

ADDENDUM NO. 3

TO PROSPECTIVE BIDDERS UNDER  
Wastewater Treatment Plant Upgrades Project  
Bamberg Board of Public Works  
Bamberg, SC

RECEIPT OF THIS ADDENDUM MUST BE ACKNOWLEDGED IN THE  
SPACE PROVIDED IN THE BID FORM IN SECTION 00 41 00

Addendum Item	Page or Drawing	Location and Description of Change
<b>PART A - TECHNICAL SPECIFICATIONS</b>		
1.	01 66 00	Delete Part 1.03 of Specification Section 01 66 00.
2.	Appendix	Add Geotechnical Engineering Report Bamberg SCIIP Design (S&ME Project No. 23350483), attached hereto, as an Appendix to the Technical Specifications.
<b>PART B – CONSTRUCTION DRAWINGS</b>		
3.	E-00-001 E-00-002 E-00-003 E-00-101 E-00-501 E-00-601 E-00-602 E-01-101 E-02-101 E-03-101	On Drawing Sheets E-00-001, E-00-002, E-00-003, E-00-101, E-00-501, E-00-601, E-00-602, E-01-101, E-02-101, E-03-101 the Engineer of Record shown is incorrect. Seal and signatures should be replaced by the seal of Amy T. Howard, PE (SC License Number 16565). Conformed Construction Drawings prepared after award will indicate this change.
4.	S-03-101 S-03-301 S-03-302	On Drawing Sheets S-03-101, S-03-301, and S-03-302 add General Note 4, as follows:  <i>4. ELEVATION OF BOTTOM OF CLARIFIER CELL #4 WAS NOT SURVEYED AND ELEVATIONS ARE ESTIMATED BASED ON RECORD DRAWINGS. CONTRACTOR TO VERIFY BOTTOM ELEVATION OF CLARIFIER CELL #4 AND ELEVATION OF INLET PIPE TO SPRAY PUMPS PRIOR TO CONSTRUCTION OF CHLORINE CONTACT CHAMBER. NOTIFY ENGINEER OF ANY DISCREPANCIES.</i>

---

PART C – QUESTIONS AND ANSWERS

---

- |    |   |
|----|---|
| 1. | Do the existing aeration basins have a liner?<br><b>Existing aeration basins have a clay bottom.</b>  |
| 2. | Are existing as-builts available?<br><b>Existing as-builts are available and can be shared by the Engineer upon request.</b>  |
| 3. | What factors will determine the award of this project? Is the award to be based on the lowest single prime amount on the bid form or is the intention to be able to breakup and select pricing based on the bid form line items? Is the intention to increase or decrease the project scope by any of the bid line items?<br><b>See Section 00 21 13, Article 19 for Evaluation of Bid and Award of Contract.</b> |
| 4. | Are digital signatures for bid documents acceptable in lieu of wet ink signatures?<br><b>Yes.</b>   |
| 5. | Is there a geotechnical engineering report available for existing soil conditions?<br><b>Yes, geotechnical engineering report is being added as an Appendix to the Technical Specifications via this Addendum. Additionally, see Note 4 of General Notes on Drawing S-03-101, S-03-301, and S-03-302.</b>   |
| 6. | Are coatings required on existing/new concrete and precast?<br><b>No coatings are required on existing/new concrete and precast.</b>  |
| 7. | What are the average and peak flows to be assumed for bypass pumping?<br><b>Technical Specification Section 33 01 30.50, Part 3.01.A.2 indicated a peak flow of 2.75 MGD shall be used for bypass pumping purposes.</b>   |
| 8. | The influent diversion box (doghouse) is shown with a precast base slab (S-01-101). Can the base slab be cast in place after setting the doghouse?<br><b>For purposes of bidding, the design shall remain as is shown on Drawing S-01-101. Further discussion may be entertained after contract award.</b>  |
- 

This addendum shall be incorporated into and made a part of the Contract Documents

**\*\*END OF SECTION\*\***



Geotechnical Engineering Report  
Bamberg SCIIP Design  
Bamberg, South Carolina  
S&ME Project No. 23350483

PREPARED FOR:

**Brown and Caldwell**  
200 Center Point Circle, Suite 330  
Columbia, South Carolina 29210

PREPARED BY:

**S&ME, Inc.**  
9751 Southern Pine Boulevard  
Charlotte, North Carolina 28273

**September 20, 2023**



September 20, 2023

Brown and Caldwell  
200 Center Point Circle, Suite 330  
Columbia, South Carolina 29210

Attention: Mr. Bob West

Reference: **Geotechnical Engineering Report  
Bamberg SCIIP Design**  
Bamberg, South Carolina  
S&ME Project No. 23350483


Dear Mr. West:

S&ME, Inc. is pleased to submit this Geotechnical Engineering Report for the proposed Bamberg Waste Water Treatment Plant (WWTP) improvements in Bamberg, South Carolina. Our geotechnical services were provided in general accordance with our proposal No. 23350483 dated July 31, 2023 and authorized by issuance of a Purchase Order by Brown and Caldwell on August 8, 2023.

The purpose of this geotechnical study was to determine the general subsurface conditions at the site and to evaluate those conditions with regard to the design and construction of the project. This report presents our findings together with our conclusions and recommendations for site construction.

S&ME appreciates the opportunity to assist you during this phase of the project. If you have questions, please contact us.

