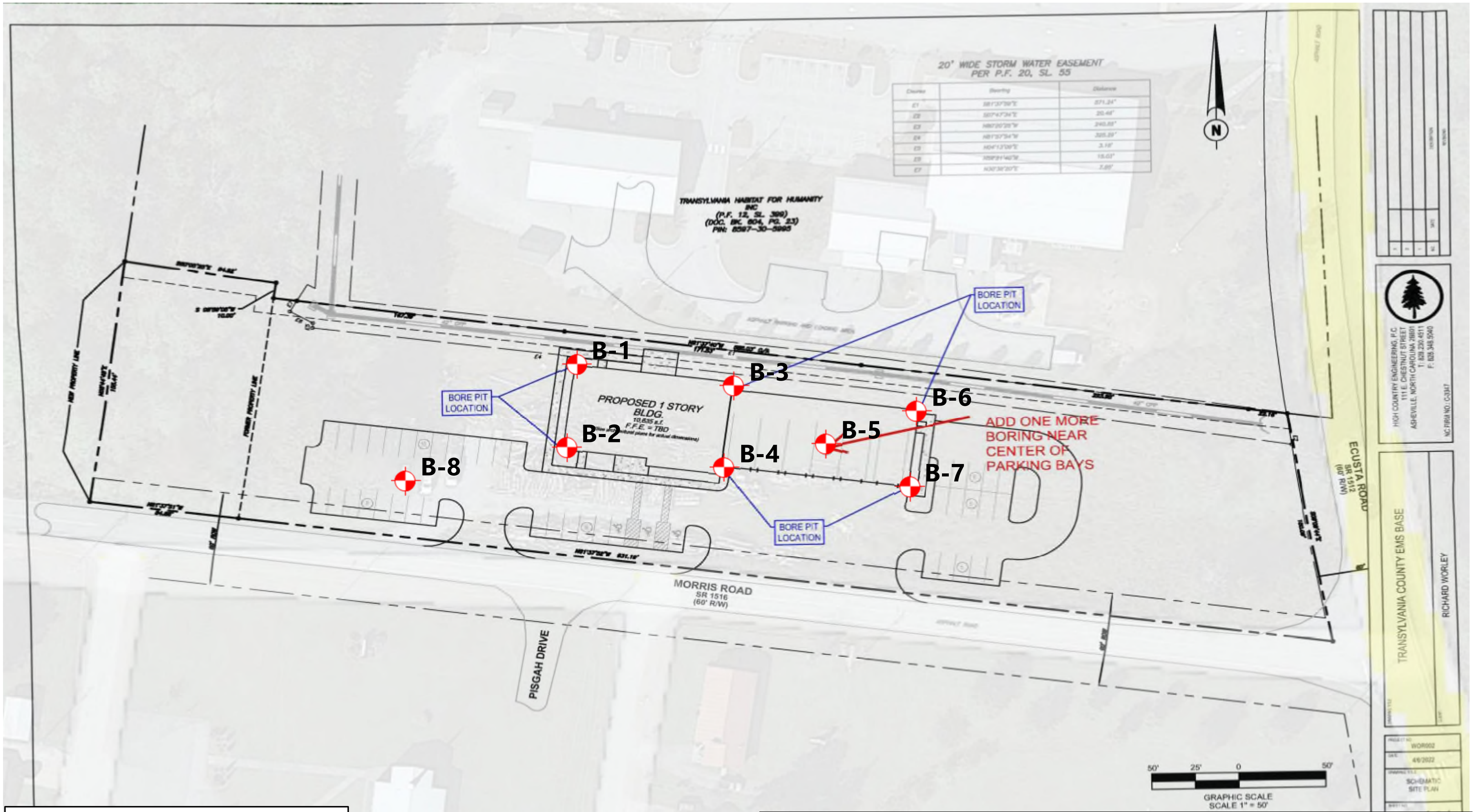
TRANSYLVANIA COUNTY EMERGENCY SERVICES BASE
BREVARD, TRANSYLVANIA COUNTY, NORTH CAROLINA

SCALE:
AS SHOWN

DATE:
6/10/2022

PROJECT NUMBER
22410052

FIGURE NO.
1



LEGEND

⊕ Approximate Boring Location

NOTE:
THE AERIAL PHOTOGRAPH FROM GOOGLE EARTH WAS MODIFIED BY S&ME. DRAWING IS FOR GENERAL INFORMATION ONLY AND SHOULD NOT BE USED FOR THE MEASUREMENT OR ESTIMATION OF QUANTITIES OR DISTANCES.

BORING LOCATION PLAN – EMS BASE

TRANSYLVANIA COUNTY EMERGENCY SERVICES BASE
BREVARD, TRANSYLVANIA COUNTY, NORTH CAROLINA

SCALE:
NOT TO SCALE

DATE:
6/10/2022

PROJECT NUMBER
22410052

FIGURE NO.
2

LEGEND

⊕ Approximate Boring Location

NOTE:
THE AERIAL PHOTOGRAPH FROM GOOGLE EARTH WAS MODIFIED BY S&ME. DRAWING IS FOR GENERAL INFORMATION ONLY AND SHOULD NOT BE USED FOR THE MEASUREMENT OR ESTIMATION OF QUANTITIES OR DISTANCES.

BORING LOCATION PLAN – BORROW PIT

TRANSYLVANIA COUNTY EMERGENCY SERVICES BASE
BREVARD, TRANSYLVANIA COUNTY, NORTH CAROLINA

SCALE:	NOT TO SCALE
DATE:	6/10/2022
PROJECT NUMBER	22410052
FIGURE NO.	3

Appendix II – Field Data

Test Boring Log Legend

Soil Test Boring Logs

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	PPV, tsf
0-2	Very Soft	0.0-0.25
3-4	Soft	0.25-0.5
5-8	Firm	0.5-1.0
9-15	Stiff	1.0-2.0
16-30	Very Stiff	2.0-4.0
Over 30	Hard	4.0+

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

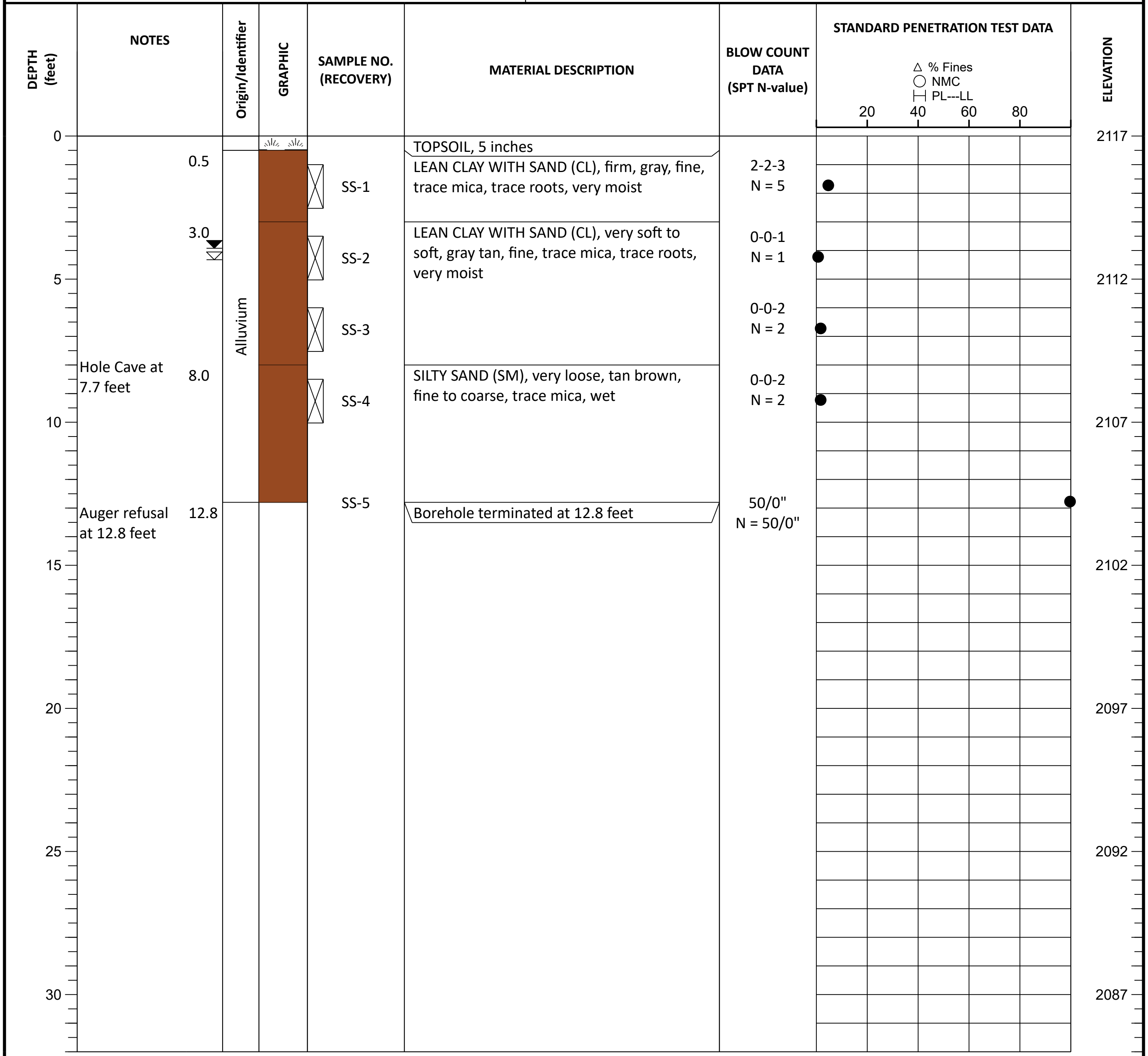
▽	**At Time of Drilling (ATD)**	Groundwater observation made anytime during the drilling process. Depending on time of reading and drilling methodologies, this value may be influenced by the drilling process.
⧨	**End of Drilling**	Groundwater measurement soon after all drilling processes are complete, and the borehole is at final depth. Drilling fluids, if introduced during drilling, may influence this measurement.
▼	**After Drilling**	Groundwater measurements made in a borehole hours to days after drilling is complete. Depending on subsurface conditions, elapsed time, drilling process, etc. this observation may reflect a stabilized level.