Sincerely,

  
  
David A. Bixler II, P.E.  
Operations Manager  
SC PE Reg. No. 26044  
9-20-2023

  
Leo Cruz-Cruz  
Engineering Technician

  
S & ME, INC.  
No. C00473



# Table of Contents

- 1.0 Introduction .....1**
  - 1.1 Project and Site Descriptions ..... 1
  - 1.2 Purpose and Scope ..... 1
- 2.0 Exploration Procedures .....2**
  - 2.1 Field Testing .....2
- 3.0 Area Geology and Subsurface Conditions .....2**
  - 3.1 Physiography and Area Geology .....2
  - 3.2 Subsurface Conditions .....3
- 4.0 Conclusions and Recommendations .....3**
  - 4.1 Earthwork .....4
    - 4.1.1 Site Preparation .....4
    - 4.1.2 Existing Fill .....4
    - 4.1.3 Excavation Characteristics .....4
    - 4.1.4 Temporary Excavations/Shoring .....5
    - 4.1.5 Groundwater/Dewatering .....5
    - 4.1.6 Proofrolling/Subgrade Evaluation .....6
    - 4.1.7 Subgrade Repair after Exposure .....6
    - 4.1.8 Fill Material and Placement .....7
    - 4.1.9 Cut and Fill Slopes .....7
  - 4.2 Foundation Support .....7
    - 4.2.1 Bar Screening Bearing Elevation Stabilization and Structure Foundation Recommendations .....7
    - 4.2.2 Foundation Lateral Capacity .....8
  - 4.3 Floor Slabs .....9
  - 4.4 Below-Grade Walls .....9
- 5.0 Limitations of Report .....10**



**List of Tables**

Table 4-1: Lateral Earth Pressure Design Parameters ..... 5  
Table 4-2: Below-Grade Wall Design Parameters..... 9

**Appendix**

- Site Vicinity Plan, Figure 1
- Boring Location Plan, Figure 2
- Test Boring Log Legend
- Boring Logs, B-1 and B-2



## 1.0 Introduction

### 1.1 Project and Site Descriptions

Initial project information is based on e-mail correspondence between Bob West with Brown and Caldwell (B&C) and David Bixler with S&ME during the period of July 11 and July 21, 2023, and a site visit by Mr. West and Mr. Bixler on July 20, 2023. Included in the email correspondence was a site plan prepared by B&C dated August 25, 2022, showing an aerial photo of the site, existing structures, and the locations of the proposed new structures.

We understand that B&C is designing improvements to the existing Bamberg WWTP in Bamberg, South Carolina (reference Site Vicinity Plan, Figure 1). Improvements include a new grit removal structure, bar screening structure, influent flume metering manhole, chlorine contact chamber, and effluent flow meter with associated gravity sewer lines. Our requested geotechnical services are for the grit removal structure and bar screening structure only.

The locations for the two new structures are relatively flat and immediately adjacent to asphalt paved parking areas. The boring locations were located in the grass vegetated areas.

The grit removal structure is expected to be a slab-on-grade with turn down foundations and equipment. The bar screening structure will be cast-in-place concrete below grade. Structural loading information was not provided.

### 1.2 Purpose and Scope

The purpose of this geotechnical study was to explore the subsurface conditions at the site and develop geotechnical recommendations for the design and construction of the grit removal and bar screening structures. S&ME has completed the following scope of geotechnical services for this project:

- Visited the site to observe site surface conditions and mark test locations.
- Contacted South Carolina 811 and coordinated with Bamberg WWTP personnel to have them mark site utilities.
- Mobilized a power drilling rig mounted on a truck and crew to the site.
- Drilled two soil test borings.
- Attempted water level measurements.
- Backfilled the boreholes.
- Performed geotechnical analysis and prepared this geotechnical report.

## **2.0 Exploration Procedures**

### **2.1 Field Testing**

In order to explore the general subsurface conditions at the site, two soil test borings were performed on August 22, 2023. The field tests were advanced at the approximate locations shown on the Boring Location Plan (Figure 2) in the Appendix. The test locations were selected and located in the field by S&ME personnel using the referenced drawings provided. Northings and eastings presented on the boring logs were obtained from approximate boring locations based on site plan prepared by B&C dated August 25, 2022. Elevations were interpolated from Google Earth and topographic maps found in ArcGIS online.

A Diedrich D-50 drill rig was used to advance the borings with hollow-stem, continuous flight augers. Standard Penetration Test (SPT) split-spoon sampling was performed at designated intervals in the soil test borings in general accordance with ASTM D1586 to provide an index for estimating soil strength and relative density or consistency. The drill rig used to drill the borings is equipped with a hydraulic automatic hammer for Standard Penetration Tests. In conjunction with the SPT testing, samples are obtained for soil classification purposes. Representative portions of each soil sample from the soil test borings were placed in sealed containers and taken to our laboratory. The results of the soil test borings are presented in the Appendix.

Water level measurements were attempted in the borings at the termination of drilling activities. All borings were backfilled with soil cuttings to the ground surface following completion of drilling.

Once the samples were received in our laboratory, an S&ME professional visually and manually examined each sample to estimate the distribution of grain sizes, plasticity, organic content, moisture condition, color, presence of lenses and seams, and apparent geological origin. The results of the classifications, designated in general accordance with the Unified Soil Classification System (USCS) and ASTM D2488 are presented on the attached boring logs. Similar soils were grouped into strata on the boring logs. The strata contact lines represent approximate boundaries between the soil types; the actual transition between the soil types in the field may be gradual in both the horizontal and vertical directions.

## **3.0 Area Geology and Subsurface Conditions**

### **3.1 Physiography and Area Geology**

The project site is within the Atlantic Coastal Plain Physiographic Province in the southern part of South Carolina. The Plain consists of marine sediments (gravel, sand, silt, and clay) that gradually thicken as the Atlantic Ocean is approached. The project site is specifically within the Duplin Formation which typically consists of sands, sandy and silty clays, and occasionally shelly sands.



### 3.2 Subsurface Conditions

Subsurface conditions as indicated by the borings generally consist of surficial topsoil underlain by fill soils and Coastal Plain soils. The generalized subsurface conditions at the site are described below. For more detailed soil descriptions and stratifications at a particular boring location, the respective boring log should be reviewed.

**Surface Materials:** All borings encountered approximately 1 inch or less of topsoil material at the existing ground surface. Clearing was not required to access boring locations.

**Fill Soils:** Fill soils were encountered in both borings beneath the surficial material. The fill soils consisted of clayey sand (USCS Symbol SC) and extended to depths of approximately 8 feet below the existing ground surface. The fill soils were noted as moist with SPT N-values ranging from 4 to 11 blow per foot (bpf). Portions of these soils were noted to contain trace amounts of organics.

**Coastal Plain Soils:** Coastal Plain soils were encountered underlying the surficial material in each of the borings. The coastal plain soils generally consisted of sandy lean clay (USCS Classification CL), fat clay (CH), and clayey sand (SC). SPT N-values ranged from 8 to 13 blow per foot (bpf). The coastal plain soils were noted as ranging from moist to wet and were noted to contain trace amounts of mica. All borings were terminated in coastal plain soils at the target depth. The uppermost Coastal Plain soils in boring B-1 were noted to contain trace amounts of organics.

**Water Levels:** Groundwater level measurements were attempted at the termination of drilling activities in each boring. Groundwater at the termination of drilling was measured at depths of 17 and 20 feet for borings B-1 and B-2, respectively.

## 4.0 Conclusions and Recommendations

Our conclusions and recommendations are based on the project information outlined previously and on the data obtained from the field. If the structural loading, geometry, or proposed structure locations are changed or significantly differ from those outlined, or if conditions are encountered during construction that differ from those encountered by the soil test borings, S&ME requests the opportunity to review our recommendations based on the new information and make necessary changes.

Generally, the project can be constructed as planned, and we recommend that shallow spread foundations be considered for support of the proposed structures. These and other design considerations and their impact to site construction are discussed in detail in the following sections and should be considered by the structural and project civil engineer.



## **4.1 Earthwork**

### *4.1.1 Site Preparation*

The entire construction area should be stripped of vegetation, topsoil, trash, debris, and organic materials to a minimum of 10 feet outside the structural (building and wall) limits. Debris (including topsoil) from stripping operations should be properly disposed of off-site. Alternatively, topsoil may be used in landscaped areas with slopes of 4:1 (horizontal to vertical) or flatter.

The borings indicate that topsoil/rootmat thicknesses were generally 1 inch or less at the site. However, topsoil thicknesses are expected to vary across the site. In addition, the depth of topsoil stripping will also be dependent upon prevailing weather conditions at the time of construction. During wet conditions, rubber-tired equipment will mix topsoil with underlying "clean" soils, causing stripping depths to be greater than topsoil depths indicated on the borings. We recommend that topsoil stripping be performed with light, tracked equipment to reduce disturbance of the underlying soils, or be performed during dry periods.

### *4.1.2 Existing Fill*

Existing fill soils were encountered in each of the borings. As previously discussed, these fill soils generally consisted of clayey sand (SC). The fill materials exhibited SPT N-values of 4 to 11 bpf. Our experience suggests that properly compacted fill will typically exhibit N-values of at least 8 bpf and be relatively clean and free of deleterious inclusions.

Based on the blow counts, it appears that the fill soils are variably compacted. The fill soils near the grit removal structure (boring B-2) appear reasonably well compacted and relatively free of deleterious materials. Therefore, these fill soils appear suitable for support of the structure. However, thorough evaluation of these soils should be performed by a representative of the geotechnical engineer during site grading.

We anticipate that poorly compacted existing near surface fill soils encountered in boring B-1 in the vicinity of the bar screening structure will be removed during site excavations. Any remaining fill should be evaluated at planned final grade. If poorly compacted fill soils are present, we recommend these be undercut and replaced with graded aggregate base course (GABC) as recommended in Section 4.2.1. Again, a thorough evaluation should be performed by a representative of the geotechnical engineer during site grading.

### *4.1.3 Excavation Characteristics*

Excavations at the site will include mass grading, excavations for footings, excavations for the bar screening structure, and new utilities. Based on the testing performed and project information provided to us, the excavations for the site should be in newly placed fill, existing fill and/or coastal plain soils. These soils can be excavated using traditional earth-moving equipment (e.g., dozers, trackhoes, pans, front-end loaders, etc.).



#### 4.1.4 Temporary Excavations/Shoring

For temporary excavations, shoring and bracing or flattening (laying back) of the slopes should be performed to obtain a safe working environment. Excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. We recommend that all excavated soils be placed away from the edges of the excavation, at a distance equaling or exceeding the depth of the excavation. The contractor is solely responsible for site safety. This information is provided only as a service and under no circumstances should we be assumed responsible for construction site safety.