PROJECT: Transylvania County EMS Base
Brevard, North Carolina
S&ME Project No. 22410052

BORING LOG: B-01

Sheet 1 of 1

DATE DRILLED: 05/25/2022
ELEVATION: 2117 ft
DRILL RIG: Mobile Drill B-57
DATUM: NAVD88
DRILLER: Phenom Geotech
BORING DEPTH: 12.8 ft
HAMMER TYPE: Automatic hammer
CLOSURE: Cuttings with Hole Closure Device
DRILLING METHOD: 3-1/4" HSA
LOGGED BY: Christian Moloney
SAMPLING METHOD: SS
NOTES:
LATITUDE:
LONGITUDE:
PROJECT COORDINATE SYSTEM - World Geodetic System Longitude / Latitude (WGS 84)



DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)
0				TOPSOIL, 5 inches	
0.5		Alluvium	SS-1	LEAN CLAY WITH SAND (CL), firm, gray, fine, trace mica, trace roots, very moist	2-2-3 N = 5
3.0			SS-2 SS-3	LEAN CLAY WITH SAND (CL), very soft to soft, gray tan, fine, trace mica, trace roots, very moist	0-0-1 N = 1 0-0-2 N = 2
8.0	Hole Cave at 7.7 feet		SS-4 SS-5	SILTY SAND (SM), very loose, tan brown, fine to coarse, trace mica, wet	0-0-2 N = 2 50/0" N = 50/0"
12.8	Auger refusal at 12.8 feet			Borehole terminated at 12.8 feet	

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	05/25/2022	4.2	4.2 ft., hole caved 7.7 ft. at TOB
END OF DRILLING	▼			
AFTER DRILLING	▼	05/26/2022	3.8	3.8 ft. at 24hrs
AFTER DRILLING	▼			

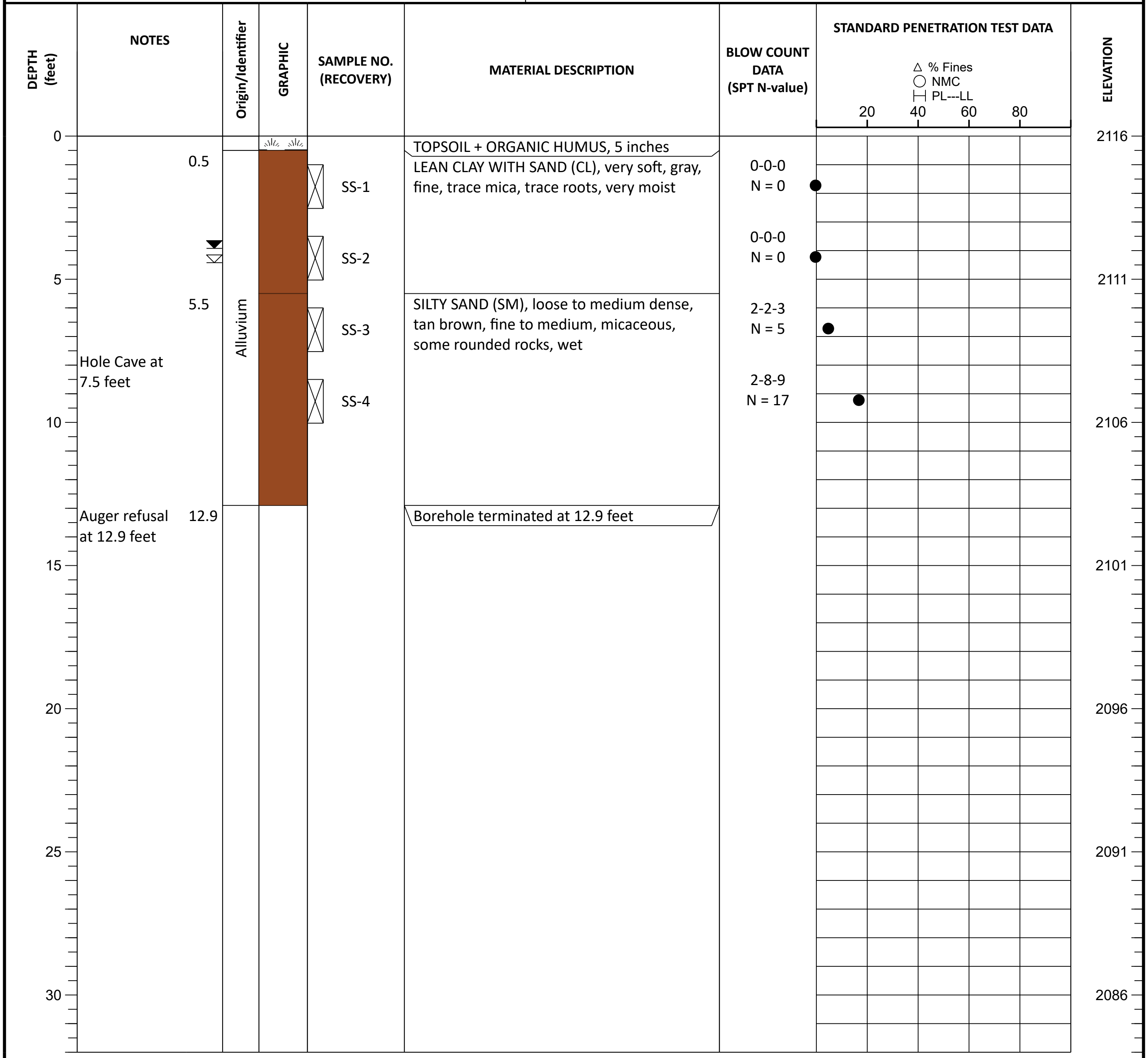
GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
AR = Auger Refusal

PROJECT: Transylvania County EMS Base
Brevard, North Carolina
S&ME Project No. 22410052

BORING LOG: B-02

Sheet 1 of 1

DATE DRILLED: 05/25/2022
ELEVATION: 2116 ft
DRILL RIG: Mobile Drill B-57
DATUM: NAVD88
DRILLER: Phenom Geotech
BORING DEPTH: 12.9 ft
HAMMER TYPE: Automatic hammer
CLOSURE: Cuttings with Hole Closure Device
DRILLING METHOD: 3-1/4" HSA
LOGGED BY: Christian Moloney
SAMPLING METHOD: SS
NOTES:
LATITUDE:
LONGITUDE:
PROJECT COORDINATE SYSTEM - World Geodetic System Longitude / Latitude (WGS 84)



NOTES		Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)
				TOPSOIL + ORGANIC HUMUS, 5 inches	
	0.5	Alluvium	SS-1	LEAN CLAY WITH SAND (CL), very soft, gray, fine, trace mica, trace roots, very moist	0-0-0 N = 0
			SS-2		0-0-0 N = 0
	5.5		SS-3	SILTY SAND (SM), loose to medium dense, tan brown, fine to medium, micaceous, some rounded rocks, wet	2-2-3 N = 5
Hole Cave at 7.5 feet			SS-4		2-8-9 N = 17
Auger refusal at 12.9 feet	12.9			Borehole terminated at 12.9 feet	

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	05/25/2022	4.3	4.3 ft., hole caved 7.5 ft. at TOB
END OF DRILLING	▼			
AFTER DRILLING	▼	05/26/2022	3.8	3.8 ft. at 24hrs
AFTER DRILLING	▼			

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: Transylvania County EMS Base
Brevard, North Carolina
S&ME Project No. 22410052

BORING LOG: B-03

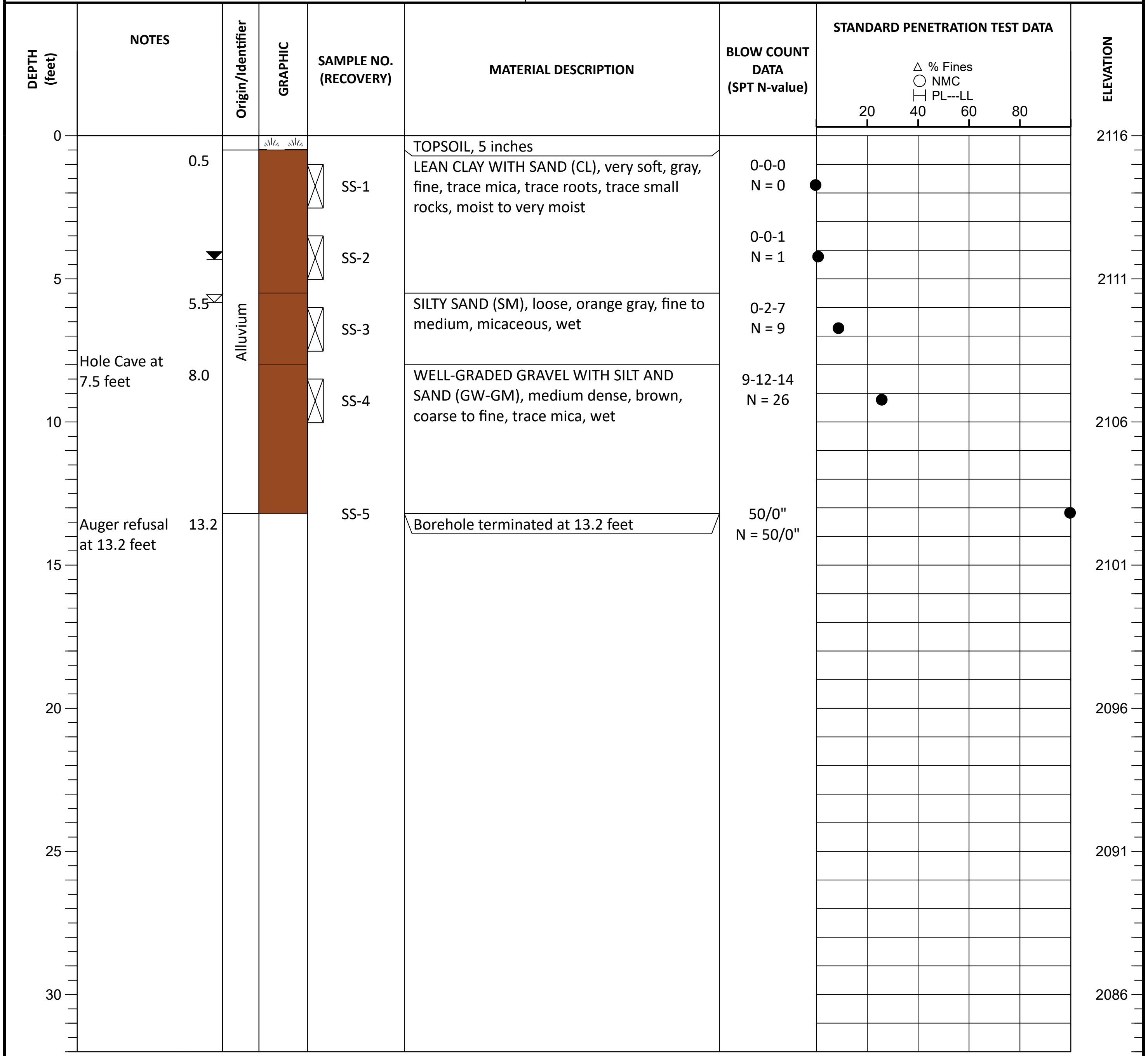
Sheet 1 of 1

DATE DRILLED: 05/25/2022	**ELEVATION:** 2116 ft
DRILL RIG: Mobile Drill B-57	**DATUM:** NAVD88
DRILLER: Phenom Geotech	**BORING DEPTH:** 13.2 ft
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings with Hole Closure Device
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Christian Moloney
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** World Geodetic System Longitude / Latitude (WGS 84)

NOTES:

LATITUDE:

LONGITUDE:



DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)
0		Alluvium		TOPSOIL, 5 inches	
0.5			SS-1 SS-2	LEAN CLAY WITH SAND (CL), very soft, gray, fine, trace mica, trace roots, trace small rocks, moist to very moist	0-0-0 N = 0 0-0-1 N = 1
5.5			SS-3	SILTY SAND (SM), loose, orange gray, fine to medium, micaceous, wet	0-2-7 N = 9
8.0	Hole Cave at 7.5 feet		SS-4	WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM), medium dense, brown, coarse to fine, trace mica, wet	9-12-14 N = 26
13.2	Auger refusal at 13.2 feet		SS-5	Borehole terminated at 13.2 feet	50/0" N = 50/0"

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	05/25/2022	5.7	5.7 ft., hole caved 7.5 ft. at TOB
END OF DRILLING	▼			
AFTER DRILLING	▼	05/26/2022	4.2	4.2 ft. at 24hrs
AFTER DRILLING	▼			

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

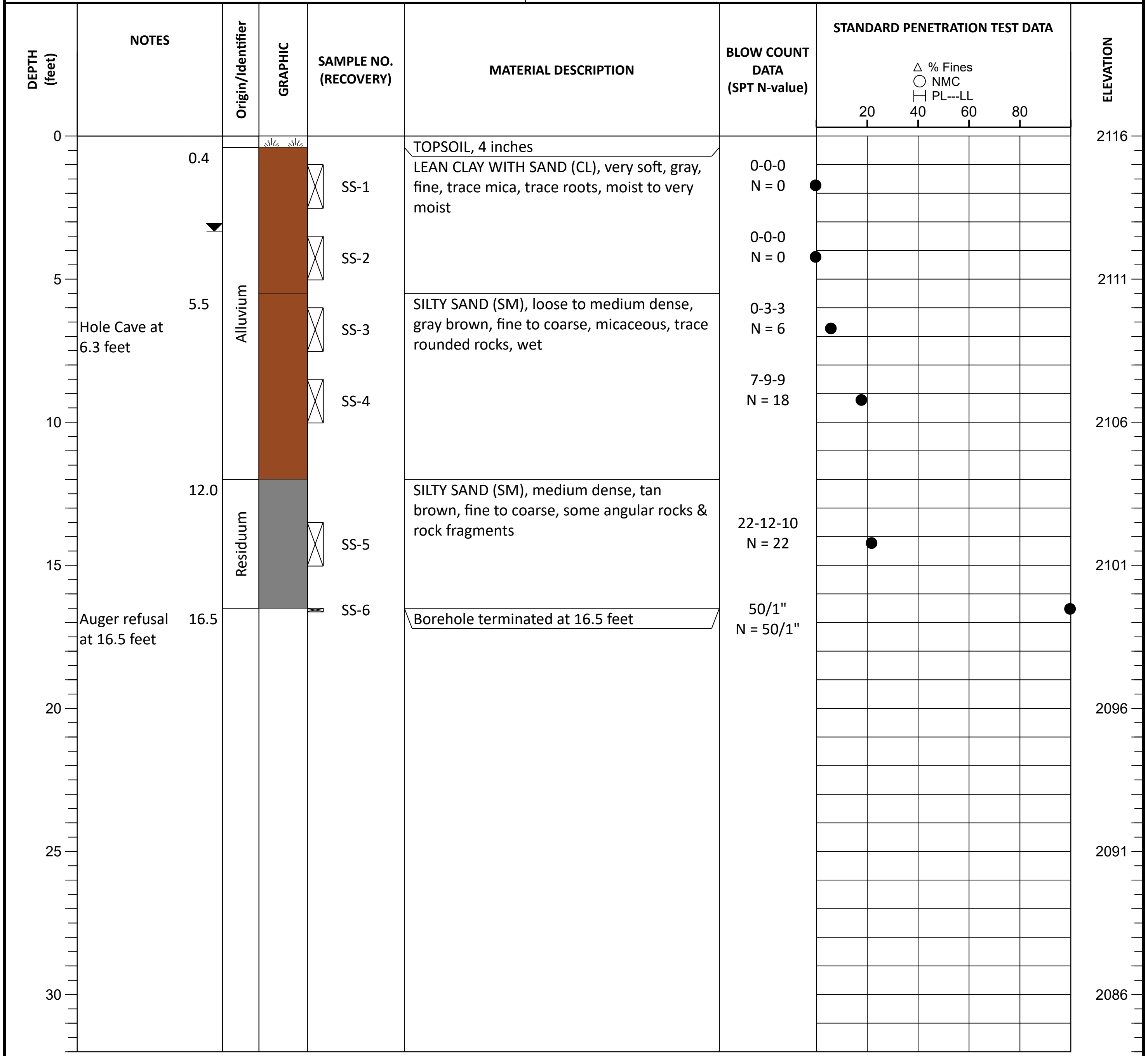
PROJECT:

Transylvania County EMS Base
Brevard, North Carolina
S&ME Project No. 22410052

BORING LOG: B-04

Sheet 1 of 1

DATE DRILLED: 05/25/2022
ELEVATION: 2116 ft
DRILL RIG: Mobile Drill B-57
DATUM: NAVD88
DRILLER: Phenom Geotech
BORING DEPTH: 16.5 ft
HAMMER TYPE: Automatic hammer
CLOSURE: Cuttings with Hole Closure Device
DRILLING METHOD: 3-1/4" HSA
LOGGED BY: Christian Moloney
SAMPLING METHOD: SS
NOTES:
LATITUDE:
LONGITUDE:
PROJECT COORDINATE SYSTEM - World Geodetic System Longitude / Latitude (WGS 84)



NOTES		Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)
	0.4			TOPSOIL, 4 inches	
		Alluvium	SS-1	LEAN CLAY WITH SAND (CL), very soft, gray, fine, trace mica, trace roots, moist to very moist	0-0-0 N = 0
			SS-2		0-0-0 N = 0
Hole Cave at 6.3 feet	5.5		SS-3	SILTY SAND (SM), loose to medium dense, gray brown, fine to coarse, micaceous, trace rounded rocks, wet	0-3-3 N = 6
			SS-4		7-9-9 N = 18
	12.0	Residuum	SS-5	SILTY SAND (SM), medium dense, tan brown, fine to coarse, some angular rocks & rock fragments	22-12-10 N = 22
Auger refusal at 16.5 feet	16.5		SS-6	Borehole terminated at 16.5 feet	50/1" N = 50/1"

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	05/25/2022	3.2	3.2 ft., hole caved 6.3 ft. at TOB
END OF DRILLING	▼			
AFTER DRILLING	▼	05/26/2022	3.2	3.2 ft. at 24hrs
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
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PROJECT: Transylvania County EMS Base
Brevard, North Carolina
S&ME Project No. 22410052

BORING LOG: B-05

Sheet 1 of 1

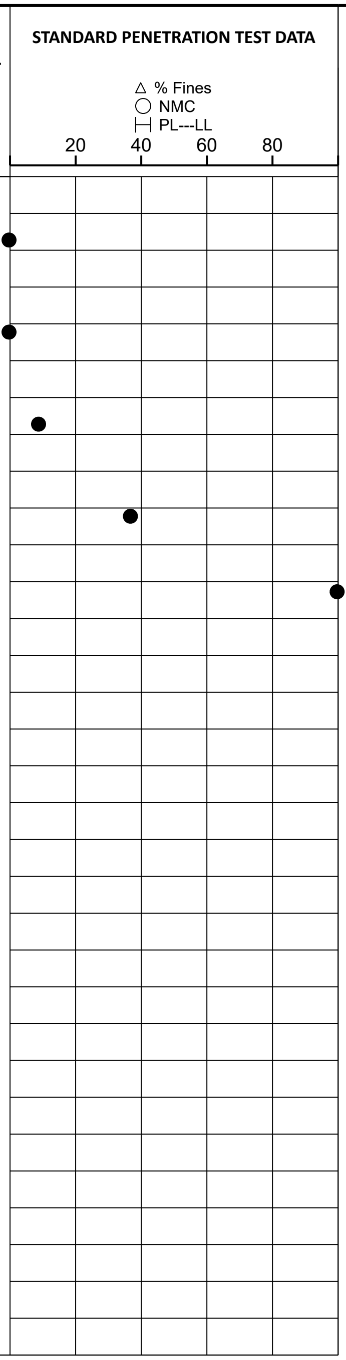
DATE DRILLED: 05/25/2022	**ELEVATION:** 2115 ft
DRILL RIG: Mobile Drill B-57	**DATUM:** NAVD88
DRILLER: Phenom Geotech	**BORING DEPTH:** 11.3 ft
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings with Hole Closure Device
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Christian Moloney
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** World Geodetic System Longitude / Latitude (WGS 84)

NOTES:

LATITUDE: **LONGITUDE:**

NOTES		Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)
				TOPSOIL, 4 inches	
	0.4	Alluvium	SS-1	LEAN CLAY WITH SAND (CL), very soft, gray, fine, trace mica, trace roots, moist to very moist	0-0-0 N = 0
			SS-2		0-0-0 N = 0
Hole Cave at 6.2 feet	5.3		SS-3	SILTY SAND (SM), loose, gray tan, fine to medium, micaceous, wet	0-3-6 N = 9
	8.0		SS-4	SILTY SAND (SM), dense, brown gray, fine to coarse, micaceous, trace rounded rocks, some clay, wet	18-19-18 N = 37
Auger refusal at 11.3 feet	11.3		SS-5	Borehole terminated at 11.3 feet	50/0" N = 50/0"

DEPTH (feet)	ELEVATION
0	2115
5	2110
10	2105
15	2100
20	2095
25	2090
30	2085



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	05/25/2022	3.0	3 ft., hole caved 6.2 ft. at TOB
END OF DRILLING	▼			
AFTER DRILLING	▼	05/26/2022	2.9	2.9 ft. at 24hrs
AFTER DRILLING	▼			

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:

Transylvania County EMS Base
Brevard, North Carolina
S&ME Project No. 22410052

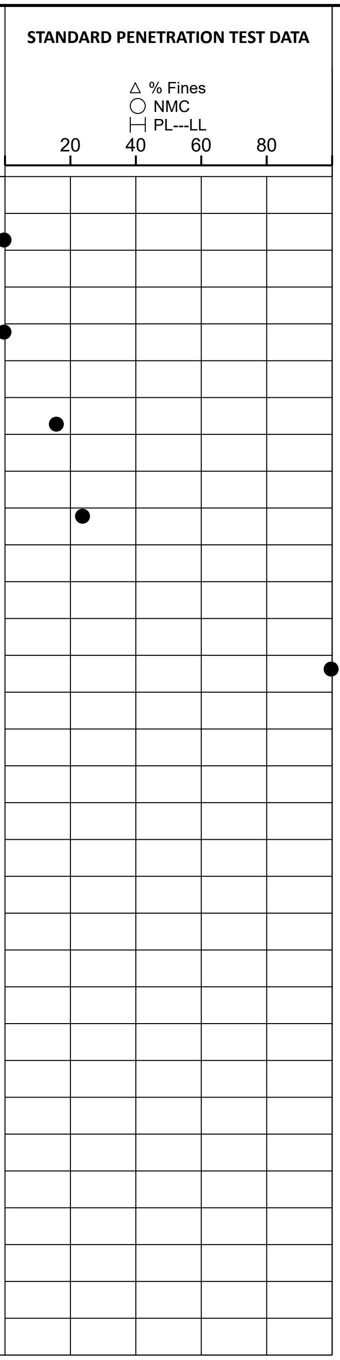
BORING LOG: B-06

Sheet 1 of 1

DATE DRILLED: 05/25/2022	**ELEVATION:** 2115 ft	**NOTES:**
DRILL RIG: Mobile Drill B-57	**DATUM:** NAVD88	
DRILLER: Phenom Geotech	**BORING DEPTH:** 13.4 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings with Hole Closure Device	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Christian Moloney	**LATITUDE:** **LONGITUDE:**
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** World Geodetic System Longitude / Latitude (WGS 84)	

NOTES		Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)
	0.3	Alluvium		TOPSOIL, 3 inches	
			SS-1	LEAN CLAY WITH SAND (CL), very soft, gray, fine, trace roots, trace mica, moist to very moist	0-0-0 N = 0
			SS-2		0-0-0 N = 0
Hole Cave at 5.2 feet	5.5		SS-3	SILTY SAND (SM), medium dense, gray tan, fine to medium, micaceous, trace to some rounded rocks, wet	3-7-9 N = 16
	8.0		SS-4	SILTY SAND WITH GRAVEL (SM), medium dense, gray tan, fine to medium, micaceous, wet	11-12-12 N = 24
Auger refusal at 13.4 feet	13.4		SS-5	Borehole terminated at 13.4 feet	50/0" N = 50/0"

DEPTH (feet)	ELEVATION
0	2115
5	2110
10	2105
15	2100
20	2095
25	2090
30	2085



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	05/25/2022	4.8	4.8 ft., hole caved 5.2 ft. at TOB
END OF DRILLING	▼			
AFTER DRILLING	▼	05/26/2022	3.8	3.8 ft. at 24hrs
AFTER DRILLING	▼			