The shoring system should be designed by a registered structural engineer and should be designed to withstand the lateral loads exerted by the surrounding soils, hydrostatic pressures, as well as any anticipated surcharge loads. The following lateral earth pressure parameters should be considered for the shoring system:

**Table 4-1: Lateral Earth Pressure Design Parameters**

Material	Moist Unit Weight $\gamma_m$ (pcf)	Friction Angle $\varphi'$	Effective Cohesion, $c'$ (psf)	Earth Pressure Coefficient		
				At Rest $K_0$	Active $K_a$	Passive $K_p$
Newly Placed Fill	120	28°	50	0.53	0.36	2.77
Existing Fill and Coastal Plain Soils	120	28°	50	0.53	0.36	2.77

#### 4.1.5 Groundwater/Dewatering

Groundwater level measurements were attempted at the termination of drilling activities in each boring after target depth was achieved. Groundwater at the termination of drilling was measured at depths of 17 and 20 feet for borings B-1 and B-2, respectively. Depending on final grades, it is not anticipated that groundwater will be encountered during excavations.

However, please note that water levels tend to fluctuate with seasonal and climatic variations, as well as with some types of construction operations. Therefore, water may be encountered during construction at depths not indicated during this study.



#### *4.1.6 Proofrolling/Subgrade Evaluation*

Upon completion of the stripping activities, we recommend that areas to provide support for the foundations, floor slabs, structural fill, and any pavement areas be proofrolled with a loaded dump truck or similar pneumatic tired vehicle (minimum loaded weight of 20 tons) under the observation of a staff professional or a senior soil technician. The proofrolling procedures should consist of four complete passes of the exposed areas, with two of the passes being in a direction perpendicular to the preceding ones. Any areas which deflect, rut or pump excessively during proofrolling or fail to "tighten up" after successive passes should be undercut to suitable soils and replaced with compacted fill. In areas where subgrade evaluation with proofrolling is not practical, subgrade evaluation could instead be performed with hand auger borings and Sowers Dynamic Cone Penetration (DCP) testing.

After the subgrade/proofroll evaluation has been completed and approved, final site grading should proceed immediately. If construction progresses during wet weather, the proofrolling operation shall be repeated with at least one pass in each direction immediately prior to placing aggregate base course in the pavement areas or pouring of foundations. If unstable conditions are exposed during this operation, additional undercutting or scarifying may be required.

#### *4.1.7 Subgrade Repair after Exposure*

The exposed subgrade material will consist of silty and clayey soils which are known to deteriorate when exposed to environmental changes such as freezing, erosion, and softening from ponded rainwater. Also, these materials can deteriorate and rut when exposed to construction traffic. Our experience with local soils indicates that these materials are very sensitive to moisture and their condition will degrade quickly if these soils are allowed to saturate.

We recommend that exposed subgrade surfaces in the building area that have deteriorated be properly repaired by scarifying and recompacting immediately prior to additional construction. It should be noted that the level of difficulty and cost of developing a stable subgrade will depend upon the weather conditions before and during construction as well as the time available to stabilize the subgrade. If subgrade preparation operations must be performed during wet weather conditions, undercutting the deteriorated soil and replacing it with compacted crushed stone, rather than soil fill, may be preferable.

We recommend that the grading subcontractor smooth-roll exposed subgrades at the end of each workday, limit construction traffic to defined areas, and protect exposed subgrade soils during construction. This is essential for construction during the typically wetter, cooler months of November through April. If subgrades are rough-graded and not immediately covered by floor slab bearing materials or aggregate base course, then the grading subcontractor should cover the exposed subgrades with a sacrificial layer of crushed stone, leave the subgrades approximately 6 to 8 inches high, or be prepared to repair/stabilize the subgrades at a later date.

#### *4.1.8 Fill Material and Placement*

For all structural areas, all fill used for site grading operations should consist of a clean (free of organics and debris), low plasticity soil (Liquid Limit less than 50, Plasticity Index less than 25). Structural fill soils should generally classify as CL, ML, SC, SM, SW, or GW in accordance with the USCS. Additionally, the maximum grain size should not exceed 3 inches.

The low plasticity clean fill and coastal plain soils (CL and SC) at the site can typically be used as structural fill. Fat clays (CH) or elastic silts (MH) and soils containing concentrated organics, if encountered, are not considered suitable for re-use as structural fill and should only be re-used in landscaped areas.

All fill should be placed in loose lifts not exceeding 8 inches in thickness and at moisture contents within 3 percent of the optimum moisture content of the material as determined by ASTM D698 (standard Proctor). Each lift of fill should be uniformly compacted to a dry density of at least 95 percent of the maximum dry density of the material determined according to ASTM D698 (standard Proctor), with the upper 18 inches of fill beneath foundations, slabs, and pavements compacted to at least 98 percent. The geotechnical engineer's representative should perform in-place field density tests to evaluate the compaction of the structural fill and backfill placed at the site. We recommend that one density test be performed per 2,500 square foot area per lift in building and driveway/parking areas and one test per lift per 100 linear feet in utility trenches.

#### *4.1.9 Cut and Fill Slopes*

We recommend that construction of any cut and fill slopes should be no steeper than 3H:1V (horizontal to vertical). If steeper slopes are required, detailed slope stability analyses should be performed. The tops and bases of all slopes should be located a minimum of 10 feet from structural limits and a minimum of 5 feet from pavement limits. To prevent shallow surface failures on the exposed slope faces we also recommend that the soils exposed on all slope faces be compacted with track-mounted equipment prior to final seeding and mulching. Surface water runoff should be directed away from the slopes.

## **4.2 Foundation Support**

Based on the results of the soil test borings performed, subsurface conditions are favorable for the relatively lightly loaded structure supported on traditional shallow spread foundations, provided the site preparation and fill placement procedures outlined in this report are implemented.

#### *4.2.1 Bar Screening Bearing Elevation Stabilization and Structure Foundation Recommendations*

From our boring data, it appears that loose clayey sand fill soils will be encountered at the anticipated base of the bar screening structure excavation at the site. Finished elevations were not provided to us at the time of this report. Due to the potential loose relative density, stabilization activities are recommended to provide a stable working base. Therefore, we recommend that the subgrade soils at the bottom of the bar screening structure excavation be over-excavated roughly 2 feet, and the resulting excavation base be observed to determine if further over-excavation is required to provide a stable base for fill placement. If the base is stable, the over-excavation should be backfilled with graded aggregate base course (GABC) materials up to the required bearing



elevation. The GABC should be placed in 6 to 8-inch lifts and be compacted to at least 95 percent of the modified Proctor maximum dry density (ASTM D1557).

Within the bar screening structure footprint, bearing conditions will likely consist of Coastal Plain soils or newly placed fill. Within the grit removal structure footprint, bearing conditions will likely consist of existing fill soils. We recommend that a net allowable bearing pressure of up to **2,500 pounds per square foot** (psf) be used for design of shallow foundations for the grit removal structure and assumed mat foundation for the bar screening structure bearing on these materials.

Minimum wall and column footing dimensions of 18 and 24 inches, respectively, should be maintained to reduce the possibility of a localized, punching-type shear failure. Foundations should bear at least 12 inches below finished grade for frost protection and protective embedment.

All footing excavations should be observed by the geotechnical engineer's representative to confirm that suitable soils are present at/below the proposed bearing elevation. High plasticity soils, if encountered at foundation bearing elevation, should be undercut per the direction of the geotechnical engineer. If evaluation with DCP testing encounters soft or other unsuitable materials in the footing excavations, undercutting may be required. Soft soils should be undercut until suitable soils are encountered. Undercut foundations should be backfilled with compacted structural fill, washed stone wrapped in a non-woven geotextile, or lean concrete.

Based on the general stratigraphy in the area, our experience with similar projects, the anticipated magnitude of the structural loads, and the anticipated bearing elevations, settlement potential for the structure should be less than approximately 1 inch total and ½ inch differential, provided that our recommendations are followed. This conclusion is contingent upon compliance with the site preparation and fill placement recommendations outlined in this report. The majority of the settlement should occur shortly after construction.

Prepared bearing surfaces for foundations should not be disturbed or left exposed during inclement weather. Saturation of the footing subgrade can cause a loss of strength and increased compressibility. If foundation excavations must remain open overnight or if rainfall becomes imminent while the bearing soils are exposed, we recommend that a 2 to 4-inch thick "mud-mat" of lean (2000 psi) concrete be placed on the bearing soils before placement of reinforcing steel to help protect the bearing soils from further disturbance. Also, concrete should not be placed on frozen subgrades.

#### *4.2.2 Foundation Lateral Capacity*

Lateral capacity of footings includes a soil lateral pressure and coefficient of friction as described in IBC Section 1806. Where bearing in natural soils, footings will be embedded in material mostly similar to those described as Class 4 in Table 1806.2. Where footings are cast neat against the sides of excavations in natural soils, an allowable lateral bearing pressure of 150 psf per foot depth below natural grade may be used in computations. A coefficient of friction of 0.25 multiplied by the dead load may be used to calculate lateral sliding resistance.



### 4.3 Floor Slabs

Ground-level floor slabs may be supported on properly compacted new fill, properly evaluated existing fill, and/or low plasticity coastal plain soils. A minimum 6-inch-thick layer of compacted graded stone (SCDOT GABC), as well as a plastic moisture vapor retarder, should be provided beneath all building floor slabs to provide a capillary break in areas where floor coverings/spaces prohibit a damp slab condition.

The floor slabs should be designed to resist the anticipated dead and live loads. We recommend that the floor slabs be designed using a using a Standard Modulus of Subgrade Reaction ( $k$ ) of 100 pounds per cubic inch (pci) to accommodate the subsurface variability as some softer slab bearing areas should be anticipated, even though some localized stiffer areas may be encountered. The Standard Modulus of Subgrade Reaction represents the value correlated for a 30-inch diameter Plate Bearing Test.

Immediately prior to constructing the floor slabs, we recommend that the areas be evaluated to detect any softened, loosened, or disturbed areas that may have been exposed to wet weather or construction traffic. Areas that are found to be disturbed or indicate pumping action during proofrolling should be undercut and replaced with adequately compacted structural fill. This evaluation should be performed under the direction of the geotechnical engineer.

### 4.4 Below-Grade Walls

The below-grade walls of the bar screening structure should be designed with regard to the lateral pressure exerted by the retained soils in accordance with the 2018 South Carolina Building Code. In addition to the lateral loads exerted by the retained materials, allowances should be included for lateral stresses imposed by any temporary or long-term surcharge loads, such as cars or trucks, adjacent to the tops of the walls, including foundation loads from the pump station building.