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: Transylvania County EMS Base
Brevard, North Carolina
S&ME Project No. 22410052

BORING LOG: B-07

Sheet 1 of 1

DATE DRILLED: 05/25/2022	**ELEVATION:** 2115 ft
DRILL RIG: Mobile Drill B-57	**DATUM:** NAVD88
DRILLER: Phenom Geotech	**BORING DEPTH:** 11.1 ft
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings with Hole Closure Device
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Christian Moloney

NOTES:

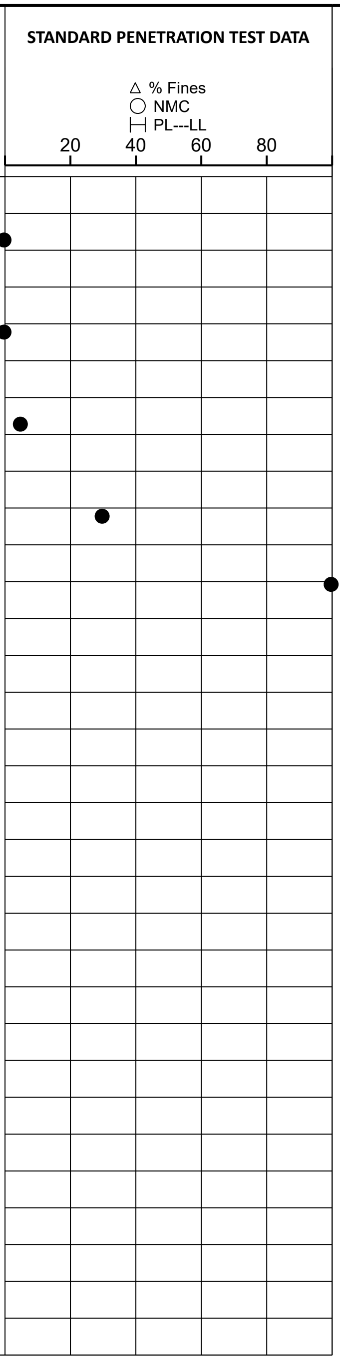
LATITUDE:

LONGITUDE:

SAMPLING METHOD: SS

PROJECT COORDINATE SYSTEM - World Geodetic System Longitude / Latitude (WGS 84)

DEPTH (feet)	NOTES		Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0							2115
		0.2	Alluvium		TOPSOIL, 2 inches		
				SS-1	LEAN CLAY WITH SAND (CL), very soft to firm, gray, fine, trace mica, trace roots, very moist	0-0-0 N = 0	
				SS-2		0-0-0 N = 0	
5							2110
				SS-3		1-2-3 N = 5	
	Hole Cave at 7.6 feet	7.5			SILTY SAND (SM), loose, gray orange, fine to medium, micaceous, wet		
		8.5		SS-4	WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM), medium dense, brown gray, coarse to fine, trace mica, wet	10-12-18 N = 30	
10							2105
	Auger refusal at 11.1 feet	11.1		SS-5	Borehole terminated at 11.1 feet	50/0" N = 50/0"	
15							2100
20							2095
25							2090
30							2085



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	05/25/2022	2.7	2.7 ft., hole caved 7.6 ft. at TOB
END OF DRILLING	▼			
AFTER DRILLING	▼	05/26/2022	2.7	2.7 ft. at 24hrs
AFTER DRILLING	▼			

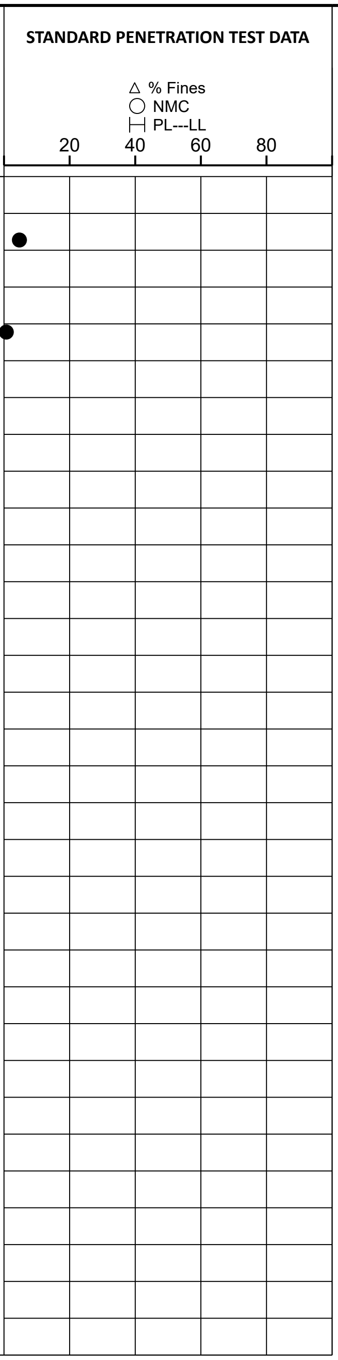
GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
AR = Auger Refusal

PROJECT:	Transylvania County EMS Base Brevard, North Carolina **S&ME Project No. 22410052**	**BORING LOG: B-08** *Sheet 1 of 1*

DATE DRILLED: 05/25/2022	**ELEVATION:** 2118 ft	**NOTES:**
DRILL RIG: Mobile Drill B-57	**DATUM:** NAVD88	
DRILLER: Phenom Geotech	**BORING DEPTH:** 5.0 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings with Hole Closure Device	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Christian Moloney	**LATITUDE:** **LONGITUDE:**
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** World Geodetic System Longitude / Latitude (WGS 84)	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0					GRAVEL BASE, 8 inches		2118
	0.8	Alluvium		SS-1	LEAN CLAY WITH SAND (CL), firm, gray tan, fine, trace mica, moist	2-2-3 N = 5	
	3.0			SS-2	LEAN CLAY WITH SAND (CL), very soft, gray tan, fine, trace mica, trace roots, very moist	0-0-1 N = 1	
5	Hole Cave at 3.9 feet 5.0				Borehole terminated at 5.0 feet		2113
10							2108
15							2103
20							2098
25							2093
30							2088

STANDARD PENETRATION TEST DATA



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	05/25/2022	3.6	3.6 ft., hole caved 3.9 ft. at TOB
END OF DRILLING	▼			
AFTER DRILLING	▼	05/26/2022	2.1	2.1 ft. at 24hrs
AFTER DRILLING	▼			

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

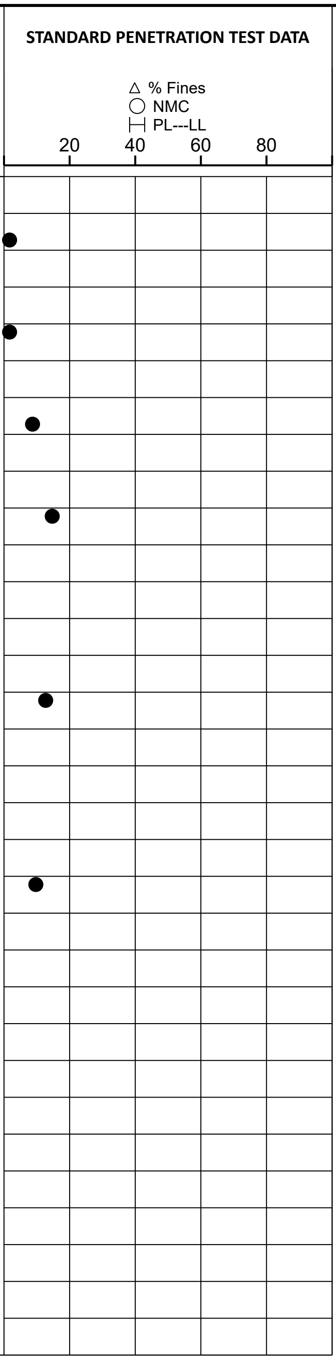
PROJECT: Transylvania County EMS Base
Brevard, North Carolina
S&ME Project No. 22410052

BORING LOG: B-09

Sheet 1 of 1

DATE DRILLED: 05/25/2022
ELEVATION: 2201 ft
DRILL RIG: Mobile Drill B-57
DATUM: NAVD88
DRILLER: Phenom Geotech
BORING DEPTH: 20.0 ft
HAMMER TYPE: Automatic hammer
CLOSURE: Cuttings with Hole Closure Device
DRILLING METHOD: 3-1/4" HSA
LOGGED BY: Christian Moloney
SAMPLING METHOD: SS
NOTES:
LATITUDE:
LONGITUDE:
PROJECT COORDINATE SYSTEM - World Geodetic System Longitude / Latitude (WGS 84)

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0					TOPSOIL, 5 inches		2201
	0.5	Fill	🟥	SS-1	SANDY LEAN CLAY (CL), very soft, brown, fine to medium, log (wood 5.5 to 5.8 ft.), trace roots, mixed with topsoil, some roots and wood, very moist	1-1-1 N = 2	
				SS-2		0-1-1 N = 2	
5							2196
	5.9	Residuum	⬛	SS-3	SILTY SAND (SM), loose to medium dense, orange tan, fine to coarse, trace mica, trace angular rock fragments	5-5-4 N = 9	
				SS-4		5-6-9 N = 15	
10							2191
				SS-5		6-6-7 N = 13	
15							2186
	Hole Cave at 17.2 feet						
				SS-6		4-5-5 N = 10	
20	20.0				Borehole terminated at 20.0 feet		2181
25							2176
30							2171



GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	05/25/2022		not encountered, hole caved 17.2 ft. at TOB
END OF DRILLING	▼			
AFTER DRILLING	▼	05/26/2022		not encountered at 24hrs
AFTER DRILLING	▼			

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

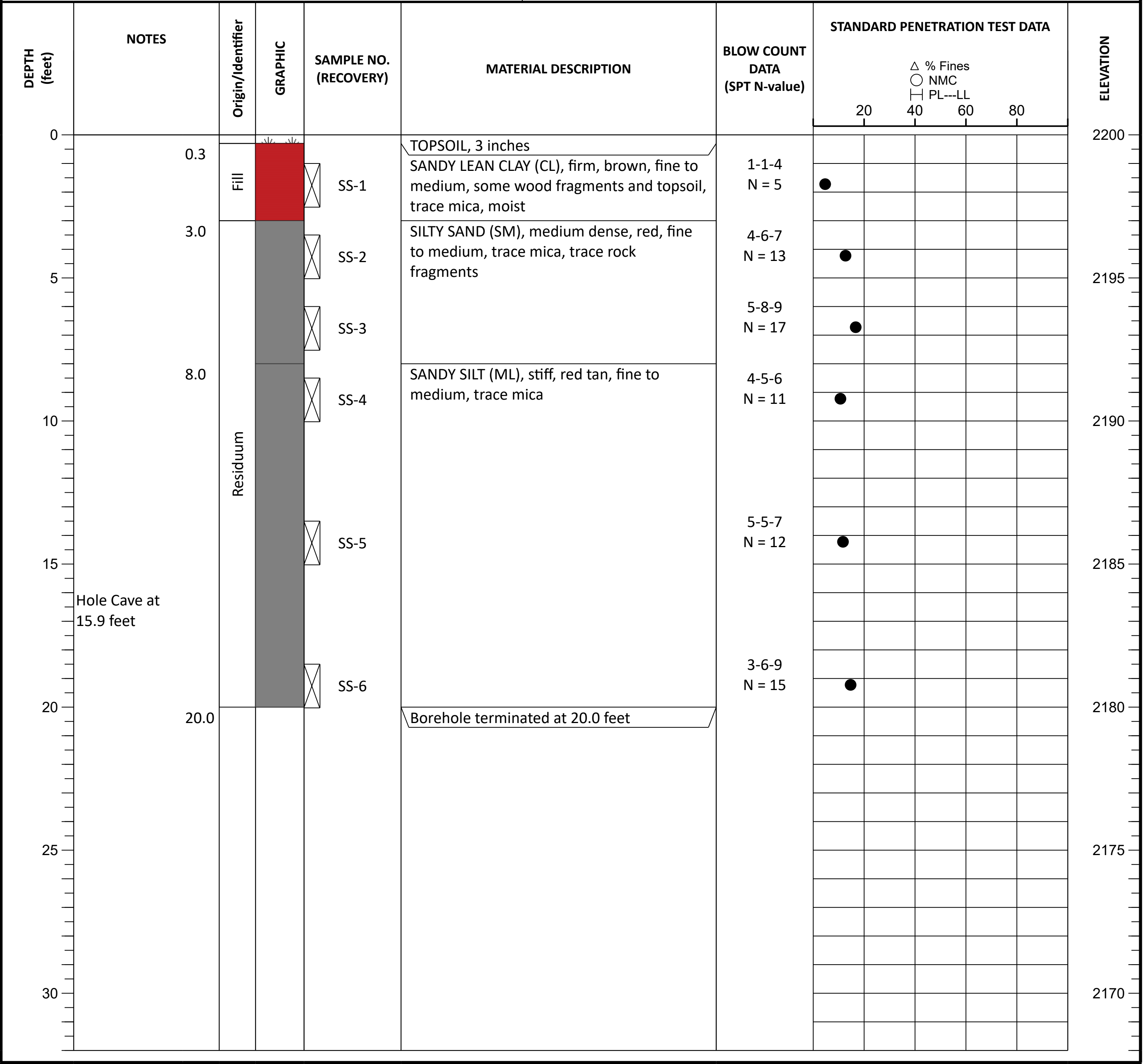
PROJECT: Transylvania County EMS Base
Brevard, North Carolina
S&ME Project No. 22410052

BORING LOG: B-10

Sheet 1 of 1

DATE DRILLED: 05/25/2022	**ELEVATION:** 2200 ft	**NOTES:**
DRILL RIG: Mobile Drill B-57	**DATUM:** NAVD88	
DRILLER: Phenom Geotech	**BORING DEPTH:** 20.0 ft	
HAMMER TYPE: Automatic hammer	**CLOSURE:** Cuttings with Hole Closure Device	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Christian Moloney	**LATITUDE:** **LONGITUDE:**

SAMPLING METHOD: SS
PROJECT COORDINATE SYSTEM - World Geodetic System Longitude / Latitude (WGS 84)



DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)
0.3		Fill		TOPSOIL, 3 inches	
		Fill	SS-1	SANDY LEAN CLAY (CL), firm, brown, fine to medium, some wood fragments and topsoil, trace mica, moist	1-1-4 N = 5
3.0		Residuum	SS-2	SILTY SAND (SM), medium dense, red, fine to medium, trace mica, trace rock fragments	4-6-7 N = 13
		Residuum	SS-3		5-8-9 N = 17
8.0		Residuum	SS-4	SANDY SILT (ML), stiff, red tan, fine to medium, trace mica	4-5-6 N = 11
		Residuum	SS-5		5-5-7 N = 12
	Hole Cave at 15.9 feet	Residuum	SS-6		3-6-9 N = 15
20.0				Borehole terminated at 20.0 feet	

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	▽	05/25/2022		not encountered, hole caved 15.9 ft. at TOB
END OF DRILLING	▼			
AFTER DRILLING	▼	05/26/2022		not encountered at 24hrs
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
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AR = Auger Refusal

Appendix III – Laboratory Testing

Laboratory Test Reports

Form No: TR-D2216-T265-2
Revision No. 1
Revision Date: 08/16/17

LABORATORY DETERMINATION OF WATER CONTENT

ASTM D 2216 ☑ *AASHTO T 265* ☐

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	22410052	Report Date:	6/10/22
Project Name:	Transylvania County Emergency Services Base (Updated)	Test Date(s):	6/7 - 6/8/22
Client Name:	Transylvania County		
Client Address:	152 Public Safety Way Brevard, North Carolina 28712		
Sampled by:	Phenom Geotech	Sample Date:	5/25/22
Sampling Method:	Split-spoon & Bulk		

Method: **A** **(1%)** ☐ **B** **(0.1%)** ☑

Balance ID. 7536 Calibration Date: 1/31/22
Oven ID. 7621 Calibration Date: 7/31/21

Boring No.	Sample No.	Sample Depth	Tare #	Tare Weight	Tare Wt.+ Wet Wt	Tare Wt. + Dry Wt	Water Weight	Percent Moisture
		ft.		grams	grams	grams	grams	%
B-3	SS-2	3.5 - 5.0'	301	0.00	408.13	295.56	112.57	**38.1%**
B-5	SS-1	1.0 - 2.5'	320	0.00	434.44	320.51	113.93	**35.5%**
B-9	SS-3	6.0 - 7.5'	338	0.00	311.57	259.96	51.61	**19.9%**
B-9	SS-6	18.5 - 20.0'	350	0.00	444.62	366.07	78.55	**21.5%**
B-10	SS-2	3.5 - 5.0'	362	0.00	428.79	347.88	80.91	**23.3%**
B-10	SS-4	8.5 - 10.0'	363	0.00	401.23	332.80	68.43	**20.6%**
B-10	SS-5	13.5 - 15.0'	374	0.00	400.78	325.19	75.59	**23.2%**
B-10	Bulk	10.0 - 15.0'	84	0.00	689.34	582.02	107.32	**18.4%**

Notes / Deviations / References

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Matt Jacobs		NICET Lab Level III / 118202	6/10/22
Technician Name		*Certification Type / No.*	*Date*
Brian Vaughan, P.E.	Brian Vaughan	QA Supervisor	6/10/22
Technical Responsibility	*Signature*	*Position*	*Date*

This report shall not be reproduced, except in full, without the written approval of S&ME, Inc.

Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

ASTM D 4318 ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

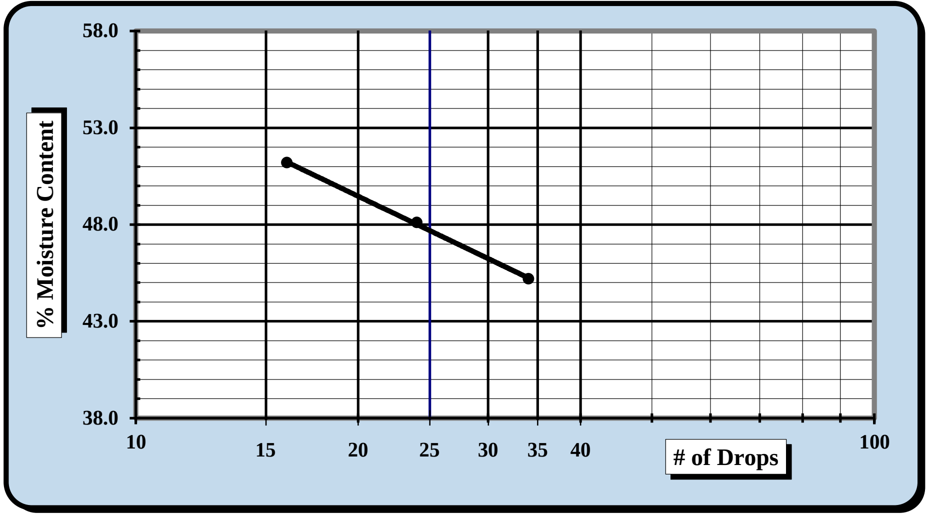
Project #:	22410052	Report Date:	6/10/22
Project Name:	Transylvania County Emergency Services Base (Updated)	Test Date:	6/9/22
Client Name:	Transylvania County		
Client Address:	152 Public Safety Way Brevard, North Carolina 28712		

Boring #:	B-2	Log #:	154	Sample Date:	5/25/22
Location:	SS-2	Type:	Split-spoon	Depth:	3.5 -5.0'

Sample Description: LEAN CLAY WITH SAND (CL) - light and dark gray

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	7537	1/31/2022	Grooving tool	14185	9/29/2021
LL Apparatus	13859	9/29/2021			
Oven	7313	7/30/2021			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	Q-1	Q-2	Q-3				3	4	
A	Tare Weight	16.64	16.58	15.72				11.60	12.27	
B	Wet Soil Weight + A	34.93	35.73	34.55				19.07	19.58	
C	Dry Soil Weight + A	29.24	29.51	28.17				17.53	18.08	
D	Water Weight (B-C)	5.69	6.22	6.38				1.54	1.50	
E	Dry Soil Weight (C-A)	12.60	12.93	12.45				5.93	5.81	
F	% Moisture (D/E)*100	45.2%	48.1%	51.2%				26.0%	25.8%	
N	# OF DROPS	34	24	16				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							25.9%		



One Point Liquid Limit

N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic ☐

Liquid Limit	**48**
Plastic Limit	**26**
Plastic Index	**22**
Group Symbol	**CL**

Multipoint Method ☑
One-point Method ☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *% Passing the #200 Sieve:* N/A

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Matt Jacobs	6/10/22	Brian Vaughan, P.E.	6/10/22
Technician Name	*Date*	*Technical Responsibility*	*Date*

Form No. TR-D4318-T89-90
Revision No. 1
Revision Date: 7/26/17

LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

ASTM D 4318 ☒ *AASHTO T 89* ☐ *AASHTO T 90* ☐

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

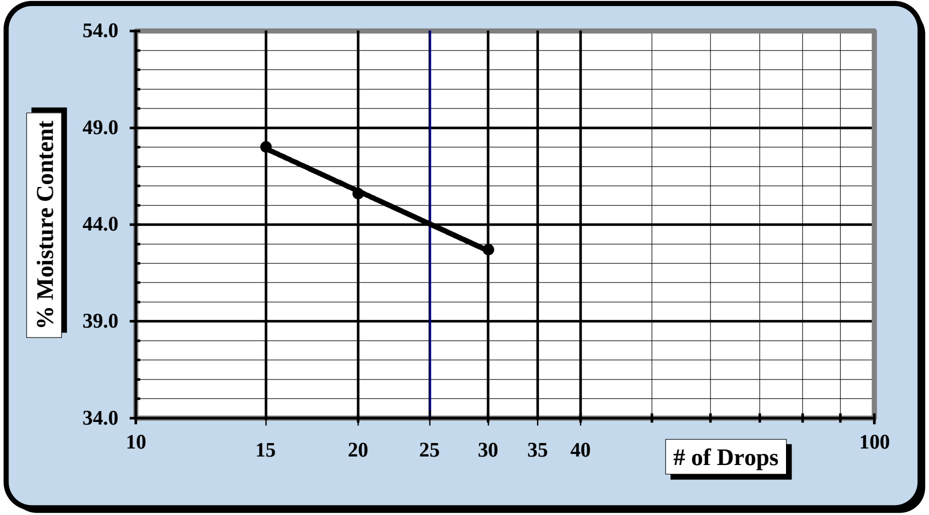
Project #:	22410052	Report Date:	6/10/22
Project Name:	Transylvania County Emergency Services Base (Updated)	Test Date:	6/9/22
Client Name:	Transylvania County		
Client Address:	152 Public Safety Way Brevard, North Carolina 28712		

Boring #:	B-10	Log #:	154	Sample Date:	5/25/22
Location:	Bulk	Type:	Bulk	Depth:	10.0 - 15.0'

Sample Description: SANDY SILT (ML) - brown red, medium to fine, trace mica

Type and Specification	*S&ME ID #*	*Cal Date:*	*Type and Specification*	*S&ME ID #*	*Cal Date:*
Balance (0.01 g)	7537	1/31/2022	Grooving tool	14185	9/29/2021
LL Apparatus	13859	9/29/2021			
Oven	7313	7/30/2021			

Pan #		Liquid Limit						Plastic Limit		
	Tare #:	P-1	P-2	P-3				1	2	
A	Tare Weight	16.31	15.20	16.51				12.11	12.16	
B	Wet Soil Weight + A	38.15	35.33	36.62				19.14	18.97	
C	Dry Soil Weight + A	31.61	29.03	30.10				17.39	17.29	
D	Water Weight (B-C)	6.54	6.30	6.52				1.75	1.68	
E	Dry Soil Weight (C-A)	15.30	13.83	13.59				5.28	5.13	
F	% Moisture (D/E)*100	42.7%	45.6%	48.0%				33.1%	32.7%	
N	# OF DROPS	30	20	15				*Moisture Contents determined by ASTM D 2216*		
LL	LL = **F** * FACTOR									
Ave.	*Average*							32.9%		



One Point Liquid Limit

N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	☐
Liquid Limit	**44**
Plastic Limit	**33**
Plastic Index	**11**
Group Symbol	**ML**
Multipoint Method	☑
One-point Method	☐

Wet Preparation ☐ Dry Preparation ☑ Air Dried ☑ *% Passing the #200 Sieve:* 63.2%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Matt Jacobs	6/10/22	Brian Vaughan, P.E.	6/10/22
Technician Name	*Date*	*Technical Responsibility*	*Date*

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Form No. TR-D698-2
Revision No. : 1
Revision Date: 07/25/17