The pressures exerted on walls will depend on the materials used as backfill and on the boundary condition (i.e., allowable movement) at the top of the wall. Basement/foundation walls are typically restrained from rotation/movement and should be designed using "at-rest" lateral earth pressures. Walls that are not restrained from movement (e.g., cantilever retaining walls) can be designed using "active" lateral earth pressures; however, the lateral movement can result in settlement behind the walls which could cause distress in slabs, structures, and utilities. Design of the retaining walls should consider the boundary conditions and the amount of acceptable deflection. Based on the locally available, suitable fill soils (i.e., low plasticity or granular materials), we recommend the following lateral earth pressure parameters be used:

**Table 4-2: Below-Grade Wall Design Parameters**

Lateral Earth Pressure Condition	Coefficient	Equivalent Fluid Pressure ( $\gamma_{EQ}$ )
At-Rest	$(K_o) = 0.53$	64 psf/ft*
Active	$(K_A) = 0.36$	43 psf/ft*
Passive	$(K_P) = 2.77$	332 psf/ft*
<b>Unit Weight of Soil (moist)</b>	<b>120 pcf**</b>	



A minimum of 12 inches of free-draining granular material and/or approved manufactured product should be placed directly behind the walls to provide drainage and prevent buildup of hydrostatic forces.

Fat clays (CH) and elastic silts (MH) should not be used as wall backfill. Care should be taken to prevent retaining wall backfill from being over-compacted, as this could result in excessive lateral stresses against the walls. Hand-held equipment should be used to avoid placing high stresses on the walls during compaction. Heavy compactors and grading equipment should not be allowed to operate within 5 to 10 feet of the walls during backfilling to avoid developing excessive temporary or long-term lateral soil pressures.

## **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.

## Appendix



**Approximate Site Location**



**SITE VICINITY PLAN**

**BAMBERG WWTP BAR SCREENING AND GRIT STRUCTURE REPLACEMENT**

277 MT. CARMEL CEMETERY ROAD  
BAMBERG, SOUTH CAROLINA

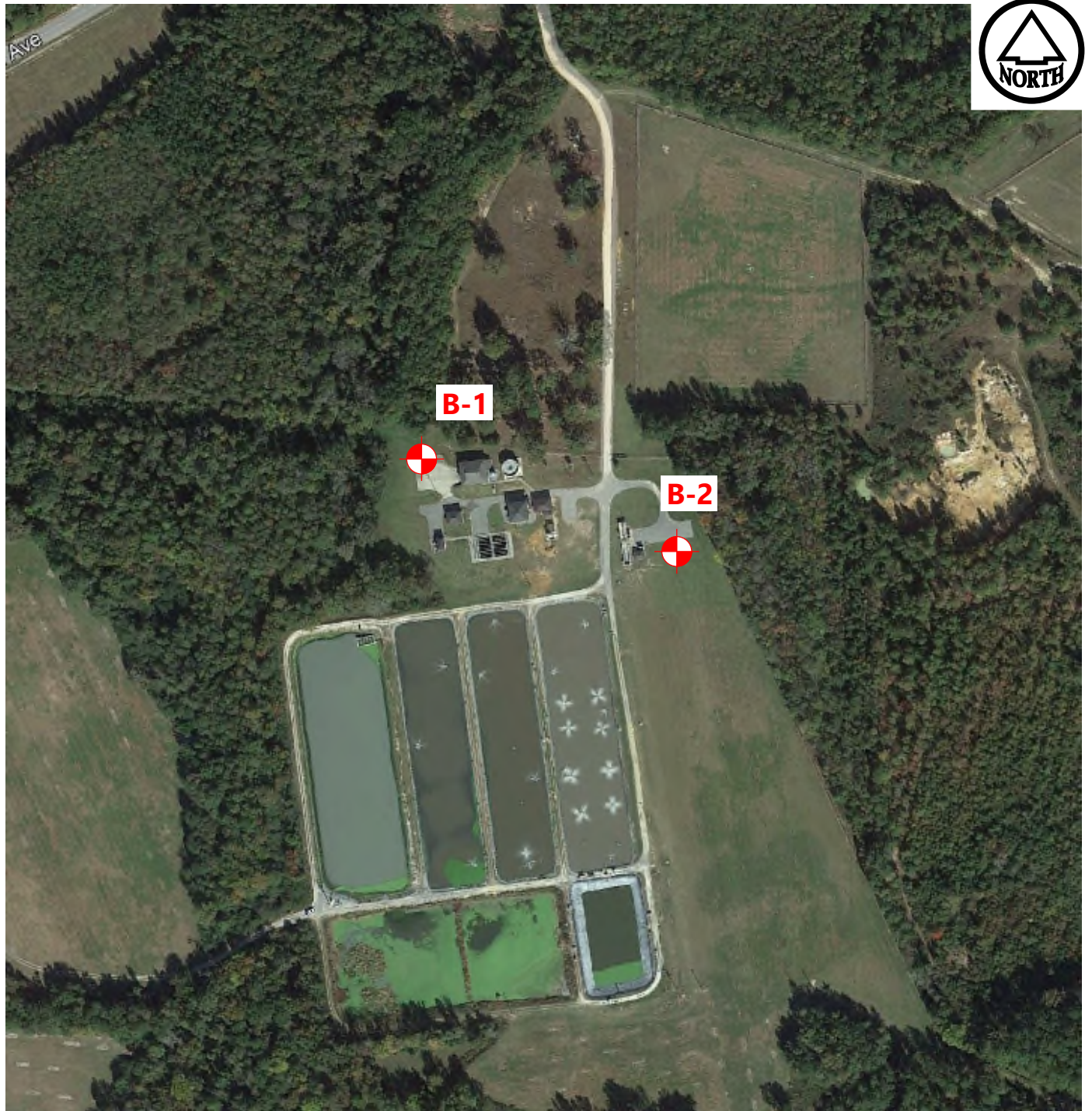
PROJECT NO.: 23350483

SCALE:	NTS
DRAWN BY:	SJM
CHECKED BY:	DAB
DATE:	SEPT 2023

FIGURE NO.