MOISTURE - DENSITY REPORT

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

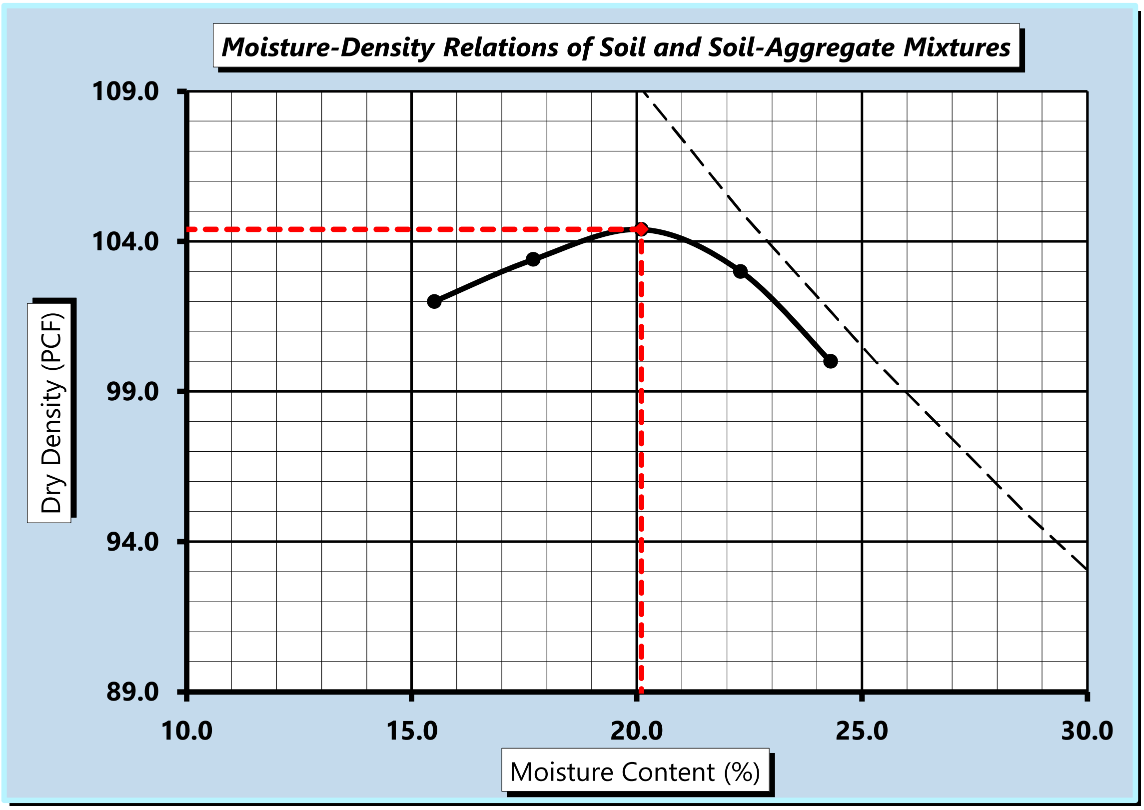
Project #:	22410052	Report Date:	6/10/22
Project Name:	Transylvania County Emergency Services Base (Updated)	Test Date:	6/7/22
Client Name:	Transylvania County		
Client Address:	152 Public Safety Way Brevard, North Carolina 28712		

Boring #:	B-10	Log #:	154	Sample Date:	5/25/22
Location:	Bulk	Type:	Bulk	Depth:	10.0 - 15.0'

Sample Description: SANDY SILT (ML) - brown red, medium to fine, trace mica

Maximum Dry Density **104.4** PCF. Optimum Moisture Content **20.1%**

ASTM D 698 - - Method A



Soil Properties

Natural Moisture Content	18.4%
Specific Gravity of Soil	2.700
Liquid Limit	44
Plastic Limit	33
Plastic Index	11

% Passing

3/4"	100.0%
3/8"	99.7%
#4	98.1%
#10	92.0%
#40	78.8%
#60	74.6%
#100	70.7%
#200	63.2%

Oversize Fraction

Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

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:
ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Brian Vaughan, P.E.	Brian Vaughan	QA Supervisor	6/10/22
Technical Responsibility	*Signature*	*Position*	*Date*

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Form No: TR-D422-WH-1Ga
Revision No. 1
Revision Date: 8/10/17

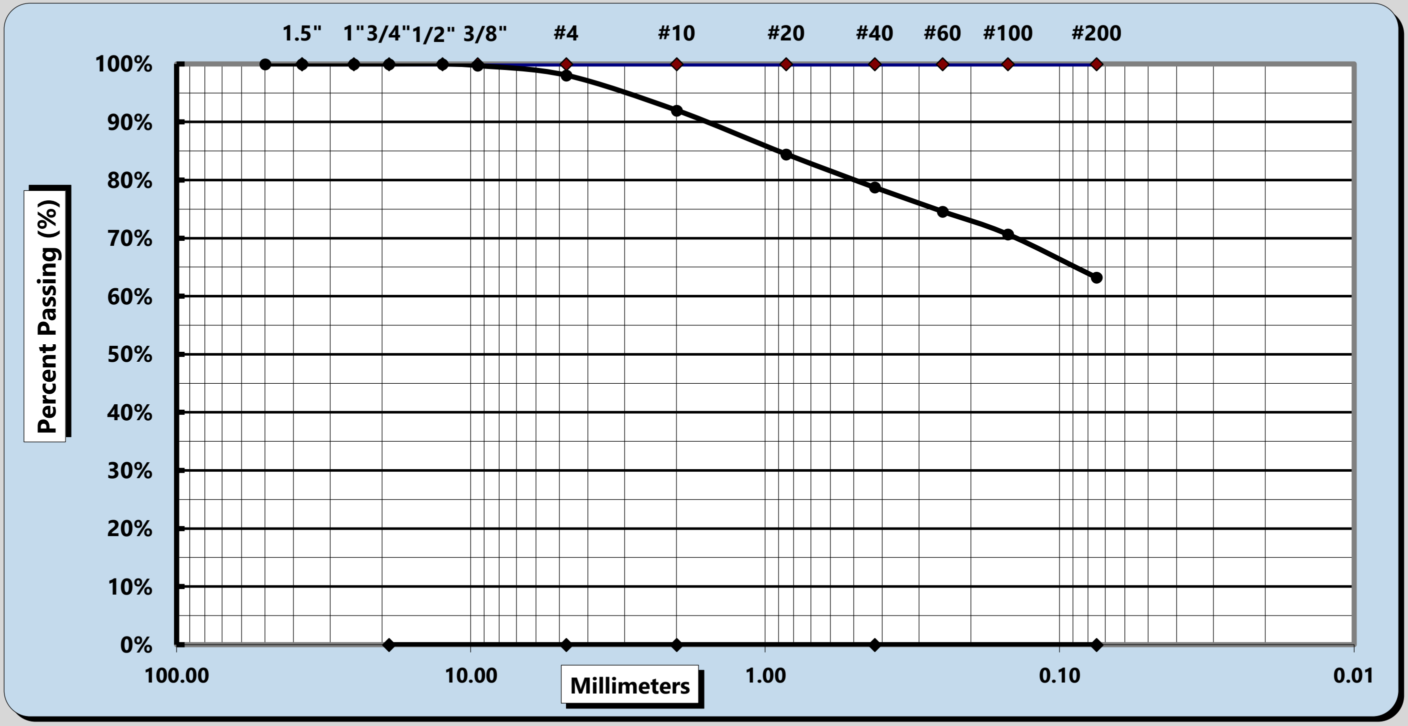
SIEVE ANALYSIS OF SOILS

ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	22410052			Report Date:	6/10/22
Project Name:	Transylvania County Emergency Services Base (Updated)			Test Date(s):	6/7 - 6/9/22
Client Name:	Transylvania County				
Client Address:	152 Public Safety Way Brevard, North Carolina 28712				
Boring #:	B-10	Log #:	154	Sample Date:	5/25/22
Location:	Bulk	Type:	Bulk	Depth:	10.0 - 15.0'

Sample Description: SANDY SILT (ML) - brown red, medium to fine, trace mica



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

Maximum Particle Size	9.50 mm	Coarse Sand	6.0%	Fine Sand	15.5%
Gravel	1.9%	Medium Sand	13.2%	Silt & Clay	63.2%
Liquid Limit	44	Plastic Limit	33	Plastic Index	11
Specific Gravity	2.650			Moisture Content	18.4%
Coarse Sand	6.0%	Medium Sand	13.2%	Fine Sand	15.5%

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

Notes / Deviations / References:

Brian Vaughan, P.E.	Brian Vaughan	QA Supervisor	6/10/22
Technical Responsibility	*Signature*	*Position*	*Date*

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Appendix IV – Miscellaneous

Field Testing Procedures

Important Information about Your Geotechnical Report

Field Testing Procedures

Soil Test Borings

All borings and sampling were conducted in accordance with ASTM D-1586 test method. Initially, the borings were advanced by either mechanically augering or wash boring through the overburden soils. When necessary, a heavy drilling fluid is used below the water table to stabilize the sides and bottom of the borehole. At regular intervals, soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-barrel or split-spoon sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated as the "Standard Penetration Resistance" or N-value. The penetration resistance, when properly evaluated, can be correlated to consistency, relative density, strength and compressibility of the sampled soils.

Water Level Readings

Water level readings are normally taken in conjunction with borings and are recorded on the Boring Logs following termination of drilling (designated by ▽) and at a period of 24 hours following termination of drilling (designated by ▼). These readings indicate the approximate location of the hydrostatic water table at the time of our field exploration. The groundwater table may be dependent upon the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should also be expected with variations in surface run-off, evaporation, construction activity and other factors.

Occasionally the boreholes sides will cave, preventing the water level readings from being obtained or trapping drilling water above the cave-in zone. In these instances, the hole cave-in depth (designated by HC) is measured and recorded on the Boring Logs. Water level readings taken during the field operations do not provide information on the long-term fluctuations of the water table. When this information is required, piezometers are installed to prevent the boreholes from caving.

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.

Scope of Geotechnical Services

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.

Portion obtained with permission from “Important Information About Your Geotechnical Engineering Report”, ASFE, 2004