**1**





**LEGEND**



APPROXIMATE BORING LOCATION

NOTE: AERIAL IMAGE OBTAINED FROM GOOGLE EARTH PRO AND MODIFIED BY S&ME TO SHOW PROPOSED TEST LOCATIONS. DO NOT USE DRAWING TO DETERMINE DISTANCES OR QUANTITIES.



**BORING LOCATION PLAN**  
**BAMBERG WWTP BAR SCREENING AND GRIT STRUCTURE REPLACEMENT**

277 MT. CARMEL CEMETERY ROAD  
BAMBERG, SOUTH CAROLINA

PROJECT NO.: 23350483

SCALE: NTS

DRAWN BY: SJM

CHECKED BY: DAB

DATE: SEPT 2023

FIGURE NO.

2



# 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

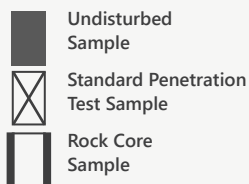
### RQD

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

### ROCK HARDNESS

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

## KEY



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

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

(Rock Quality Designation)

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

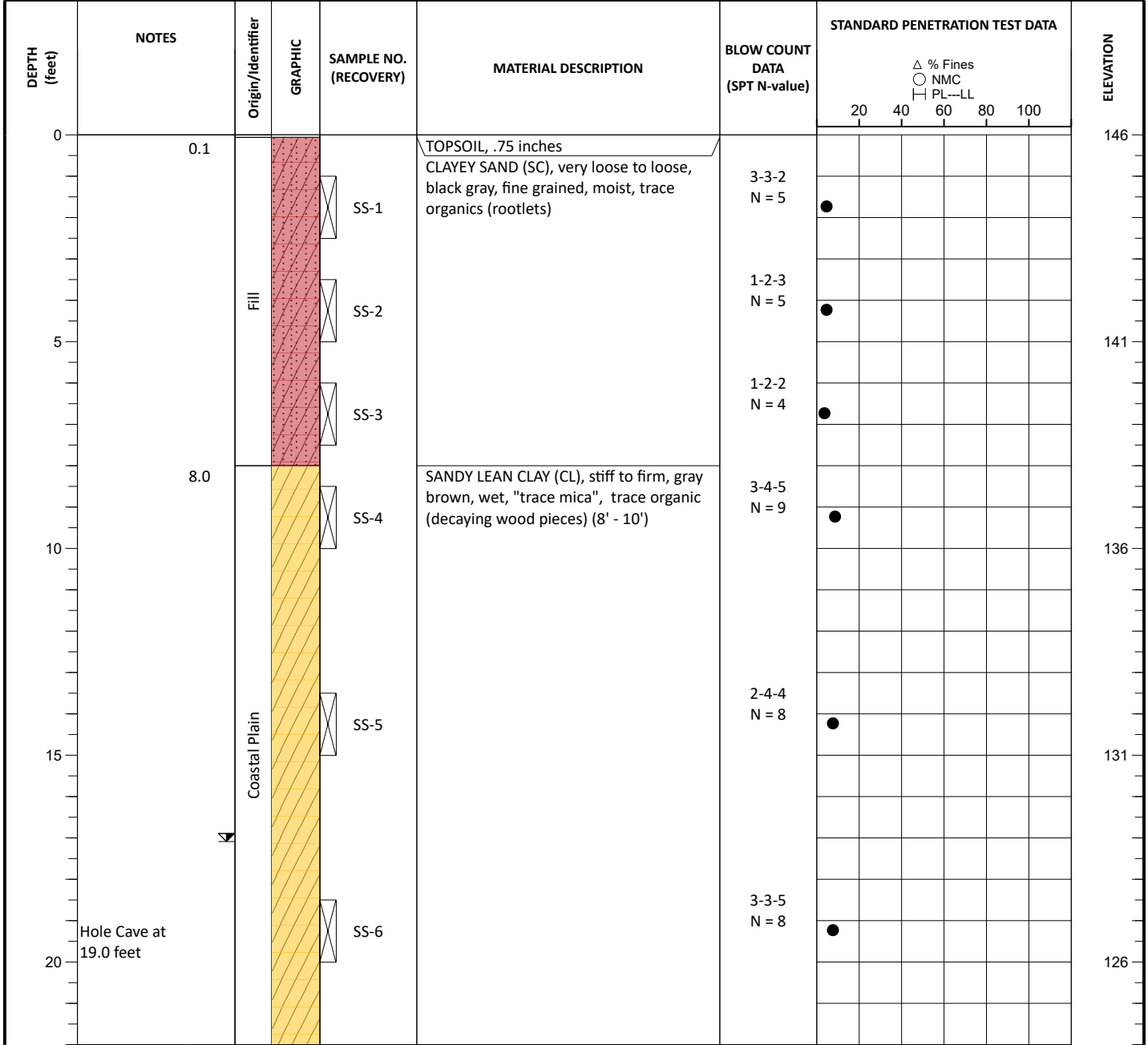
(Recovery)

### 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

	<b>At Time of Drilling (ATD)</b>	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.
	<b>End of Drilling</b>	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.
	<b>After Drilling</b>	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.

<b>PROJECT:</b> Bamberg WWTP Bar Screening Bamberg, South Carolina S&ME Project No. 23350483		<b>BORING LOG: B-1</b> <i>Sheet 1 of 2</i>	
<b>DATE DRILLED:</b> 08/22/2023	<b>ELEVATION:</b> 146 ft	<b>NOTES:</b> Northing, easting & elevation should be considered approximate	
<b>DRILL RIG:</b> Diedrich D-50 (Truck)	<b>DATUM:</b> NAVD88		
<b>DRILLER:</b> Capital Drilling	<b>BORING DEPTH:</b> 25.0 ft		
<b>HAMMER TYPE:</b> Automatic hammer	<b>CLOSURE:</b> Cuttings with Hole Closure Device		
<b>DRILLING METHOD:</b> 2 1/4" HSA	<b>LOGGED BY:</b> Leo Cruz-Cruz		
<b>SAMPLING METHOD:</b> SS	<b>PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet</b>		




GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	☒			
END OF DRILLING	☒	08/22/2023	17.0	
AFTER DRILLING	☒			
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

<b>PROJECT:</b> Bamberg WWTP Bar Screening Bamberg, South Carolina S&ME Project No. 23350483		<b>BORING LOG: B-1</b> <i>Sheet 2 of 2</i>	
<b>DATE DRILLED:</b> 08/22/2023	<b>ELEVATION:</b> 146 ft	<b>NOTES:</b> Northing, easting & elevation should be considered approximate	
<b>DRILL RIG:</b> Diedrich D-50 (Truck)	<b>DATUM:</b> NAVD88		
<b>DRILLER:</b> Capital Drilling	<b>BORING DEPTH:</b> 25.0 ft		
<b>HAMMER TYPE:</b> Automatic hammer	<b>CLOSURE:</b> Cuttings with Hole Closure Device		
<b>DRILLING METHOD:</b> 2 1/4" HSA	<b>LOGGED BY:</b> Leo Cruz-Cruz		
<b>SAMPLING METHOD:</b> SS	<b>PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet</b>		

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA					ELEVATION
							20	40	60	80	100	
22.0		Coastal Plain		SS-7	CLAYEY SAND (SC), loose, brown gray, fine grained, moist	3-4-6 N = 10						121
25.0												
					Borehole terminated at 25.0 feet							
30												116
35												111
40												106

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	☒			
END OF DRILLING	☒	08/22/2023	17.0	
AFTER DRILLING	☒			
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

<b>PROJECT:</b> Bamberg WWTP Bar Screening Bamberg, South Carolina S&ME Project No. 23350483		<b>BORING LOG: B-2</b> <i>Sheet 1 of 2</i>	
<b>DATE DRILLED:</b> 08/22/2023	<b>ELEVATION:</b> 152 ft	<b>NOTES:</b> Northing, easting & elevation should be considered approximate	
<b>DRILL RIG:</b> Diedrich D-50 (Truck)	<b>DATUM:</b> NAVD88		
<b>DRILLER:</b> Capital Drilling	<b>BORING DEPTH:</b> 25.0 ft		
<b>HAMMER TYPE:</b> Automatic hammer	<b>CLOSURE:</b> Cuttings with Hole Closure Device		
<b>DRILLING METHOD:</b> 2 1/4" HSA	<b>LOGGED BY:</b> Leo Cruz-Cruz		
<b>SAMPLING METHOD:</b> SS	<b>PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet</b>		

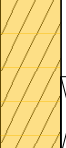
DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA					ELEVATION
							20	40	60	80	100	
0	0.1	Fill		SS-1	TOPSOIL, 1 inch CLAYEY SAND (SC), medium dense to loose, black gray, fine grained, moist, trace organics (rootlets)	3-4-7 N = 11	●					152
				SS-2		3-4-4 N = 8	●					
5				SS-3		1-2-4 N = 6	●					147
8.0		Coastal Plain		SS-4	FAT CLAY (CH), stiff, gray brown, moist, trace mica	2-3-6 N = 9	●					142
12.0				SS-5	SANDY LEAN CLAY (CL), stiff to firm, gray brown, moist, trace mica, trace coarse gravel (22' - 25')	3-4-4 N = 8	●					137
15				SS-6		2-5-6 N = 11	●					132
20	Hole Cave at											

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	☒			
END OF DRILLING	☒	08/22/2023	20.0	
AFTER DRILLING	☒			
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

<b>PROJECT:</b> Bamberg WWTP Bar Screening Bamberg, South Carolina S&ME Project No. 23350483		<b>BORING LOG: B-2</b> <i>Sheet 2 of 2</i>	
<b>DATE DRILLED:</b> 08/22/2023	<b>ELEVATION:</b> 152 ft	<b>NOTES:</b> Northing, easting & elevation should be considered approximate	
<b>DRILL RIG:</b> Diedrich D-50 (Truck)	<b>DATUM:</b> NAVD88		
<b>DRILLER:</b> Capital Drilling	<b>BORING DEPTH:</b> 25.0 ft		
<b>HAMMER TYPE:</b> Automatic hammer	<b>CLOSURE:</b> Cuttings with Hole Closure Device		
<b>DRILLING METHOD:</b> 2 1/4" HSA	<b>LOGGED BY:</b> Leo Cruz-Cruz		
<b>SAMPLING METHOD:</b> SS	<b>PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane South Carolina FIPS 3900 Feet</b>		

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA					ELEVATION
							20	40	60	80	100	
21.0	21.0 feet	Coastal Plain		SS-7	SANDY LEAN CLAY (CL), stiff to firm, gray brown, moist, trace mica, trace coarse gravel (22' - 25')	3-6-7 N = 13						127
25.0	25.0											
					Borehole terminated at 25.0 feet							
30												122
35												117
40												112

GROUNDWATER		DATE	DEPTH (FT)	REMARKS
ATD	☒			
END OF DRILLING	☒	08/22/2023	20.0	
AFTER DRILLING	☒			
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